

CONTENTS

1. “India’s Pharma Sector Gets a Shot of Growth at 7.8% in April: From Generic Drugs to Global Vaccines, Transforming Lives Worldwide”
2. Forging One Force: The Synergy of India’s Armed Forces
3. Solid-State Lithium-Ion Battery Failures: A Breakthrough in Understanding
4. National Manuscripts Mission (NMM)
5. Higher Defence Spending Won’t Stretch India’s Finances

Topic : “India’s Pharma Sector Gets a Shot of Growth at 7.8% in April: From Generic Drugs to Global Vaccines, Transforming Lives Worldwide”

Relevance : GS Paper 3 Science and Technology – Pharmaceuticals

Source : PIB

Context :

India’s pharmaceutical industry, already a global powerhouse, is now experiencing renewed momentum with a **7.8% year-on-year growth in April 2025**, driven by:

- Rising global and domestic demand,
- Introduction of new innovative drugs, and
- Government-backed initiatives.

This growth highlights India's dual role: **healthcare provider to the world** and **engine of domestic healthcare access and employment**.

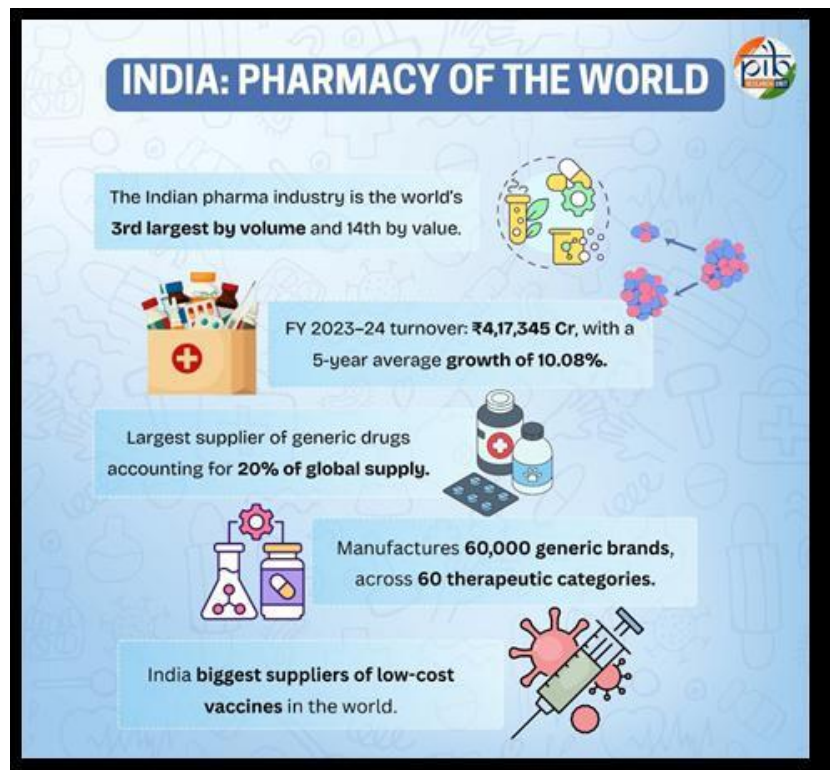
2. India’s Global Position in the Pharma Sector

- 3rd in the world by volume, 14th by value.
- 20% of the world’s generic medicines are supplied by India.

DEL-HYD-B’LORE-PUNE-TPT

<https://pragnyiascoachinghyderabad.com>

+91 9880486671

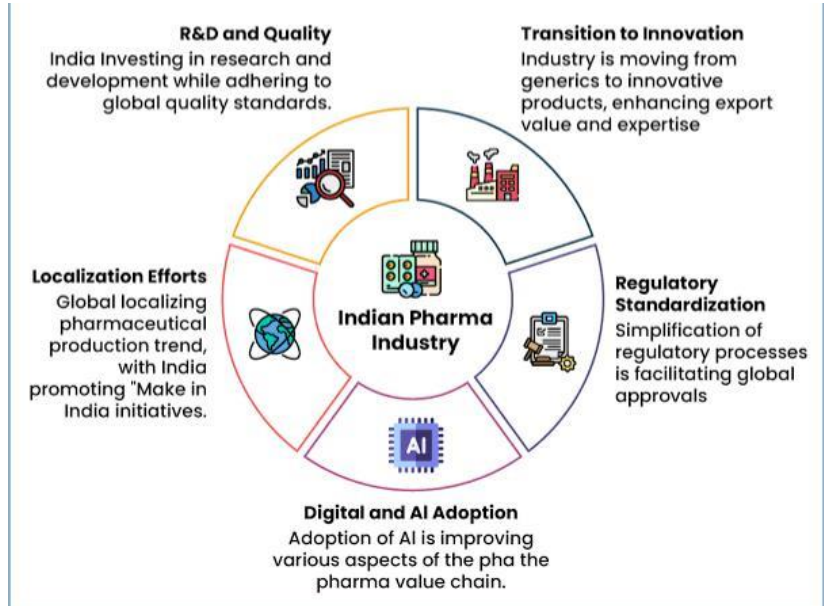


- It is a leading exporter of affordable vaccines, especially to developing nations.

This means India is the pharmacy of the world—producing **cost-effective, high-quality drugs** accessible across continents.

3. Domestic Turnover and Impact

- 2023-24 turnover:** ₹4,17,345 crore.
- Consistent double-digit growth:** Over 10% CAGR in the past five years.
- Implication:** Not only has this helped in making essential medicines cheaper in India, but it has also:
 - Boosted healthcare penetration to rural areas,
 - Generated employment in manufacturing and R&D,
 - Empowered India's Atmanirbhar Bharat vision.



4. Government Schemes Powering the Pharma Revolution

a. Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PMBJP)

- 15,479 Jan Aushadhi Kendras** across India.
- Offer generic drugs at up to 80% lower prices.**
- Example:** Heart medicine reduced from ₹500 to ₹100.
- Goal:** Ensure **universal affordability and accessibility** of essential medicines.

b. Production Linked Incentive (PLI) Scheme for Pharmaceuticals

- ₹15,000 crore allocation.**
- Focus:** Boost domestic production of **high-end formulations**, such as:
 - Cancer drugs**
 - Diabetes medication**
- Supports 55 critical projects**, fostering R&D and innovation.

The digital pharmacist

Draft law recognises potential of e-commerce in pharmaceutical sector. But more needs to be done to ensure that medical products are safe, effective and conform to prescribed quality standards



SHAILAJA CHANDRA

A DRAFT LAW to replace the 1940 Drugs and Cosmetics Act with a Drugs, Medical Devices and Cosmetics Bill, 2022 was uploaded by the Union Health ministry in early July, seeking public comments and objections, within 45 days. The primary objective of any drug law is to ensure that the medical products sold in country are safe, effective and conform to prescribed quality standards. This article addresses how the new law could help consumers but what more is required.

The first major feature in the new Bill that affects consumers relates to e-commerce. The regulatory cover will come where the rules are notified but the inclusion of a provision in the Bill is reassuring. Presently, online sales of medicines account for a fraction of the total pharma sales in India but are forecast to grow exponentially. The traditional retail chemist sector has been the mainstay for the population but has generally been unorganised. The sale of substandard, even counterfeit, drugs – particularly in smaller towns and villages – remains widespread.

There are several pros and cons concerning online sales. Like all online shopping, the consumer gets the advantage of discounts and the comfort of shopping from home. During Covid, e-pharmacy platforms were promoted by government digital platforms, so the experience of regulating the sector is available. In normal times, e-commerce can summarise three uniquely Indian disadvantages. The first relates to medicine conditions, which require medicines to be stored at below 10 degrees Celsius and 70 per cent relative humidity – unsuitable in most of India. It can mandate establishing a back-end link and monitor time for drug supply having good storage conditions. This is what happens in all countries the world over that allow e-commerce. It can monitor all transactions otherwise impossible to track.

The second advantage of e-commerce could be fulfilling a legal requirement – providing a bill to the consumer and retaining overcopy bearing the batch numbers and expiry dates of the drugs. In addition, the practice of accruing prescription drugs over the counter would cease. There are presently over 540 Schedule H drugs that require a doctor's prescription and the fact that they can be easily accessed over the counter is well-known. In the case of e-commerce, registration of a pharmacy can require enrollment with the central and state drug control organisations and the practice of uploading a prescription from a registered medical practitioner can be enforced. Some Indian pharmacy outlets have begun facilitating getting a prescription after tele-consultations.

The flipside of shopping for medical drugs on the internet is that it could encourage overuse or inappropriate use of drugs, increase dependency on habit-forming medicine – for example, sleep-inducing drugs or self-medication with products for weight loss, male enhancement, even treating mental illness – which is fraught with dangers



Mains Practice Question:
The e-pharmacy sector holds immense potential to address the persisting issue of affordability and accessibility of medicines in India. Discuss.

consequences. The rules can easily exclude identified medication or make access stringent. On balance, however, the advantage lies in facilitating e-commerce for medical drugs.

The draft law also proposes according a greater focus on medical devices, which include thousands of engineered apparatuses like stents, joint implants, pacemakers, catheters, etc., which require quality regulation. Rules for medical devices were notified in 2017 but now it is proposed to establish a statutory Medical Device Technical Advisory Board, with experts from the fields of atomic energy, science and technology, electronics and related fields like biomedical technology to guide the process. This is a welcome move that will bring in the required expertise.

What the Bill does not address is the need to stop the continued mismanagement of the wholesale and retail drugs trade in India – a nightmare for every state drug controller. The problem ranges from Bhagathi Palay in Chennai, Chawki, Delhi – Asia's biggest drug wholesale market some say – or the unregulated practices at the border and the spectrum, labelling, steroids into poor and uneducated patients. In the past, calls – whether at drug wholesale hubs or small pharmacies – have unearthed counterfeit and spurious drugs but have resulted in little deterrence. Drugs move from the manufacturers to the carrying and forwarding agents who, in turn, assign the drugs to "registered" wholesalers or stockists" located in Bhagathi Palay or other state drug wholesale hubs. Rule 1945 of the Drugs and Cosmetics Rules 1945 lays down that a wholesale drug licence can be given to a qualified pharmacist or one who has passed the matriculation examination or is equivalent or a graduate with one year's experience in dealing with drug sale. This is a relic from 80 years ago. When the country is

There are presently over 540 Schedule H drugs that require a doctor's prescription and the fact that they can be easily accessed over the counter is well known. In the case of e-commerce, registration of a pharmacy can require enrollment with the central and state drug control organisations and the practice of uploading a prescription from a registered medical practitioner can be enforced.

Some Indian pharmacy outlets have begun facilitating getting a prescription after tele-consultations.

reported to have over 700,000 pharmacists, this anachronism must be discarded.

In fairness, it was sought to be corrected in December 2016 by deleting the above clauses from the Drugs Rules and a draft was even quoted in 2016 in the recommendations of the health ministry's Drugs Consultative Committee headed by the Director General of Health Services. But after seven years, the regulatory criteria continue to allow a matriculate or an ordinary graduate (after with a few years experience) to get a licence as a wholesaler or stockist. It is essential to introduce a binding and enabling provision to only license qualified pharmacists and put the safety of millions of citizens before the self-generation of a few thousand wholesalers and stockists.

And that brings me to the consumer side of the sale of drugs, particularly in small pharmacies. My research and field study – "Unqualified Medical Practitioners in India", published by Shiv Nadar University in 2017 – describes how easily prescription drugs can be purchased from a medical shop owner, a petty licensee provides legal cover in absence of the shop owner. That he himself possesses zero knowledge about pharmaceuticals has not bothered any state regulator. This must be stopped. Unless digitisation of procurement, inventory control and accountability for dispensing drugs gets encrypted into a digital trail, random audits and inspections will serve no purpose.

The debate should not be between e-commerce and retail sale. It should be between being compliant and non-compliant.

The writer is former secretary, Ministry of Health. Views are personal

c. PLI for Bulk Drugs (API)

- Allocation: **₹6,940 crore.**
- Focus: Manufacture **raw materials domestically** (e.g., Penicillin G) to:
 - Cut import dependence from countries like China,
 - Strengthen self-reliance in pharma supply chains.

d. PLI for Medical Devices

- Allocation: **₹3,420 crore.**
- Encourages domestic manufacturing of:
 - MRI machines,
 - Cardiac implants, etc.
- Goal: Make India a **medical tech hub.**

e. Bulk Drug Parks Scheme

- Allocation: **₹3,000 crore.**
- Parks being set up in:
 - Gujarat,
 - Himachal Pradesh,
 - Andhra Pradesh.
- These hubs will reduce production costs by integrating infrastructure and logistics.

f. Strengthening of Pharmaceuticals Industry (SPI) Scheme

- Allocation: **₹500 crore.**
- Focus: Improve **lab infrastructure and technological capacity.**
- Helps SMEs and domestic firms **compete globally.**

5. India's Vaccine Powerhouse Role

India is central to **global vaccine distribution**, particularly in public health programs:

- **UNICEF:** 55-60% of vaccine supply from India.
- **WHO Requirements:**
 - 99% of **DPT vaccines**,

DEL-HYD-B'LORE-PUNE-TPT

The great omission in the draft disability policy

Unless there is political inclusion of the disabled, the goal of inclusiveness and empowerment will remain elusive



SHASHANK PANDEY

The Department of Empowerment of Person with Disabilities (DoEPwD) recently released the draft of the national policy for persons with disabilities ("Policy") – public comments have been invited till July 15, 2022 (at: panda.d@nic.in). The necessity for a new policy which replaces the 2006 policy was felt because of multiple factors such as India's signing of the United Nations Convention on Rights of Persons with Disabilities; enactment of a new disability legislation (Rights of Persons with Disabilities Act 2016) which increased the number of disabilities from seven conditions to 21 and bringing a parity to the Indian Strategy for Asian and Pacific Decade of Persons with Disabilities, 2010-2022 ("Indian commitment"). The last was prepared under the aegis of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) which identifies 10 goals for Asia-Pacific countries to ensure the inclusion and the empowerment of persons with disabilities and conformity with the Sustainable Development Goals 2020.

These commitments have changed the discourse around disability by shifting the focus from the individual to society, i.e., from a medical model of disability to a social or human rights model of disability.

The political empowerment and the inclusion of the disabled are an issue that has not found traction in India's democratic discourse. India does not have any policy commitment that is aimed at enhancing the political participation of

The principle of the draft policy is to showcase the Government's commitment to the inclusion and empowerment of persons with disabilities by providing a mechanism that ensures their full participation in society.

In furtherance of this commitment, the policy document highlights a detailed commitment to education, health, skill development and employment, sports and culture, social security, accessibility and other institutional mechanisms. However, a glaring omission is the absence of any commitment to the political uplift of persons with disabilities.

About political participation Article 29 of the Convention on Rights of Persons with Disabilities mandates that state parties should "ensure that persons with disabilities can effectively and fully participate in political and public life on an equal basis with others, directly or through freely chosen representatives." "The Indian goals also promote participation in political processes and in decision making. The Rights of Persons with Disabilities Act 2016, embodied these principles within its fold. The anti-discrimination commitment under this Act recognises the political domain wherein disabled people should be allowed to realise their human rights and fundamental freedoms. The document fails to take cognisance of such mandates.

Political empowerment and the inclusion of the disabled are an issue that has not found traction in India's democratic discourse. India does not have any policy commitment that is aimed at enhancing the political participation of

The exclusion of disabled people from the political space happens at all levels of the political process in the country, and in different ways. For instance, the inaccessibility of the voting process, barriers to participation in party politics or a lack of representation at the local, state or national levels have all aggravated the marginalisation of the disabled.

