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Fiber Optic Networks for the future of 5G

5G technology

is going to make inroads into the country very soon. Top smartphone manufacturers in India have already released phones with 5G capability. With over 117 crore telecom users and more than 82 crore internet subscribers, India is one of the fastest-growing markets for digital consumers.

Digital infrastructure, which seamlessly integrates with physical and traditional infrastructure, is critical to India's growth story and the country's thrust towards self-reliance.

Internet connectivity is critical for making the **Digital India project** inclusive, and widespread use of optical fibre in the remotest corners of the country is vital to ensure that no one is left behind in this endeavour.

In this context, let's understand the fundamentals of 5G and Optical Fibre.

5G Technology

- 5G is the 5th generation mobile network. It is a new global wireless standard after **1G, 2G, 3G, and 4G** networks.
- 5G works in **3 bands (Low, Mid and High frequency spectrum)** - all of which have their own uses as well as limitations.

- It enables a new kind of network that is designed to connect virtually everyone and everything together including machines, objects, and devices.
- In India, Satcom Industry Association-India (SIA) has voiced concerns over the Government's plan to include the **Millimetre Wave (mm Wave) bands** in the 5G **spectrum auction**.

Benefits of 5G

- **Enhanced Mobile Broadband:**

- In addition to making our smartphones better, 5G mobile technology can usher in new immersive experiences such as **Virtual reality (VR)** and **Augmented Reality (AR)** with faster, more uniform data rates, lower latency, and lower cost-per-bit.

- **High Speed Technology:**

- 5G will increase the downloading and uploading speeds over the mobile network.
- Internet speeds in the high-band spectrum of 5G have been tested to be as high as 20 Gbps (gigabits per second).
 - The maximum internet data speed in 4G has been recorded at 1 Gbps.
- 5G will also reduce the latency i.e. the time taken by a network to respond.

- **Machine-to-Machine Interaction:**

- 5G will be the first technology to facilitate machine-to-machine communication, the foundation of **Internet of Things (IoT)**.
 - Combined with IoT, **cloud, big data, AI, and edge computing**, 5G could be a critical enabler of the **fourth industrial revolution**.

- **Boost to the Economy:**

- 5G is expected to create a cumulative economic impact of USD1 trillion in India by 2035, according to a report by a government-appointed panel (2018).
 - It will give a huge amount of economic boost to India by increased connectivity between machines and various sectors which will in turn increase efficiency.
 - Production will also increase which would lead to huge revenue collections.

- **Collaborative Network Deployment:**

- 5G will lead to, for the first time, the business verticals and technical verticals come together for network deployment.
 - Earlier, the **telecommunications** used to discuss internally and deploy networks but now, the businesses, technology companies and cyber experts will be coming together for deploying networks.

Optical Fiber can quantify benefits

- **High Speed:**

- Fiber provides more bandwidth and has standardized performance up to 10 Gbps and beyond, something that it is impossible to achieve when using copper.

- More bandwidth means that fiber can carry more information with far greater efficiency than copper wire.

- **Range of Transmission:**

- Since data travels in the form of light in fiber-optic cables, very little signal loss occurs during transmission and data can move at higher speeds and greater distances.

- **Not susceptible to interference:**

- Fiber-optic cable is also much less susceptible to noise and electromagnetic interference than copper wire.

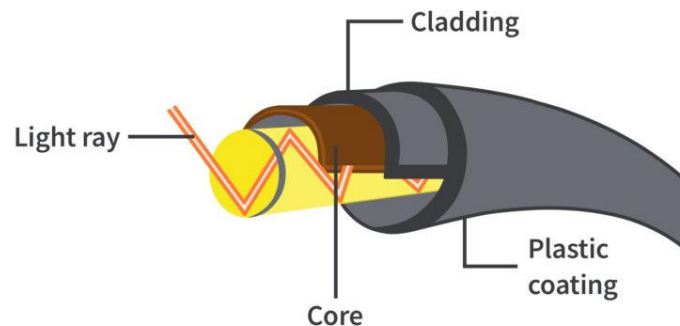
- It is so efficient, in fact, that roughly 99.7% of the signal reaches the router in most cases.

- **Durability:**

- Fiber-optic cable is completely immune to many environmental factors that affect copper cable.
- The core is made of glass, which is an insulator, so no electric current can flow through.

Optical Fibre

- Optical fibre is the backbone of the digital infrastructure — the data is transmitted by light pulses travelling through long strands of thin fibre.
- Metal wires are preferred for transmission in optical fibre communication as signals travel with fewer damages.
 - The optical fibre works on the principle of **total internal reflection (TIR)**.
- Light rays can be used to transmit a huge amount of data (In case of long straight wire without any bend).
 - In case of a bend, the optical cables are designed such that they bend all the light rays inwards (using TIR).



Challenges for 5G Rollout in India

- **Low Fiberization Footprint:**
 - There is a need to upgrade fibre connectivity across India, which at present connects only 30% of India's telecom towers.

- India exported optical fibre worth \$138 million to over 132 countries between April 2020 and November 2021.
- Indian optical fibre cable consumption is predicted to increase to 33 million fibre km by 2026 from 17 million fibre km in 2021.
 - A little more than 30% of mobile towers have fibre connectivity; this needs to be scaled up to at least 80%.
- **Dumping by other countries:**
 - Countries like China, Indonesia and South Korea have been **dumping** their fibre products in India at rates lower than the market price.
 - **The World Trade Organisation** defines dumping as “an international price discrimination situation in which the price of a product offered in the importing country is less than the price of that product in the exporting country’s market”.
- **Choosing the Optimal 5G Technology Standard:**
 - The tussle between the homegrown 5Gi standard and the global 3GPP standard needs to be concluded in order to hasten 5G technology implementation.
 - While 5Gi brings obvious benefits, it also increases 5G India launch costs and interoperability issues for telcos.
 - 3GPP is a collaborative Project Agreement between telecommunications industry partners (Organizational Partners) for formalizing global mobile 3G wireless systems

based on radio access technologies and Global System for Mobile Communications (GSM) specifications.

- **'Make in India' Hardware Challenge:**

- The ban on certain foreign telecom OEMs (original equipment manufacturer) upon which most of the 5G technology development depends, presents a hurdle in itself.

- **Lesser Government Subsidies:**

- A low likelihood of government subsidies is expected, given the history of high reserve prices set by the governments for spectrum auctions amid ongoing fiscal deficits.

- **Health and Environmental Setbacks:**

- Concerns regarding impact of 5G and low intensity radiofrequency (RF) electronic magnetic field (EMF) radiation on human health, and its environmental impact have been raised by various scientists.
- 5G technology and associated RF radiation from wirefree gadgets and network cell towers will be “extremely harmful and injurious to the health and safety of the people and also of animals and birds.
- Radiation at very high levels, also referred to as ionizing radiation, heats up our tissue and can eventually lead to cancer.

Initiatives w.r.t. Digital Inclusiveness

- **BharatNet:**

- **BharatNet** is the world's largest rural broadband connectivity programme using Optical fibre. And also a flagship mission implemented by **Bharat Broadband Network Ltd. (BBNL)**.
- It is a highly scalable network infrastructure to provide on demand, affordable broadband connectivity of 2 Mbps to 20 Mbps for all households and on demand capacity to all institutions, to realize the vision of Digital India, in partnership with States and the private sector.
- It is being implemented by the Department of Telecommunication under the Ministry of Communications.
- **National Broadband Mission:**
 - **NMB** will facilitate universal and equitable access to broadband services across the country, especially in rural and remote areas.
 - The vision of the Mission is to fast-track growth of digital communications infrastructure, bridge the **digital divide**, facilitate digital empowerment and inclusion, and provide affordable and universal access to broadband for all.
- **Ghar Tak Fibre Scheme:**
 - **GTFS** aims to connect all 45,945 villages of Bihar with high-speed optical fibre.
 - Under the scheme, Bihar has to provide at least five fibre-to-the-home (FTTH) connections per village and at least one WiFi hotspot per village.

- The Scheme will lead digital services including **e-Education, e-Agriculture, Tele-Medicine, Tele-law** and other social security schemes in Bihar ensuring easy access to all state natives.
- It is also likely to boost the local employment generation with the implementation of Bharat Net initiative which will be done by recruiting local workers.
- **Other Initiatives:**
 - **GramNet**
 - **JanWiFi**
 - **Fibre First Initiative**

Going Forward

- **Anti-Dumping Duties:**
 - India should impose **anti-dumping duties** on the imports of cheap fibre products from countries like China, Indonesia etc.
- **Production-Linked Incentive:**
 - In order to boost domestic manufacturing of optical fibre, the government should consider introducing a **PLI** scheme that aims to give companies incentives on incremental sales from optical fibre manufactured in domestic units.
- **Bridging the Rural-Urban Gap:**

- 5G can be deployed at different band spectrums and at the low band spectrum, the range is much longer which is helpful for the rural areas.
- **Government's Assistance:**
 - The government has complete control over the inputs. One of the key inputs of 5G is the band spectrum.
 - By managing the design of the spectrums, the government can control the price to be paid by the people.
 - The government shall support the telecom companies to roll out networks which are sustainable and affordable for the public.
- **Viable Technology from Consumers' Perspective:**
 - For widespread 5G deployment, it needs to become financially viable otherwise rural integration will remain a pipe dream.
 - Also, the 5G technology has to be viable to the telecom operators too.

Lightning kills

Seventeen people have been **killed by lightning** recently in various parts of Bihar, Six deaths have been reported from Bhagalpur district, while three people were killed in Vaishali, and two each in Banka and Khagaria. Other deaths happened in Madhepura, Saharsa, Munger and Katihar.

Of all the atmospheric phenomena, **lightning perhaps is the most dangerous and mysterious**. In India, **lightning kills about 2,000-2,500 people every year**.

Bihar is just one of the several hotspots for lightning in India, as a new atlas of lightning shows.

What is lightning?

Scientifically, **lightning is a rapid and massive discharge of electricity** in the atmosphere some of which is **directed towards earth**. The discharges are generated in **giant moisture-bearing clouds** that are **10-12 km tall**. The base of these clouds typically lies **within 1-2 km of the Earth's surface**, while the top is 12-13 km away. **Temperatures in the top** of these clouds are in the range of **-35° to -45°C**.

As **water vapour moves upward in the cloud**, the falling temperature causes it to **condense**. As they move to **temperatures below 0°C**, the water droplets change into small ice crystals. They continue to move up, gathering mass until they are so heavy that they start to fall to Earth. This leads to a system in which, simultaneously, smaller ice crystals are moving up and bigger crystals are coming down.

Collisions follow and trigger the release of electrons, a process that is very similar to the **generation of sparks of electricity**. As the moving free electrons cause more collisions and more electrons, a chain reaction ensues. This process results in a situation in which the **top layer of the cloud gets positively charged**, while the **middle layer is negatively charged**. The electrical potential difference between the two layers is huge, of the order of a **billion to 10 billion**

volts. In very little time, a massive current, of the order of **100,000 to a million amperes**, starts to flow between the layers.

While the **Earth is a good conductor of electricity**, it is **electrically neutral**. However, in comparison to the middle layer of the cloud, it becomes **positively charged**. As a result, about 15%-20% of the current gets directed towards the Earth as well. It is this **flow of current** that results in damage to life and property on Earth.

Direct lightning strikes are rare but even **indirect strikes are fatal** given the immense amount of charge involved.

Which areas are lightning-prone?

A recently released **annual report on lightning** by the **Climate Resilient Observing Systems Promotion Council (CROPC)**, which works closely with government agencies like the **India Meteorological Department**, includes a **lightning atlas** which maps vulnerability at the district level.

According to the report, **Madhya Pradesh has reported the largest number of cloud** to ground lightning strikes, followed by Chhattisgarh, Maharashtra, Odisha and West Bengal. Other states with high strike rate include Bihar, UP, Karnataka, Jharkhand and Tamil Nadu.

Lightning is fairly common, though it is not often realised in the urban centres. In India, well **over one crore lightning strikes** have been recorded in recent years. It is only over the last few years that lightning records have begun to be maintained, thanks to the efforts of CROPC and India Meteorological Department.

In 2019-20, about **1.4 crore lightning strikes were recorded**, which increased to 1.85 crore in 2020-21.

In 2021-22, **about 1.49 crore strikes were recorded across the country**. The reduction, in line with the trend observed globally, has been attributed to the impact of the Covid-19 pandemic.

“The reason attributed to **reduction in lightning is due to Covid-2019 pandemic** induced **reduction in aerosol level**, pollution, environmental upgradation and relatively stable weather system in the Indian subcontinent,” the annual lightning report said.

But most of this reduction was seen in the **cloud-to-cloud lightning**. Of the strikes that reach the Earth, **only a 2.5% reduction** was observed.

How can the effects of lightning strikes be mitigated?

Lightning is not classified as a natural disaster in India. But recent efforts have resulted in the setting up of an **early warning system** that is already saving many lives. **More than 96% of lightning deaths happen in rural areas**. As such, most of the mitigation and public awareness programmes need to focus on these communities.

Lightning protection devices are fairly unsophisticated and low-cost. Yet, their deployment in the rural areas, as of now, is extremely low.

States are being encouraged to prepare and implement **lightning action plans**, on the lines of heat action plans. An international centre for excellence on lightning research to boost detection and early warning systems is also in the process of being set up.

What is 'critical information infrastructure', who protects it?

The Union Ministry of Electronics and IT (MeitY) has declared **IT resources** of ICICI Bank, HDFC Bank and UPI managing entity NPCI as '**critical information infrastructure**'. The notification to this effect was issued on 16 June 2022. What is 'critical information infrastructure', and who protects it?

What is critical information infrastructure?

The **Information Technology Act of 2000** defines "**Critical Information Infrastructure**" as a "**computer resource**, the **incapacitation or destruction** of which shall have **debilitating impact on national security**, economy, public health or safety".

The government, under the Act, has the power to declare **any data, database, IT network** or communications infrastructure as CII to protect that digital asset.

Any person who secures access or attempts to secure access to a protected system in **violation of the law** can be punished with a jail term of up to 10 years.

Why is CII classification and protection necessary?

World over governments have been moving with alacrity to protect their **critical information infrastructure**. IT resources form the backbone of countless critical operations in a **country's infrastructure**, and given their interconnectedness, disruptions can have a **cascading effect** across sectors. An information

technology failure at a power grid can lead to prolonged outages crippling other sectors like **healthcare, banking services**.

In 2007, a **wave of denial-of-service attacks**, allegedly from Russian IP addresses, hit major **Estonian banks**, government bodies – ministries and parliament, and media outlets. It was cyber aggression of the kind that the world had not seen before, and it came in the wake of Estonia's decision to move a **memorial to the Soviet Red Army** to a location of less prominence. The attacks played havoc in one of the most networked countries in the world for almost three weeks.

On 12 October 2020 as **India battled the pandemic**, the **electric grid supply to Mumbai suddenly snapped** hitting the mega city's hospitals, trains and businesses. Later, a study by a US firm that looks into the use of the internet by states, claimed that this power outage could have been a **cyber attack**, allegedly from a China-linked group, aimed at critical infrastructure. The government, however, was quick to deny any cyber attack in Mumbai.

But the incident underlined the possibility of **hostile state and non-state actors** probing **internet-dependent critical systems** in other countries, and the necessity to fortify such assets.

How are CIIs protected in India?

Created in January 2014, the **National Critical Information Infrastructure Protection Centre (NCIIPC)** is the nodal agency for taking all measures to protect the nation's critical information infrastructure.

It is mandated to guard CIIs from “**unauthorized access**, modification, use, disclosure, disruption, incapacitation or distraction”.

According to its website, **NCIIPC will monitor and forecast national-level threats** to CII for policy guidance, expertise sharing and situational awareness for early warning or alerts. The basic responsibility for protecting the CII system shall lie with the agency running that CII, it says.

“In the event of any threat to **critical information infrastructure** the National Critical Information Infrastructure Protection Centre may call for information and give directions to the critical sectors or persons serving or having a critical impact on Critical Information Infrastructure,” the NCIIPC website adds.

Inter-State Council

Tamil Nadu Chief Minister **M K Stalin** wrote to Prime Minister Narendra Modi on 16 June 2022, asking that **at least three meetings** of the **Inter-State Council** should be held every year to “**strengthen the spirit of cooperative federalism**”. Stalin also suggested that bills of national importance should be placed before the Council before being tabled in Parliament. He said this was because there is no “**effective and interactive communication**” between the states and the Centre on **issues of common interest**.

What is the Inter-State Council?

It is a mechanism that was constituted “**to support Centre-State and Inter-State coordination and cooperation in India**”. The **Inter-State Council** was established under **Article 263 of the Constitution**, which states that the President may constitute such a body if a need is felt for it. The Council is basically meant to **serve as a forum for discussions** among various governments. **In 1988, the Sarkaria Commission** suggested the Council should exist as a **permanent body**, and **in 1990 it came into existence** through a Presidential Order.

The main functions of the Council are **inquiring into and advising on disputes** between states, investigating and discussing subjects in which two states or states and the Union have a common interest, and making recommendations for the **better coordination of policy and action**.

The **Prime Minister is the chairman of the Council**, whose members include the **Chief Ministers of all states and UTs** with legislative assemblies, and **Administrators of other UTs. Six Ministers of Cabinet rank** in the Centre's Council of Ministers, nominated by the Prime Minister, are also its members.

What issues has Chief Minister Stalin raised?

Mainly, the DMK chief has flagged the **lack of regular meetings**, saying the Council has met only once in the last six years — and that there has been **no meeting since July 2016**. Since its constitution in 1990, the body has met only 11 times, although its procedure states it should meet at least three times every year.

Stalin appreciated the reconstitution of the Council, carried out last month. The body will now have **10 Union Ministers as permanent invitees**, and the standing committee of the Council has been reconstituted with Home Minister Amit Shah as Chairman. Finance minister Nirmala Sitharaman and the Chief Ministers of Maharashtra, UP, and Gujarat are some of the other standing committee members.

Stalin has frequently disagreed with the central government's policies on **matters of taxation**, on the **medical examination NEET**, and often talked about the **rights of states**. Highlighting the need for the Council to meet regularly, he said, "What could be settled amicably among the executive branches is often taken to the doorsteps of the judicial branch."