Ground realities, no data Section II of the Rights of Persons with Disabilities Act, prescribes that "The Election Commission of India and the State Election Commissions shall ensure that all polling stations are accessible to persons with disabilities and all materials related to the electoral process are easily understandable by and accessible to them". Although this mandate has been in existence for a few years, the disabled people still report accessibility issues before and on election day. There is still no widespread adaptation of braille electronic voting machines and even wheelchair services at all polling centres. The Election Commission of India has developed its own procedures for handling PwDs during the electoral process. Political parties in India still do not find the disabled as the large

electorate to specifically address their needs. The lack of live aggregate data on the exact number of the disabled people in every constituency only further their marginalisation. The lack of accessible space for party meetings, inaccessible transport for campaigning or an attitudinal barrier among voters and party leaders can be termed as contributing factors. Thus, we seldom see disability being highlighted in the manifestos of parties.

Inadequate representation Representation plays an important role in furthering the interests of the marginalised community. Our Constitution makers recognised this when they provided for reservation for Scheduled Caste/Scheduled Tribes in the legislature. Disabled people are not presented enough at all three levels of governance. The response to a right to information filing by this writer to the Parliamentary Affairs Ministry showed that the Government does not maintain data on the disability aspect of members. The first visually disabled Member of Parliament in independent India, Sadan Gauria, hardly finds mention in our political or disability discourse. We have often failed to acknowledge disabled political personalities who have overcome the myriad barriers in India's political space.

However, few States have begun the initiative at local levels to increase participation. For instance, Odisha started the initiative of nominating at least one disabled person in each panchayat. If a disabled person is not elected in a panchayat, then they are nominated as a pan-

chayat member as per changes in the law concerned. This is a step that has increased the participation of the disabled in the political space at local level.

'Make the right real' The goal of the policy document – of inclusiveness and empowerment – cannot be achieved without political inclusion. The policy can follow a long-term approach: building the capacity of disabled people's organisations and empowering their members through training in the electoral system, government structure, and basic organisational and advocacy skills; the creation, amendment or removal of legal and regulatory frameworks by lawmakers and election bodies to encourage the political participation of the disabled; inclusion of civil society to conduct domestic election observation or voter education campaigns; and a framework for political parties to conduct a targeted outreach to persons with disabilities when creating election campaign strategies and developing policy positions.

The document lays emphasis on the point that central and state governments must work together with other stakeholders to "make the right real". This right can be realised as part of a crackdown on political right-wing political participation within it. This will only come to the universal principle on disability, i.e., "Nothing about us, without us."

Shashank Pandey is a Senior Advocate at the National Centre for Promotion of Employment for Disabled People (NCPEDP). He was a legislative assistant to Members of Parliament (LAMP) Fellow

How is India streamlining the pharma sector?

Why has the drug regulator tweaked norms for exports? Where does India stand as a drugs manufacturer? Does the change follow allegations of sub-standard medicines being exported? Will a centralising authority help with several important drugs set to go off the patent list?

Rindu Shajan Perappadan

The story so far: India's drug regulator, the Central Drugs Standard Control Organisation (CDSCO), has withdrawn powers delegated to State licensing authorities to issue NOCs (no objection certificates) for manufacture of unapproved, banned or new drugs for export purposes. This latest announcement covering drugs for export comes at a time when India has been under scrutiny for allegations of supplying substandard drugs causing health concerns in several countries. The CDSCO is now the sole authority for issuing manufacturing licences for drugs meant for export.

What is India's role in the pharma market? India ranks third worldwide as a producer of drugs and pharmaceuticals by volume, exporting to around 200 countries/territories. The Indian pharmaceutical industry supplies 62% of the global demand for vaccines and is a leading supplier of DPT (diphtheria, pertussis and tetanus), BCG (Bacillus Calmette-Guérin, used primarily against tuberculosis), and measles vaccines. At least 70% of WHO's vaccines (as per the essential immunisation schedule) are sourced from India, the Centre

Local regulators will have to hand over details of all approvals given from August 2018 to May 2024 to the central drug regulator

had noted in a submission in Parliament.

What will be the impact? India is a key player in the international generic medicine market and any change in policy has direct impact on manufacturers and importers, say industry insiders. The centralising of the licensing authority is significant, they point out, because according to a study conducted by the Department of Pharmaceuticals, India needs to get ready to take advantage of drug sales worth \$251 billion going off-patent this coming decade. The study notes: "In the years between 2022 and 2030, the pharmaceutical sector in India will undergo landmark changes as several drugs are expected to go off-patent and provide an opportunity for the entry of generic products. Expiry of patents is very promising for the Indian generic drug market as it is expected to expand and grow further with inclusion of these new drugs. With ongoing developments, India has started focusing on self-reliance at a large scale. Hence, it is imperative to identify these drugs beforehand, draft and implement strategies which help in their timely entry into the market by promoting generic drug manufacturing."

What are the challenges? India is dealing with several challenges, including tackling intellectual property rights, lack of research and development etc. The study points out that understanding the political, economic, sociocultural, technological, environmental, and legal factors is vital for assessing the opportunities and challenges in the pharmaceutical market in India. "The industry must adapt to changes in these external factors, navigate regulatory requirements, leverage technology advancements, and align their strategies with the evolving needs of the pharmaceutical industry to succeed in the global market," it noted. Speaking about the change, Raheem Shah, business development director, BDR Pharmaceuticals, says the move is welcome as the centralisation of NOCs will formalise the Indian pharma industry. "This will result in the efficiency of the overall process along with bolstering pharma exports to key international

markets. It will help to bring uniformity in protocols, achieve the target of reaching \$450 billion by 2047," he adds.

What about the quality of manufacturing? An article in the *British Medical Journal* titled, "Indian government cracks down on 18 drug companies for poor quality manufacturing", noted that the Indian government had cancelled the licences of over 10 pharmaceutical companies as part of a crackdown on poor quality manufacturing. The action last March came after an inspection of 76 drug firms across 20 States. "The government is also understood to have given notices to a further 26 companies for not complying with good manufacturing processes. The Indian pharmaceutical industry has an estimated 10,500 companies, with drug exports having more than doubled in the past decade. But the industry has faced a series of scandals of late, including a World Health Organization investigation into four contaminated cough syrups that caused acute kidney injuries and were linked to the deaths of 66 children in the Republic of the Gambia last year," it added.

In what seems like an effort to keep a strict watch, the latest order by CDSCO states that pharmaceutical companies will have to get their NOCs from the zonal offices of CDSCO online before applying for manufacturing licences from their respective State/UT drug regulators. The Drugs Controller General of India, Rajeev Singh Raghuvanshi, said the decision was taken to facilitate the application process. In 2018, the CDSCO had permitted State and UT drug licensing authorities to grant permissions to export some specific drugs. As per the new order, local regulators will have to hand over the details of all the approvals they have given from August 2018 to May 2024 to CDSCO.

The centralisation of powers hasn't come as an overnight development, says an industry expert. The Central government's advisory group on drugs had earlier this year noted that getting NOCs from local drug regulators for pharmaceutical products is a tedious process, leading to delays. Says Harish K. Jain, president, Federation of Pharma Entrepreneurs: "We don't anticipate any major impact as far as costing or delays with this latest move. Export of goods is on the Union List. Also, the central authority was always the Central government; the power to hand out licences for export of drugs was delegated to States a few years ago."



GETTY IMAGES

<https://pragnyiascoachinghyderabad.com>

+91 9880486671

- 52% of **BCG vaccines**,
- 45% of **measles vaccines**.

These vaccines are essential for **developing nations**, especially in Africa, South Asia, and Latin America, placing India at the heart of global health equity.

6. Economic and Employment Impact

- Job creation across:
 - **Factories**
 - **Laboratories**
 - **Distribution chains**
 - **R&D centres**
 - India's pharma growth touches lives—from **rural youth employed in manufacturing units to scientists in bio-research facilities.**

7. Foreign Direct Investment (FDI) and Policy Push

- **₹12,822 crore in FDI (2023-24).**
- India allows:
 - **100% FDI in Greenfield pharmaceutical projects,**
 - **100% FDI in medical device manufacturing.**
- This liberalised FDI regime positions India as a **favoured destination for global pharma giants.**

8. Strategic Significance: Pharma as a Lifeline

- India's pharma industry is not just about business—it's about **saving lives affordably and sustainably**.
- Government initiatives like:
 - **PMBJP**
 - **PLI**
 - **Bulk Drug Parks**
 - **SPI Scheme**
 - Ensure a **robust pharma ecosystem** that is:
 - **Self-reliant,**
 - **Affordable,**

India's patent law safeguards under fire

The new recommendation reduces the period within which patent applications can be challenged to six months

LEENA MENGHANEY
ROHAN JOSEPH

the patent office decides to grant or reject a patent application.

This week the *Economic Times*[LMI] reports that the Economic Advisory Council (EAC) to the Prime Minister recommended the period within which patent applications are open to challenge by the public be restricted to a mere six months from the date of its publication.

Since the Indian Patent Offices receive an average of 50,000 patent applications a year, examiners often miss critical information about the patent application under

consideration. A recent study on pharmaceutical patent grants in India revealed that 7 out of 10 patents are granted in error by the In-

dian Patent Office. A robust pre-grant opposition system provides an additional administrative layer of scrutiny that prevents the grant of frivolous patents through third

Evergreening monopolies on medical products is a lucrative game for pharmaceutical corporations allowing them to charge high prices. And the Organisation of Pharmaceutical Producers of India (OPPI) – Big Pharma's association in India –



Avarice: Evergreening monopolies on medical products is a lucrative game for pharmaceutical corporations. • GETTY IMAGES

Group Limited (GSK) for Combivir on a fixed-dose combination of two AIDS drugs, zidovudine/lamivudine. GSK withdrew the patent application in India and several other countries after the patent opposition in India pointed out that the patent claims did not cover a new invention but simply the combination of two existing drugs.

Several such challenges before the patent office have successfully ensured the availability of affordable HIV medicines to millions living across the developing world. The 99% reduction in the prices of antiretrovirals following the generic competition, from \$10,000 per person per year down to less than \$100, has been a critical factor in the expansion of antiretroviral treatment to millions in low and middle-income countries.

Prescribing a timeline and cutting short the window period for pre-grant opposition makes it difficult to challenge frivolous patent applications on drugs and vaccines. The information in patent applications does not permit the public to rapidly identify the claimed medical product. The identification and further analysis are time-consuming.

ing as several applications are pending on the same medicine, vaccine or technology. Reducing the opportunities for filing challenges to pending patent claims will not increase efficiency or reduce pendency. On the contrary, pre-grant oppositions provide information to the examiners that can help speed up the examination process and deny invalid patents.

The real challenge
The humanitarian medical organisation, Médecins Sans Frontières (MSF), has supported hundreds of pregnant oppositions in India, working closely with patient groups to safeguard generic competition to increase access to affordable medicines from India.

In our experience, tackling the overwhelming number of evergreening patent claims on known drugs and technologies is the real challenge for the Indian patent office. The attempt to dilute the timeline on pre-grant opposition diverts from the real

(Leena Menghaney and Roshan Joseph are lawyers and work for Access Campaign at Médecins Sans Frontières.)

A 'no' to pharma freebies, a 'yes' for public good

The recent Supreme Court judgment should be applied to other unethical practices and expenditure out of public funds



VINEET KOTHARI

The judge said that in the process of interpretation of the law, it is the responsibility of the court to discern the social purpose which the specific provision subserve

The judgment said: "Thus, pharmaceutical companies' gifting of freebies to doctors, etc. is clearly 'prohibited by law' and not allowed to be claimed as a deduction under Section 37(i). Doing so would wholly undermine public policy. The well-established principle of interpretation of taxing statutes – that they need to be interpreted strictly – cannot sustain when it results in an absurdity contrary to the intentions of the Parliament."

Uplifting the Central Board of Direct Taxes (CBDT) circular dated August 1, 2012, and applying it to the case, the Court also cited and relied upon Regulation 6.8 of the Indian Medical Council (Professional Conduct, Etiquette and Ethics) Regulations, 2002 framed under the Medical Council Act, 1956, now repealed and substituted by the National Medical Commission Act, 2019. The Court also highlighted *Quershi* (2007) 2 SCC 755 and *Commissioner of Income Tax vs Khemchand Motilal Jain* to show that the assessee was not a willful

While overruling the Income Tax Tribunal's view in the case of *PHIL Pharma* (2017) and *Max Hospital* (2014) ILR 1 P. 620, the Court held that Regulations 2002 did apply to pharma companies also. Further, they could not be allowed to perpetuate the illegality of violations of norms by doctors. Invok-



beneficiaries could have saved over \$600 million in out-of-pocket payments had they been dispensed generic equivalent drugs. In a previous study by ProPublica titled "Dollars for Doctors: No There is Proof: Docs who get Company Cash Tend to Prescribe

Brand Name Meds" dated March 17, 2016 also, similar feelings were echoed. In the U.S., by the reason of the Physician Payments Sunshine Act 2010 also known as Section 6002 of the Affordable Care Act (ACA) of 2010, the law compels the manufacturers of drugs, devices, biologic and medical supplies to report to the Centers for Medicare and Medicaid Services, the three broad categories of payments or transfers of value such as meals, travel reimbursements and consulting fees. These include expenses borne by manufacturers such as speaker fees, travel, gift, honoraria, entertainment, charitable contribution, education grants and research grants, etc.

The issue of retail price
Obviously, the uncovered field this judgment – and it was not a controversy in hand before the Court – is the sale of medicines. Maximum Retail Price, or MRP. This is a scam and a case of underhand dealing that happens in the pharma world (the giving away

freebie is a smaller part of it) because drugs are invariably sold by pharmacist shops at MRP on the shelves. This is what affects medical treatment. Even though the Drug Price Control Order and Drugs and Cosmetics Act are there on the statute book, there is hardly any action to keep the sale price of medicines under control with due and proper investigation into their so-called

One fails to understand why the law cannot be amended to compel the manufacturer of drugs to sell at the verified genuine cost, that also factors in a reasonable profit

margin for each product by bringing manufacturers, both foreign or domestic, under the control of the MCI or any other equivalent body such as the Institute of Chartered Accountants of India. This must be at a uniform rate throughout the country; further, classified life saving drugs should be sold at cost or only at subsidised rates.

Nobody is against the pharma industry earning a reasonable profit. But there is an urgent need to check looting that is driven by drug manufacturers to distribute their products using freebies or 'bribes'.

Further application
This judgment can also go far. It should be debated and applied to other unethical practices and expenditure out of public funds. The strategy here should be to use financial tools such as income-tax provisions for disallowing such expenditure and taxing the same as perquisites or taxable income in the hands of recipients viz. assurances and declarations in election campaigns by political parties by giving away free laptops, waived electricity charges, food grains, loan waivers, etc. It is taxpayers' money that is being used to garner votes.

Justice Vineet Kohari is a former Acting Chief Justice of the Gujarat and Madras High Courts and Judge of the Rajasthan and Karnataka High Courts

- Globally competitive.

9. Vision for the Future: ‘Amrit Kaal’ in Healthcare

- India envisions a “healthcare for all” model.
- The **Modi government's vision** includes:
 - Empowering the common man through **accessible medicine**,
 - Making India a **global leader in drug innovation** and biotech,
 - Strengthening global health diplomacy using vaccines and medical aid.

India's pharma sector is a **shining example of inclusive growth, innovation, and global leadership**. With consistent growth, strategic policy support, and expanding global presence, it is:

- **Healing the world affordably,**
- **Powering domestic employment,**
- **Transforming India into a global health capital.**

As India steps into **Amrit Kaal**, the pharmaceutical sector stands as a cornerstone of its development journey—**scientific, self-reliant, and socially driven**.

Prelims Practice Question:

With reference to the recent developments in India's pharmaceutical sector, consider the following statements:

1. India ranks first globally in terms of pharmaceutical exports by value.
2. The Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PMBJP) offers medicines that are up to 80% cheaper than branded drugs.
3. The Production Linked Incentive (PLI) Scheme for Pharmaceuticals aims to reduce India's dependence on imports for raw materials like Penicillin G.
4. India meets over 90% of global demand for the BCG (Bacillus Calmette-Guérin) vaccine.

What is the NPPA's role in fixing drug prices?

Why is the pharma lobby seeking a 10% increase for scheduled drugs? How will it impact consumers?

BINDU SHAJAN PERAPPADAN

The story so far: Consumers may have to pay more for medicines and medical devices if the National Pharmaceutical Pricing Authority (NPPA) allows a price hike of over 10% in the drugs and devices listed under the National List of Essential Medicines (NLEM), this coming month. The escalation which is expected to have an impact on nearly 800 drugs and devices is propelled by the rise in the Wholesale Price Index (WPI). Lobby groups that represent domestic pharmaceutical companies have been engaging with the Central Government to ask it to extend the 10% annual hike to scheduled formulations under price control.

How does the pricing mechanism work?

■ Prices of Scheduled Drugs are allowed an increase each year by the drug regulator in line with the WPI and the annual change is controlled and rarely crosses 5%. But the pharmaceutical players pointed out that over the past few years, input costs have flared up. “The hike has been a long standing demand by the pharma industry lobby. All medicines under the NLEM are under price regulation. As per the Drugs (Prices) Control Order 2013, scheduled drugs, about 15% of the pharma market, are allowed an increase by the government as per the WPI, while the rest 85% are allowed an automatic increase of 10% every year. The pharma lobby is now asking for at

least a 10% increase for scheduled drugs too than going by the WPI,” said an industry expert.

Who regulates prices?

■ The NPPA was set up in 1997 to fix/review prices of controlled bulk drugs and formulations and to enforce price and availability of the medicines in the country, under the Drugs (Prices) Control Order, 1995-2013. Its mandate is to implement and enforce the provisions of the Drugs (Prices) Control Order in accordance with the powers delegated to it, to deal with all legal matters arising out of the decisions of the NPPA and to monitor the availability of drugs, identify shortages and to take remedial steps.

The ceiling price of a scheduled drug is determined by first working out the simple average of price to retailer in respect of all branded and generic versions of that particular drug formulation having a market share of more than or equal to 1%, and then adding a notional retailer margin of 8% to it. The ceiling price fixed/revised by the NPPA is notified in the Gazette of India (Extraordinary) from time to time.

The NPPA is also mandated to collect/maintain data on production, exports and imports, market share of individual companies, profitability of companies etc., for bulk drugs and formulations and undertake and/or sponsor relevant studies in respect of pricing of drugs/ pharmaceuticals.

Prices are revised when there is a rise in the price of bulk drugs, raw materials, cost of transport, freight rates, utilities like fuel, power, diesel, and changes in taxes and duties. The cost rises for imported medicines with escalation in insurance and freight prices, and depreciation of the rupee. The annual hike in the prices of drugs listed in the NLEM is based on the WPI. The NLEM lists drugs used to treat fever, infection, heart disease, hypertension, anaemia etc and includes commonly used medicines like paracetamol, azithromycin etc.

Why are inputs costs high?

■ Speaking about the proposed move China Srivivasan, co-convenor, All India Drug Action Network (AIDAN), pointed out that one of the challenges is that 60%-70% of the country's medicine needs are dependent on China. “Self-reliance for India also means self-reliance in bulk drugs (Active Pharmaceutical Ingredients/APIs) and chemicals/intermediates that go into making the drug.” Mr. Srivivasan also said the method to calculate the annual ceiling price increase should be revised. “WPI is dependent on price rise in a basket of a range of goods that are not directly linked with the items that go into the cost of medicines. More importantly, the unrealistic simple average method of calculating ceiling prices should be replaced by a cost-plus mechanism that was prevalent under the earlier DPCO 1995,” he said.

Why India should support antibiotics development

India needs an investment mindset that can fund and sustain drug discovery and development

ABDUL GHAFUR

ANAND ANANDKUMAR

Antimicrobial resistance (AMR) is a looming public health crisis impacting every country globally with a disproportionate impact on lives and livelihood in low and middle-income countries. A recent report from the Global Research on Antimicrobial Resistance (GRAM) project found that in 2019, an estimated 4.95 million people suffered from at least one drug-resistant infection and AMR directly caused 1.27 million deaths.

AMR is one of India's major public health problems, directly contributing to about 30% of deaths due to neonatal sepsis across India. These are due to multidrug resistant (MDR) hospital-acquired infections in many cases. Over 30% of the COVID-19 deaths in India could be attributed to our failure to treat the secondary bacterial infections caused by MDR pathogens with the appropriate antibiotics.

Irrational antibiotic use by the medical community, the general public and the farmers generate drug-resistant superbugs. Inadequate infection control measures in the hospitals and the sanitation issues in the community result in the dissemination of these superbugs.

To tackle the AMR crisis, we need robust investment in research and development of new antibiotics, rapid and affordable diagnostics, strengthening infection control and prevention practices, formulating and implementing antibiotic stewardship programmes across the country and ensuring equitable access to life-saving antibiotics. One such immediate intervention is a welcome move by the Government of India to pass legislation banning the use of streptomycin and tetracycline in agriculture and the growth promotional use of colistin in poultry farming.

With India's reputation as the pharmacy of the global South, with numerous global compliant manufacturing plants, it's time to expand our focus and investment in early R&D of life-saving antibiotics. We have the intellectual firepower and critical talent pool. However, we need robust investment from Government and private sector in specialised training courses

control measures in the hospitals and the sanitation issues in the community result in the dissemination of these superbugs.

To tackle the AMR crisis, we need robust investment in research and development of new antibiotics, rapid and affordable diagnostics, strengthening infection control and prevention practices, formulating and implementing antibiotic stewardship programmes across the country and ensuring equitable access to life-saving antibiotics. One such immediate intervention is a welcome move by the Government of India to pass legislation banning the use of streptomycin and tetracycline in agriculture and the growth promotional use of colistin in poultry farming.

With India's reputation as the pharmacy of the global South, with numerous global compliant manufacturing plants, it's time to expand our focus and investment in early R&D of life-saving antibiotics. We have the intellectual firepower and critical talent pool. However, we need robust investment from Government and private sector in specialised training courses

control measures in the hospitals and the sanitation issues in the community result in the dissemination of these superbugs.

To tackle the AMR crisis, we need robust investment in research and development of new antibiotics, rapid and affordable diagnostics, strengthening infection control and prevention practices, formulating and implementing antibiotic stewardship programmes across the country and ensuring equitable access to life-saving antibiotics. One such immediate intervention is a welcome move by the Government of India to pass legislation banning the use of streptomycin and tetracycline in agriculture and the growth promotional use of colistin in poultry farming.

With India's reputation as the pharmacy of the global South, with numerous global compliant manufacturing plants, it's time to expand our focus and investment in early R&D of life-saving antibiotics. We have the intellectual firepower and critical talent pool. However, we need robust investment from Government and private sector in specialised training courses

control measures in the hospitals and the sanitation issues in the community result in the dissemination of these superbugs.

To tackle the AMR crisis, we need robust investment in research and development of new antibiotics, rapid and affordable diagnostics, strengthening infection control and prevention practices, formulating and implementing antibiotic stewardship programmes across the country and ensuring equitable access to life-saving antibiotics. One such immediate intervention is a welcome move by the Government of India to pass legislation banning the use of streptomycin and tetracycline in agriculture and the growth promotional use of colistin in poultry farming.

With India's reputation as the pharmacy of the global South, with numerous global compliant manufacturing plants, it's time to expand our focus and investment in early R&D of life-saving antibiotics. We have the intellectual firepower and critical talent pool. However, we need robust investment from Government and private sector in specialised training courses

control measures in the hospitals and the sanitation issues in the community result in the dissemination of these superbugs.

To tackle the AMR crisis, we need robust investment in research and development of new antibiotics, rapid and affordable diagnostics, strengthening infection control and prevention practices, formulating and implementing antibiotic stewardship programmes across the country and ensuring equitable access to life-saving antibiotics. One such immediate intervention is a welcome move by the Government of India to pass legislation banning the use of streptomycin and tetracycline in agriculture and the growth promotional use of colistin in poultry farming.

With India's reputation as the pharmacy of the global South, with numerous global compliant manufacturing plants, it's time to expand our focus and investment in early R&D of life-saving antibiotics. We have the intellectual firepower and critical talent pool. However, we need robust investment from Government and private sector in specialised training courses

control measures in the hospitals and the sanitation issues in the community result in the dissemination of these superbugs.

To tackle the AMR crisis, we need robust investment in research and development of new antibiotics, rapid and affordable diagnostics, strengthening infection control and prevention practices, formulating and implementing antibiotic stewardship programmes across the country and ensuring equitable access to life-saving antibiotics. One such immediate intervention is a welcome move by the Government of India to pass legislation banning the use of streptomycin and tetracycline in agriculture and the growth promotional use of colistin in poultry farming.

With India's reputation as the pharmacy of the global South, with numerous global compliant manufacturing plants, it's time to expand our focus and investment in early R&D of life-saving antibiotics. We have the intellectual firepower and critical talent pool. However, we need robust investment from Government and private sector in specialised training courses



Precarious: The market for antibiotics is broken and the drug pipeline is drying up.

pled with an investment mindset that can fund and sustain drug discovery and development.

Dry antibiotic pipeline

During the last decade, the success rate from Phase I to FDA approval for new antibacterial drugs was found to be 16.3% in comparison to the overall industry average of 7.9%. Despite this higher success rate, antibiotic development suffers from a lack of investment and quick market uptake of newly approved products. The exit of big pharma from antibiotic development coupled with a lack of investment from venture capitalists and the paucity of enabling regulatory and policy solutions to support the commercial viability of antibacterial agents has pushed AMR into a global health crisis.

Why is the market for antibiotics broken and the drug pipeline ultra thin? Unlike most new drugs, post-approval, new antibiotics are used sparingly (antibiotic stewardship practices) and reserved mainly for cases in which older antibiotics are ineffective. In addition, the reimbursement mechanisms in several countries discourage hospitals from using an expensive novel broad-spectrum antibacterial agent when a cheaper generic option

ity of enabling regulatory and policy solutions to support the commercial viability of antibacterial agents has pushed AMR into a global health crisis.

Why is the market for antibiotics broken and the drug pipeline ultra thin? Unlike most new drugs, post-approval, new antibiotics are used sparingly (antibiotic stewardship practices) and reserved mainly for cases in which older antibiotics are ineffective. In addition, the reimbursement mechanisms in several countries discourage hospitals from using an expensive novel broad-spectrum antibacterial agent when a cheaper generic option

ity of enabling regulatory and policy solutions to support the commercial viability of antibacterial agents has pushed AMR into a global health crisis.

Why is the market for antibiotics broken and the drug pipeline ultra thin? Unlike most new drugs, post-approval, new antibiotics are used sparingly (antibiotic stewardship practices) and reserved mainly for cases in which older antibiotics are ineffective. In addition, the reimbursement mechanisms in several countries discourage hospitals from using an expensive novel broad-spectrum antibacterial agent when a cheaper generic option

ity of enabling regulatory and policy solutions to support the commercial viability of antibacterial agents has pushed AMR into a global health crisis.

Why is the market for antibiotics broken and the drug pipeline ultra thin? Unlike most new drugs, post-approval, new antibiotics are used sparingly (antibiotic stewardship practices) and reserved mainly for cases in which older antibiotics are ineffective. In addition, the reimbursement mechanisms in several countries discourage hospitals from using an expensive novel broad-spectrum antibacterial agent when a cheaper generic option

ity of enabling regulatory and policy solutions to support the commercial viability of antibacterial agents has pushed AMR into a global health crisis.

Why is the market for antibiotics broken and the drug pipeline ultra thin? Unlike most new drugs, post-approval, new antibiotics are used sparingly (antibiotic stewardship practices) and reserved mainly for cases in which older antibiotics are ineffective. In addition, the reimbursement mechanisms in several countries discourage hospitals from using an expensive novel broad-spectrum antibacterial agent when a cheaper generic option

ity of enabling regulatory and policy solutions to support the commercial viability of antibacterial agents has pushed AMR into a global health crisis.

Why is the market for antibiotics broken and the drug pipeline ultra thin? Unlike most new drugs, post-approval, new antibiotics are used sparingly (antibiotic stewardship practices) and reserved mainly for cases in which older antibiotics are ineffective. In addition, the reimbursement mechanisms in several countries discourage hospitals from using an expensive novel broad-spectrum antibacterial agent when a cheaper generic option

ity of enabling regulatory and policy solutions to support the commercial viability of antibacterial agents has pushed AMR into a global health crisis.

Why is the market for antibiotics broken and the drug pipeline ultra thin? Unlike most new drugs, post-approval, new antibiotics are used sparingly (antibiotic stewardship practices) and reserved mainly for cases in which older antibiotics are ineffective. In addition, the reimbursement mechanisms in several countries discourage hospitals from using an expensive novel broad-spectrum antibacterial agent when a cheaper generic option

ity of enabling regulatory and policy solutions to support the commercial viability of antibacterial agents has pushed AMR into a global health crisis.

tion is available. These unique challenges in the current treatment guidelines and archaic reimbursement models contribute to commercial failure and restricted or lack of access for patients in dire need of these life-saving agents.

Most major pharma companies have exited the AMR space because of the low return on investment (ROI). Surprisingly, around 80% of the antibiotics currently in the clinical pipeline are developed by small biotech companies. To reverse this trend, we need immediate solutions and sustainable mechanisms in the long term.

The push-pull model

Small companies are getting early-stage funding from public-private partnerships like CARIX (the Combating Antibiotic Resistance Bacteria Biopharmaceutical Accelerator), which has provided more than \$500 million in funding for 92 antibacterial projects over the past five years. This funding is an example of the push model that has catalysed the creation of a robust pipeline of projects in early discovery.

The pull vector may come from the “Pioneering Antimicrobial Subscriptions to End Upgrading Resistance” (PAS-TEUR) Act, if and when the U.S. government passes it. Companies that develop critically needed antibiotics for drug-resistant infections would receive a federal government contract ranging from \$750 million to \$3 billion spread over ten years.

To incentivise the creation of new treatments, the U.S. Congress enacted the Generating Antibiotic Incentives Now Act (GAIN Act) of 2012, which provides benefits to manufacturers of Qualified Infectious Disease Products (QIDPs) including five years of additional non-patent exclusivity.

In addition, the recent creation of the AMR Action Fund with a mandate to invest more than \$1 billion to address the current funding gaps in the development of new antibiotics will give a boost to late-stage molecules in clinical development.

(Abdul Ghafur is Coordinator, Chemical Declaration on AMR and Consultant in Infectious Diseases, Apollo Cancer Institute, Chennai. Anand Anandkumar is CEO, Bugworks, Bengaluru.)

Which of the above statements are correct?

- (a) 1, 2 and 3 only
- (b) 2 and 3 only
- (c) 1 and 4 only
- (d) 2, 3 and 4 only

Answer:

(b) 2 and 3 only

Explanation:

- **Statement 1:** Incorrect. India ranks **3rd in volume and 14th in value** of pharmaceutical production, not 1st by value.
- **Statement 2:** Correct. Under PMBJP, generic medicines are offered at prices **up to 80% lower** than branded ones.
- **Statement 3:** Correct. A dedicated PLI scheme with ₹6,940 crore focuses on critical raw materials like **Penicillin G** to reduce import dependency.
- **Statement 4:** Incorrect. India supplies **52% of global BCG vaccine demand**, not over 90%.