Tamil Nadu has long advocated the need for a Council. In 1969, Stalin's father, M Karunanidhi, spoke about **setting up an expert committee** to study **Centre-state relations**. Months later, his government appointed a committee headed by **P V Rajamannar**, a former Madras High Court Chief Justice, which submitted a report in 1971, recommending "the Inter-State Council should be constituted immediately".

What happened in the last meeting of the Inter State Council?

In 2016, the meeting included consideration of the **Punchhi Commission's recommendations** on Centre-State Relations that were published in 2010. At the time, M Karunanidhi had criticised then Chief Minister J Jayalalithaa for not personally attending the meeting.

The meeting saw detailed discussion on the recommendations. States asked for maintaining the federal structure amid growing “**centralisation**”. **Imposition of Article 356 of the Constitution**, which deals with the imposition of President’s Rule in states, was a matter of concern. Bihar Chief Minister Nitish Kumar, who was then with the Opposition, demanded that the post of Governor should be abolished.

Welfare of the urban poor cannot be an afterthought in economic growth plans

Urban poverty in India is **over 25 percent**. By 2030, that percentage would be at 50.

Half of India is expected to urbanise by 2030 and at least half of that population could be such migrants.

To make rapid economic progress,

India needs to improve the well-being of the workforce

that migrates to cities in the hope of a better life.

A large number of migrants who returned to their homes in villages

have come back to cities

in search of work after the Covid pandemic.

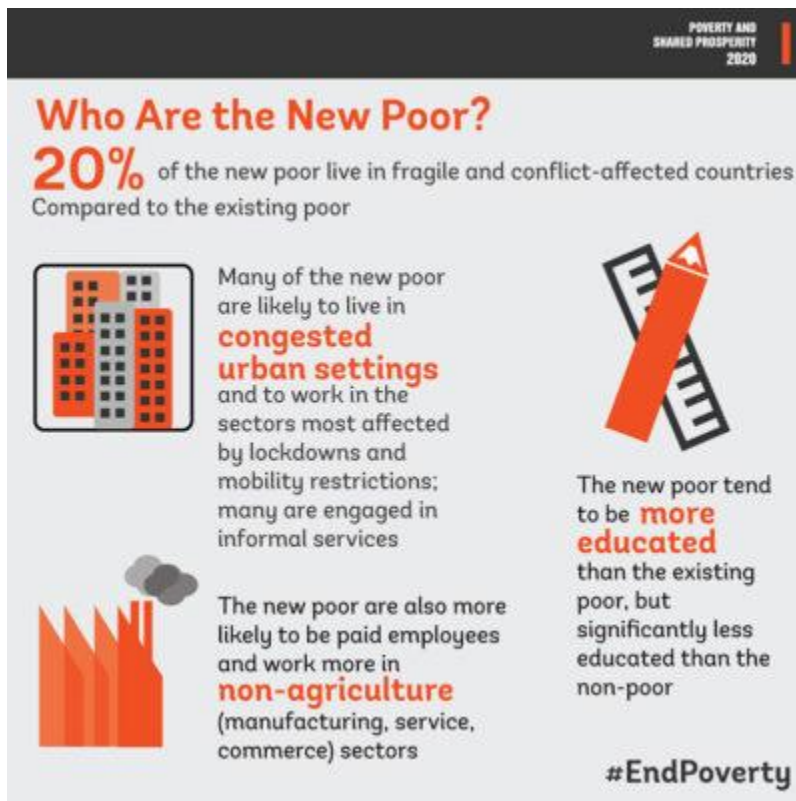
Social protection-related registration of informal workers

has increased but the nature of opportunities continues to be insecure.

With

mechanisation resulting in the greater displacement of people dependent on farms

, the trail of migrants in search of livelihoods is going to increase.



Steps to Improve the Lives of The Urban Poor

1. **Need for elected leadership in urban local bodies**

- **Article 243S (5) of the Constitution** states: “Nothing in this article shall be deemed to prevent the Legislature of a State from making any provision for the Constitution of Committees in addition to the Ward Committees.”

- The population of an urban ward varies from 1,500-6,000 in smaller towns to 30,000 to 2,00,000 in the metros.
 - Such a **large population is not amenable to community-level connections.**
 - As a result, local strongmen often determine access to public services for the poor.
- Having **elected representation at the basti or slum cluster level** will empower a large number of people and improve the overall quality of life for these slums.

2. **Access to public services for the right people**

- With the portability of names and cards, **nearly half the urban population has access to cheap food grains** under the National Food Security Act (NFSA).
- But there is a need to establish identity markers based on the NFSA list and **record the deprived households without access who may have been left out of this list.**
- Through a participatory identification of the poor by a community connect process, it should be possible to **delete the non-entitled beneficiaries of NFSA as well.**

3. **Community-based awareness of social welfare schemes**

- A major reason for the lack of access to social welfare schemes is the **lack of awareness at the grassroots level.**

- Once the deprived households are identified, **special community connect campaigns** to ensure access to social welfare schemes should be started.
- Such campaigns should cover schemes related to LPG connection, bank accounts, life and accident insurance, EPFO and ESI facilities, and healthcare programmes like Ayushman Bharat and Pradhan Mantri Jan Arogya Yojana (PMJAY), employment schemes and drinking water, electricity, sanitation and other projects.

4. Utilize the reach of SHGs to implement social welfare schemes

- **Complete coverage of deprived households by SHGs** should be attempted in a mission mode.
 - Nearly **70 lakh women in seven lakh self-help groups** are under the National Urban Livelihood Mission.
- This process should be **accompanied by access to credit for all groups** for diversification of livelihoods.
- Creating **basti-level women's collectives** will address several difficult challenges, **loans for street vendors under Svanidhi Scheme**, etc. is a good step in that direction.

Keeping the Balance


SELF-HELP GROUPS:
▶ Formed In 2011
▶ Mobilised credit of around **₹70,000 crore**

NUMBER OF SHGS:
26 lakh

MEMBERS:
3 crore

FUNDS USED FOR:
Activities such as starting a shop, milch cattle, goatery unit and farm livelihoods

RECENT TREND: More women getting skilled to take up economic activities | Growth in the overall SHG numbers



5. Establish Migration Support Centres]

- There is a need to establish Migration Support Centres.
- These centres will make the arrival process of migrants to cities in search of work less traumatic by **ensuring access to basic amenities.**
- The **expansion of rental housing and property titles to settlers** who fulfil the basic requirements will ease access to credit.
- Support for the destitute and the homeless must be made a priority.

6. Skill Development

- **Skilling, upskilling, and re-skilling opportunities must be readily available** for poor households.
- Steps need to be taken to enable them to **combine work with skill up-gradation.**
- Providing **apprenticeships to those who are eligible** will also help.



7. Urban local bodies must focus on the poor

- **Specially designated teams** for the poor must be present in **every municipality and cooperation.**
 - A lack of funds prevents these bodies from employing enough resources and manpower to handle the volume of poor living in their jurisdiction.
- All this requires **governance reforms** such as redirection of taxes collected, reallocation of stamp duties, etc.
- **Professionals with specialised skill** sets should be brought in to effectively plan and handle their finances.

8. Rebuild census towns as robust growth centres

- **Census towns are rural gram panchayat but urban in character.**
- Many such rural growth clusters have been **identified by the Ministry of Rural Development as part of the Rurban Mission.**

- Some are **tourism clusters, some specific economic activity clusters, and yet others are farm and non-farm clusters.**
- These need to be **reworked as robust growth centres.**

9. Access to better education and health care]

- The **Atmanirbhar Health Infrastructure Yojana** has **prioritised strengthening urban health centres** and the **creation of frontline health teams.**
- **Improvement of schools, health facility expansion, and anganwadis** will go a long way in connecting deprived households to human development requirements.

10. Enforce minimum wages

- Labour **contractors very often disburse lower than the minimum wages**, though they do not show that on paper.
- **Domestic helps need support for wages** as oversupply leads to distress employment.
- With a section of the population ageing and life expectancy increasing, there should be **employment opportunities for people with caregiving skills.**

11. Break caste hierarchies in urban living

- Contrary to B R Ambedkar's hope that **urbanisation will break caste hierarchies**, our large **cities are among the most segregated.**
- This leads to **uneven and unequal development across sections of society.**

- **Master Plans must factor in the housing and welfare needs** of the working class.

The loss of jobs and incomes after the pandemic has **driven a large section of the urban poor to move back to their villages** and withdraw their children from private schools. **Healthcare costs have gone up and the cost of essential commodities, other than free food grains, has also increased.** Without **urgent intervention and robust policy changes**, even rapid urbanization will not be able to drag a large majority of our population out of poverty. **The well-being of the urban poor cannot be an afterthought.**

Cotton needs long-term strategies

Cotton fabric is a sustainable material that ought to be used more frequently.

Cotton with reasonable costs is the key. The textile sector is **dreading the worst due to the ongoing scarcity and high cost** of cotton. **Exports of cotton** worth \$2 billion are in jeopardy. India cultivates cotton on 12 million hectares but lags in productivity.

India and Cotton production

- India's **current cotton productivity of 440 kg/ha of lint** (long-fiber varieties), down from its peak of 516 kg/ha five years ago, compares **poorly with the global average of 775 kg/ha.**

- In the **absence of a clear strategic policy** and **enabling regulatory environment**, India may not be able to provide cotton at an affordable price to the textile industry.
 - **This might result in India turning into a net importer of cotton** from being the largest exporter in 2013-14.
- India's cotton production **threefold from 13 million bales in 2002 to a peak of 39 million bales** in 2013 but **dropped to 32 million bales in 2021**.
- Cotton yields have been **stagnant over the past five years** and have **just begun to slow down**, putting strain on supplies.
- The **imbalance between supply and demand** has raised prices and **negatively impacted** the textile sector.
- By 2026, the **textile industry would require 45 million bales** for both domestic use and exports to nations like Bangladesh and Vietnam.
- **Without an immediately developed strategy** involving numerous stakeholders and Central and State Ministries, it is improbable that **India would produce enough cotton in five years**.

Reasons for downfall in cotton production

Low yield

- A total of 62 districts, or **37% of the cotton-growing area**, have very low **yields** of 230 kg/ha, and another **69 districts, or 35% of the land**, have **medium yields** of 420 kg/ha.
 - The productivity in the **rest of the area is reasonably high at 615 kg/ha.**
- For cotton farmers, **expensive weed control and yield losses** from **pink bollworm, boll rot, and sucking pests** have become a nightmare.

High production Cost & Low productivity

- The lives and income of 70 lakh cotton farmers are being negatively impacted by rising production costs.
- Farmers are required to pay **20% of their income for cotton picking.**
- Additionally, since 2005, **no new biotech features for cotton seeds have been approved** for commercialization, which has led to ineffective pest management and decreased yields.
- Several nations obtained starting **outturns of 40–45% compared to India's 30-35 %.**
- This indicates that, in comparison to other countries, **India is losing 20% of its lint productivity.**

Outdated agronomic methods

- Cotton production is **becoming inefficient due to outdated agronomic methods** and the mechanization of tasks like picking.

Price controls on cotton seeds

- Due to price controls on cotton seeds, there have been **insufficient investments made in seed research over the past ten years**, which has prevented the creation of high-quality cottonseed variants.

What needs to be done?

- There is a need for a **holistic and long-term strategic approach**.
- **Multiple links in the value chain have to be optimized and technologically upgraded**, starting from cotton seed, crop protection, crop nutrition, irrigation, mechanization, markets, ginners, and the end-user.
- There has to be an **alignment between different Central ministries and between centers and States** where cotton is grown or textile units are based.

India must adopt breakthrough technologies and implement a new production system to achieve the global average productivity. This can be done by the following methods:

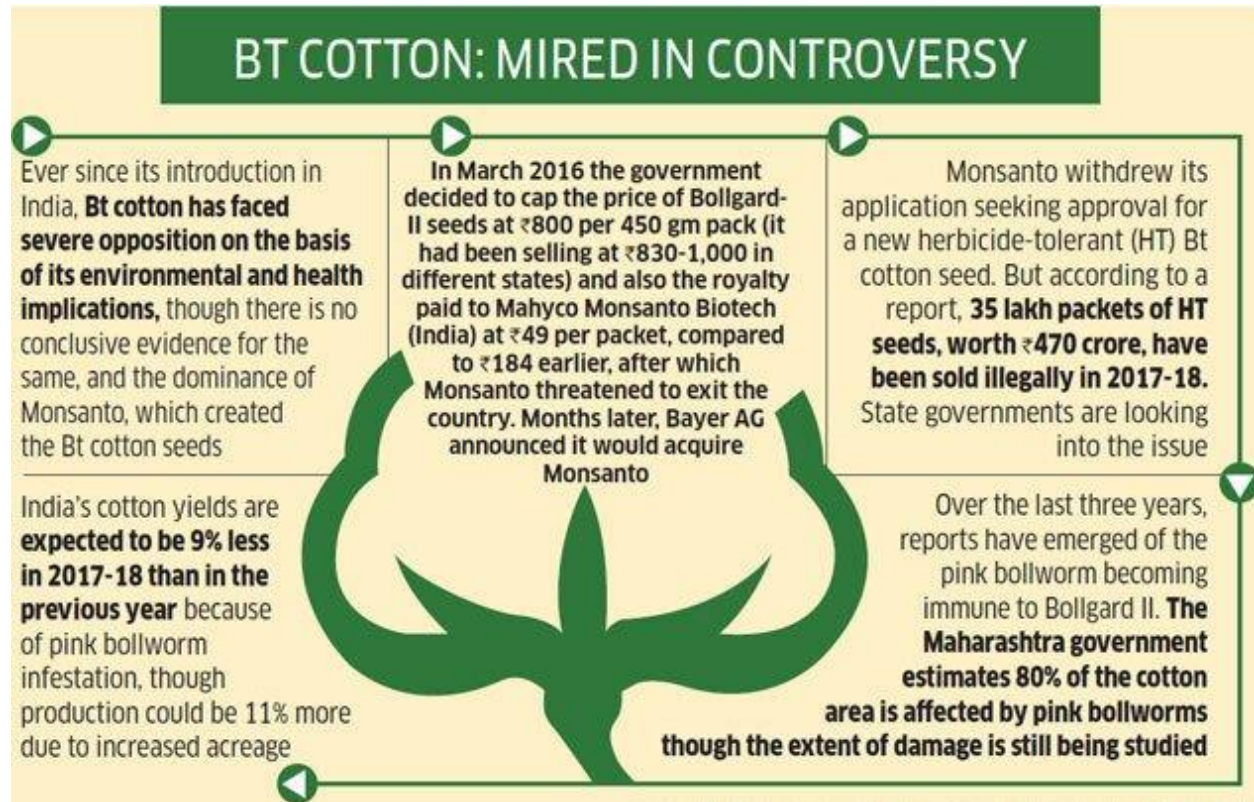
High-Density Planting System (HDPS)

- With customized agronomic techniques, there is need to increase the plant population from **the present 15,000–25,000 per hectare to 75,000–1,000,000**, which will **increase the output by 30%**.
- India needs to develop a **compact plant type** that will be **suitable to increase the plant population**.
- This will call for a **breeding effort from the seed industry** in partnership with ICAR-Central Institute for Cotton Research and ICAR-Central Institute for Research on Cotton Technology (CIRCOT).
- **Farmers have to be incentivized** to adopt this method.

High Ginning Out-Turn (GOT):

- Seed companies **need to be incentivized to invest in developing varieties** with higher ginning out-turn.
 - Ginning out-turn is the **percentage of ginned lint obtained from a mass of seed cotton**.
- The Centre must also **incentivize farmers to grow cotton with high GOT** through a better MSP and a differentiated market price for such cotton.
- It is estimated that the **adoption of high ginning out-turn** can help India to **increase cotton productivity by 20%**.

Technology deployment:



- **The next-generation insect and weed management cotton technology**, whose approval is pending with the Environment Ministry, **must be approved** immediately in order to improve the biotech features.
- To satisfy the pressing demands of farmers, **BtHt cotton must be approved for commercial use**.
 - Additionally, **it will promote R&D** and quicken efforts to **combat the pink bollworm, the danger of boll rot, and the cotton leaf curl virus**.
- In the short to medium term, effective weed management with **next-generation HtBt cotton can boost yields by 20–25%**.

- The Center must operationalize and streamline the regulatory framework, **relieve States of the responsibility of providing NOC**, maintain the **regular operation of the Genetic Engineering Appraisal Committee (GEAC)**, and promote the commercial sector to use advanced biotech traits.
- The use of **pneumatic planters and mechanical pickers is essential** to reduce the farmer's cost of cultivation and improve his competitiveness.
 - The farm machinery industry needs to make machines that suit Indian conditions and small farm holdings.
- For controlling plant **vegetative growth and canopy**, **high-quality PGRs** (Plant Growth Regulator) should be utilized in HDPS. This makes the crop suitable for mechanical harvesting.
- Before mechanical picking, the crop must be **defoliated using a good quality defoliant**.
 - These two goods must originate from the crop protection sector.
- **Pre-cleaners must be deployed in the ginning mills** to remove trash and improve the cleanliness of cotton to ensure Indian cotton fetches better prices in international markets.
- The textile industry must be involved in **making the necessary changes to the machines in ginning mills and spinning mills** to improve cotton quality.

Other changes

- At the policy level, **research investments by the seed industry must be encouraged** by the government.
- **Withdrawing price control on cotton seeds** is also essential.

For achieving higher lint productivity in cotton, improving the profitability and competitiveness of cotton farmers, and making the textile industry realize its full potential, India needs to revisit the highly successful **Technology Mission on Cotton (TMC) 1.0 of 2002**. The government must set up an inter-ministerial initiative involving ministries and all the important stakeholders to take up **TMC 2.0 on a mission mode**.

Caste - A Barrier to Economic Transformation

India has been in a phase of **jobless growth** for at least two decades now, coupled with rising poverty and discontent in rural areas. It is worth noting that **India has not been able to develop a pattern of growth that produces jobs and inclusive development** in the way most of the East Asian countries have done. **Caste**, which is mostly confined to politics, could be among the answers, a **structural factor that impedes economic transformation in India**.