Mains Model Question :

India's pharmaceutical sector is not just an industry but a cornerstone of the country's healthcare and economic strategy. Discuss the recent growth trends, government initiatives, and global significance of the sector.

India's pharmaceutical sector has emerged as a vital pillar of national health security and a driver of economic growth. Recording a 7.8% year-on-year revenue growth in April 2025, the sector continues to expand on the back of robust domestic demand, global export strength, and strategic policy support. India ranks third globally in pharmaceutical production by volume and fourteenth by value, reflecting its capacity to deliver affordable, high-quality medicines at scale.

The government's focus on self-reliance and affordability is evident in schemes such as the Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PMBJP), which operates over 15,000 Jan Aushadhi Kendras providing generic medicines at prices up to 80% cheaper than branded alternatives. This has significantly enhanced drug accessibility across rural and urban India. Simultaneously, the Production Linked Incentive (PLI) schemes for pharmaceuticals, medical devices, and bulk drugs are encouraging domestic manufacturing of critical drugs and equipment, including high-end cancer and diabetes medicines, MRI machines, and heart implants.

India's role as a global health provider is underscored by its supply of 20% of the world's generic drugs and a majority share in UNICEF's vaccine procurement. The country meets 99% of WHO's DPT vaccine demand, 52% of the BCG vaccine, and 45% of measles vaccines, demonstrating its indispensable role in global immunization.

Furthermore, foreign investment worth ₹12,822 crore in 2023-24 reflects strong global confidence in India's pharma sector. The government's welcoming stance on 100% FDI in greenfield pharma and medical devices projects further boosts this momentum. As India steps into the Amrit Kaal, the pharmaceutical industry stands as a symbol of self-reliant healthcare, economic resilience, and global goodwill, transforming lives not only within the country but across the world.

What draft Bill on regulating medical devices says, and what it does not

ANONNA DUTT
NEW DELHI, JULY 18

THE UNION Health Ministry recently released a draft of The Drugs, Medical Devices and Cosmetics Bill, 2022, proposed to replace The Drugs and Cosmetics Act, 1940, and several sets of Rules by which the industry is currently run. The draft focuses on regulating medical devices as a separate entity, makes provision for fines and imprisonment for injury and death related to clinical trials or investigations, and seeks to regulate e-pharmacies. What else is new?

Online pharmacies

No provisions to regulate online pharmacies exist in the 1940 law or any of the Rules. "Online pharmacies are currently working completely outside the law. Most of these websites have a licence for a physical shop or storage unit. In case of a violation, drug

inspectors do not know under which provision of the law or Rule they can proceed against the websites," said Sandeep Nangia, president of the Retail Distribution Chemist Alliance, and organising secretary of the All India Organisation of Chemists and Druggists (AIODC). "We need either a law or, more simply, a change in the current Rules to regulate e-pharmacies," Nangia said. Also, he said, drug inspectors often find that the licences these websites hold are from another state, over which they have no jurisdiction.

J S Shinde, president of AIODC, said that sometimes the websites don't have any licences at all, and they instead tie up with pharmacies that do, making it even more difficult to take any action. The draft Bill states: "No person shall sell or by any other person in his behalf sell, or stock or exhibit or offer for sale, or distribute, any drug by online mode except under and in accordance with a licence or permission issued in such manner

as may be prescribed."

It states the central government can formulate Rules to regulate aspects of the industry for which the old law has no provisions.

Clinical trials, investigations

The draft Bill makes provisions for compensation to participants or their legal heirs for injury or death suffered in clinical trials and investigations for drugs and medical devices. The draft also lays the onus of providing medical management for any injury arising due to the trial on the investigators.

There is a new provision for imprisonment, and fine amounting to double the compensation amount if the compensation is not paid. If the draft Bill becomes law, these provisions will be part of it, and will not be restricted to just clinical trial Rules.

The draft Bill prohibits clinical trials or clinical investigations of drugs and medical devices without permission from the central licensing authority. While companies have to

seek permission from the regulator to conduct trials even now, this is not specifically mentioned in the existing law.

The draft provides for debarring investigators and sponsors of a trial or investigation if the laid-down provisions are not followed. But this is not enough, and the draft Bill has some critical gaps, independent experts say. "Even the clinical trial Rules have fines, but a few lakhs is not enough to deter a big pharma company. However, the provisions for imprisonment under the draft Bill might act as a deterrent. What the draft Bill completely misses is post-marketing surveillance, especially for medical devices, because implants can remain within a patient's body for years. There should also be provisions for recalling medicines or devices if any issues are detected," said Malini Aisla, co-convenor of All India Drug Action Network, an independent collaboration of non-government organisations working to increase access and improve the rational use of essential medicines.

Medical devices

Under the ambit of medical devices defined by the draft Bill are diagnostic equipment, their software, implants, devices for assistance with disabilities, life support, instruments used for disinfection, and reagents or kits. The 1940 Act has medical devices as one of four categories of "drugs".

To take decisions on regulating medical devices, the draft Bill provides for creating a Medical Devices Technical Advisory Board on the lines of the existing drugs technical advisory board, with people with technical knowledge of these devices, and industry members. Other than Health Ministry officials, the board will have officials from the Department of Atomic Energy, Department of Science and Technology, Ministry of Electronics and Information Technology, DRDO, and experts in biomedical technology, biomaterials, and polymer technology.

However, drawing on the existing law on drugs, the draft Bill defines provisions for im-

prisonment or fines for "adulterated" or "spurious" medical devices. The draft states that a medical device will be considered to be adulterated if it is rusted, corroded, filthy, putrid, or decomposed, packed or stored in unsanitary conditions, contains harmful or toxic substances, or has any component or software removed making it unsafe.

The draft Bill deems a medical device to be spurious if it carries the label of a fictitious company or is purported to be of a manufacturer that has not manufactured it.

Rajiv Nath, forum coordinator of the Association of Indian Medical Devices Industry (AIMDI) said: "These are engineering products, not homogeneous powders, tablets, or liquids that can be adulterated, so treating a rusted part of a medical device as adulterated and criminal offence is absurdity in the making. A law needs to be simple, reasonable, and implementable, and must not become a barrier to Make in India or Innovate in India."

A new legislation that mirrors the old

The New Drugs, Medical Devices and Cosmetics Bill is antiquated and needs to be revised



SANDEEP NANGIA
A RETAIL DISTRIBUTION CHEMIST ALLIANCE (AIODC)



transparency. As citizens, we should not be required to run after the regulator begging for information under the Right to Information Act, 2005. Rather, the law should be written in a way to guarantee proactive disclosure of all crucial documentation related to regulatory decisions. If a new drug is being approved, the regulator should be required to disclose all the data, including clinical trial data. Every time a drug is tested in a government laboratory, the test report should be published on a publicly accessible database. Each inspection for GMP compliance should conclude with an inspection report accessible to the general public. This is the only way to ensure accountability, build public confidence in the regulator. The new law is silent on this critical issue of transparency because it is structured largely on the basis of the original colonial-era legislation. The government must consider revising this law in a way that guarantees transparency by design.

Modern regulatory delegates an incredible amount of power to unselected bureaucrats and technocrats. From a perspective of efficiency, such delegation is required, but from the perspective of accountability, it is a democratic deficit. This is why a modern regulatory system should be designed in a manner that guarantees citizens a right to participate in decision making. Making information available to citizens is only the first step in this process. The next step is to create legal pathways, such as public hearings or citizens' petitions which will enable citizens to participate in the regulatory process and register their objections. For example, every drug approval process should be accompanied by a public hearing to allow doctors and ordinary citizens to question regulators and explain their rationale for approving the new drug. The proposed legislation does not make accommodation for public participation.

Since the present reform process is still in the early days, nobody will fault the Health Ministry for jinking this draft Bill and appointing a new committee of external experts to draft a Bill reflecting the democratic character of an India celebrating its 75th year of independence.

—Dr. Prashant Kulkarni, a senior physician, is a senior

laying down rules and regulations and banning drugs which do not have supporting clinical evidence. A problem with this setup is that States such as Himachal Pradesh, which account for a bulk of pharmaceutical manufacturing on account of a tax holiday, do a poor job in enforcing the Drug and Cosmetics Act. This is not just because of poor state capacity; the fear of scaring away investors by the pharmaceutical industry likely plays a key role in the State's decision to not enforce the law. Since India is a single market, drugs manufactured in Himachal Pradesh are sold across the country and even States with relatively more competent drug regulators, such as Tamil Nadu, Karnataka and Gujarat, can do little to stop the flood of these substandard drugs. Its only the drug controller in Himachal Pradesh who can control manufacturing facilities located in that State. This is the reason that the Madhwal Committee in 2000 had recommended centralising drug regulation across the country. India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

The one issue that has come up in every review of the drug regulatory system since 1947 has been the uneven enforcement of the Drugs and Cosmetics Act across India. This is because, unlike the U.S. which has a single federal agency tasked with enforcing drug regulation across the country, India has 17 agencies for the same job: one in each State and Union Territory along with the Central Drugs Standard Control Organisation (CDSCO), which is under the control of the Union Health Ministry. State drug controllers are expected to conduct enforcement actions such as sampling, testing and prosecution for substandard drugs. The CDSCO's role is limited to regulating imports and to deciding whether new drugs have adequate clinical evidence before they can be sold. Over the years, even the CDSCO has started drawing samples for testing and prosecuting wrong manufacturers. In addition, the Health Ministry is in charge of

Topic : Forging One Force: The Synergy of India's Armed Forces

Relevance : GS Paper 3 Internal Security and Defence

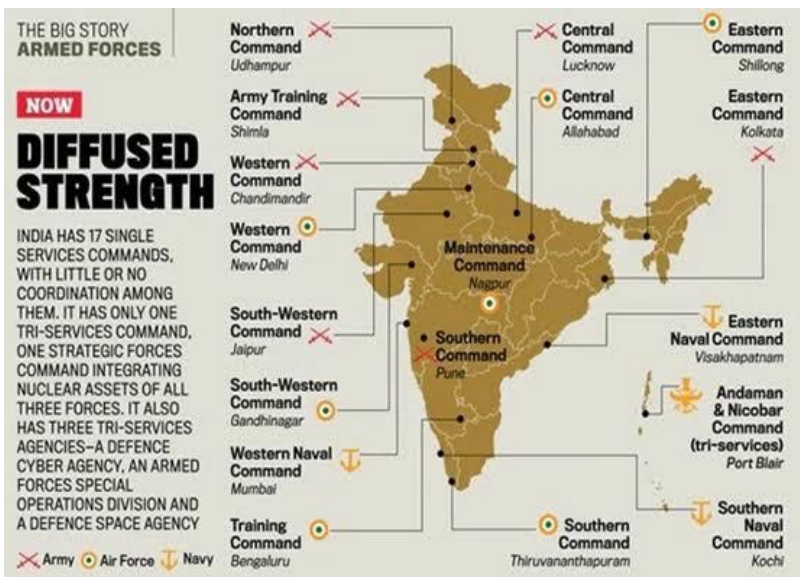
Source : PIB

Context :

In an era where security threats transcend traditional boundaries, modern militaries must function cohesively across land, air, sea, space, and cyberspace. India's response to such multi-domain threats was exemplified in **Operation SINDOOR**, launched on **May 7, 2025**, following a devastating terror attack in Pahalgam, Jammu & Kashmir that claimed 26 civilian lives.

Operation SINDOOR was a meticulously coordinated tri-services campaign against cross-border terrorism and terror infrastructure operating in Pakistan. It marked a significant evolution in

DEL-HYD-B'LORE-PUNE-TPT



<https://pragnyiascoachinghyderabad.com>

+91 9880486671

India's defence preparedness, showing how integrated command and real-time coordination can enable swift, precise, and ethical military retaliation.

Operation SINDOOR: Strategic Precision in a Multi-Domain War

A. Intelligence-Led Targeting and Operational Ethics

- Multi-agency intelligence confirmed nine terror training camps across the LoC and deeper in Pakistan.
- The operation was carefully planned to **minimize collateral damage** and avoid civilian casualties, in line with India's ethical warfare doctrine.
- The use of real-time data and pre-emptive surveillance underscored a shift toward **net-centric warfare**.

B. Air, Land, and Sea Synergy

1. Indian Air Force (IAF):

- Launched targeted airstrikes on terror hubs including **Nur Khan and Rahimyar Khan airbases**.
- Utilized indigenously developed **Akash missile systems** and legacy platforms like Pechora and OSA-AK in layered air defence.
- The **Integrated Air Command and Control System (IACCS)** allowed real-time coordination and response to drone and UAV attacks.

2. Indian Army:





- Coordinated closely with IAF in **air defence roles**, employing:
 - MANPADS**
 - Low-level air defence (LLAD) guns**
 - Long-range SAMs**
- These systems neutralized loitering munitions and drone swarms launched by Pakistan.

3. Indian Navy:

- Deployed **Carrier Battle Groups (CBG)** with **MiG-29K** fighters and AEW helicopters.
- Asserted dominance over the **Makran coast**, bottle-necking Pakistani air and naval manoeuvres.
- Conducted **24/7 maritime surveillance**, enhancing India's strategic control in the Indian Ocean Region (IOR).

4. Border Security Force (BSF):

- Played a critical role in intercepting infiltration attempts in the **Samba sector**, neutralizing militants and securing border zones.

Types of Warfare	meaning and Examples
 Information warfare	Management and use of information to pursue an advantage in offensive or defensive strategies E.g. Deep fake Technology, Narratives Warfare
 Electronic Warfare	Capability to disrupt enemy's defences and protect our own with use of electromagnetic spectrum E.g. Directed Energy Systems
 Weaponisation of Space	Placing of space based devices in orbit having destructive capabilities E.g. Development of Anti Satellite Weapons
 Cyber Warfare	Use of internet to attack information system destabilising financial systems, energy grid etc.

Institutional Reforms Driving Jointness and Integration

Chief of Defence Staff (CDS)

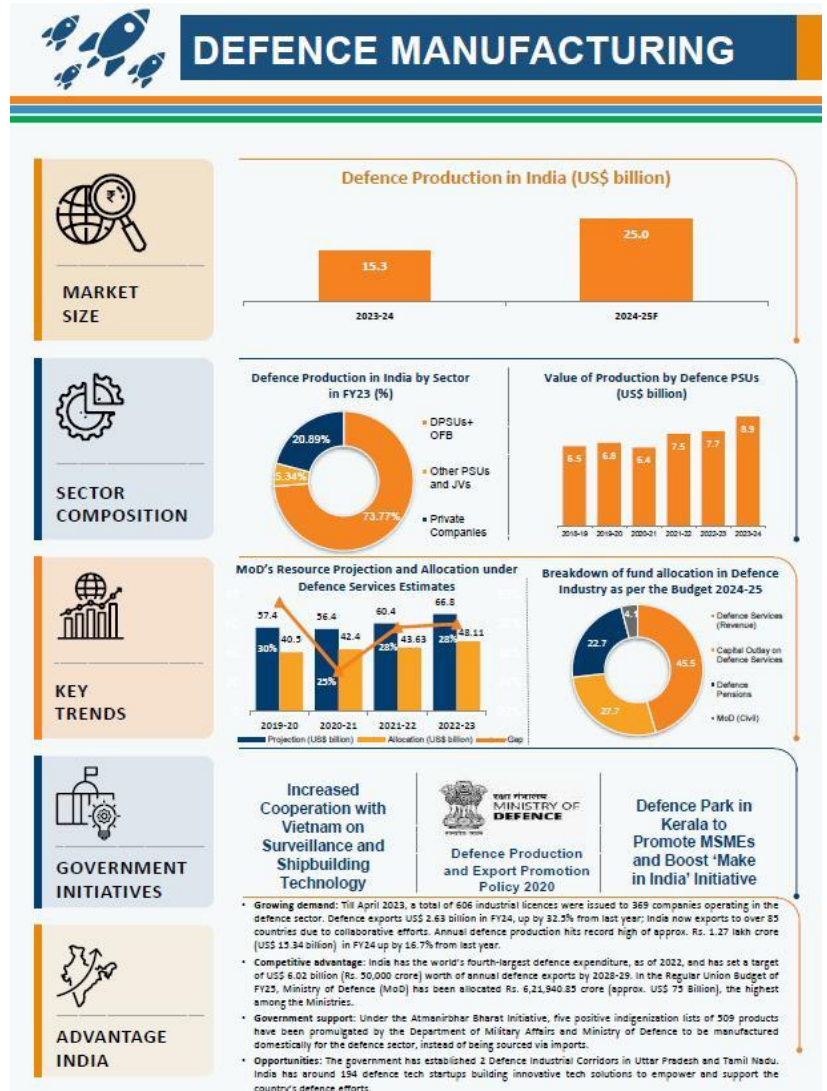
- Established in **December 2019**, the CDS acts as:
 - Principal military advisor to the Defence Minister.
 - Head of the **Department of Military Affairs (DMA)**.
 - Coordinator of **joint planning, training, and logistics** among the three services.
- The CDS is crucial for transitioning from service-specific strategies to **tri-service command structures**.

Department of Military Affairs (DMA)

- Created in **2020** to:
 - Promote **jointness in procurement, training, and staffing**.
 - Enable restructuring of military commands.
 - Support establishment of **Integrated Theatre Commands (ITCs)**.
- It houses the integrated headquarters of the Army, Navy, and Air Force, ensuring coordinated planning.

Integrated Theatre Commands (ITCs)

- Aim to unify operations based on **geographic and functional theatres**.
- Enable commanders to focus solely on operational objectives, while administrative functions are separated.
- Envision integration of **space, cyber, and electronic warfare** under one unified command.



Technology	Application
Autonomous technologies, such as robots and drones	Undertake dangerous tasks like strikes or repetitive tasks
Block Chain, Cloud Computing	To make communication and data transfer seamless, secure and fast
AI and Big Data Analytics	For surveillance, reconnaissance , and Strengthening situational awareness
Nano-Technology	To create self-healing and adaptive camouflage materials , smart skin etc.
New weapons technology	<ul style="list-style-type: none"> Directed energy weapons (High Power Lasers and High-Power Microwaves): Use focused energy to destroy, degrade or neutralize a target. Loiter Munitions (E.g Kamikaze drones): Loiters around an area, locate the target and then crash into it

Inter-Services Organisations Act, 2023

- Provides legal backing for **unified command and control** within tri-service formations.
- Grants disciplinary powers to **tri-service commanders** over personnel from all branches.
- Facilitates cultural integration while retaining service-specific identities.

Enhancing Operational Readiness and Logistical Efficiency

Joint Logistics Nodes (JLNs)

- Operational in **Mumbai, Guwahati, and Port Blair** since 2021.
- Provide shared logistics for:
 - Small arms, ammunition
 - Rations and fuel
 - Engineering and transport support
- This results in **cost savings, manpower efficiency**, and synchronized deployment.



The participation of women in the Indian Armed Forces has a long history dating back to 1888, when the Indian Military Nursing Service was formed. In the initial years, women's roles were merely subjected to those of medical professionals, such as serving as trained nurses and even doctors in major historical events like the First World War.



Building a Culture of Joint Thinking and Strategic Foresight

Joint Training Courses & Seminars

- **Future Warfare Course:**
 - Curated by the CDS for officers from Major to Major General ranks.
 - Covers AI, cyber warfare, space defence, and emerging technologies.
 - Second edition conducted in April–May 2025 at Manekshaw Centre.
- **Defence Services Technical Staff Course (DSTSC):**
 - Held at MILIT, Pune, with participants from all services and friendly nations.
 - Focused on **techno-strategic leadership** and **Atmanirbharta (self-reliance)** in defence.
- **Parivartan Chintan Conference (April 2024):**
 - A brainstorming platform for innovation in defence jointness and integration.
- **Seminar on Synergising Air and Naval Forces (Feb 2025):**
 - Emphasized joint maritime air operations and combat synergy in the Indian Ocean Region.

Integrated Tri-Service Exercises

Exercise Prachand Prahar 2025

- Held in **Arunachal Pradesh** (March 25–27, 2025).
- Involved tri-service integration for surveillance, firepower, and real-time battlefield control in high-altitude terrain.

Exercise Desert Hunt 2025

- Conducted at **AF Station Jodhpur**.
- Involved Special Forces from all three services.

Change of guard

The Army Headquarters (AHQ) will be reorganised as part of a bigger transformation of the force

How the AHQ is restructured:

At present: Two Deputy Chiefs for:

1. Information systems & training
2. Planning and systems

After change: Three Deputy Chiefs for: 1. Sustenance 2. Strategy 3. Information systems

- Director General (DG), Rashtriya Rifles, to move to Udhampur under an Additional Director General (ADG)
- New post of 'ADG Vigilance' to be created. Will report to Army Chief

- Army Training Command based in Shimla to be moved to Meerut

- New 'ADG Human Resources' will track investigations and action on HR violations

- Number of officers in AHQ to come down by over 200. Young officers to be posted out to field areas



DEFENCE BUDGET 2025

#VIKSBHARATBUDGET

MODERNISATION OF ARMED FORCES

- ₹1.8 Lakh Cr allocated under capital Budget – **4.65% increase from FY 2024–25.**
- ₹1,48,722.80 Cr for Capital acquisition, strengthening combat capabilities.
- ₹31,277.20 Cr for R&D and Infrastructure development.

- Tested interoperability, night-time operations, and rapid mobility in desert warfare scenarios.

India's Strategic Leap Forward

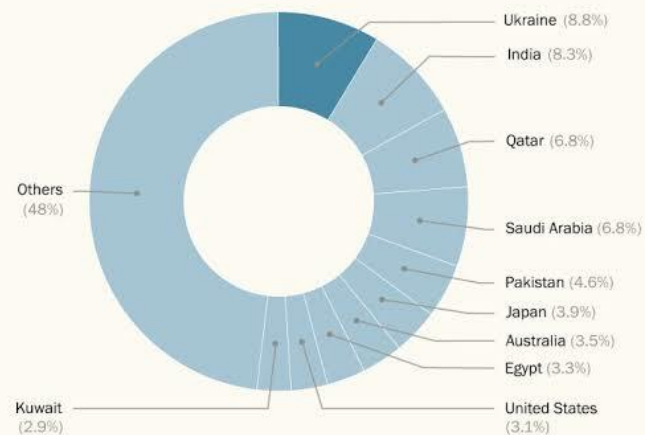
Operation SINDOOR marks a **watershed moment** in India's military history, where coordinated, ethical, and high-impact operations showcased not just retaliation, but a robust national security posture. India has transitioned into a **synergized force**—unified not just in command but in vision.

The success of this tri-service operation underscores:

- The importance of **jointness in warfare**,
- The credibility of **multi-domain integration**, and
- The strategic maturity of India as a regional power.

With sustained government support, legal reforms, logistical integration, and investment in technology and training, India is forging a truly unified military—capable, future-ready, and resolute in defending its sovereignty.

Global share of imports of major arms by the 10 largest importers, 2020–24



Source: SIPRI Arms Transfers Database, Mar. 2025.

www.sipri.org
© SIPRI 2025

Prelims Practice Question:

Q. With reference to India's recent advancements in joint military operations, consider the following statements:

1. The Inter-Services Organisations (Command, Control and Discipline) Act, 2023 empowers theatre commanders to exercise disciplinary control over personnel from all three services.
2. The Department of Military Affairs (DMA) was established to facilitate jointness in logistics, procurement, and human resource management.
3. Operation SINDOOR involved coordinated actions by the Indian Army, Navy, and Air Force against terrorist targets across the border.
4. The Integrated Air Command and Control System (IACCS) is operated by the Indian Army to coordinate air defence operations.

Which of the above statements are correct?

- (a) 1, 2 and 3 only
- (b) 1, 2 and 4 only
- (c) 2, 3 and 4 only
- (d) 1, 3 and 4 only

Answer: (a) 1, 2 and 3 only

Explanation:

- **Statement 1: Correct.** The Inter-Services Organisations Act, 2023 enables joint commanders to exercise disciplinary powers over personnel from all three services.
- **Statement 2: Correct.** The Department of Military Affairs (DMA) was created to institutionalize jointness in logistics, procurement, and HR functions.
- **Statement 3: Correct.** Operation SINDOOR was a tri-service operation involving coordinated action by the Army, Navy, and Air Force.
- **Statement 4: Incorrect.** The Integrated Air Command and Control System (IACCS) is operated by the **Indian Air Force**, not the Army.

Mains Model Question:

Q. Discuss the significance of India's move towards integrated theatre commands and jointness in military operations. What challenges does this transformation pose, and how is India addressing them?

India's push towards integrated theatre commands and jointness in military operations marks a paradigm shift in its defence architecture. Traditionally, the Indian Army, Navy, and Air Force have operated in silos with limited coordination beyond high-level strategic planning. This compartmentalization often led to inefficiencies in resource deployment, response time, and operational cohesion. However, recent geopolitical realities, including the threat of a two-front war and rapid technological advancements in warfare, have made it imperative for India to adopt a more unified approach.

The creation of the Department of Military Affairs (DMA) in 2019 and the appointment of the Chief of Defence Staff (CDS) have been crucial reforms aimed at fostering jointness. The Inter-Services Organisations (Command, Control and Discipline) Act, 2023, further reinforces this by allowing theatre commanders disciplinary control over personnel from all services, thereby streamlining command structures. Operational exercises such as Operation SINDOOR and increased emphasis on tri-service commands in the Andaman and Nicobar Islands reflect India's commitment to integrating its forces.

However, the path to jointness is not without challenges. There is institutional resistance due to entrenched service-specific doctrines and concerns over loss of autonomy. The absence of a fully evolved doctrinal framework for joint operations and disparities in technological capabilities across the services also pose difficulties. Moreover, integration requires significant infrastructure, interoperability in communication systems, and a shift in training and mindset, which takes time and sustained effort.

India is addressing these issues through phased reforms, encouraging joint training programs, and enhancing communication interoperability through platforms like the Integrated Air Command and Control System (IACCS). The vision is to create theatre-specific commands with unified leadership that can respond swiftly and effectively to any threat.

Ultimately, India's move towards integrated theatre commands aims to enhance operational synergy, cost-efficiency, and strategic deterrence in an increasingly complex security environment.

Topic : Solid-State Lithium-Ion Battery Failures: A Breakthrough in Understanding

Relevance : GS Paper 3 Science and Technology

Source : The Hindu

Context :

Lithium-ion (Li-ion) batteries are the backbone of modern energy storage. Powering everything from smartphones to electric vehicles, these batteries function by shuttling lithium ions between a positive cathode and a negative anode through an electrolyte. Traditionally, this electrolyte is a liquid that allows ion flow while preventing short circuits.

To improve safety and performance, **Solid-State Batteries (SSBs)** replace this liquid with a solid ceramic or polymer electrolyte. These are compact, non-flammable, longer-lasting, and capable of higher energy densities. SSBs are already in use in high-precision instruments like pacemakers and smartwatches, and are expected to revolutionize electric mobility and grid-scale storage.

Dendrite Formation: The Core Problem in SSBs

Despite their promise, SSBs suffer from a key issue: **spontaneous short-circuits**. This failure mode has puzzled scientists for years. Even under low currents, SSBs can fail unexpectedly. The culprit lies in **dendrite formation** — tree-like structures of lithium that grow within the battery during charging cycles.

Cause of pesky failure mode in solid state Li-ion batteries found

While these batteries are safer to operate, they have a tendency to short-circuit even with small currents; new research has found the answer in the dendrite growth

Ummati Ashar

Scientists have reported in *Science* that the key to fixing solid-state battery (SSB) failures may lie in well-documented mechanical laws, paving the way for longer operational lifetimes.

A battery consists of an electrolyte sandwiched between the positive cathode and the negative anode. "In most batteries, this electrolyte is a liquid solution, very similar to salt in water, that allows ions to move back and forth from the electrodes," said Naga Phani B. Aetukuri, an associate professor at the Indian Institute of Science, Bengaluru, not involved in the new study. His team is among the top groups in India developing SSBs.

In a battery, ions move freely through the electrolyte while electrons flow from the cathode to the anode via an external circuit, charging the battery. In the reverse process, the electrons given up by the lithium (Li) anode travel to the cathode via the external circuit, powering it. Inside the battery, the corresponding lithium ions scurry to the cathode through the electrolyte during discharge.

In an SSB Li-ion battery, a ceramic block is the electrolyte. Solid electrolytes last longer, can store more energy, and are neither volatile nor flammable. Their

Small cause, big effect

Examining a battery under a scanning electron microscope while it operated was key

- 1 Solid-state batteries (SSBs) use solid electrolytes, offering longer life, higher energy density, and better safety than liquid ones
- 2 In SSBs, lithium dendrites form on the anode and pierce the electrolyte, short-circuiting the battery over time
- 3 Researchers found this failure mode may stem from metal fatigue, similar to mechanical stress in engineering materials
- 4 Operando electron microscopy showed voids and cracks at the anode-electrolyte interface during repeated charge-discharge cycles
- 5 Even low charge-discharge rates were found to cause structural fatigue, eventually breaking the electrolyte
- 6 The new findings could improve predictive models for SSB reliability, enhancing future battery design and performance

A batch of Li-ion coin cells being tested

U.S. Faculty of Mechanical and Physical Sciences

solid structure separates the two electrodes well, reducing the need for bulky safety equipment and their weight. Currently, pacemakers and smartwatches use SSBs. On the flip side, solids can crack, so solid electrolytes are inhospitable to volume changes or higher stress. This causes a persistent problem called dendrite growth. Li ions shuttle to the anode while charging and are deposited there, forming lithium filaments at the anode.

"Have you ever seen hairy roots growing from a central root? This occurs in plants to maximise their ability to receive nutrients," Aetukuri said. Like a plant root, the anode tries to absorb as many ions as it can. "The dendritic growth of Li in SSBs maximises the anode's ability to receive the most Li ions coming its way." But like roots penetrate rocks, the dendrites pierce the electrolyte layer and reach the cathode, creating a short circuit. Scientists don't know the actual physical mechanism that causes such a failure. Now, researchers from Tongji University in Shanghai and other institutions have said the answer may lie in a known mechanical problem. Metallic materials undergo fatigue due to cyclic loading and unloading. Cracks and fractures from fatigue account for over 80% of engineering failures. The researchers surmised that, as a metal, the Li anode in a battery could suffer similar damage.

Dendrites "are microscopic features, meaning you need a microscope to visualise them. And you

need to see while they are growing — that is when the cell is under operation," Aetukuri said. For this, scientists use a technique called operando scanning electron microscopy: "a special microscopy technique where electrons are the light that lets you see what is happening at small dimensions."

The researchers observed the anode-electrolyte interface under this microscope, monitoring its evolution as they charged and discharged the coin cell. The cell was initially stable, but after 30 minutes, microscopic voids broke out, swelled, and snowballed into each other. The electrolyte finally snapped and the cell was short-circuited at the 145th cycle even though the amount of current was just a tenth of the maximum

the cell could tolerate.

"Applying a small current in one direction may not lead to failure, but repeated cycles of charging and discharging can form structural defects," a commentary published alongside the paper noted. As the battery underwent charge-discharge cycles, Li was stripped away from the anode before being plated back onto it, altering the amount of force exerted on the anode.

"We determined that failure of SSBs is closely linked to the fatigue of the [Li anode], which markedly contributes to interface degradation and dendrite growth," the researchers wrote in their paper.