Economic transformation and caste

- Academics frequently **overlook the connection between caste in India and economic transformation.**
- While **caste is crucial to economic transformation** itself, it also appears in current literature as a post-facto category for interpreting disparities in economic and social results.
- Caste through its **rigid social control and networks facilitates economic mobility** for some and **erects barriers** for others by mounting disadvantages on them.
- Caste also **shapes the ownership pattern of land and capital** and simultaneously regulates access to **political, social, and economic capital too.**

Barriers due to caste on the road to economic transformation

- There are three ways in which caste impedes the economic transformation in India:
 - **Ownership and land inequality**, are related to productivity failure within the farm sector.
 - **Elite bias in higher education** and historical neglect of mass education.
 - **Caste-based entry barriers** and **exclusive networks** in the modern sector.

- **Arthur Lewis**, a Nobel Prize winner for development economics, **emphasized the accumulation of physical capital** for economic transformation in the developing world.
- **Theodore William Schultz** underscored the **need for human capital for a better transition** to modern sectors.
 - For him, **an educated workforce enhances productivity** while entrepreneurship ability is increased through education, training, experience, and so on.
- Hence, the **divergent outcomes in the structural transformation** between countries in the global South, particularly **India, China, and southeast Asia**, are due to these three factors.
- **All the nations which succeeded in achieving inclusive growth** in the Global South had land reforms **combined with human capital, invested in infrastructure** by promoting capitalism from below, and began industrialization in the rural sector.
 - **Only India lost on all three counts.**

Land ownership and productivity

- India has **some of the greatest land disparities** in the world.
- **Unequal distribution of land** was perpetuated by British colonial intervention that legalized a traditional disparity.

- Due to British administrative methods, **some castes were given land ownership at the expense of others.**
- **Caste is still a major factor in post-colonial Indian land ownership patterns** due to the British incorporation of land governance categories and practices.
- They made an **artificial distinction between proper cultivators** who belong to certain castes and **those laborers — lower caste subjects** who cultivated granted/gifted lands (Panchami, etc.) that have **institutionalized caste within the land revenue bureaucracy.**
- The **prescribed categories and practices** have **entrenched caste inequality in land ownership.**
- Even the **subsequent land reform** that took place **after India's independence largely excluded Dalits and lower castes.**
- It **emboldened and empowered** mainly **intermediate castes** at the expense of others in rural India.
- Even the **Green Revolution** that brought changes in the farm sector **did not alter land inequality** as it was mostly achieved through technological intervention.
 - Though India has **certainly seen surplus food production** since then, the **castes that were associated with this land pattern** and benefited from the Green Revolution **tightened their social control over others in rural India.**

Land Productivity after 1990

- While land has **lost its productive capacity** since the 1990s due to the real estate and construction turn in the Indian economy, it still **works as a source of inheritance, family lineage, and speculative capital.**
- In that sense, the economic reforms of the 1990s were a watershed moment.
- Even those who **made a surplus in farm sectors could not transform their status from cultivators to capitalist entrepreneurs** in the modern sectors, except for a few castes in western and southern India.
- Those castes that had a stake in agriculture did not benefit from the economic reforms for two reasons:
 - Historical neglect of education.
 - The entry barriers erected by the upper castes in modern sectors.
- **The recent agitations** by the Jats in Haryana and Punjab, the Marathas in Maharashtra, and the Patels in Gujarat, demanding, among other things, **reservation for their castes in higher education and formal jobs exemplify this new trend.**

Ignoring of Education in India

- **Since the advent of colonialism**, the elite has dominated the Indian educational system.
 - For their administrative purposes, **British colonialists educated small groups of elites, primarily from upper castes.**

- India suffered from **caste bias in education**.
- Although the **Indian Constitution guaranteed free and compulsory education** under its directive principles, it was hardly translated into practice.
- Instead, attention was given to higher education for the elites, and hence, inequality in **access to education got translated into inequality in other economic domains** including wage differentials in India.
- **Indian elites sustained their position at the top** by denying education to a substantial proportion of the population till **positive-discrimination policies** were implemented in higher education.
- India's **turn toward service growth** — particularly its claims of emerging as a leader in software development and a natural inheritor of soft power — is arguably **an outcome of this historic elite bias in education**.

Global scenario

- **Chinese and other East Asian countries** invested in basic education and gradually shifted towards higher education.
- Their **success in manufacturing** is a direct outcome of the investment in human capital.
- In the global market, it can be seen easily that **South East Asia and China** captured low-end manufacturing jobs, and **India largely concentrated on high-end technology jobs**.

- China taking over India in manufacturing is **due to this neglect of human capital formation.**
 - In China, **rural entrepreneurship was able to grow** out of the traditional agricultural sector on a massive scale.
 - **Rural India, in contrast, hampered by a poor endowment of human capital**, could not start entrepreneurial ventures even remotely on the scale of the Chinese.

Barrier to entrepreneurship

- India did not witness high capitalism from lower strata except in a few cases.
- **Caste shaped policy outcomes**, including India's highly **unequal land reform and lack of public provision of education and health**, which in turn erected barriers to economic diversification.
- Caste also worked in building social networks.
- Castes that were already in **control of trading and industrial spaces resisted the entry of others.**
- Even those who had an **economic surplus** in farm sectors **could not invest in non-farm modern sectors.**
 - **Social inequalities have mounted barriers to economic transition.**
- Even the **relative success in South India** is being attributed to the **'Vaishya vacuum'** — an absence of traditional merchant castes.

- In contrast, such a **transition took place in South East Asia**, where diversification into urban enterprises by agrarian capitalists was possible.

The interaction between caste and economy is one cause of truncated transformation. Because **caste inhibits economic transition**, it is an **active agent rather than a residual variable**. India should firmly take a step ahead for removing caste discrimination for a better economic future.

India hit by soaring fertilizer prices, inefficient subsidies

No country has as much area under farming as India. **At 169.3 million hectares (mh) in 2019, its land used for crop cultivation was higher than** that of the US (160.4 mh), China (135.7 mh), Russia (123.4 mh), or Brazil (63.5 mh). India has an abundance of land, water, and sunshine to support a thriving agricultural sector thanks to **its perennial Himalayan rivers and average annual rainfall** of approximately 1,200 mm, compared to 475 mm in Russia, 650 mm in China, and 750 mm in the US. But there's one resource in which the country is short and **heavily import-dependent — mineral fertilizers**.

- In value terms, imports of all **fertilizers touched an all-time high of \$12.77 billion** in 2021.
- In 2021-22, India imported:

- 10.16 million tonnes (mt) of urea.
- 5.86 mt of di-ammonium phosphate (DAP)
- 2.91 mt of muriate of potash (MOP).
- In 2021-22, **India also produced 25.07 mt of urea, 4.22 mt of DAP, 8.33 mt of complex fertilizers, and 5.33 mt of single super phosphate (SSP).**
 - Complex fertilizers contain **nitrogen-N, phosphorus-P, Potassium-K, and sulphur-S in different ratios.**
- **The intermediates or raw materials** for the manufacture of these **fertilizers were substantially imported.**

Urea

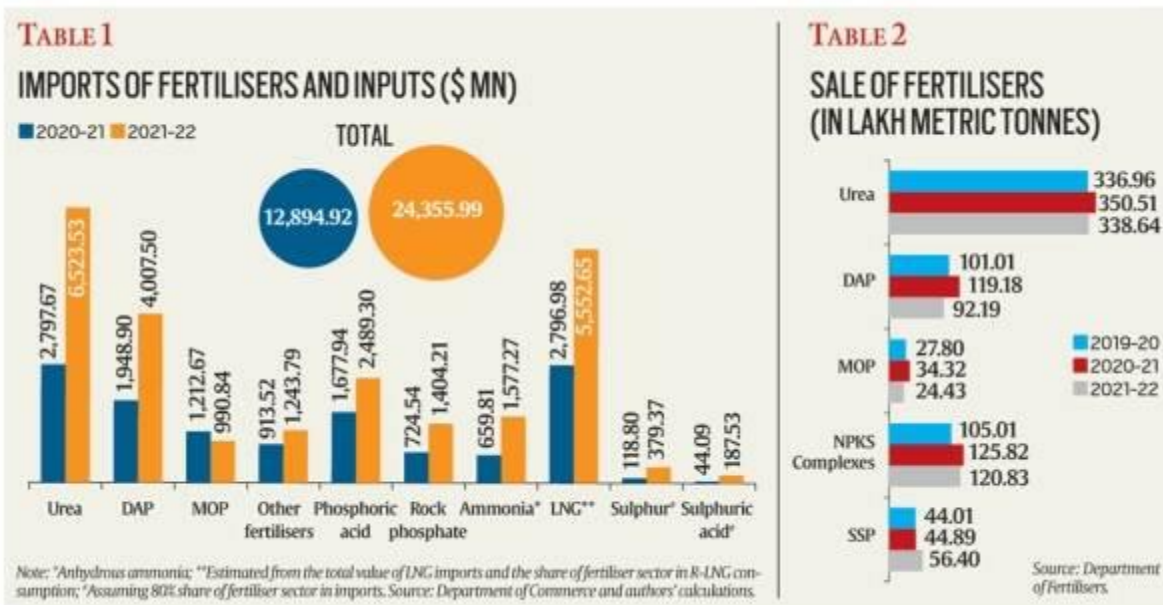
- Urea's primary feedstock is natural gas.
- In 2021-22, **India imported 23.42 mt of liquefied natural gas (LNG)** valued at \$13.47 billion.
- **The fertilizer sector's share in the consumption of re-gasified LNG was over 41 percent.**

Di-ammonium phosphate (DAP)

- For DAP, domestic **manufacturers import intermediate chemicals,** namely phosphoric acid and ammonia.

- Some even **produce phosphoric acid by importing rock phosphate and sulphuric acid**. The latter can be further made from the import of sulphur.
- During 2021, 6.44 mt of phosphoric acid, 2.31 mt of ammonia, 9.66 mt of rock phosphate, 1.92 mt of sulphuric acid, and 1.90 mt of sulphur were imported into the country.

Cost of fertilizer



- The above table shows the total value of fertilizer imports by India, inclusive of inputs used in domestic production, was a whopping \$24.3 billion in 2021-22.

There are two costs here.

Foreign exchange outgo

- **Imports of Urea:** Mostly from China, Oman, UAE, and Egypt
- **Imports of DAP:** China, Saudi Arabia, and Morocco
- **Imports of MOP:** Belarus, Canada, Russia, Israel, and Jordan
- **Imports of LNG:** Qatar, US, UAE, and Nigeria
- **Imports of phosphoric acid:** Morocco, Jordan, Senegal, and Tunisia
- **Imports of ammonia:** Saudi Arabia, and Qatar
- **Imports of rock phosphate:** Jordan, Morocco, Egypt, and Togo.

Fiscal cost

- Fertilizers are not only imported, but **Indian farmers also pay below what it costs to import or manufacture using imported inputs.**
- The difference **is paid as a subsidy by the government.**
- **Both costs are unsustainably high** to bear for a mineral resource-poor country.
- India is **feeling the impact of it**, especially with global prices of Urea, DAP, MOP, phosphoric acid, ammonia, and LNG soaring two to two-and-a-half times in the last year (they have softened a bit of late).
- There was a time farmers had to be incentivized to use chemical fertilizers for boosting crop yields.
 - Today, **they have to be restrained from over-application.**

- Farmers should know **India imports half of its natural gas requirement** – that will only go up – and hardly has any mineable rock phosphate, potash, or elemental sulphur reserves.

What could be done?

- There is a need **to cap or even reduce consumption of high-analysis fertilizers** – particularly **urea (46 percent N content), DAP (18 percent N and 46 percent P), and MOP (60 percent)**.

Nitrification inhibition compounds in urea

- These are basically chemicals that **slow down the rate at which urea is hydrolyzed** (resulting in the production of ammonia gas and its release into the atmosphere) **and nitrified** (leading to below-ground loss of nitrogen through leaching).
- By **reducing ammonia volatilization and nitrate leaching**, more nitrogen is made available to the crop, enabling farmers to harvest the same, if not better, yields with a lesser number of urea bags.
- Together with products such as **liquid nano urea** it is possible to achieve a 20 percent or more **drop in urea consumption from the present 34-35 mt levels**.

- Nano urea's ultra-small particle size is **conducive to easier absorption by the plants** than with bulk fertilizers, **translating into higher nitrogen use efficiency.**
- That works out to 6.5-7 mt fewer imports, equivalent to \$4.5-5 billion at current prices.

Promoting sales of fertilizers

- Promoting sales of **SSP** (containing 16 percent P and 11 percent S) and **complex fertilizers such as "20:20:0:13" and "10:26:26".**
- **DAP use should be restricted** mainly to paddy and wheat; other crops don't require fertilizers with 46 percent P content.
- **India can also import more rock phosphate** to make SSP directly or it can be converted into "weak" phosphoric acid.
 - The latter, having **only about 29 percent P** (compared to 52-54 percent in normal "strong" merchant-grade phosphoric acid), is **good enough for manufacturing "20:20:0:13", "10:26:26" and other low-analysis complex fertilizers.**

No plan to **cap/reduce consumption of high-analysis fertilizers can succeed** without farmers knowing what is a **suitable substitute for DAP and which NPK complex** or organic manure can bring down their urea application from 2.5 to 1.5

bags per acre. It calls for **agriculture departments and universities not just to revisit their existing crop-wise nutrient application** recommendations, but **disseminating this information to farmers on a campaign mode.**

UNESCO - global standard for AI ethics.

Artificial intelligence (AI) is more present in human lives than ever. **AI algorithms can also be partially credited** for the **rapidity with which vaccines were developed to tackle COVID-19.** The algorithms crunched complex data from clinical trials being undertaken in all corners of the world, creating global collaborations that could not have been imagined even a decade ago. But the AI has also posed several challenges in the present scenario.

Challenges associated with AI

- The data used to feed into AI often **aren't representative of the diversity of societies**, producing outcomes that can be said to be biased or discriminatory.
 - **Example:** While India and China together constitute approximately a third of the world's population, **Google Brain estimated that they form just 3% of images used in ImageNet, a widely used dataset.**
- Problems are emerging in facial recognition technologies also.

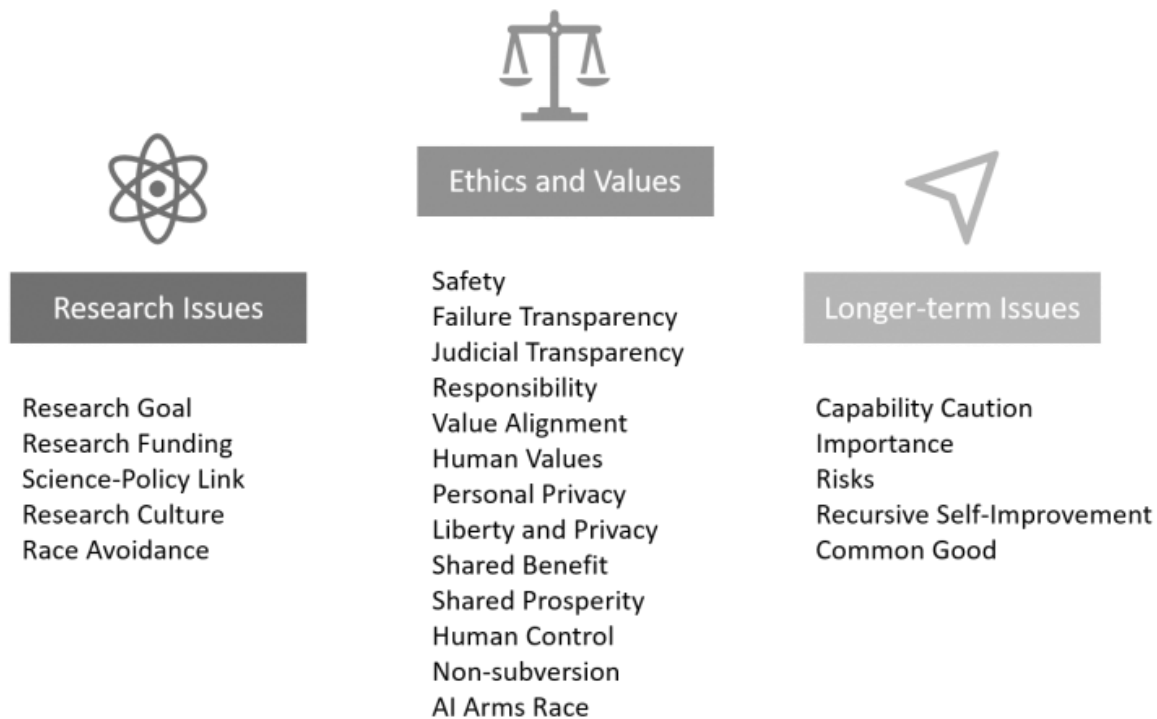
- These are used to **access phones, bank accounts, and apartments, and are employed by law-enforcement authorities, in identifying women and darker-skinned people.**
- In the programs released by major technology companies related to facial recognition, the **error rate was 1% for light-skinned men, but 19% for dark-skinned men, and up to 35% for dark-skinned women.**
 - **Biases in facial recognition technologies** have led to wrongful arrests.

AI and India

- India is one of **the world's largest markets for AI-related technologies**, valued at over \$7.8 billion in 2021.
- **The National Strategy on Artificial Intelligence released by NITI Aayog in 2018** highlights the potential of AI in solving complex social challenges faced by Indian citizens in agriculture, health, and education.
- To ensure that the full potential of these technologies is reached, the **right incentives for ethical AI governance need to be established** in national and sub-national policy.
- India has made great strides in the **development of responsible and ethical AI governance**, starting with **NITI Aayog's #AIForAll campaign** to the many corporate strategies that have been adopted to ensure that AI is developed with common, humanistic values.

World's approach toward AI

- In November 2021, 193 countries reached a groundbreaking agreement at **UNESCO on "Ethics of Artificial Intelligence"**.
 - It talks about how AI should be designed and used by governments and tech companies.



UNESCO's recommendation

UNESCO's Recommendation on the Ethics of Artificial Intelligence aims to **fundamentally shift the balance of power** between people, and the businesses and governments developing AI.

Affirmative actions

- Countries that are members of UNESCO have agreed to implement the recommendations by **enacting actions to regulate the entire AI system life cycle**, ranging from research, design, and development to deployment and use.
- This means they **must use affirmative action** to make sure that women and minority groups are fairly represented on AI design teams.
- This could take the **form of quota systems** that ensure that these teams are diverse or the form of dedicated funds from their public budgets to support such inclusion programs.

Proper management of data

- The recommendation also underscores the **importance of the proper management of data, privacy, and access to information.**
- It establishes the **need to keep control over data in the hands of users**, allowing them to access and delete the information as needed.
- It also calls on **member states to ensure that appropriate safeguards schemes** are devised for the processing of sensitive data and that effective accountability and redress mechanisms are provided in the event of harm.

Socio-cultural impacts of AI

- AI systems **should not be used for social scoring or mass surveillance purposes.**
- Particular attention must be paid to the psychological and cognitive impact that these systems can have on children and young people.
- Member states should **invest in and promote not only digital, media, and information literacy skills, but also socio-emotional and AI ethics skills** to strengthen critical thinking and competencies in the digital era.
- This is all critical for **ensuring accountability and transparency of AI-related technologies**, underpinning a strong rule of law that adapts to new digital frontiers.

Application of Recommendation

- In a number of countries, the principles of the Recommendation are already being used in AI regulation and policy, demonstrating their practical viability.
- **Finland** provides an example of good practice in this regard, with its 2017 AI Strategy.
- This was the **first of its kind in any European country** and demonstrated that governments can **effectively promote ethical AI use** without compromising the desire to be on the cutting edge of new technologies.

Road Ahead

- The new agreement is a **recognition that AI-related technologies cannot continue to operate without a common rulebook.**
- Over the coming years, the recommendation will **serve as a compass to guide governments and companies, to voluntarily develop and deploy AI technologies** that conform with the commonly agreed principles it establishes.
- **Governments should use the recommendation** to establish and update legislation, regulatory frameworks, and policy to embed humanistic principles in enforceable accountability mechanisms.

With this agreement, it can be assumed that AI to work where it can have the most impact: hunger, environmental crises, inequalities, and pandemics. If all the recommendation is followed, AI has the potential to solve the current prevailing problems.

Still a men's Parliament in India

When the Indian Republic opened its first Parliamentary session in 1952, **39 women leaders** stood in the hallowed corridors of power, confronting the polity's centuries-old trend of male domination. India was leading the way in the push for more inclusive international democracies with **5.5 percent women**

representation at a time when women made up **only 1.7 percent of the total members of the US Congress and 1.1 percent of the UK Parliament** The fact that women have a **stronger voice in the Indian parliamentary** system is a credit to their vital contribution. However, now it appears that **India has deviated from that road.**

Women in parliament: From 1947 to present

- **Despite a woman Prime Minister, a President, and a relatively higher percentage of women parliamentarians** when compared to some of the other mature democracies in the past, India's struggle with inclusivity has not eased.
- Due to systemic issues, **Parliament continues to alienate women.**
- The number of **women representatives is still considerably small**, but even more subtly, Parliament as a workspace **continues to be built exclusively for men.**
- Over the last few years, India has seen a growing push for gender equality.
 - The Supreme Court's **gender identification decision** (National Legal Services Authority vs Union of India, 2014) has given the movement a boost.
 - **Citizens have begun to affirm their gender identity** by stating their personal pronouns (she/her, he/his, they/them, etc.) as a show of unity.
- However, The issue appears to have **largely escaped the Legislature's notice.**

Parliament: Absence of gender parity

Inclined towards masculine power

- A closer examination of the **Indian parliamentary debates reveals a worrying lack of gender-neutral vocabulary.**
 - For example, after 75 years of independence, Parliament frequently refers to women in positions of leadership as Chairmen and Party men.
- In the Rajya Sabha, the **Rules of Procedure continue to refer to the Vice-President of India as the ex-officio Chairman**, stemming from the **lack of gender-neutral language** in the Constitution of India.
- The alarming degree of usage of **masculine pronouns assumes a power structure biased towards men.**
 - This tends to manifest itself in parliamentary debates, for instance, when a senior woman MP from Tamil Nadu was referred to as “Chairman madam” in the Lok Sabha during last year’s winter session.

Absence of gender-neutral Acts

- In the last decade, there have **hardly been any gender-neutral Acts.**
- Acts have made references to **women not as leaders or professionals (such as policemen), but usually as victims of crimes.**

- In its current form, the **Constitution supports historical preconceptions** that women and transgender individuals are not capable of holding positions of power in India, such as President and Vice-President, Speaker of the Lok Sabha, Governor of state, or judge.
- It is a **critique of the many Union governments** that did not take the initiative to modify the Constitution, rather than the Constitution itself.
- In the past, amendments have been brought **about to make documents gender-neutral**.
 - In 2014, under the leadership of the then Speaker of the Lok Sabha, **the Rules of Procedure of the Lok Sabha were made entirely gender-neutral**.
 - Since then, each **Lok Sabha Committee Head** has been referred to as Chairperson in all documents.
 - This initiative is proof that amending legal documents to make them **inclusive for all genders is an attainable goal if there is a will**.

Failure to adapt to changes

- Despite certain course corrections, both Houses of Parliament and Central Ministries have failed in one common aspect.
- In a compilation of ministerial replies to questions from the **17th Lok Sabha**, **so far for 75 women Parliamentarians**, 84% of the answers that used salutations (sir/madam) referred to women Parliamentarians as **'sir'**.

- During the 15th Lok Sabha, when the **Lok Sabha had a woman Speaker**, **only about 27% of the answers made this error.**
- However, there is no indication of a clear reason for such lapses, **either due to pure administrative errors or ignorance of the rules of address.**

International Practices

- Internationally, even mature democracies that legalized universal suffrage after India, such as **Canada (1960 for Aboriginal women), Australia (1962 for Indigenous women), and the United States (1965 for women of African-American descent)**, have now taken concrete measures toward gender-inclusive legislation and communication.
 - **Canada's Department of Justice** has guidelines for using **gender-neutral language** in all legislation and legal documentation.
 - **The Australian government** has incorporated gender-neutrality in its drafting Style Manual.
 - **The U.K.'s House of Commons** declared in 2007 that all laws would be drafted gender-neutrally.
- **Stereotypical language regarding women and transgender** individuals becomes more **acceptable to the rest of the population** when Parliament and government agencies reinforce gender biases in their communications.
- For citizens to follow, the country's leaders must deliver the appropriate message.

- They **may and must start with a constitutional change and an overhaul of the entire legal system.**

Suggestions

- Society needs to **change the social attitude** toward women.
- Apart from this, **concrete and effective steps** need to be taken regarding women's **education, training, employment and welfare, and political participation.**
- **The prejudice prevailing in society also has to be overcome** that women are physically weak and intellectually underdeveloped.
- The **reservation system** should be implemented for **women in women's politics** so that women **get political rights.**

In the 21st century, when people of all genders are leading the world with compassion, strength, and ambitions, the **Indian Parliament needs to reflect on its standing.** Recognition and correction of past errors through amendments to rulebooks, laws and the Constitution are just starting points and must lead to **sensitivity, equal treatment, and appreciation for the people of India, regardless of gender.**

GEMCOVAC-19

The country's **first home-grown mRNA Covid-19 vaccine** — **GEMCOVAC-19** — developed at **Pune's Gennova Biopharmaceuticals** has got a '**restricted emergency use**' nod for the 18-and-above age group. As **mRNA vaccines** are required to be kept at **sub-zero temperatures**, it was a mammoth task for Gennova scientists to develop a **thermostable mRNA Covid-19 vaccine**. Scientists had to innovate to suit local needs to make it affordable and deployable. The new vaccine can now be stored at the temperature of a standard medical refrigerator.

The mRNA platform

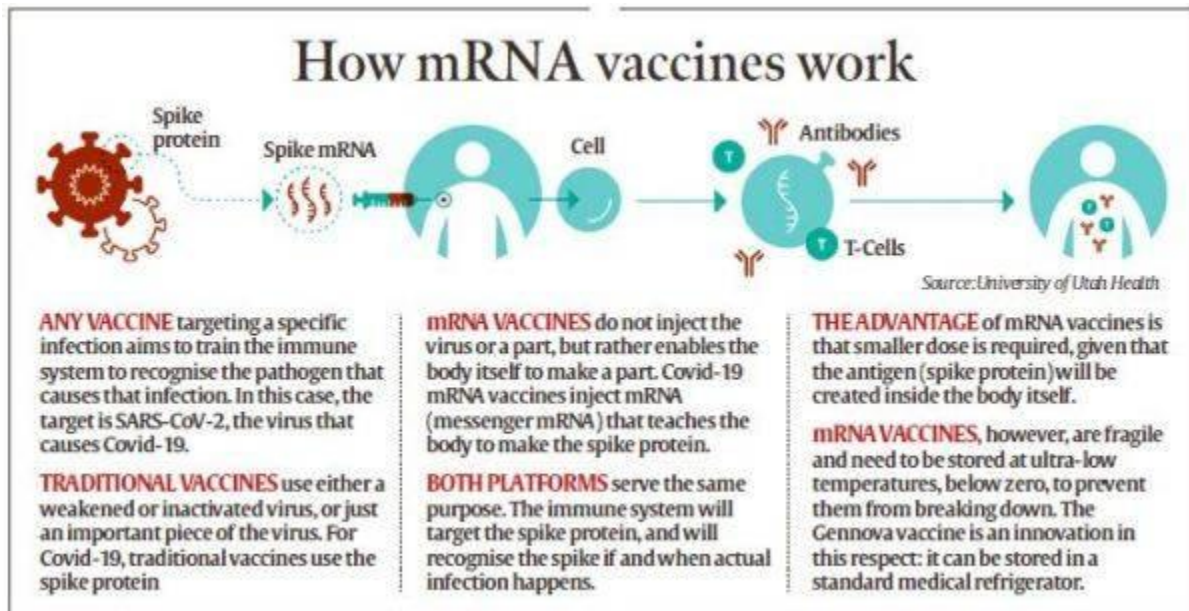
As the **Covid-19 pandemic** spread, an **mRNA vaccine** candidate was the first to enter human trials globally. The first two vaccines that were made available for use in the US were based on mRNA technology.

Unlike vaccines that put a **weakened or inactivated virus** in your body to activate an **immune response**, these two Covid-19 vaccines (Pfizer-BioNTech and Moderna) used **messenger RNA or mRNA** to deliver a message to your immune system.

Basically, the technology uses **genetically engineered mRNA** to instruct cells to make the **S-protein** found on the surface of the Covid-19 virus. According to

reports from **US-based Mayo Clinic**, after vaccination, the muscle cells begin making S-protein pieces and displaying them on cell surfaces. This causes the body to create antibodies.

But these vaccines have to be stored at **sub-zero temperatures** as mRNA is fragile and breaks down easily.



Thermostable vaccine

“Unlike in the West, where the vaccine has to be stored at **sub-zero temperatures**, the challenge in India was to be able to store the vaccine **between 2-8 degree Celsius**. We had to innovate to suit our local needs as to what is affordable and deployable. **GEMCOVAC-19** can now be stored at the temperature of a standard medical refrigerator,” says Dr Sanjay Singh, CEO of Gennova Biopharmaceuticals.

The **conversion from liquid to powder form of the vaccine** takes place via **Lyophilisation** — this is freeze-drying, a process where the water is removed from

the product after it is frozen and placed under a vacuum allowing the ice to change directly from solid to vapor without passing through a liquid phase.

However, just removing water **by Lyophilisation of the mRNA vaccine** does not work. So, the surrounding pressure has to be tweaked and then kept stable to ensure the characteristics of the vaccine are the same as before **Lyophilisation**.

For this to be achieved, the key was to add an external agent which at a certain critical concentration keeps it stable under lyophilized conditions. The

Lyophilisation technology is not new, but a lyophilized mRNA vaccine is unique.

“We performed hundreds of trials before arriving at the right formulation and right condition to ensure a **heat-stable mRNA vaccine**,” Dr Singh said.

Trials and safety

Freeze-drying the large and unstable mRNA molecule with the **nanoparticle** was a daunting challenge. However, Gennova invested countless man-hours in the

hope of lyophilizing the mRNA vaccine in a single vial within a year. This

thermostable vaccine was thoroughly tested in various animal models to ensure its safety and immunogenicity before entering human clinical trials. Phase 1 and 2 trial data across 480 participants had been submitted earlier, and data from Phase

3 trial across 4,000 participants was then presented to the **Central Drugs**

Standard Control Organisation (CDSCO). During the Phase 3 trials, 3,000

participants were administered the **mRNA Covid-19 vaccine** and 1,000 were given Covishield.

According to officials at Gennova, the trial data showed that the vaccine was safe and well-tolerated. Immunogenicity measured at 2 weeks post-dose showed that GEMCOVAC-19 is non-inferior to Covishield.

The **two-dose vaccine** will have to be administered intramuscularly, 28 days apart.

Fight against emerging variants

For the first time, the **mRNA platform has been used to develop a Covid-19 vaccine** in India. This total process may have taken one-and-a-half years, but for Dr. Singh, a biochemist who had worked on malaria vaccines at the US-based National Institutes of Health, and the team, designing an mRNA vaccine against the Omicron variant barely took 60 days.

Notably, this technology platform provides flexibility to quickly tweak the vaccine for any existing or emerging variants of the virus.

“A **pandemic-ready platform technology** has been created that can be used to quickly develop a vaccine should a **variant-of-concern** emerge due to the rapid mutation of the **SARS-CoV-2 virus**. Clinical trials need to be done to ascertain the effectiveness of the GEMCOVAC-19 against Omicron and sub-variants,” said Dr. Singh.

A **short clinical trial** will also be conducted with the **Omicron-specific vaccine**, which has also been designed for use as a booster and a protocol submitted to the DCGI.

He added: “The learning curve was steep not only in terms of production but also in conducting the clinical trials. The approval of the **nation's first mRNA vaccine**

will pave the way for the development of ***new-variant specific mRNA vaccines*** that can be used as future booster doses. It was absolutely necessary to establish the safety and immunogenicity of the new vaccine platform technology in the Indian population.”

Ready for roll-out

Gennova already has a license to manufacture and sell from the CDSCO.

Gennova Biopharmaceuticals Chief Operating Officer Samit Mehta said that talks are underway with the government on whether they would like to procure and deploy or whether the firm can reach out to the private market. On pricing, he added: “***Compared to our peers we will be competitive.***”

Authorities at Gennova said that they are actively engaged in talks with at least 25-30 countries that had evinced interest in the new vaccine.

What is Wet-bulb temperature?

New Delhi feels like it is on fire. The heat comes off the road in **blistering waves**, and the water that flows from the cold tap is too hot to touch. Daytime temperatures have hit **44 degrees Celsius (111 Fahrenheit)** and often do not fall **below 30 in the night**. A giant landfill on the outskirts of the capital spontaneously combusted recently, and the **17-story high dump** that contains

millions of tons of garbage continues to smolder, worsening the city's already dangerously polluted air.

WHAT IS WET-BULB TEMPERATURE

Photo: Piyal Bhattacharjee

- Wet-bulb temperature is the lowest temperature to which air can be cooled by the evaporation of water into the air
- It is measured by factoring in heat and humidity levels
- Theoretically, if wet-bulb temperature reaches 35 degrees Celsius –its highest point– it means humans can no longer lose internal body heat by sweating and cool themselves
- This could potentially leads to heatstrokes



Wet-bulb days in Delhi each year at present | **63 days**
RCP 8.5 or business as usual scenario (2050) | **99 days**
RCP 8.5 or business as usual scenario (2100) | **131 days**
RCP 2.6 (stringent scenario where global temperature rise will be below 2°C by 2100) | **81 days**

Daily power outages driven by a surge in **demand for electricity** have resulted in blackouts as long as eight hours in some parts of India, while **coal stocks** — the ***fuel that accounts for 70% of the country's electricity generation*** — are running low, prompting warnings of a fresh power crisis. The **northern wheat crop is scorched**. It was the ***hottest March in 122 years***. Spring just didn't happen, and those extreme temperatures continued into April and May 2022. Still, it's not until June that the monsoon is expected to arrive and provide any kind of relief.

What's most alarming **about this heatwave is** that it's not so much a one-time ordeal as a taste of things to come as the effects of global warming push India and its neighbors to levels where the climate is a core threat to human health.

The most worrying weather measurement is not the **heat typically reported in forecasts** but the **wet-bulb temperature**, which **combines heat and humidity** to indicate **how much evaporation can be absorbed into the air**. At **wet-bulb temperatures above 35 degrees Celsius**, we become unable to reduce our temperature via sweating and will suffer potentially fatal heat stroke after only a few hours, even with shade and water. Similar effects can result for those working outdoors when **wet bulb temperatures exceed 32 degrees**, and measures as low as 28 degrees caused tens of thousands of deaths in the European and Russian heatwaves of 2003 and 2010.

Humidity falls as temperature rises, so such events were once thought to be extraordinarily rare. One 2018 study concluded that the most severe temperatures of close to 35 degrees "almost never occur in the current climate." In fact, closer analysis of data from weather stations done in 2020 suggests they're already happening relatively frequently, particularly in the **heavily populated belt from the Persian Gulf through Pakistan and northwest India**.

Just 12% of India's 1.4 billion citizens have access to **air conditioning**, which means hundreds of millions of people are simply unable to cool themselves when their bodies reach the point of heatstroke. It's a situation mirrored in neighboring Pakistan, which is experiencing similarly **catastrophic heatwave conditions**. Daily wage earners, who toil in the fields, work in factories and construction, sweep streets and build roads, have no escape.

Multiple regions of India have already been **edging close to critical wet-bulb temperatures**, according to government data, though the maximum humidities

haven't necessarily been occurring at the same time as the peak temperatures. In the eastern Odisha state, **peak temperatures and humidities** in parts of the capital Bhubaneswar would have produced **wet-bulb temperatures of 36.6 Celsius** if they happened at the same time, the data show.

The risk is that, even if the **most hazardous levels** are avoided in the current heatwave, each hot season is a fresh roll of the dice on whether a freak event will occur that will lead to vast numbers of deaths. The odds lengthen with each passing year. The world is currently in the **grip of a La Nina climate cycle**, which typically **brings cooler summer weather to India**. When that next flips to **El Nino**, the risks will ramp higher still.

That the government hasn't declared a **national disaster** and rolled out an appropriate response will come as no surprise to those who lived through the nation's deadly Covid-19 epidemic.