"You can cut a wire by using a cutter in a single go. ... If you don't have a cutter, you could bend the wire back and forth multiple times and the wire just breaks after a few times due to fatigue," Aetukuri said. "This work shows that cycling the cell at low rates, equivalent to applying a low stress multiple times, can also lead to cell failure."

"While not a lot might change in manufacturing, battery models that predict SSB failures will be a lot more sophisticated and likely more accurate due to this work," Aetukuri said. The researchers wrote that future studies should investigate how Li's stress-strain relationship varies with cycling rate and temperature.

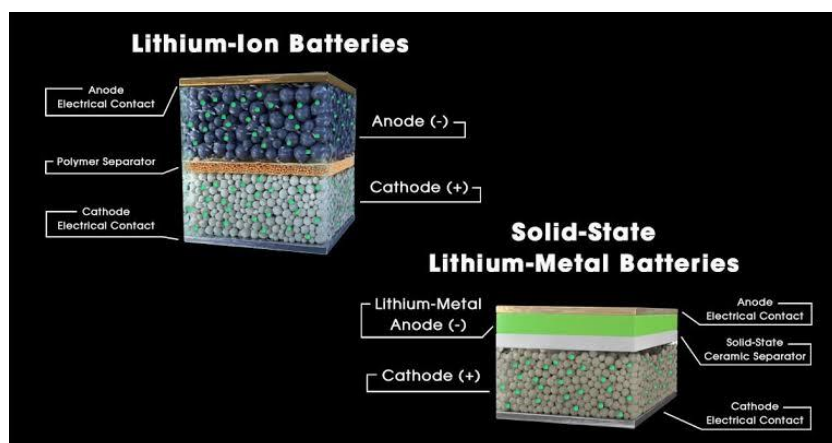
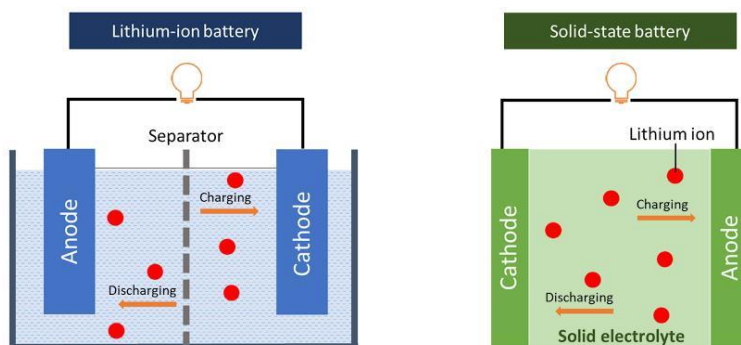
Ummati Ashar is a freelance science journalist

As lithium ions deposit onto the anode, they form thin metallic filaments. Over time, these dendrites can grow long enough to pierce the solid electrolyte and reach the cathode. This creates a direct electronic path, short-circuiting the battery and rendering it unsafe or unusable.

New Discovery: Fatigue as the Underlying Cause

Recent research by scientists from Tongji University, published in *Science*, has linked this failure to **mechanical fatigue**, a phenomenon well-known in metallurgy. Repeated cycling of the battery — i.e., charging and discharging — puts stress on the lithium anode. Over time, this **cyclic stress** creates microscopic voids at the interface between the anode and the electrolyte.

Using a real-time imaging technique known as **operando scanning electron microscopy**, researchers observed these micro-voids evolve. Initially stable, the interface broke down after several charge-discharge cycles. The solid electrolyte fractured and ultimately led to internal shorting of the cell — all with just one-tenth of the current it was rated to handle.



Understanding Mechanical Fatigue in Batteries

Mechanical fatigue refers to the gradual weakening of materials due to repeated loading and unloading. Much like bending a wire repeatedly until it snaps, **repetitive lithium deposition and stripping** weakens the anode. Even low-stress cycling eventually leads to internal structural failure.

The researchers concluded that this fatigue is not just incidental but a **primary contributor to dendrite growth and battery failure**. This breakthrough understanding could pave the way for more accurate battery models and safer designs.

The Role and Importance of Lithium-Ion Batteries Today

Li-ion batteries are central to the modern digital and clean energy economy. Their high energy-to-weight ratio, efficiency, and fast rechargeability make them ideal for:

- Consumer electronics (smartphones, laptops)
- Electric vehicles (EVs)
- Grid energy storage for renewable power
- Aerospace, military, and medical applications

With rising climate goals and fossil fuel substitution, battery technologies are enabling a **transition to sustainable energy systems**.

The Rise of Solid-State Batteries (SSBs)

SSBs are considered the next generation of battery tech. Their advantages over traditional Li-ion batteries include:

- Greater safety (non-flammable solid electrolytes)
- Higher energy density (potentially doubling range in EVs)
- Longer operational life and minimal maintenance
- Compact and lightweight designs

However, challenges like dendrite growth, manufacturing cost, and material limitations remain to be solved before widespread adoption.

India's Policy Initiatives and Battery Strategy

India is heavily investing in battery technology to support its clean mobility and energy goals.

1. National Mission on Transformative Mobility and Battery Storage (2019)

Aims to localize battery manufacturing and create a strong supply chain for electric mobility and grid storage applications.

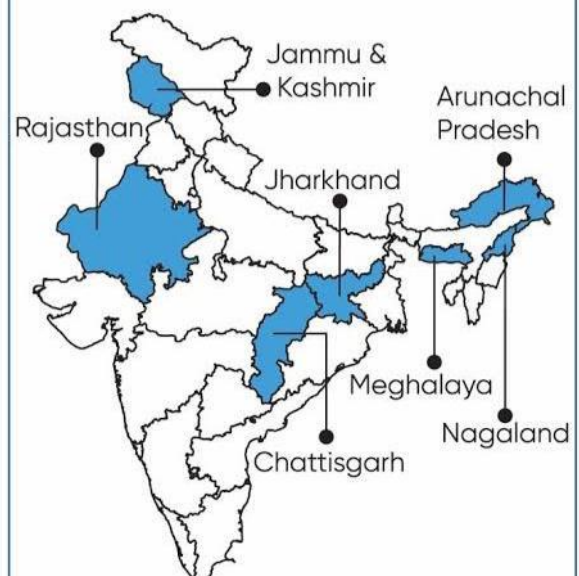
2. Production Linked Incentive (PLI) Scheme for Advanced Chemistry Cells

With an outlay of ₹18,100 crore, this scheme supports domestic battery production of 50 GWh. Technologies like SSBs and advanced Li-ion are eligible. Key players include Reliance, Ola, Amara Raja, and others.

Usage of Lithium

	Rechargeable batteries for mobile phones, laptops, digital cameras and electric vehicles
	Non-rechargeable batteries for things like heart pacemakers, toys and clocks
	Magnesium-lithium alloy is used for armour plating
	Aluminium-lithium alloys are used in aircraft, bicycle frames and high-speed trains
	Lithium oxide is used in special glasses and glass ceramics
	Lithium chloride is one of the most hygroscopic materials known, and is used in air conditioning and industrial drying system
	Lithium stearate is used as an all-purpose and high-temperature lubricant.

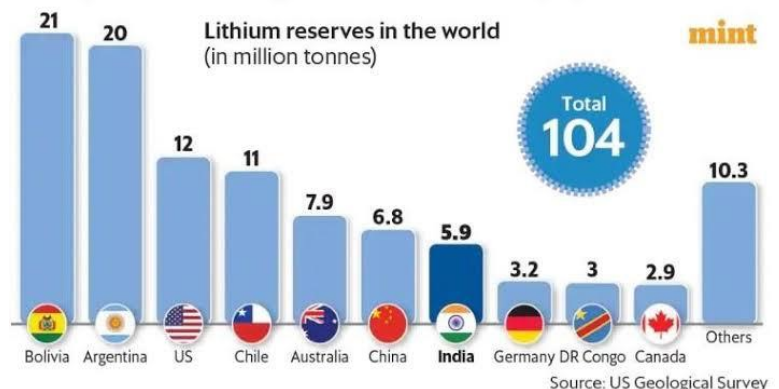
Lithium in India



Note: During field season programme 2022-23, GSI has taken up 18 projects on Lithium and associated elements in these states.

Fields of white gold

India may account for 5.7% of global reserves if the discovery in J&K is confirmed.



3. FAME India Scheme (Faster Adoption and Manufacturing of Electric Vehicles)

Promotes adoption of EVs by providing incentives for electric two-wheelers, three-wheelers, and buses. It indirectly boosts demand for Li-ion batteries.

4. National Electric Mobility Mission Plan (NEMMP)

Focuses on achieving mass EV adoption by 2030. Emphasis is placed on improving battery cost, availability, and safety.

Challenges Facing India in Battery Technology

India faces critical hurdles in achieving battery independence:

- **Raw Material Scarcity:** India imports most of its lithium and cobalt from countries like Australia, Chile, and Congo.
- **Technological Dependence:** Much of India's battery R&D still depends on foreign patents and technologies.
- **Recycling Infrastructure:** E-waste from batteries poses a major environmental risk. India lacks efficient battery recycling systems.
- **High Cost and Scale-up Barriers:** Manufacturing solid-state batteries at scale is expensive and technically challenging.

Future Roadmap: What Needs to Be Done

To build a robust battery ecosystem, India must:

- **Strengthen Resource Diplomacy:** Secure lithium supply from friendly nations like Australia, Argentina, and Bolivia.
- **Enhance R&D:** Focus on indigenous innovation via

Battery storage potential to be 600 GWh by 2030: NITI report

With demand for EVs, stationary storage and consumer electronics driving adoption, India will have battery storage potential of 600 GWh by 2030, a NITI Aayog report said

16% Expected compound annual growth rate (CAGR) in global battery demand through 2020-30

25% CAGR in global demand for batteries between 2010 and 2020, reaching an annual demand of about 730 gigawatt hour (GWh)



LIB energy storage consumption of different segments in 2020:

4.5 GWh: Consumer electronics
0.92 GWh: EV sales, around 10% of market

Expected key drivers in growth of battery demand:

- Electrification of transportation
- Battery energy storage in electricity grids

In India, the estimated cumulative stock of lithium-ion batteries (LIBs) in 2020 was about 15 GWh

Source: NITI Aayog/PTI

Sanan V Shankar
Navin Mittal
Lakshmi Valdeeswaran
Introduction

After years of research, Lithium Ion Batteries (LIBs) have established themselves as the unique, preferred means to store power. From handheld camcorders to smartphones, laptops to electric vehicles and space stations, large power plants to home UPS devices, LIBs find a variety of applications. The small size of the batteries, light weight, affordability and the ability to sustain multiple charge cycles make LIBs a popular choice for energy storage.

The growth in use is propelled by megatrends such as climate-driven sustainability, immense infrastructure growth, ever-expanding communications and digitisation. First developed in the 1970s they are now used extensively in commercial electric vehicles (EV). By 2025, in value terms, the global demand for LIBs is likely to cross about \$100 billion with the automobile sector leading as the fastest growing consumer.

Two key aspects of safety and sustainability continue to pose impediments in the growth envisaged in LIB usage. In India, reports of fatality and material loss due to fire from LIBs are on the rise. While not much data from India is available from battery waste, recycling associations overseas clearly report an unexpected increase in the number of fires, most of it attributable to LIBs.

Concern around sustainability and lifecycle management of LIBs necessitates consideration in two dimensions: (1) Will our mines be able to cater to the growing demand of metals required for these batteries? and (2) Can countries find environmentally sustainable solutions to deal with the mountains of garbage created by end-of-life batteries?

(i) **Safety:** The EV sector is unique and is bracing through several demands that have an overall bearing on the safety of the vehicles. First pertains to delivering vehicles that are not just sleek, slim and light weight in design but also those that offer maximum range and performance.

Second pertains to meeting fast charging expectations. Both range and fast charging aspects require thorough understanding all the way from the metal chemistries to the overall LIB system level.

Third is the ever evolving metal compositions that offer high performance and affordability. As batteries constitute a significant part of the EV cost, cheaper metals and



Challenges of lithium ion batteries

FOR SUSTAINABILITY. The partial recovery model must give way to a circular economy one where all metals are recycled

components (including battery management systems) ensure viability in a highly competitive market.

Design of EVs is complex. Unlike traditional practices, design of EVs is integrated with that of the battery and its components. The customisations on the battery end get only more complex with new features, swappable battery options and connectivity requirements as in the case of autonomous cars.

Notwithstanding all of the above, EVs also need an accelerated go-to-market approach to cater to the sustainability goals driven by organisations and nations across the world.

(ii) **Environmental sustainability:** According to predictions, the volume of the end-of-life LIBs is likely to increase from 705,000 tonnes in 2025 to about 9 million tonnes by 2040. As the long-term sustainability of depending on primary mineral sources (mines) is in question, recycling is key.

similar to the incidents that have been witnessed recently.

Design of EVs is complex. Unlike traditional practices, design of EVs is integrated with that of the battery and its components. The customisations on the battery end get only more complex with new features, swappable battery options and connectivity requirements as in the case of autonomous cars.

Notwithstanding all of the above, EVs also need an accelerated go-to-market approach to cater to the sustainability goals driven by organisations and nations across the world.

Some of the world's largest battery OEMs procure their own end-of-life products for recycling. Rather than recover each metal separately, they recover them as alloys or aggregates. However, as metal chemistries between newer generations of batteries are different from those manufactured 7-10 years ago (average lifetime of LIBs), the long-term viability of such an approach poses quite some evolutionary risk.

PARTIAL RECOVERY
Most recycling processes today practise partial recovery wherein only high-margin metals are recovered from waste; the rest is discarded. This results in a loss of economic opportunity for nations, most of which continue to rely on high-cost imports. It also provides little economic incentive for other recyclers to recover low-margin metals from the discarded waste.

Measures to mitigate the environmental, social and financial impacts of LIB waste are being rolled out and on August 24, the government notified the Battery Waste Management Rules 2022 to manage a wide range of batteries that include LIBs. The mechanism of "Extended Producer Responsibility" (EPR) increases the accountability battery manufacturers need to assume towards collection, refurbishment/recycle of batteries. This move is expected to accelerate the development of infrastructure for waste collection and improve recycling rates from the mere 5-9 per cent, as it stands today.

A mandated minimum percentage of recycled material in all products also opens doors for new technologies to be adopted. The need of the hour is to accelerate the development of circular economy solutions that recycle all the metals and facilitate a cradle-to-cradle (infinite loop) approach.

The ultimate goal is to meet sustainability goals and deploy technologies/best practices that reduce dependency on primary ores. Unless that is done, partial recovery of metals or export of black powder (crushed battery waste) for recovery will continue.

The yawning gap between technology readiness that addresses both sustainability and safety issues in LIBs cannot be solved overnight. A strong collaboration among technologists, policy-makers and governments is required to help manage the 'EV revolution'. Unless this is done, it will be a bumpy ride, which because of sheer scale will leave a large negative impact in the journey towards a safe and sustainable future.

Conclusion
Mittal and Valdeeswaran are technology innovators and Shankar is a science enthusiast

institutions like IISc, CSIR-CECRI, and ARCI.

- **Support Battery Recycling:** Develop a circular economy by encouraging battery collection and reuse.
- **Invest in Solid-State Research:** Promote deeper investigation into fatigue resistance, stress-strain mapping, and failure modeling in SSBs.

A Critical Step in Battery Innovation

The discovery that **mechanical fatigue leads to dendrite growth in solid-state lithium batteries** is a significant scientific milestone. It demystifies a long-standing failure mode and opens up new paths for design improvement. As India pushes for electric mobility and energy security, addressing these failure mechanisms will be key to developing reliable, high-performance, and domestically produced batteries.