India does have a "**National Action Plan on Heat Related Illnesses**" and the federal government on 1 May 2022 issued an advisory to states urging them to ensure hospitals were ready to deal with an expected surge in demand. But given that the **India Meteorological Department** (which started collecting nationwide records in 1901) has been raising the alarm with heat wave warnings on 25 April 2022, it all feels a little underdone. Recommended measures such as **whitewashing roofs to cool building interiors would be insufficient** to deal with a major heatwave. Advice to ensure secure power supply to health centers won't help if heat and the load from millions of air conditioners cause the power grid to fall over when it's most needed.

Dew Point and Dry Bulb Temperatures

- **Dry Bulb Temperature:**

- The Dry Bulb temperature, usually referred to as "air temperature", **is the air property that is most commonly used.** When people refer to the **temperature of the air they are normally referring to the dry bulb temperature.**
- The Dry Bulb Temperature refers basically **to the ambient air temperature.** It is called "Dry Bulb" because the **air temperature is indicated by a thermometer not affected by the moisture of the air.**
- Dry-bulb temperature **can be measured using a normal thermometer freely exposed to the air but shielded from radiation and moisture.**
- The dry-bulb temperature is an **indicator of heat content.**

- **Dew Point Temperature:**

- The Dew Point is the temperature where **water vapour starts to condense out of the air**(the temperature at which air becomes completely saturated).
 - **Above this temperature the moisture stays in the air.**
- If the dew-point temperature is close to the dry air temperature - **the relative humidity is high.**
- If the dew point is well below the dry air temperature - **the relative humidity is low.**

- The Dew Point temperature is **always lower than the Dry Bulb temperature and will be identical with 100% relative humidity**(the air is at the saturation line).

What is the GST Council, and what does it do?

The **47th meeting** of the **Goods and Services Tax Council** began in Chandigarh 28 June 2022, almost marking **five years of the tax system** coming into effect on 1 July 2017.

Over these five years, the **GST setup has gone through numerous changes**, and the ongoing two-day meeting is expected to look at matters such as the **GST compensation to states**, and the **imposition of taxes** on some currently-exempt goods and services.

What is the GST Council?

The **Goods and Services Tax regime** came into force after the **Constitutional (122nd Amendment) Bill** was passed by both Houses of Parliament in 2016. More than **15 Indian states then ratified it** in their state Assemblies, after which the President gave his assent.

The **GST Council** – a **joint forum of the Centre and the states** — was set up by the President as per **Article 279A (1)** of the amended Constitution.

The members of the Council include the **Union Finance Minister (chairperson)**, the **Union Minister of State (Finance)** from the Centre. Each state can nominate a minister in-charge of finance or taxation or any other minister as a member.

VOTING STRENGTH	GST COUNCIL
Centre 1/3 VOTE IN COUNCIL	Chairperson Union finance minister
States 2/3 WEIGHT IN COUNCIL	Other Member From Centre Minister of state for finance
DECISIONS NEED 75% VOTE SUPPORT	Vice-chairperson One of the state finance ministers
	Members State finance ministers

Why was the Council set up?

The Council, according to **Article 279**, is meant to “**make recommendations to the Union and the states on important issues related to GST**, like the goods and services that may be subjected or exempted from GST, model GST Laws”.

It also decides on various rate slabs of GST.

For instance, an interim report by a panel of ministers has suggested **imposing 28 per cent GST on casinos**, online gaming and horse racing. A decision on this will be taken at the Council meeting on 29 June 2022.

What has changed this time?

The ongoing meeting is the first since a **decision of the Supreme Court** in May this year, which stated **recommendations of the GST Council are not binding**.

The court said **Article 246A** of the Constitution gives both Parliament and state legislatures “**simultaneous**” **power to legislate on GST** and recommendations of the Council “**are the product of a collaborative dialogue involving the Union and States**”. This was hailed by some states, such as **Kerala and Tamil Nadu**, who believe states can be more flexible in accepting the recommendations as suited to them.

The council’s meeting is also likely to focus on the **issue of extension of the GST compensation regime** beyond June 2022. This was a special mechanism by which states were assured that their revenues would not be affected by the new GST system. Some states are already demanding that the compensation be continued.

Earlier, the Council had agreed to **extend the levy of compensation cess till 2026**, but only for repayment of the borrowings made in the aftermath of the pandemic to provide compensation to states.

What Is the Internet of Things (IoT)?

Internet of things (IoT) broadly means “**All objects**, which are **connected to the web**, will be **enabled to share and process data** through their sensors and communication devices independently”. It is estimated that by 2023, globally there may be 7 billion connected people, more than 30 million applications and embedded systems, more than **60 trillion GBs of data** and **around 8 trillion**

revenue opportunities. The IoT market value is expected to reach \$11 trillion with security spending reaching \$3.5 billion shortly.

The **history of IoT evolution** started with **archaic mode of interaction between human and thing** (people and things), followed by **interaction of machine and machine** (things and things), leading to **interaction of people kicking off through proverbial internet** (people and people), resulting in multiple things getting connected on net (web of things) and then finally the **internet of humanity.**

IoT in agriculture basically involves the network **wherein physical components** in the sector are to be connected with the internet which may be the farms comprising trees, plants, and animals, the tools and various objects in the sector. This enables **information exchange, monitoring and tracking**, helping humans manage complex agricultural sectors more productively under certain protocols. For example, most of the developed countries such as **Germany, Japan and US** has already moved ahead in **sensor technology** and manufacturing processes. The net benefit of IoT application is the increased agricultural output, **improved quality of agricultural products**, reduced labour costs coupled with increased agricultural income for farmers.

Intelligent agricultural machinery or IoT incorporates **cluster IoT, remote IoT** and **internal IoT**. While cluster IoT focuses on communication and control between agricultural machinery operating in the same area, **remote IoT is between operation sites** and remote terminals and servers. The communication

between sensors, actuators and the central processing unit in agricultural machinery is referred to as **Internal IoT**.

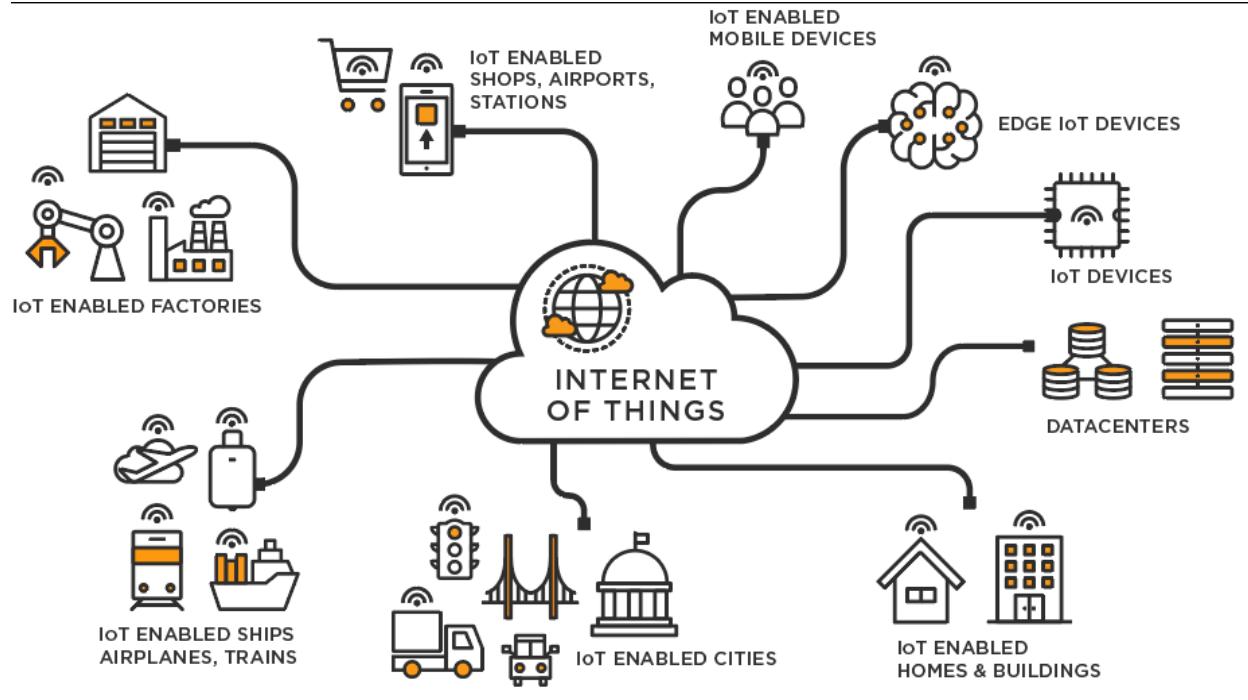
IoT finds immense application in the agricultural sector, wherein, the sustainable future of food is considered as the target by almost all the developing economies. By 2050, it is expected that the **world population will grow by 30%** to 10 billion and this requires **increase in agricultural productivity by 1.5 times**. The global climate stability target involves inter alia at least 67% curtailing of greenhouse gas emission which necessitates rectifying problems with the current system. In developing Countries, there are multiplicities of problems in the agricultural sector such as **lack of a system for crop selection, faulty irrigation system**, no integration with weather forecasting, no process for soil testing, inefficient animal husbandry etc.

In view of the above, **monitoring of climate conditions** and efficient decision making should necessarily be part of the **sustainable agricultural strategy**. Precision in agricultural decision making with the help of data i.e., tons of data, collected by smart agriculture sensors help the agricultural scientists to devise suitable strategies to address the challenges. This may result in better control over the internal processes and, as a result, lower production risks. **Application of IoT** may also contribute to **greenhouse automation** wherein weather stations automatically adjust the conditions to match the given parameters and smart sprinklers controller allows managing irrigation and lighting systems remotely. Globally, in **light of the water scarcity** having significant impact on **agricultural production**, application of IoT enables choosing appropriate irrigation methods

instead of **traditional flood irrigation method**, solving the problem of water **shortage** to a great extent. IoT also finds application in **cattle monitoring and management** wherein IoT devices are attached to the animals on a farm to monitor their health and log performance. The collar tags attached to the species (comprising wireless link, actuators, sensors, and terminal equipment) helps to deliver temperature, health, activity, and nutrition insights on each individual cow as well as collective information about the herd. This enables farmers to analyze nutritional and physiological status of animals and ensure their healthy growth. **Crop management is another key area**, where IoT finds application, especially in **collecting data specific to crop farming; temperature and precipitation to leaf water potential** and overall crop health. This may help inter alia monitor crop growth and any anomalies to effectively prevent any diseases or infections that can harm the proposed yield. Soil testing is another area of application wherein efficient planning may help strategically coordinate crop cycle and irrigation which may lead to efficiency improvement in the areas of power usage and fertiliser cycle. **Agricultural product quality, safety and traceability** is another benefit of IoT wherein agricultural product warehousing, logistics, and distribution comes into picture. Through **high speed internet connectivity** coupled with application of electronic data exchange, electronic tags and barcodes; the agricultural inputs and outputs could be traced, used and stored legitimately, thereby reducing wastage, resulting in enhanced efficiency in the system. **Advanced research in the area of IoT system structure** is still in progress due to which there may be reduction in the timeliness of data transmission by IoT due

to issues such as data transmission instability coupled with data sharing difficulties, **poor positioning accuracy** etc. Data speed is another requirement for IoT enabled systems which is indeed lacking in almost all the developing economies where farming activity mostly occurs in remote rural areas. The **investment required for 5G** and related technologies, a key enabler for agricultural IoT, is also very high and facilitating the same in rural areas is indeed a challenge.

Barring these few challenges, **end-to-end farm management systems** should necessarily be **part of IoT strategy** in the upcoming technology era. A powerful dashboard with analytical capabilities and in-built accounting/reporting features enables farmers to improve efficiency by continuous monitoring, **efficient coordination**, and **automated low-level decision making**. Thus, it is time to focus on facilitating increased investment in the agricultural sector, through public private partnership led by Government investing in key areas to derive the desired long term benefits to the economy.



What is vertical farming?

Vertical farming is an agricultural method through which crops are grown in vertically stacked layers. It is done in a controlled environment using techniques such as aquaponics, hydroponics and aeroponics, that does not make use of soil.

With a growing population and not much operational farmland to go around, vertical farming may be used to fulfill the growing food demands of the world.

Origins of Vertical Farming

In 1915, Gilbert Ellis Bailey coined the term vertical farming and he went on to write a namesake book. The modern concept was first proposed in 1999 by professor Dickson Despommier. His concept centered on the idea that urban areas

should grow their own food which can save time and resources required for transportation. Dickson Despommier was a professor of Public and Environmental Health at Columbia University. Challenging his students on whether food could be grown on the rooftops of New York skyscrapers, a concept was created in which a 30-story vertical farm grown by hydroponics and artificial light could feed about 50,000 people.

Although the professor's farm was not built, the idea did take off, inspiring many later designs.

As a result, governments and developers around the world would take note of vertical farming and implement it in cities such as Abu Dhabi, New York, Los Angeles, Bangalore, Dubai, Beijing etc. Between 2014 and November 2020 about \$1.8 billion were invested into startups working on creating vertical farms.

Types of Vertical Farms

The following are the known types of Vertical Farming

1. Vertical Farms in buildings

Abandoned buildings are repurposed for vertical farming, but it's not necessary that such buildings be used often. Depending on the requirements new buildings are also used to construct vertical farms.

1. Shipping-Container Vertical Farms

Old or recycled shipping containers are equipped with LED lighting, vertically stacked farms, climate controls and monitoring sensors. Such types of farms can save space and get a higher yield in the process.

1. Underground Vertical Farms

Also known as 'Deep Farms', these types of vertical farms are built in underground tunnels, abandoned mine shafts or any subterranean environment. The constant temperature and humidity means that they require less energy for heating and as for water supply, the underground water source can be used. Such farms can also produce 7 to 9 times more food than a conventional farm.

Techniques of Vertical Farming

Hydroponics

Hydroponics is the method of growing plants without the involvement of soil. Here, plant roots are submerged in magnesium, nitrogen, potassium calcium etc. These solutions support roots, improving chances of higher yield and reducing dependence on water.

Studies have shown that there have been 11 times yield compared to conventional farms at a cost of 13 times less water. Thus hydroponics is the most widely used method in Vertical Farming.

Aquaponics

A slightly advanced method that Hydroponics, Aquaponics integrated production of plants with that of aquatic organisms in a closed loop system resembling nature itself.

Aeroponics

Like the name suggests, Aeroponics does not use mediums like solid or liquid, instead it uses air to grow plants. A liquid solution is used in air where the plants are located, through which the plants absorb nutrients. It is the most suited method as it requires neither water nor soil and requires no growing medium.

Advantages and Disadvantages of Vertical Farming

The following are the advantages and disadvantages of vertical farming

Advantages

1. Efficiency

Conventional farms require too much land and water, while vertical farming requires a fraction of it with more yield per acre. Another additional benefit is that vertical farming can produce crops throughout the year. Even more that one crop can be harvested at once due to their individual land and plots.

1. Weather resistant

Traditional farming is subjected to unpredictable weather patterns and natural disasters such floods, droughts, wildfires, etc. In a controlled environment of

vertical farming such factors are negated and thus less susceptible to disruption in the supply chain process.

1. Environmental Conservation

Vertical farming helps in environmental conservation as deforestation that accompanies traditional farming can be negated, thus saving resources in the long run.

Producing food indoors reduces or eliminates conventional plowing, planting, and harvesting by farm machinery, protecting soil, and reducing emissions.

Vertical Farming

Disadvantages

1. Huge costs

Vertical farming is quite costly and some use urban settings where the real estate prices are high, thus, its maintenance costs are even higher as compared to traditional farming.

1. High Energy Consumption

During the growing season, the sun shines on a vertical surface at an extreme angle such that much less light is available to crops than when they are planted on flat land.

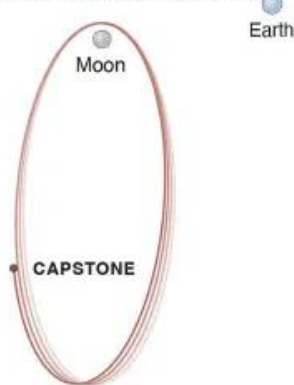
Road ahead

- **Encouraging Soilless Techniques for Food Security:** Strengthening food production and distribution systems is key to fighting hunger and tackling the burden of malnutrition.
 - The development of aquaponics and hydroponics embrace all dimensions of food security.
 - The government shall consider these methods as viable alternatives for traditional farming and provide assistance in making these techniques affordable to a larger number of farmers.
- **Providing Knowledge and Skills:** While these alternative techniques can be utilized by a variety of stakeholders, from household farmers and small- to large-scale farmers, specific knowledge and skills must be developed for safe, successful and sustainable implementation.
- **Facilitating Sustainable Farming:** In a country like India, there is a constant pressure on agricultural land and its conversion to other uses.
 - With Aeroponics and Hydroponics, the discussions around farming can move away from land constraints to focussing more on sustainable farming techniques.

- **Way Ahead for Schools:** Such systems are difficult but not impossible to maintain, the prerequisite is to have at least basic understandings of these systems.
 - Schools might also encourage students to install Aquaponic systems at schools as their practical task for core **STEM** subjects like Maths, Biology, Chemistry, and Engineering.

What is CAPSTONE?

CAPSTONE will orbit the moon in a stable and efficient path called a near-rectilinear halo orbit.



On 29 June 2022, **NASA launched CAPSTONE**, a microwave oven-sized **CubeSat** weighing just **55 pounds (25 kg)**. CAPSTONE, short for **Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment**, is designed to test a unique, **elliptical lunar orbit**.

The satellite, launched on **Rocket Lab's Electron rocket** from the Rocket Lab Launch Complex 1, is heading toward an orbit intended in the future for **Gateway**, a **Moon-orbiting outpost** that is part of **NASA's Artemis program**.

As a **pathfinder for Gateway**, CAPSTONE aims to help reduce risk for future spacecraft by **validating innovative navigation technologies**, and by verifying the dynamics of the **halo-shaped orbit**.

The orbit is known as a **near-rectilinear halo orbit (NRHO)**. It is significantly elongated, and is located at a precise balance point in the **gravities of Earth** and the Moon. This offers stability for long-term missions like Gateway, NASA said on its website.

At the Moon, **CAPSTONE will enter NRHO**, where it will fly within **1,600 km of the Moon's North Pole** on its near pass and 70,000 km from the South Pole at its farthest. The spacecraft will repeat the cycle every six-and-a-half days and maintain this orbit for at least six months to study dynamics.

CAPSTONE will gain experience with small dedicated launches of **CubeSats** beyond low-Earth orbit, to the Moon, and beyond, NASA said.