Prelims Practice Question:

Q. With reference to Solid-State Lithium-ion Batteries (SSBs), consider the following statements:

1. Solid electrolytes in SSBs reduce the risk of flammability compared to conventional liquid electrolytes.
2. Dendrite formation in SSBs occurs due to high voltage overload during a single charge cycle.
3. Recent research has linked the failure of SSBs to mechanical fatigue of the lithium anode due to repeated charge-discharge cycles.
4. SSBs are currently widely used in electric vehicles and heavy industrial machinery.

Which of the statements given above are correct?

- A. 1 and 3 only
- B. 2 and 4 only
- C. 1, 2 and 3 only
- D. 1, 3 and 4 only

Answer: A. 1 and 3 only

Explanation:

- **Statement 1 is correct:** Solid electrolytes are non-volatile and non-flammable, reducing fire risk in batteries.
- **Statement 2 is incorrect:** Dendrite formation is not due to high voltage overload in a single cycle, but due to repeated stress (mechanical fatigue) from cycling.
- **Statement 3 is correct:** The recent discovery attributes SSB failure to mechanical fatigue of the Li anode caused by repeated charge-discharge cycles.
- **Statement 4 is incorrect:** SSBs are not yet widely used in EVs or heavy machinery; they are currently limited to devices like pacemakers and smartwatches.

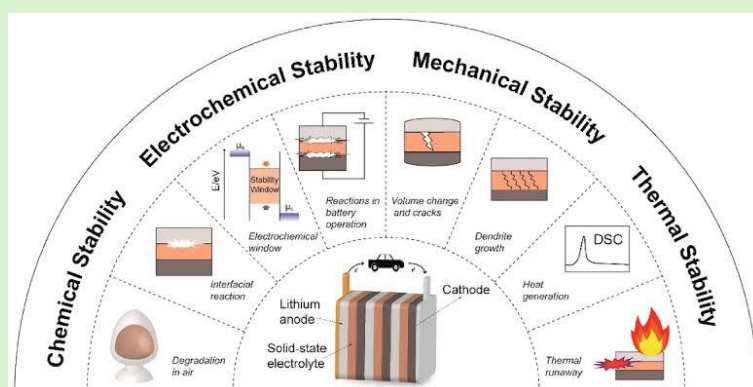
Mains Model Question

Discuss the recent findings on the failure mechanisms of solid-state lithium-ion batteries. How do these findings impact the future development of battery technology, particularly in the context of India's push for electric mobility and energy security?

Solid-state lithium-ion batteries (SSBs) represent a promising advancement over conventional lithium-ion batteries due to their improved safety, higher energy density, and longer lifespan. Unlike traditional batteries that use liquid electrolytes, SSBs employ a solid ceramic or polymer electrolyte, making them less flammable and more compact. However, despite these advantages, a persistent issue of spontaneous short-circuits has limited their widespread adoption.



Recent research published in *Science* has shed light on the core reason behind this failure mode: mechanical fatigue of the lithium anode caused by repeated charging and discharging cycles. This fatigue leads to the formation and growth of dendrites—needle-like lithium filaments—that penetrate the solid electrolyte, causing internal short circuits. Using advanced operando scanning electron microscopy, researchers observed that microscopic voids form and grow at the anode-electrolyte interface during cyclic stress, eventually fracturing the electrolyte and shorting the cell even at low current levels.



Understanding that mechanical fatigue, rather than isolated high voltage or single-cycle overload, drives dendrite formation is a significant breakthrough. It means that battery models can now incorporate these mechanical effects to predict failure more accurately and guide the design of more robust SSBs.

For India, which aims to transition aggressively towards electric mobility under initiatives like the National Electric Mobility Mission Plan and the Production Linked Incentive scheme for battery manufacturing, this insight is crucial. Solid-state batteries promise safer, more energy-dense alternatives to existing lithium-ion technology. However, overcoming fatigue-related failures will be key to commercial viability.

India's ongoing focus on indigenous battery R&D, securing raw materials, and scaling up manufacturing will benefit from integrating this new understanding. Improved battery longevity and safety will accelerate EV adoption and energy storage solutions, furthering India's climate and energy security goals. Thus, addressing mechanical fatigue in SSBs is not only a scientific milestone but also a strategic imperative for India's clean energy future.

Topic : National Manuscripts Mission (NMM)

Relevance : GS Paper 1 History and Culture

Source : Indian Express

Context :

The **National Manuscripts Mission (NMM)** is an initiative by the Government of India aimed at preserving and promoting the vast manuscript heritage of the country. Manuscripts here refer to handwritten documents, often ancient or medieval texts, encompassing a wide range of subjects such as literature, science, medicine, philosophy, history, art, and religion. These manuscripts are invaluable for understanding India's rich cultural, intellectual, and historical legacy.

PM to launch revamped National Manuscripts Mission on June 9

Sreeparna Chakrabarty
NEW DELHI

Prime Minister Narendra Modi will on June 9 launch the revamped National Manuscripts Mission, announced in the Union Budget for 2025-26.

The Gyan Bharatam Mission, which is expected to cover more than one crore manuscripts, would be responsible for the survey, documentation, and conservation of India's manuscript heritage lying with academic institutions, museums, libraries, and private collectors.



Manuscripts will be digitised with the help of the NMM at the Oriental Research Institute, Mysuru. M.A. SRIRAM

To accommodate this new initiative, the Union Budget had hiked the bud-

getary allocation for the existing National Manuscripts Mission (NMM) from ₹3.5 crore to ₹60 crore.

Sources told *The Hindu* that a series of meetings, helmed by the Union Culture Secretary, had taken place to finalise the contours of the new organisation being set up and it was expected to be launched on June 9 by the Prime Minister.

The Hindu had reported last October that the Union Culture Ministry was set to "revive and relaunch" the NMM and

mulling over the formation of an autonomous body to help preserve ancient texts in India.

The NMM is part of the Indira Gandhi National Centre for the Arts. It was set up in 2003, but had not taken off as expected.

3 lakh titles digitised
According to sources, the NMM has till date prepared a metadata of 52 lakh manuscripts and roughly over three lakh titles have been digitised. However, only one-third of them have been uploaded.

Established in 2003 under the **Indira Gandhi National Centre for the Arts (IGNCA)**, the NMM was envisioned to survey, document, conserve, and digitise manuscripts spread across India. Manuscripts are found in academic institutions, museums, libraries, and in the possession of private collectors. Despite the abundance of these texts, many remain vulnerable due to neglect, decay, or lack of systematic preservation efforts.

Revamping the National Manuscripts Mission: What's New?

In the Union Budget 2025-26, the government announced a significant revamp of the NMM, to be launched as the **Gyan Bharatam Mission** by Prime Minister Narendra Modi on June 9. This relaunch comes after the NMM, since its inception, did not progress as expected, hindered by limited funding and infrastructural constraints.

Key changes under the revamped NMM include:

- **Budget Increase:** The budget allocation has been substantially increased from ₹3.5 crore to ₹60 crore, reflecting the government's enhanced commitment to manuscript preservation.
- **Expanded Scope:** The new mission aims to cover **more than one crore (10 million) manuscripts**, far beyond the current scope, intensifying efforts for documentation and digitisation.
- **Survey and Documentation:** A comprehensive survey will be conducted to locate manuscripts across India, including those in remote areas and private collections.
- **Digitisation and Conservation:** Digitisation will safeguard manuscripts against physical deterioration and allow broader access through digital platforms. Conservation efforts will include physical preservation to protect fragile manuscripts from further decay.

Objectives of NMM

- **Survey and Documentation:** Locate, document, and create a national database of manuscripts (currently holding 4 million records).
- **Conservation:** Use modern and indigenous methods to preserve manuscripts.
- **Scholar Training:** Develop expertise in manuscript studies, including languages, scripts, and conservation techniques.
- **Digitisation:** Convert rare and endangered manuscripts into digital formats for broader access.
- **Publication & Access:** Publish critical editions and facilitate public engagement through seminars, lectures, and outreach programs.
- **Institutional Network:** Over 100 Manuscripts Resource Centres and Manuscripts Conservation Centres across India.

such as Ayurveda, astronomy, linguistics, mathematics, philosophy, and the arts. Deciphering and preserving these texts is crucial because:

- **Cultural Heritage:** Manuscripts provide direct insight into India's diverse cultural history and civilizations, helping us understand socio-religious practices and philosophical ideas across time.

National Mission for Manuscripts

- The National Mission for Manuscripts (NMM) is an autonomous body under the Culture Ministry. It was launched in 2003.
- NMM's mandate includes identifying, documenting, conserving, and making accessible India's manuscript heritage.
- The manuscripts encompass a variety of themes, textures, aesthetics, scripts, languages, calligraphies, illuminations, and illustrations.
- NMM's motto is 'conserving the past for the future'.
- Approximately 75% of existing manuscripts are in Sanskrit, while 25% are in regional languages.

and allow broader access through digital platforms. Conservation efforts will include physical preservation to protect fragile manuscripts from further decay.

- **Organizational Restructuring:** The formation of an autonomous body is proposed to efficiently manage the mission, potentially allowing more focused and professional administration.
- **Technology Integration:** Use of modern technologies for scanning, metadata creation, and online archiving will be enhanced to facilitate easier access and study.

Importance of Manuscript Deciphering and Preservation

Manuscripts are more than historical artifacts; they are the reservoirs of India's intellectual traditions and cultural identity. They hold key knowledge in fields

National Mission for Manuscripts (NMM)

- **Established:** February 2003 by the Ministry of Tourism and Culture.
- **Motto:** *Conserving the past for the future.*
- **Mandate:** Document, conserve, and disseminate knowledge preserved in manuscripts.
- **Significance:** India has around ten million manuscripts, the largest collection globally.
- **Languages Covered:** 75% in Sanskrit, 25% in regional languages.

- **Historical Research:** They are primary sources for historians, enabling reconstruction of India's past beyond colonial or modern narratives.
- **Scientific Knowledge:** Many manuscripts contain ancient scientific and medical knowledge, which can contribute to contemporary research and innovation.
- **Linguistic Diversity:** Manuscripts exist in numerous Indian and regional languages and scripts, helping preserve endangered languages and dialects.
- **Global Scholarship:** Making manuscripts accessible through digitisation promotes global academic collaboration and increases awareness about India's contributions to world knowledge.

Current Status and Future Prospects

Till now, the NMM has prepared metadata for around 52 lakh manuscripts and digitised over three lakh titles, but only about one-third of these are accessible online. The revamped mission aims to address these gaps, increase digitisation rates, and make manuscripts widely available to scholars and the public.

By launching the Gyan Bharatam Mission, the Indian government is signalling a renewed focus on protecting this vast cultural treasure, integrating modern technology with traditional knowledge, and ensuring India's manuscript heritage is preserved for future generations.

The Union Budget 2025-26 has introduced the 'Gyan Bharatam Mission', a groundbreaking initiative to survey, document, and conserve India's priceless manuscript heritage!

01 Objective: Conservation of over 1 crore manuscripts in academic institutions, museums, libraries, and private collections.

02 Budget Boost: National Manuscripts Mission (NMM) funding increased **from ₹3.5 crore to ₹60 crore!**

DID YOU KNOW? India holds an estimated 5 million manuscripts—probably the largest collection in the world!

What is a Manuscript? A handwritten composition on paper, bark, cloth, metal, or palm leaf—at least 75 years old!

₹ BUDGET 2025-26 UNION MINISTRY OF FINANCE

Gyan Bharatam Mission

- For survey, documentation and conservation of our manuscript heritage with academic institutions, museums, libraries and private collectors
- To cover more than 1 crore manuscripts
- National Digital Repository of Indian knowledge systems to be set up for knowledge sharing

Follow us on social media: @PIB_India, @PIBHindi, @pibindia, @pibindia, @pibindia, @pibindia

Prelims Practice Question

Q. Consider the following statements regarding the National Manuscripts Mission (NMM):

1. The NMM is a part of the Indira Gandhi National Centre for the Arts (IGNCA).
2. The revamped NMM, named Gyan Bharatam Mission, aims to cover over one crore manuscripts.
3. The budget allocation for NMM was decreased in the Union Budget 2025-26.
4. Digitisation of manuscripts helps in their conservation and wider accessibility.

Which of the statements given above are correct?

- A. 1 and 2 only
- B. 1, 2 and 4 only
- C. 2 and 3 only
- D. 1, 3 and 4 only

Answer: B. 1, 2 and 4 only

Explanation:

- Statement 1 is correct: The NMM functions under the Indira Gandhi National Centre for the Arts.
- Statement 2 is correct: The revamped mission, called the Gyan Bharatam Mission, targets documenting over one crore manuscripts.
- Statement 3 is incorrect: The budget for NMM was substantially increased from ₹3.5 crore to ₹60 crore in 2025-26.
- Statement 4 is correct: Digitisation protects manuscripts from physical deterioration and facilitates wider scholarly access.

Mains Model Question

Q. Discuss the significance of the National Manuscripts Mission and the recent revamp announced in the Union Budget 2025-26. How does the preservation and digitisation of manuscripts contribute to India's cultural and academic landscape?

The National Manuscripts Mission (NMM), established in 2003 under the Indira Gandhi National Centre for the Arts, is a crucial initiative aimed at preserving India's vast and diverse manuscript heritage. Manuscripts encompass handwritten texts in various languages, scripts, and subjects, including philosophy, science, literature, and history. These manuscripts are invaluable as they carry the intellectual, cultural, and historical knowledge accumulated over centuries. However, many manuscripts remain scattered, fragile, and vulnerable to deterioration due to environmental factors and neglect.

Recognising this, the Government of India announced a major revamp of the NMM in the Union Budget 2025-26, launching the Gyan Bharatam Mission with a significantly increased budgetary allocation from ₹3.5 crore to ₹60 crore. This revamp aims to extend the scope of the mission to cover over one crore manuscripts, focusing on comprehensive survey, documentation, conservation, and digitisation efforts. The enhanced budget and restructuring are expected to improve operational efficiency and leverage modern technology for digitisation and metadata creation, ensuring greater accessibility for researchers and the public.

The revamped National Manuscripts Mission not only preserves India's rich heritage but also strengthens its academic and cultural infrastructure, aligning with the broader goals of cultural conservation and knowledge dissemination in the digital age.

The preservation and digitisation of manuscripts serve multiple purposes. Firstly, they safeguard fragile manuscripts from physical degradation, preventing irreversible loss of cultural heritage. Secondly, digitisation democratizes access, allowing scholars, students, and the general public across the globe to engage with these ancient texts, fostering greater academic research and interdisciplinary studies. Additionally, manuscripts hold potential insights into ancient scientific knowledge, linguistic diversity, and historical narratives, contributing to India's soft power and cultural diplomacy.



Topic : Higher Defence Spending Won't Stretch India's Finances

Relevance : GS Paper 3 Defence and Economy

Source : The Hindu

Context :

India is currently witnessing a strategic recalibration of its defence budget amid evolving security challenges. The Ministry of Defence is reportedly seeking an additional ₹50,000 crore in the Supplementary Demand for Grants this financial year. Despite such a significant increase, economists maintain that the government has sufficient fiscal space to absorb this expenditure without deviating from the fiscal deficit target of 4.4%.

Fiscal Flexibility Amid Rising Defence Expenditure

India's ability to increase defence spending without overstretching its finances is supported by multiple macroeconomic factors:

- **Higher-than-Expected RBI Dividend Transfers:** The Reserve Bank of India transferred a record ₹2.1 lakh crore dividend for 2023-24, 141% higher than the previous year. This unexpected windfall provides additional revenue to the government.

'Higher defence spending won't stretch India's finances'

Higher-than-expected dividends from the Reserve Bank of India, lower oil prices, will provide fiscal flexibility; the past also shows that the deficit has been contained during heightened tensions

T.C.A. Sharad Raghavan
NEW DELHI

The Central Government has enough fiscal space to absorb a jump in defence expenditure without deviating from fiscal deficit target of 4.4% for this financial year, say economists.

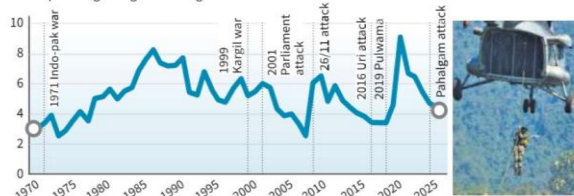
This is largely in keeping with India's past performance where the fiscal deficit has been under control during periods of heightened tensions with Pakistan unless it escalated into a full-blown war, or if global crises had taken place.

The Ministry of Defence will be reportedly seeking an increase in its Budget to the tune of ₹50,000 crore this year in the Supplementary Demand for Grants in December. This extra spending, however, is manageable for the government as it is expecting higher revenue and has the flexibility to cut some other expenditure.

"While additional defence outlays may initially appear to pressure the deficit target, the actual impact of -0.14% of the Gross Domestic Product (GDP) may be offset by multiple factors throughout the year," Rishi Shah, partner, Grant Thornton Bharat, told *The Hindu*. "The current macroeconomic tailwinds – notably softening global oil prices and stable tax revenue growth – provide a favourable buffer for this reprioritisation."

No cause for concern

The Centre's fiscal deficit remained reasonably in control during heightened tensions with Pakistan – except during outright wars or global crises



Source: Ministry of Statistics & Programme Implementation • Note: Data for 2025-26 is a target, not the actual

Dr. Radhika Pandey, Associate Professor at the National Institute of Public Finance and Policy, agrees with this assessment.

"Even if the government does expedite defence deals to ramp up defence infrastructure and logistics, 4.4% fiscal deficit target will likely not be deviated from," she explained.

"If there are to be cuts in expenditure on higher defence spending, then those would more likely be from the revenue expenditure side," Dr. Pandey added. "Even here, it won't be concentrated in any one item or sector, but would be spread across various schemes and outlays."

Higher RBI dividend

A major factor that could work in the government's favour is a higher-than-expected dividend transfer from the Reserve Bank of India. *The Hindu* had reported on Saturday that

the Ministry of Finance was – in parallel to the RBI – examining how it could increase dividend transfers from the Central bank.

The RBI transferred a record ₹2.1 lakh crore dividend last year for financial year 2023-24, a whopping 141% higher than the previous year's transfer.

'Enough fiscal space'

"The government has enough fiscal space to do it and is expecting higher transfers of RBI dividends," said Madan Sabnavis, chief economist, Bank of Baroda. "There is likely additional revenue coming for the government. If nothing else changes and only defence spending goes up, that can be absorbed."

An analysis by *The Hindu* shows the Centre's fiscal deficit remained reasonably in control during heightened tensions with Pakistan – except in outright war or global crises.

The fiscal deficit rose from 3% in 1970-71 to 3.45% in 1971-72 – coinciding with the 1971 war with Pakistan – and further to 3.9% in 1972-73 before dropping again. Similarly, it rose from 5.3% in 2000-01 to 6.1% in 2001-02 following the Kargil War. However, the fiscal deficit fell following the 2001 Parliament attack and the subsequent heightened tensions with Pakistan, as it did following the 2016 Uri attack.

The 26/11 Mumbai terror attack in 2008 was during the Global Financial Crisis, when India, along with several other countries, had significantly loosened its purse strings to stabilise economy – thereby raising deficit levels significantly.

Similarly, fiscal deficit ballooned in 2019-20 and 2020-21 – after 2019 Pulwama attack – due to the government's COVID-19 pandemic response rather than border tensions.

• **Softening Global Oil Prices:** Reduced oil prices ease the import bill and inflationary pressures, which helps in maintaining fiscal discipline.

• **Stable Tax Revenue Growth:** Continuous tax revenue inflows further bolster the government's fiscal position.

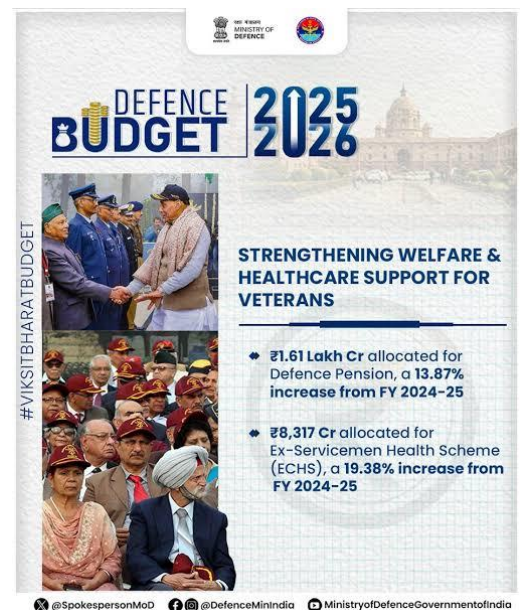
• **Reprioritisation of Expenditure:** The government has the flexibility to reallocate funds, possibly by cutting down on non-essential or less urgent revenue expenditure across various sectors.

According to experts like Rishi Shah of Grant Thornton Bharat and Dr. Radhika Pandey of the National Institute of Public Finance and Policy, these factors create a favourable buffer to accommodate the rise in defence expenditure.

Historical Perspective on Defence Spending and Fiscal Deficit

India's fiscal deficit history shows resilience during times of heightened geopolitical tensions, with exceptions largely limited to full-scale wars or global crises:

- **1971 Indo-Pak War:** The fiscal deficit rose from 3% to 3.45%, further reaching 3.9% post-war before normalization.
- **Kargil Conflict (1999-2000):** Deficit increased from 5.3% to 6.1% following the war.
- **Post-Uri and Post-Parliament Attack Periods:** The deficit remained contained despite heightened tensions.
- **Global Financial Crisis and 26/11 Attack (2008):** The fiscal deficit ballooned due to the global crisis rather than security issues alone.
- **Pulwama Attack and COVID-19 (2019-2021):** Increased deficit attributed mainly to pandemic response, not defence spending.



This historical trend suggests that India's fiscal management mechanisms are capable of absorbing increased defence costs while maintaining economic stability.

Composition and Significance of India's Defence Budget

India's defence budget plays a crucial role in ensuring national security and operational preparedness:

- **Revenue Expenditure:** Covers salaries, pensions, and maintenance costs.
- **Capital Expenditure:** Allocated for procurement of weapons, equipment, and infrastructure development.
- **Pension Payments:** A significant recurring cost owing to a large number of veterans.

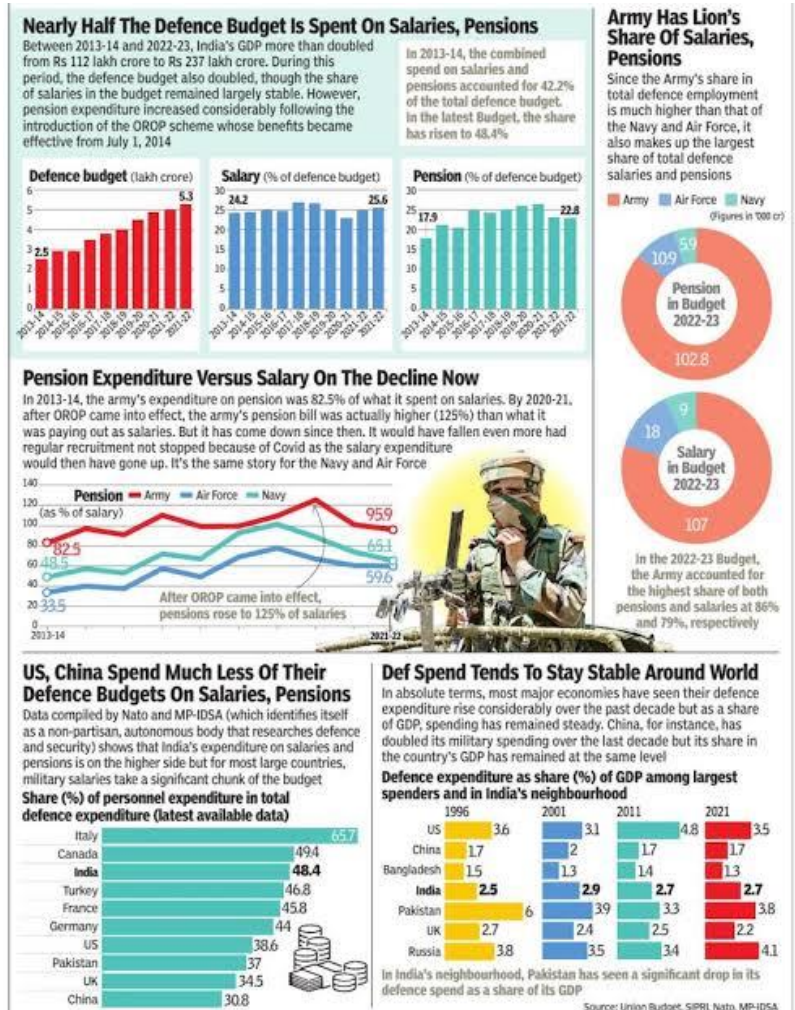
Strategic Importance

- India's geographic location with sensitive borders demands robust defence preparedness.
- Defence spending supports modernisation, including the acquisition of advanced aircraft, naval vessels, missile systems, and surveillance technologies.
- Infrastructure development such as border roads, airfields, and communication networks enhances operational capabilities.

India's Defence Spending in the Global Context

India is among the top five global defence spenders, reflecting its status as a major regional power:

DEL-HYD-B'LORE-PUNE-TPT



- **Modernisation and Indigenisation:** Initiatives like 'Make in India' aim to reduce reliance on imports and boost domestic defence manufacturing.
- **International Partnerships:** Defence cooperation with countries like the USA, Russia, France, and Israel facilitates technology transfers and joint military exercises.
- **Emerging Security Challenges:** Cybersecurity, space security, and hybrid warfare demand sustained investment in defence capabilities.

India's defence spending is essential to safeguard sovereignty and maintain regional stability. The government's fiscal strategy, aided by higher RBI dividends, lower oil prices, and steady tax revenues, allows for a significant increase in defence budgets without compromising fiscal deficit targets. This balanced approach ensures that India can modernise its armed forces, build strategic infrastructure, and maintain economic stability simultaneously.

Prelims Practice Question:

Consider the following statements regarding India's defence expenditure and fiscal management:

1. The Reserve Bank of India's dividend transfer to the government has no impact on fiscal flexibility for defence spending.
2. India's fiscal deficit has historically remained under control during periods of heightened tensions except in the event of full-scale war or global crises.
3. Defence capital expenditure primarily covers salaries and pensions of armed forces personnel.

Which of the above statements is/are correct?

Options:

- A) 1 and 2 only
- B) 2 only
- C) 2 and 3 only
- D) 1 and 3 only

Answer:

B) 2 only

Explanation:

- Statement 1 is incorrect because higher-than-expected RBI dividend transfers provide additional revenue to the government, improving fiscal flexibility to accommodate increased defence spending.
- Statement 2 is correct as India's fiscal deficit has generally remained under control during heightened tensions unless it escalated into a full-scale war or was influenced by global crises.
- Statement 3 is incorrect since defence capital expenditure is mainly used for procurement of weapons, equipment, and infrastructure development, while salaries and pensions fall under revenue expenditure.

Mains Model Question:

Discuss the implications of increased defence spending on India's fiscal health. How does India manage to balance higher defence outlays without compromising its fiscal deficit targets? Elaborate on the significance of defence expenditure in India's broader economic and strategic context.

India's increased defence spending often raises concerns about its impact on the country's fiscal health, especially given competing demands for developmental and social welfare spending. However, recent analyses indicate that India has sufficient fiscal space to absorb higher defence expenditures without deviating from its fiscal deficit target. This resilience is supported by several factors, including higher-than-expected dividend transfers from the Reserve Bank of India (RBI) and favourable macroeconomic conditions such as lower global oil prices and stable tax revenue growth. These elements provide the government with the flexibility to reprioritise budgets and accommodate additional defence outlays without jeopardising fiscal discipline.



‘India was the top arms importer in 2019-2023’

Dinakar Peri
NEW DELHI

India was the top arms importer in the world in the period 2019-23, with imports having gone up by 4.7% compared with the period 2014-18, according to Swedish think tank Stockholm International Peace Research Institute (SIPRI).

At the same time, arms imports by European countries increased by 94% between 2014-18 and 2019-23, the report said, which comes against the backdrop of the war in Ukraine.

"Although Russia remained India's main arms supplier [accounting for 36% of its arms imports], this was the first five-year period since 1960-64 when deliveries from Russia [for the Soviet Union prior to 1991] made up less than half of India's arms im-



The U.S. has increased its global role as an arms supplier, exporting more arms to more countries than it has ever done. GETTY IMAGES

ports," as per new data on international arms transfers from SIPRI released on Monday. "Nine of the 10 biggest arms importers in 2019-23, including the top three of India, Saudi Arabia and Qatar, were in Asia and Oceania or the West Asia. Ukraine became the fourth biggest arms importer after it received transfers of major arms in 2022-23."

In the interim Budget presented in February for financial year 2024-25, the

total allocation for the Defence Ministry was ₹6.2 lakh crore, of which the capital allocation for new procurements was ₹1.72 lakh crore, 5.78% higher than the Budget Estimates of last year. India seems to have come back to the top slot in arms imports after briefly ceding space to Saudi Arabia in the past.

Imports of Pakistan, the fifth largest arms importer in 2019-23, went up by 43%, with China supplying

as much as 82% of all its arms imports.

Arms exports by the world's largest supplier, the U.S., grew by 17% between 2014-18 and 2019-23, while those by Russia fell by more than half. France emerged as the world's second largest arms supplier as its exports grew by 47%.

Europe's capacity

Over half of arms imports by European countries, 55%, in 2019-23 were from the U.S., up from 35% in 2014-18. "Europe is responsible for about a third of global arms exports, including large volumes going outside the region, reflecting Europe's strong military-industrial capacity," said SIPRI Director Dan Smith.

In this regard, Matthew George, Director of the SIPRI arms transfers programme, said the U.S. had increased its global role as

an arms supplier – an important aspect of its foreign policy – exporting more arms to more countries than it has ever done in the past.

On France, which is now the second largest arms supplier, the report said 42% of its arms went to states in Asia and Oceania, and 34% to West Asia.

"The largest single recipient of French arms exports was India, which accounted for nearly 30%. The increase in French arms exports was largely due to deliveries of combat aircraft to India, Qatar and Egypt," the report stated.

"With many high-value arms on order – including nearly 800 combat aircraft and combat helicopters – European arms imports are likely to remain at a high level," said Pieter Wezeman, senior researcher with the SIPRI arms transfers programme.

Historically, India's fiscal deficit has remained relatively stable during periods of heightened border tensions or conflict, except in cases of full-scale wars or major global crises. For instance, while the fiscal deficit increased during the 1971 war and the Kargil conflict, it remained contained during other tense periods like the 2016 Uri attack. This trend underscores India's capacity to manage defence spending prudently, balancing strategic needs with fiscal prudence.

Defence expenditure in India is broadly categorised into revenue expenditure—covering salaries, pensions, and maintenance—and capital expenditure, which includes procurement of equipment, infrastructure development, and technological modernization. Capital expenditure is critical for modernising the armed forces, enhancing operational readiness, and supporting the “Make in India” initiative for defence manufacturing. Strategically, sustained investment in defence not only safeguards national security but also supports geopolitical stability in a region marked by complex security challenges.

India's ability to manage higher defence spending without straining its fiscal framework reflects sound economic planning and effective fiscal management. Defence expenditure remains vital for the country's sovereignty and economic growth, while fiscal discipline ensures long-term macroeconomic stability.