The spacecraft is **currently in low-Earth orbit**. It is attached to Rocket Lab's Lunar Photon.

ISRO's 'POEM' platform

What is POEM?

The **PSLV Orbital Experimental Module** is a platform that **will help perform in-orbit experiments** using the final, and **otherwise discarded** stage of ISRO's workhorse rocket, the **Polar Satellite Launch Vehicle (PSLV)**.

The **PSLV is a four-stage rocket** where the first three spent stages fall back into the ocean, and the **final stage (PS4)** — after launching the satellite into orbit — ends up as space junk. However, in **PSLV-C53 mission**, the spent final stage will be utilised as a “**stabilised platform**” to perform experiments.

“It is the first time that the PS4 stage would orbit the earth as a **stabilised platform**,” ISRO said in a statement prior to the launch. After the primary mission, the fourth stage will “**write some poems in orbit**”, ISRO Chairman S Somanath said in a post-launch address from Mission Control.

POEM is carrying six payloads, including two from Indian space start-ups **Digantara** and **Dhruva** Space.

How will ISRO keep POEM 'alive and stable' in orbit?

According to ISRO, **POEM has a dedicated Navigation Guidance and Control (NGC)** system for **attitude stabilisation**, which stands for controlling the orientation of any aerospace vehicle within permitted limits. The NGC will act as the **platform's brain** to stabilize it with specified accuracy.

POEM will derive its power from solar panels mounted around the PS4 tank, and a **Li-Ion battery**. It will navigate using “**four sun sensors, a magnetometer, gyros & NavIC**”.

“It carries dedicated control thrusters using **Helium gas storage**. It is enabled with a telecommand feature,” ISRO said.

Has ISRO repurposed and used PS4 rocket junk earlier?

The **Indian space agency** first demonstrated the capability of using **PS4 as an orbital platform** in 2019 with the **PSLV-C44 mission** that **injected Microsat-R and Kalamsat-V2 satellites** into their designated orbits. The fourth stage in that mission was kept alive as an orbital platform for space-based experiments.

In a statement after the successful **PSLV-C44 launch**, ISRO had said:

“Subsequently, the **fourth stage (PS4) of the vehicle** was moved to a **higher circular orbit of 453 km** after two restarts of the stage, to establish an orbital platform for carrying out experiments. **Kalamsat-V2**, a student payload, **first to use PS4 as an orbital platform**, was taken to its designated orbit about **1 hour and 40 minutes after lift-off.**”

While in that mission, the **fourth stage had Li-Ion batteries** solar panels are an addition this time. The latest repurposing and **upgrade of the fourth stage of the PSLV rocket** involves stabilization of the orbital platform.

What is Anthrax?

After finding several **carcasses of wild boar**, Kerala health officials on 30 June 2022 confirmed the **presence of anthrax**, a serious infectious disease caused by **spore-forming bacteria**, in Athirappilly of Thrissur district.

Health Minister Veena George confirmed **the outbreak** and said the government was taking **immediate steps** to prevent the **spread of the disease**.

Anthrax has usually been found in **India's southern states** and is less frequently found in the northern states. Over the past years, it has been reported in **Andhra Pradesh, Jammu and Kashmir, Tamil Nadu, Assam, Orissa** and **Karnataka**.

What is Anthrax?

Anthrax, also known as **malignant pustule** or **wool sorter's disease**, is a rare but serious disease caused by the **rod-shaped bacteria** known as **Bacillus anthracis**.

It occurs naturally in soil and, according to the WHO it is primarily a disease of **herbivores**, with both domestic and wild animals being affected by it.

Anthrax is a zoonotic disease, meaning that **it is naturally transmissible from animals** (usually vertebrates) to humans. People can get the disease through contact with infected animals or animal products that are contaminated with bacteria.

According to the WHO, **Anthrax is generally regarded as non-contagious**. There have been instances of **person-to-person transmission** however, such instances are extremely rare.

How do animals get Anthrax?

Domestic and wild animals can get infected when they **breathe in** or **ingest spores in contaminated soil**, plants or water.

Host animals shed the bacteria into the ground, which sporulates when exposed to the air. These spores, which **can persist in the soil for decades**, wait to be taken up by another host, subsequently germinating and multiplying, leading to its spread. Flies also appear to play a significant role in explosive outbreaks of the disease, as per the WHO.

Herbivorous animals can get the disease through contaminated soil and feed, while **omnivorous** and **carnivorous animals** get infected through contaminated meat, bones and other feeds. **Wild animals** get sick through feeding on **anthrax-infected carcasses**, according to the Ministry of Health and Family Welfare's National Health Portal.

How do humans get infected?

Humans almost always contract the disease directly or indirectly **from animals or animal products**.

People get infected with **anthrax** when **spores enter the body**, through **breathing, eating contaminated food** or **drinking contaminated water**, or through cuts or scrapes in the skin. The spores then get "**activated**" and multiply, spreading across the body, producing toxins and causing severe illness, according to the Centres for Disease Control and Prevention (CDC), The US's national public health agency.

Humans can acquire the disease by handling carcasses, bones, wool, hides or other products from infected animals. People that deal with animals can get cutaneous anthrax when spores from the enter through cuts or scrapes on the skin. They can also **get inhalation anthrax**, by inhaling spores present on the wool, hide or hair of the animal. Ingesting raw or undercooked meat from infected animals can get people sick with **gastrointestinal anthrax**.

People that are most at **risk of contracting the disease** are people that work with animals, such as **farmers, veterinarians, livestock handlers**, wool sorters and laboratory professionals, according to the National Health Portal.

What are the symptoms of Anthrax?

In **livestock species**, like cattle, sheep or goats, the first sign is usually the sudden death of one or two animals within the herd. Prior to their death, they might show signs of high fever. In wildlife, **sudden death is also a usual indicator**, often accompanied by bloody discharge from **natural orifices** (mouth, nose, ear, anus), bloating, **incomplete rigour mortis** and the absence of clotting of the blood, according to WHO.

In humans, **cutaneous anthrax symptoms** can include groups of small blisters that may itch, painless skin sores with a black centre, with the possibility of swelling around them. This is the **most common route of the disease** and is seldom fatal.

Inhalation anthrax includes **fever and chills, shortness of breath, coughing** and **nausea** to name a few. It's the **most deadly form of the disease** and can lead to death within 2-3 days. Lastly, **gastrointestinal anthrax symptoms** can include nausea and vomiting (with blood), swelling of the neck, stomach pain and diarrhoea.

How can it be treated?

Antibiotic therapy that is administered early in the course of the infection has been proven to be responsive, according to the WHO. **Penicillin** has long been the **antibiotic of choice** and in recent years, **ciprofloxacin** and **doxycycline** have also been used as alternatives.

One way to prevent the disease is by **vaccination of livestock** so that the disease cannot spread. There are also **vaccines for humans**, but their availability is

usually restricted to at-risk individuals, such as lab workers and people who handle animals.

What happened in Kerala?

The Kerala government was alerted on 29 June 2022, after **anthrax was reported** in several carcasses of wild boar in the **Athirappilly forest region** in Thrissur.

“**Wild boars** have died en masse in the **Athirappilly forest area**. Subsequently, the Health Department, the Animal Husbandry Department and the Forest Department conducted an investigation. Samples of these were tested to confirm the case of anthrax infection,” Health Minister Veena George had said.

She added that the department was taking immediate steps to prevent the disease.

A **vaccination drive for domestic cattle in the area was initiated**, and the people who had handled the wild boar carcasses were reportedly placed under medical surveillance and given preventative treatment.

Officials in Kerala have stated that there is no need for people to worry about the situation and that due to the **preventative measures** undertaken by the government, there are fewer chances for the disease to spread from wild animals to cattle or human beings.

Crisis in rice

Rice is the most important food crop of India covering about one-fourth of the total cropped area and providing food to about half of the Indian population. India is the

second largest producer and consumer of rice in the world after China and accounts for 21 per cent of the world's total rice production.

This is the staple food of the people living in the eastern and the southern parts of the country, particularly in the areas having over 150 cm annual rainfall. There are about 10,000 varieties of rice in the world out of which about 4,000 are grown in India.

Rice is life for thousands of millions of people. In Asia alone, more than 2,000 million people obtain 60 to 70 per cent of their calories from rice and its products. Recognising the importance of this crop, the United Nations General Assembly declared 2004 as the "International Year of Rice" (IYR).

The theme of IYR—"Rice is life" reflects the importance of rice as a primary food source, and is drawn from an understanding that rice-based systems are essential for food security, poverty alleviation and improved livelihood.

Conditions of Growth:

Rice is grown under varying conditions in India from 8° to 25° N latitude and from sea level to about 2,500 metre altitude. It is a tropical plant and requires high heat and high humidity for its successful growth. The temperature should be fairly high at mean monthly of 24°C. It should be 20°- 22°C at the time of sowing, 23°-25°C during growth and 25°-30°C at the harvesting time. The average annual rainfall required by rice is 150 cm.

It is the dominant crop in areas of over 200 cm annual rainfall and is still an important crop in areas of 100-200 cm rainfall. The 100 cm isohyet forms the limit of rice in rainfed areas. In areas receiving less than 100 cm annual rainfall, rice can

be grown with the help of irrigation, as is done in Punjab, Haryana and western U.P. About 40 per cent of rice crop in India is raised under irrigation.

However, it is the temporal distribution of rainfall, rather than the total amount of annual rainfall which is more decisive. The rainfall should be fairly distributed throughout the year and no month should have less than 12 cm of rainfall. Lesser amount of rainfall is required as the harvesting time approaches.

The fields must be flooded under 10-12 cm deep water at the time of sowing and during early stages of growth. Therefore, the fields must be level and have low mud walls to retain water. This peculiar requirement of rice makes it primarily a crop of plain areas. Rice grown in well watered lowland plain areas is called wet or lowland rice.

In hilly areas, the hill slopes are cut into terraces for the cultivation of rice. Such a cultivation in which the hill slopes are cut into terraces is called terraced cultivation. The supply of water to the hill terraces is not as much as in the plain areas and the rice grown in hilly areas is called dry or upland rice.

Rice can be grown on a variety of soils including silts, loams and gravels and can tolerate acidic as well as alkaline soils. However, deep fertile clayey or loamy soils which can be easily puddled into mud and develop cracks on drying are considered ideal for raising this crop.

Such soil requirements make it dominantly a crop of river valleys, flood plains, deltas and coastal plains and a dominant crop there. High-level loams and lighter soils can be used for quick maturing varieties of rice. Black lava soil is also useful for rice cultivation.

Rice culture is not much suited to mechanisation and is called 'hoe-culture'. Most of the work in preparing the seed-bed, in broadcasting seeds, or in transplantation of plants from nurseries to the fields, in harvesting and in winnowing operations is done by human hand. Thus it is a labour intensive cultivation and requires large supply of cheap labour for its successful cultivation.

It is, therefore, primarily grown in areas of high population density which provide abundant labour and at the same time, offer ready market for its consumption. In most rice producing states, labour is locally available but in Punjab and Haryana, rice cultivation mainly depends upon the migrant labourers from Bihar and eastern U.P.

To sum up it can be said that rice needs plenty of heat, plenty of rain, plenty of alluvium and plenty of labour to provide plenty of food for plenty of people. There is no other food crop which is so plentiful as rice in India.

Methods of Rice Cultivation:

Following methods of rice cultivation are practised in India.

1. Broadcasting method:

Seeds are sown broadcast by hand. This method is practised in those areas which are comparatively dry and less fertile and do not have much labour to work in the fields. It is the easiest method requiring minimum input but its yields are also minimum.

2. Drilling method:

Ploughing of land and sowing of seeds is done by two persons. This method is mostly confined to peninsular India.

3. Transplantation method:

This method is practised in areas of fertile soil, abundant rainfall and plentiful supply of labour. To begin with, seeds are sown in nursery and seedlings are prepared. After 4-5 weeks the seedlings are uprooted and planted in the field which has already been prepared for the purpose. The entire process is done by hand. It is, therefore, a very difficult method and requires heavy inputs. But at the same time it gives some of the highest yields.

4. Japanese method:

This method includes the use of high yielding varieties of seeds, sowing the seeds in a raised nursery-bed and transplanting the seedlings in rows so as to make weeding and fertilizing easy. It also involves the use of a heavy dose of fertilizers so that very high yields are obtained. The Japanese method of rice cultivation has been successfully adopted in the main rice producing regions of India.

Rice Cropping Seasons:

Rice is grown almost throughout the year in hot and humid regions of eastern and southern parts of India where two to three crops in a year are not uncommon. But in the northern and hilly parts of the country, the winters are too cold for rice

cultivation and only one crop is grown in those areas. Table 24.1 gives the period of sowing and harvesting the rice crop.

Rice Cropping Seasons in India:

Crop	Local name	Sowing	Harvesting	Percentage of area	Percentage of Production
Autumn (Kharif)	Aus or Karkar	May- June	Sept-Oct.	39.4	43.91
Winter (Rabi)	Aman, Sali or Karthika	June- July	Nov.-Dec.	54.2	48.79
Summer (Spring)	Boro or Dalua	Nov. - Dec.	March- April	6-4	7-24

The revival of the southwest monsoon this month has resulted in the total area sown under kharif crops not only recovering, but even exceeding last year's coverage from June to mid-July. However, paddy (rice) acreage was 12.50 lakh hectares (lh) as of July 15, down 17.4 percent from 155.53 lh the previous year.

Cause for concern

- On the surface, not much, as government godowns held more than 47.2 million tonnes (mt) of rice as of July 1. These were nearly three-and-a-half times the minimum level of stocks required to meet the quarter's "operational" (public distribution system) and "strategic reserve" (exigency) requirements. Rice stocks are still close to last year's highs.
- That comfort does not extend to wheat, where public stocks have fallen from all-time highs to 14-year lows in less than a year.
- Inflation-affected policymakers would fear a repeat of the wheat story in rice.
- In wheat, a single bad crop — the one scorched by the March-April 2022 heat wave — caused all of the damage, reducing stocks to just above the minimum buffer.
- it is India's largest agricultural crop (accounting for more than 40% of total foodgrain output), and the country is also the world's largest exporter (a record 21.21 mt valued at \$9.66 billion was shipped out during the fiscal year ended March 2022).
- Unlike wheat, import options for rice are limited due to any production shortfall, despite India's own share of global trade in the cereal being more than 40%.

Acreeage decreased

- Farmers start by planting paddy seeds in nurseries, where they grow into young plants.

- These seedlings are then uprooted and replanted in the main field, which is typically 10 times the size of the nursery seed bed, 25-35 days later.
- Nursery sowing is typically done prior to the monsoon rains. Farmers must wait for their arrival before beginning transplantation, which necessitates the field being “puddled,” or tilled in standing water.
- To control weed growth in the early stages of the crop, the water depth must be maintained at 4-5 cm for the first three weeks or so after transplanting.
- All of this would be impossible without the monsoon, which has been exceptionally good this year. From June 1 to July 17, the country received 353.7 mm of rain, 12.7 percent more than the “normal” historical average for this period.
- Despite this, a vast paddy-growing belt stretching from Uttar Pradesh to West Bengal has received very little rain.
- Cumulative rainfall in West UP has been 55.5 percent below the long-term average, and in East UP, Bihar, Jharkhand, and Gangetic West Bengal, it has been 70 percent, 45.8 percent, 48.9 percent, and 45.1 percent, respectively.
- Due to insufficient rainfall, farmers in UP had planted only 26.98 lh of paddy by July 15, compared to 35.29 lh at the same time last season.
- Farmers in Bihar (from 8.77 lh to 6.06 lh), West Bengal (4.68 lh to 3.94 lh), and Jharkhand (2.93 lh to 1.02 lh) reported lower acreages as well. Those in Odisha, Chhattisgarh, and eastern Madhya Pradesh have also been affected, though the gap should narrow as the monsoon season approaches.

Gravity of the situation

- It certainly appears so in UP, where the western and eastern subdivisions have received only 90 mm and 79.6 mm of rain, respectively.
- In his area, paddy nursery sowing takes place from June 1 to June 10, and transplanting takes place from July 1 to July 10.
- This time, there was some rain near the end of June, but not much after that. “The seedlings should leave the nurseries in 25-35 days, after which they will age and have insufficient time to grow in the main field.” “How will farmers transplant if there is no water?” he asked.
- Interestingly, farmers with access to basic irrigation in eastern Uttar Pradesh use the ‘Sanda’ double-transplanting method of paddy cultivation under delayed rainfall conditions.
- In this case, after 25 days in the nursery, the seedlings are uprooted and replanted in a puddled field that is only about twice the size of the former.
- After establishment, the plants begin tillering and are thus rejuvenated for the next 10-15 days. When it rains, they are uprooted and replanted in the main field, which is ten times the size of the original nursery.
- Sanda paddy yields are said to be higher than regular one-step transplanting. Because the Sanda plants have already tillered, their establishment in the main field would be near 100 percent with little mortality.

Rice crisis likely

- To begin, the India Meteorological Department predicts that the current monsoon trough, which is active and south of its normal position, will “very likely gradually shift northwards from tonight (Sunday)”. This should provide much-needed relief to farmers in the Gangetic plains in the coming days.
- Second, unlike wheat, which is grown only in a few states north of the Vindhyas, paddy cultivation occurs across a larger geographical area. Rice is also a kharif (monsoon) and rabi (winter-spring) crop.
- As a result, losses in one area or season may be offset by gains in another. Everyone in wheat, from farmers to traders to policymakers, was caught off guard by the sudden rise in temperatures after mid-March, which reduced grain yields by a fifth or more.
- Rice is less likely to reveal major negative surprises. And with current stocks, it should be doable.

What is Large Hadron Collider at CERN?

The **world's most powerful particle collider**, the **Large Hadron Collider (LHC)**, will begin **smashing protons** into each other at unprecedented levels of energy beginning 5 July 2022.

Scientists will **record and analyse the data**, which are expected to throw up evidence of “**new physics**” — or physics beyond the **Standard Model of Particle Physics**, which explains how the **basic building blocks of matter** interact, governed by **four fundamental forces**.

The LHC

The **Large Hadron Collider** is a **giant, complex machine** built to study particles that are the **smallest known building blocks of all things**.

Structurally, it is a **27-km-long track-loop buried 100 metres underground** on the **Swiss-French border**. In its operational state, it fires **two beams of protons** almost at the **speed of light** in opposite directions inside a ring of **superconducting electromagnets**.

The **magnetic field** created by the **superconducting electromagnets** keeps the protons in a tight beam and guides them along the way as they travel through beam pipes and finally collide.

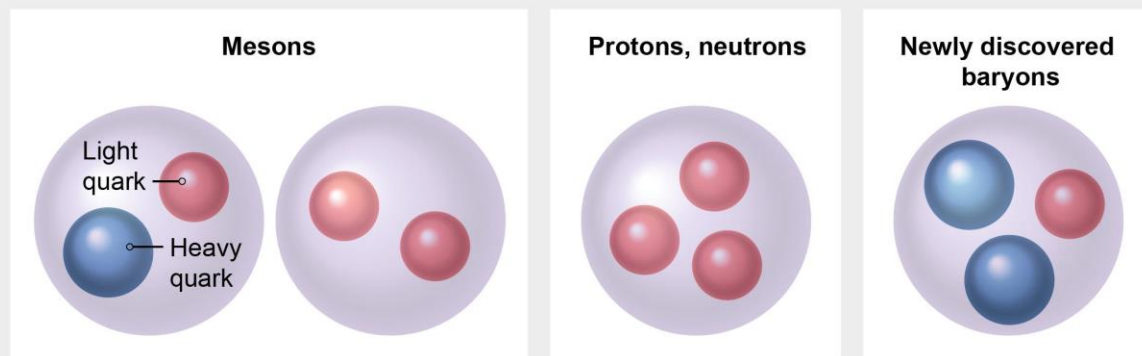
“**Just prior to collision**, another type of magnet is used to ‘**squeeze**’ the particles closer together to increase the chances of collisions. The particles are so tiny that the task of making them collide is akin to firing **two needles 10 km apart** with such precision that they meet halfway,” according to the European Organisation for Nuclear Research (originally Conseil Européen pour la Recherche Nucléaire, or **CERN**, in French), which runs the particle accelerator complex that houses the LHC.

Since the **LHC's powerful electromagnets** carry almost as much current as a **bolt of lightning**, they must be kept chilled. The LHC uses a **distribution system of**

liquid helium to keep its critical components **ultracold at minus 271.3 degrees Celsius**, which is colder than interstellar space. Given these requirements, it is not easy to warm up or cool down the gigantic machine.

RAJA SIR'S Exotic New Particles Cracking IAS Academy Since 2005 - Feel The Pulse of UPSC

A new particle discovered at the Large Hadron Collider (LHC) is the first baryon known to comprise two heavy quarks. Baryons are particles made of three quarks, and include the familiar protons and neutrons inside atoms. Protons and neutrons, however, have only lightweight quarks whereas the new " Ξ_{cc}^{++} " particle has two heavy "charm" quarks and one lightweight "up" quark. Particles called mesons, made of two quarks, are known to contain either a pair of light quarks or one heavy and one light.



Latest upgrade

Three years after it shut down for maintenance and upgrades, the collider was switched back on **this April**. This is the **LHC's third run**, and from 5 June 2022, it will operate **round-the-clock for four years at unprecedented energy levels** of 13 tera electron volts. (A TeV is 100 billion, or 10-to-the-power-of-12, electron volts. An electron volt is the energy given to an electron by accelerating it through 1 volt of electric potential difference.)

“We aim to be delivering **1.6 billion proton-proton collisions per second**” for the **ATLAS and CMS experiments**, CERN’s head of accelerators and technology Mike Lamont said, according to an AFP report. This time, the proton beams will be narrowed to **less than 10 microns** — a **human hair is around 70 microns thick** — to increase the collision rate, he said.

(**ATLAS is the largest general purpose particle detector experiment at the LHC**; the Compact **Muon Solenoid (CMS) experiment** is one of the largest international scientific collaborations in history, with the same goals as ATLAS, but which uses a different magnet-system design.)

Previous runs & ‘God Particle’ discovery

Ten years ago, on 4 July 2012, scientists at CERN had announced to the world the **discovery of the Higgs boson** or the ‘**God Particle**’ during the **LHC’s first run**. The discovery concluded the decades-long quest for the ‘**force-carrying**’ subatomic particle, and proved the **existence of the Higgs mechanism**, a theory put forth in the mid-sixties.

This led to **Peter Higgs** and his collaborator **François Englert** being awarded the **Nobel Prize for physics in 2013**. The Higgs boson and its related energy field are believed to have played a vital role in the creation of the universe.

The **LHC’s second run (Run 2) began in 2015 and lasted till 2018**. The second season of data taking produced five times more data than Run 1.

The **third run will see 20 times more collisions** as compared to Run 1.

‘New Physics’

After the discovery of the **Higgs boson**, scientists have started using the data collected as a tool to look beyond the Standard Model, which is currently the **best theory of the most elementary building blocks of the universe** and their interactions.

Scientists at CERN say they don't know what Run 3 will reveal; the hope is to use the collisions to further the understanding of so-called "**dark matter**".

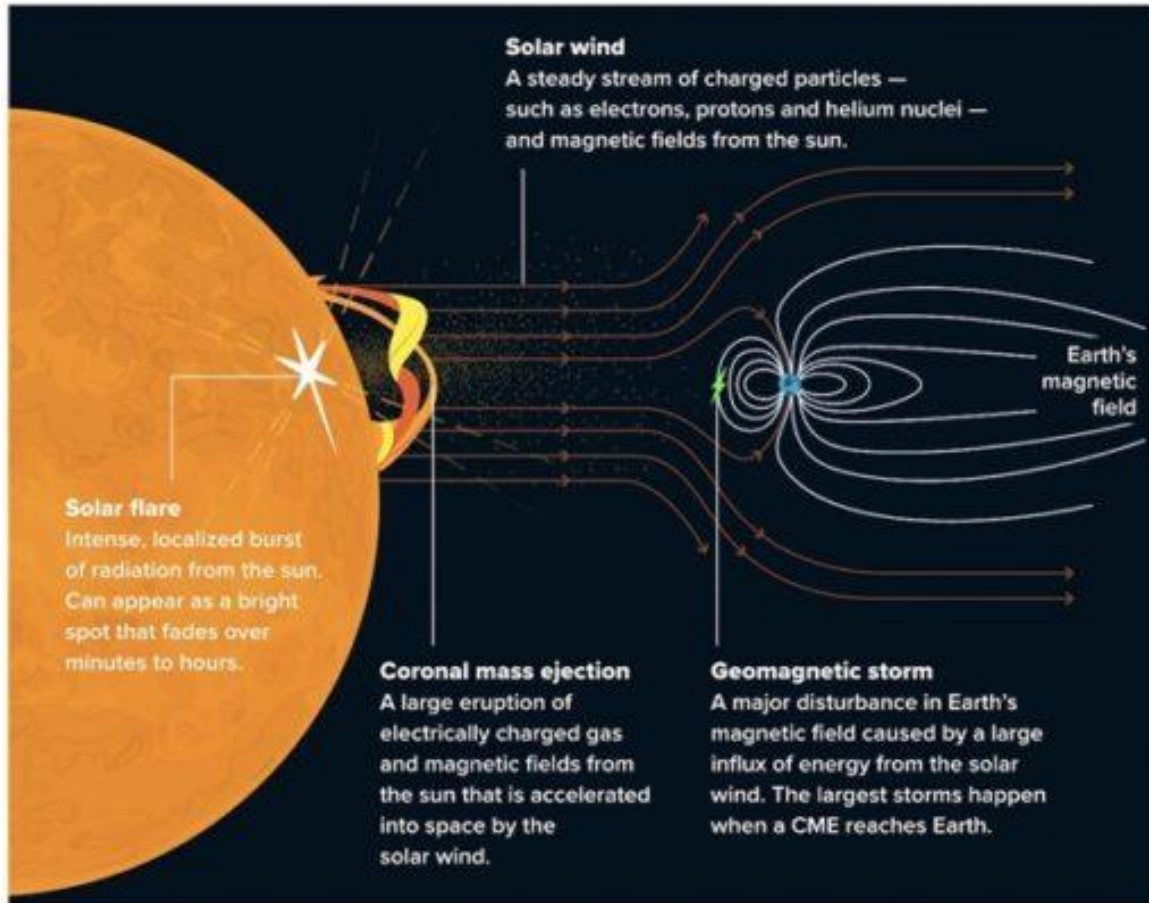
This hard-to-detect, hoped-for particle is believed to make up most of the universe, but is completely invisible as it does not **absorb, reflect, or emit light**.

Luca Malgeri, a scientist with the CERN, told Reuters: "CERN scientists hope that it might be spotted, even fleetingly, in the debris of the billions of collisions, just as the Higgs boson was."

Solar flares and geo magnetic storms

Solar flares and magnetic storms belong to a set of phenomena known collectively as "space weather". Technological systems and the activities of modern civilization can be affected by changing space-weather conditions. However, it has never been demonstrated that there is a causal relationship between space weather and earthquakes. Indeed, over the course of the Sun's 11-year variable cycle, the occurrence of flares and magnetic storms waxes and wanes, but earthquakes occur without any such 11-year variability. Since earthquakes are driven by

processes in the Earth's interior, they would occur even if solar flares and magnetic storms were to somehow cease occurring.



Geomagnetic Storms

- Solar Storms occur during the **release of magnetic energy** associated with **sunspots** ('dark' regions on the Sun that are cooler than the surrounding photosphere - the lowest layer of the solar atmosphere), and can last for a few minutes or hours.
- A geomagnetic storm is a **major disturbance of Earth's magnetosphere** that occurs when there is a very **efficient exchange of energy from the solar wind into the space environment** surrounding Earth.

- The magnetosphere **shields our home planet from harmful solar and cosmic particle radiation**, as well as erosion of the atmosphere by the solar wind – the constant flow of charged particles streaming off the Sun.
- These storms **result from variations in the solar wind** that produce major changes in the currents, plasmas, and fields in Earth's magnetosphere.
 - The solar wind conditions that are effective for creating geomagnetic storms are sustained (for several to many hours) periods of high-speed solar wind, and most importantly, a southward directed solar wind magnetic field (opposite the direction of Earth's field) at the dayside of the magnetosphere.
 - This **condition is effective for transferring energy** from the solar wind into Earth's magnetosphere.
- The largest storms that result from these conditions are associated with solar **Coronal Mass Ejections (CMEs)** where a billion tons or so of plasma from the sun, with its embedded magnetic field, arrives at Earth.
 - CMEs are large ejections of plasma and magnetic fields that **originate from the Sun's corona** (outermost layer).

Impact

- **Can Impact Space Weather:**

- Not all solar flares reach Earth, but solar flares/storms, **Solar Energetic Particles (SEPs)**, high-speed solar winds, and **Coronal Mass Ejections (CMEs)** that come close can impact space weather in **near-Earth space and the upper atmosphere.**
- **Can Hit Operations of Space-Dependent Services:**
 - Solar storms can hit operations of space-dependent services like **Global Positioning Systems (GPS)**, radio, and satellite communications. Aircraft flights, power grids, and space exploration programmes are vulnerable.
- **Can Potentially Create Disturbances in the Magnetosphere:**
 - **Coronal Mass Ejections (CMEs)** with ejectiles loaded with matter travelling at millions of miles an hour, **can potentially create disturbances in the magnetosphere**, the protective shield surrounding the Earth.
 - Astronauts on spacewalks face health risks from possible exposure to solar radiation outside the Earth's protective atmosphere.

Prediction of Solar Storms

- Solar physicists and other scientists use **computer models to predict solar storms** and solar activities in general.
 - Current models are **capable of predicting a storm's time of arrival** and its speed.

- But the storm's structure or orientation still cannot be predicted.
- Certain orientations of the magnetic field **can produce a more intense response** from the magnetosphere, and trigger more intense magnetic storms.
 - With the **increasing global dependence on satellites** for almost every activity, **there is a need for better space weather forecasts** and more effective ways to protect satellites.

Critical minerals, the centerpiece of a new India-Australia collaboration?

India and Australia on 4 July 2022 decided to strengthen **their partnership** in the field of projects and supply chains for **critical minerals**.

As part of his **six-day tour of Australia**, Union Coal and Mines Minister Pralhad Joshi met his counterpart, Resources and Northern Australia Minister Madeleine King, after which Australia confirmed that it would "**commit A\$5.8 million** to the three-year **India-Australia Critical Minerals Investment Partnership**".

"Australia has the resources to help India fulfil its **ambitions to lower emissions** and meet growing demand for **critical minerals** to help India's space and defence industries, and the manufacture of **solar panels, batteries** and **electric vehicles**....Australia welcomes India's strong interest and support for a bilateral

partnership which will help advance critical minerals projects in Australia while diversifying global supply chains,” King said.

What are critical minerals?

Critical minerals are elements that are the **building blocks** of **essential modern-day technologies**, and are at risk of supply chain disruptions. These minerals are now used everywhere from making **mobile phones, computers to batteries, electric vehicles** and **green technologies** like solar panels and wind turbines. Based on their individual needs and strategic considerations, different countries create their own lists.

However, such lists mostly include **graphite, lithium** and **cobalt**, which are used for making EV batteries; **rare earths** that are used for making magnets and silicon which is a key mineral for making computer chips and solar panels. **Aerospace, communications** and **defence industries** also rely on several such minerals as they are used in manufacturing fighter jets, drones, radio sets and other critical equipment.

Why is this resource critical?

As countries around the world **scale up their transition** towards clean energy and digital economy, these critical resources are **key to the ecosystem** that fuels this change. Any supply shock can severely imperil the economy and strategic autonomy of a country over-dependent on others to procure critical minerals.

But these supply risks exist due to **rare availability**, growing demand and complex processing value chain. Many times the complex supply chain can be disrupted by **hostile regimes**, or due to **politically unstable regions**.

As a US government statement in February noted: “As the **world transitions to a clean energy economy**, global demand for these critical minerals is set to skyrocket by 400-600 per cent over the next several decades, and, for minerals such as **lithium and graphite** used in **electric vehicle (EV) batteries**, demand will increase by even more — as much as 4,000 per cent.”

They are critical as the world is fast shifting from a **fossil fuel-intensive to a mineral-intensive energy system**.

What is the China ‘threat’?

According to the 2019 **USGS Mineral Commodity Summaries report**, China is the **world’s largest producer of 16 critical minerals**.

China, according to a report on the role of critical minerals by the **International Energy Agency**, is “responsible for some 70% and 60% of global production of **cobalt** and **rare earth elements**, respectively, in 2019. The level of concentration is even higher for processing operations, where China has a strong presence across the board. China’s share of refining is around **35% for nickel, 50-70% for lithium and cobalt**, and **nearly 90%** for rare earth elements.”

It also controls cobalt mines in the Democratic Republic of Congo, from where 70% of this mineral is sourced.

In 2010, China suspended rare earth exports to Japan for two months over a territorial dispute. The decision, according to the Brookings Institution, made the market prices of RREs jump anywhere between 60% to 350%. The prices returned to normal only after a year of China resuming shipments.

CRITICAL MINERALS

OUR GROWING DEPENDENCE ON CRITICAL MINERALS

WHAT ARE CRITICAL MINERALS? Minerals deemed critical vary by country. The United States classifies **35 minerals** as critical because they are:

- essential to economic and national security,
- from vulnerable supply chains, or
- a key part of the manufacturing of a product. ¹

TOP INDUSTRIES THAT RELY ON CRITICAL MINERALS

- 1 Telecommunications and electronics
- 2 Energy
- 3 Defence
- 4 Aerospace
- 5 Transportation 2

CRITICAL MINERALS ARE EVERYWHERE

- Lithium is used to create batteries.
- Potash is used in fertilizer.
- Helium is used in MRIs.
- Indium is used to make LCD screens.
- Uranium is used in radiation therapy.
- Strontium is used in fireworks. 3

What are countries around the world doing about it?

In 2021, the US ordered a review of **vulnerabilities in its critical minerals supply chains** and found that an over-reliance on “**foreign sources** and adversarial nations for critical minerals and materials posed national and economic security threats”. Post the supply chain assessment, it has shifted its focus on **expanding domestic mining, production, processing, and recycling of critical minerals and materials**.

India has set up **KABIL** or the **Khanij Bidesh India Limited**, a joint venture of three public sector companies, to “**ensure a consistent supply of critical and strategic minerals to the Indian domestic market**”. Announcing the formation of KABIL in 2019, Coal and Minister Pralhad Joshi had said: “While **KABIL would ensure mineral security of the nation**, it would also help in realizing the overall objective of import substitution.”

Australia's Critical Minerals Facilitation Office (CMFO) and **KABIL** had recently signed an MoU aimed at ensuring reliable supply of critical minerals to India.

The UK on 4 July 2022 unveiled its **new Critical Minerals Intelligence Centre** to study the future demand for and supply of these minerals. It also said that the country's critical mineral strategy will be unveiled later this year.

In June last year, the US, Canada and Australia had launched an interactive map of critical mineral deposits with an aim to help governments to identify options to diversify their critical minerals sources.

Nairobi Fly Infection that destroys vital organs

Around 100 students of an engineering college in **East Sikkim** have reported skin infections after coming in contact with **Nairobi flies**, officials said on 5 June 2022.

The population of **Nairobi flies**, a **species of insect native to East Africa**, is growing at a fast pace on campus of the **Sikkim Manipal Institute of Technology (SMIT)** in Majhitar, officials were quoted as saying. The flies can overwhelm new areas in search of breeding grounds and food supply, Health Department officials said.

The college administration said infected students had been given medication and were recovering. One student who was recently infected had to undergo surgery in his hand.

What are Nairobi flies?

Nairobi flies, also called **Kenyan flies** or **dragon bugs**, are small, **beetle-like insects** that belong to two species, **Paederus eximius** and **Paederus sabaeus**. They are orange and black in colour, and thrive in areas with high rainfall, as has been witnessed in Sikkim in the past few weeks.

Like most insects, the **beetles are attracted by bright light**.

How are humans affected by them?

Usually, the **insects attack pests** that **consume crops** and are beneficial for humans — but at times, they come in contact with humans directly and cause harm. Health officials say these flies do not bite, but if disturbed while sitting on anyone's skin, they release a potent acidic substance that causes burns.

This substance is called **pederin**, and can cause irritation if it comes in contact with the skin, leading to lesions or unusual marks or colouring on the skin. The skin begins to heal in a week or two, but some secondary infections can occur, especially if the victim scratches the irritated skin.

Have there been outbreaks of the disease?

Major outbreaks have happened in **Kenya** and other parts of eastern Africa. In 1998, unusually heavy rain caused a large number of insects to come into the region, reported the Associated Press.

Outside Africa, outbreaks have happened in **India, Japan, Israel**, and **Paraguay** in the past.

What is the way to protect oneself against Nairobi flies?

Sleeping under mosquito nets can help. If a fly lands on a person, it should be gently brushed off, and should not be disturbed or touched to reduce the chances of it releasing pederin.

The area where the **flies sits should be washed with soap and water.** If they are squelched and end up leaving toxic fluids on the skin, care should be taken that unwashed hands do not touch any other part of the body, particularly the eyes.

Fields Medal

Ukrainian mathematician Maryna Viazovska, chair of **Number Theory** at École polytechnique fédérale de Lausanne (EPFL) in Switzerland, was on 5 July 2022 named as one of **four recipients of the 2022 Fields Medal**, an honour that is often described the **Nobel Prize in mathematics**.

The **Fields Medal** is awarded by the **International Mathematical Union (IMU)**, an international non-governmental and **non-profit scientific organisation** that aims to promote international cooperation in mathematics.

The IMU recognised **Viazovska's work** on the sphere-packing problem in 8 and 24 dimensions, EPFL said in an announcement. Previously, the problem had been solved for only **three dimensions or fewer**.

The other winners were **French mathematician Hugo Duminil-Copin** of the University of Geneva; **Korean-American June Huh of Princeton**; and **Briton James Maynard of the University of Oxford**.

Viazovska, 37, is **only the second female Fields Medalist**, after the Iranian Maryam Mirzakhani in 2014.

Fields Medal

The **Fields Medal** is awarded **every four years** to **one or more mathematicians** under the **age of 40** in recognition of “**outstanding mathematical achievement** for existing work and for the promise of future achievement”.

The winners are announced at the **International Congress of Mathematicians (ICM)**, which was supposed to be held in **Russia this year**, but was moved to Helsinki.

The honour carries a physical medal of **14K gold, 63.5 mm in diameter** and weighing 169 g, and with a unit price of approximately 5,500 Canadian dollars, according to the IMU website. There is also a cash award of CAD 15,000.

The obverse of the medal is embossed with the **head of Archimedes facing right**, and the Latin words “**Transire suum pectus mundoque potiri**”, translated as “**To pass beyond your understanding and make yourself master of the universe**”.

The reverse has the inscription “Congregati ex toto orbe mathematici ob scripta insignia tribuere”, or “The mathematicians having congregated from the whole world awarded (this medal) because of outstanding writings”.

History of the Medal

According to the IMU website, the **1924 ICM in Toronto adopted a resolution** that at each conference, **two gold medals** would be awarded to recognise outstanding mathematical achievement.

The Canadian mathematician **Prof J C Fields**, who was **secretary of the 1924 Congress**, later donated funds to establish the medals, which were named in his honour. In 1966, it was agreed that, **in light of the great expansion of mathematical research**, up to four medals could be awarded at each Congress, the IMU says.

The **Fields Medal Symposium** is organised by the Fields Institute, Toronto, Canada. “The goals of the program for the Fields Medal Symposium are to present the work of a Fields Medalist and its impact, **to explore the potential for future directions** and areas of its influence, to provide inspiration to the next generations of mathematicians and scientists, as well as to present the Medalist to a broader public,” the IMU says.

Indian-origin winners

Among the **more than 60 mathematicians** who have been awarded the **Fields Medal since 1936**, there are two of Indian origin — **Akshay Venkatesh** of the Institute for Advanced Study at Princeton, who won in 2018, the last time the honour was announced, and **Manjul Bhargava** of the Department of Mathematics at Princeton University, in 2014.

According to the IMU, **Venkatesh** was awarded the Medal “**for his synthesis of analytic number theory, homogeneous dynamics**, topology, and representation

theory, which has resolved long-standing problems in areas such as the **equidistribution of arithmetic objects**".

Bhargava was honoured for "**developing powerful new methods in the geometry of numbers**, which he applied to count rings of small rank and to bound the average rank of elliptic curves".

India's largest floating solar plant

India's largest floating Solar Plant is now fully operational at Ramagundam, Pedapalli district in Telangana.

Solar Plants

- The Jawaharlal Nehru National Solar Mission (JNNSM), also called the National Solar Mission (NSM), which inaugurated in January 2010, manifested the first time, the government primary focused being promoting and developing Solar Plant.
- As per the scheme, the total installed capacity target was set as 20GW till 2022.
 - In 2015, the target was revised to 100GW and in August 2021, the government set a solar target of 300GW by 2030.

- In terms of installed Solar capacity, India holds 5th rank after US, China, Japan and Germany.

Floating Solar Panels

- These are **Photovoltaic (PV)** components launched on platforms that float on water reservoirs, lakes.
- These platforms are typically anchored on calmer bodies of water, such as ponds, lakes or reservoirs.
- These installations are relatively prompt to construct, hushed to run and require no land smoothing or removal of flora.

Highlights of Ramagundam Project

- It is equipped with advanced technology and Eco-friendly features.
- The project expands over 500 acres of the reservoir. Divided into 40 blocks where each having 2.5 MW.
- Each block consists of one floating platform and an display of 11,200 solar nodes.
- The solar modules are placed on floaters assembled with HDPE (**High-Density Polyethylene**) material.
- The whole floating system is harbored through special HMPE (High Modulus Polyethylene) rope to the dead weights placed in the balancing reservoir bed.

- This project is unique and special in a way that all the electrical equipment and tools including inverter, transformer, HT panel, and SCADA (Supervisory Control and Data Acquisition) are also on floating Ferro cement platforms.

Environment Benefits of the Project

- **Limited Land Required:**
 - Referencing Eco, the most basic advantage is the minimum land requirement mostly for associated evacuation arrangements.
- **Reduce Water Evaporation Rate:**
 - Further, with the presence of floating solar panels, the evaporation rate from water bodies is minimized, which helps in water conservation.
 - Around 32.5 lakh cubic meters per year of water evaporation can be exempted.
- **Reducing CO2 emission**
 - These free floating Solar Plants will help in maintaining below water bodies temperature and hence maintaining carbon dioxide level enhancing efficiency and generation.

Similar Solar Energy Initiatives

- **Solar Park Scheme**
 - Plan to build various solar parks, each with a capacity around 500 MW, across several states.
- **Rooftop Solar Scheme**
 - To tackle solar power by installing solar panels on the roof of the houses.
- **Atal Jyoti Yojana (AJAY):**
 - The AJAY scheme was launched in September 2016 for the installation of solar street lighting (SSL) systems in states with less than 50% households engulfed with grid power (as per Census 2011).

Importance of Solar Power to India's Commitment to Climate Change

Mitigation

- Solar power is a crucial projection of India's commitment to address global warming according to the terms of the Paris Agreement, also to achieve net zero carbon emissions, by 2070.
- PM Modi at the United Nations Conference of Parties meeting in Glasgow, in November 2021, quoted that India will be reaching a non-fossil fuel energy capacity of 500 GW by 2030 and encounter half its energy requirements via renewable energy by 2030.

- To enhance the renewable energy installation drive in the long run, the Centre in 2020 set a target of 450GW of RE-based installed capacity to be achieved by 2030, within which the aim for solar was 300GW.

The development and full functioning of the floating Solar Plant will largely help in reducing the land requirement with growing land population density. It is a great initiative to use water bodies as more resourceful way without affecting aquatic life. The floating solar plant will ensure less water evaporation as well maintaining efficiency of temperate water bodies.

Nord Stream



- Nord Stream consists of two pipelines, which have two lines each.
 - Nord Stream 1 was **completed in 2011** and runs **from Vyborg in Leningrad (Russia) to Lubmin near Greifswald, Germany.**
 - Nord Stream 2 which runs from **Ust-Luga in Leningrad to Lubmin** was completed in September 2021 and has the capacity to handle 55 billion cubic meters of gas per year once it becomes operational.
- The twin pipelines together can transport a **combined total of 110 billion cubic metres (bcm) of gas a year** to Europe for at least 50 years.
- The Nord Stream crosses the **Exclusive Economic Zones (EEZs)** of several countries including Russia, Finland, Sweden, Denmark and Germany, and the territorial waters of Russia, Denmark, and Germany.
- In Germany, the pipeline connects to the **OPAL (Baltic Sea Pipeline) and NEL (North European Pipeline)** which further connects to the **European grid.**

Objections to the Pipeline:

- **By Germany:**
 - According to environmentalists, it **does not fit in with German efforts to cut dependence on fossil fuels** and fight **climate change.**

- Nord Stream 2 has **not yet started operating** because Germany says it **does not comply with German law** and has suspended its approval. The project is also awaiting approval from the **European Commission**.
- **Strategic Objection:**
 - The **strategic objection**, particularly from the **US**, is that it will make **Europe too dependent on Russia**, increasing Russia's influence in Europe.
 - Moreover, there is concern that **Russia could use it as a geopolitical weapon**.
 - Ukraine has objected because it will **lose around USD 2 billion in transit fees** once the pipeline becomes operational.
 - Moreover, so long as Russian gas transits through Ukraine, Russia is unlikely to intervene and cause instability in Ukraine and Europe will stay invested in its security.
 - Countries like **Poland and Belarus also stand to lose transit fees** and hence oppose the pipeline as it will bypass existing pipelines running through them.

Importance for Europe and Russia:

- **Europe:**

- Europe requires more than **100 billion cubic metres (bcm) of natural gas each year** and around 40% of its gas comes from Russia.
- Over the last few years, Europe has become more dependent on gas imports because of a decrease in domestic gas production. Reducing dependence on Russian gas is difficult as there are no easy replacements.
- Many European businesses have large investments in Nord Stream 2 and there is pressure on governments from these businesses. Finally, a reduction in gas from Russia would increase already high gas prices and that would not be popular domestically.
- **Russia:**
 - As for Russia, which has the largest natural gas reserves in the world, around **40% of its budget comes from sales of gas and oil.**
 - Nord Stream 2 is important because it **eliminates the risks related with sending gas through transit countries**, cuts operating costs by doing away with transit fees and gives direct access to its most important European customer, Germany.
 - It increases Europe's dependence on Russia while giving it a reliable customer.

Europe's alternative sources of energy

There have been growing concerns that there could be further restrictions to European gas supplies, well beyond the **scheduled maintenance** that has been imposed. European countries rely on **Russian energy** for their cold winters, but now believe that Russia could **weaponize** their dependency as a response to their sanction due to the **conflict in Ukraine**. If **Nord Stream 1** does not resume its supply to Europe, it will not have adequate gas supply by the end of the year. Everything is possible, everything can happen," said Robert Habeck, the Guardian quoted German vice-chancellor and economics minister. He added, "It could be that the gas flows again, maybe more than before. It can also be the case that nothing comes."

As an **alternative source for energy**, European countries have increasingly turned towards the US, from whom they purchase **liquefied natural gas (LNG)** that comes via ships. Since ship delivered gas ends up being far more expensive, there are also attempts to get non-Russian pipeline gas from **Norway and Azerbaijan**.

While EU countries were earlier seeking to **phase out fossil fuels** and emphasize renewable forms of energy, many are now returning towards coal to deal with the energy crisis. Despite attempts to entirely abandon coal by 2030, Germany's parliament on 8 July passed **emergency legislations** to reopen their old coal plants for electricity production.

Economics minister Habeck called the shift “**painful but necessary**”, as reported by The Guardian, a move that was also supported by the country’s environment oriented Green Party.

Canada stepped in to help Germany

To assist **Berlin’s energy crisis**, the Canadian government announced it would circumvent its own sanctions and return a repaired **Russian gas turbine** to Germany that is required for the **Nord Stream 1 gas pipeline**.

While the Canadian government announced that it would introduce fresh sanctions on **Russia’s industrial manufacturing sector**, it said in a statement that it was introducing a “**time-limited and revocable permit**” to allow the return of the key component.

Last month, Gazprom had blamed the delayed return of the turbine for the reduced supply of gas through the pipeline, which was required for the maintenance work scheduled on 11 July, according to The Guardian.

Jonathan Wilkinson, the Canadian minister of natural resources, said that the decision to exempt the turbine from the sanctions would support Europe’s access to “**reliable and affordable energy** as they continue to transition away from **Russian oil and gas**”.

Without a **supply of natural gas**, “the German economy will suffer very significant hardship and Germans themselves will be at risk of being unable to heat their homes as winter approaches,” he added.

This decision has drawn the **ire of the Ukrainian government**, which stated that the return of the **Russian gas turbine** would “**strengthen Moscow’s sense of**

impunity". Claiming that the decision would be in breach of sanctions against Russia, it has called on Canada to reverse its decision.

Interpol's ICSE initiative

India's **Central Bureau of Investigation** has joined the **Interpol's International Child Sexual Exploitation (ICSE) initiative** that will allow it to collaborate with investigators in other countries for **detecting child sex abuse online** and identifying abusers, victims, and crime scenes from audio-visual clips using specialised software.

Officials said 11 July 2022 that **India is the 68th country** to have access to this database and software. Interpol's website said that on average, the database helps identify **seven child victims everyday globally**.

What is Interpol?

Interpol is the **world's largest international police organisation** with 195 member countries, and is **headquartered in Lyon, France**. Each member country hosts an Interpol National Central Bureau that connects their national law enforcement to it and **in India the CBI is that nodal agency**.

What is the ICSE database that the CBI has joined?

The **ICSE database** uses video and image comparison to analyse **Child Sex Exploitation Material (CSEM)** and make connections between victims, abusers

and places. As of July 2022, over 30,000 victims of child abuse and over 13,000 criminals have been identified by the Interpol using this database and software.

“The database **avoids duplication of effort** and saves precious time by letting investigators know whether a series of images has already been discovered or identified in another country, or whether it has similar features to other images,” said the Interpol.

Using the image and video comparison software, the investigators attempt to **identify locations of markers** visible in a piece of media. This can be through the signage nearby, the kind of artwork, photos on a wall, etc. The detectives in all **68 countries of the grouping** can further exchange information across the world.

“By analysing the **digital, visual and audio content of photographs** and videos, victim identification experts can retrieve clues, identify any overlap in cases and combine their efforts to locate victims of child sexual abuse,” the Interpol website said.

What has India done to combat online child sex abuse?

India reported over **24 lakh instances of online child sexual abuse** from 2017 to 2020, with **80% victims being girls below the age of 14 years**, according to Interpol data. More than **60% unidentified victims were prepubescent**, including infants and toddlers. Around 65% of unidentified victims were girls, but severe abuse images were more likely to have boys, the Interpol said on its website.

In 2019, the CBI set up a special unit called the '**Online Child Sexual Abuse and Exploitation Prevention/Investigation (OCSAE)**', for tracking and monitoring posting, circulation and downloads of CSEM online.

Based on intelligence developed by the unit, the CBI started a country-wide operation against the alleged peddlers of online CSEM in India last year. In a crackdown across 14 states, the probe agency carried out searches at **77 locations** and arrested seven people in an operation launched on 14 November, Children's Day, last year. The operation resulted in **seizure of electronic data and gadgets** showing patterns of money trail and involvement of various offenders. The operation targeted **over 50 social media groups** having more than 5,000 alleged offenders sharing **child sexual abuse material** with some accused based in Pakistan, Canada, Bangladesh, Nigeria, Sri Lanka, the US, Saudi Arabia, the UK, and others.

Back in 2020, the **cyber wing of the Maharashtra Police** had acquired a software from Interpol to track child sex abuse captured on video and in photos.

In 2019, the **National Centre for Missing and Exploited Children**, a US-based non-profit organisation, had started sharing tip-offs about **child sex abuse** with Indian agencies. Received by the **National Crime Records Bureau**, this information was passed on to the states where the incidents took place, to boost detection of those sharing such content.

Interpol

Interpol is the shorter and better known name of the International Criminal Police Organization, a network comprising 192 member nations, including India. The

agency, with its headquarters in Lyon, France, was established in 1923. It's website says, "Our role is to enable police around the world to work together to make the world a safer place. Our high-tech infrastructure of technical and operational support helps meet the growing challenges of fighting crime in the 21st century. "

Since when has India been a member?

India has been a member since 1956. Like any member nation, India maintains a National Central Bureau which serves as the national platform for cooperation between domestic law enforcement units and the international police community. The NCB is the designated contact point for the Interpol. India has collaborated with the Interpol in tackling a myriad of organised crimes such as poaching, wildlife trafficking, spurious drugs and fake medicine rackets, among others.

What does Interpol do?

The Interpol basically connects police across the world even if these individual member nations do not have diplomatic relations. The Interpol facilitates information exchange, knowledge sharing and research between nations. This is done by issuing colour-coded "notices" in four languages - English, Spanish, French, and Arabic. The Interpol doesn't have law enforcement powers such as arrest. When a member nation approaches it with a specific request backed with court orders, the Interpol sends it out to other countries. The information received is sent back to the country.

What are different Interpol notices?

Red Notice

A Red Notice is a request to locate and provisionally arrest an individual pending extradition. It is issued by the General Secretariat at the request of a member country or an international tribunal based on a valid national arrest warrant. However, the arrest of the fugitive is based on the rule of the member nation where he or she is located.

Yellow Notice

A Yellow Notice is issued to help locate missing persons, often minors, or to help identify persons who are unable to identify themselves. This is highly useful in cases of human trafficking or in case of missing persons due to calamities.

Blue Notice

A Blue Notice is issued to collect additional information about a person's identity, location or activities in relation to a crime. This does not guarantee extradition or arrest of the person.

Black Notice

A Black Notice is a request to seek information on unidentified bodies in member nations.

Green Notice

A Green Notice is issued to provide warnings and intelligence about persons who have committed criminal offences and are likely to repeat these crimes in other countries.

Orange Notice

An Orange Notice is issued to provide warnings about warn of an event, a person, an object or a process representing a serious and imminent threat to public safety.

Purple Notice

A Purple Notice is a request to seek or provide information on the modus operandi, objects, devices and concealment methods used by criminals. Last year the Interpol issued such notices to highlight human trafficking and modern day slavery prevalent in the fisheries sector.

INTERPOL-United Nations Security Council Special Notice

The INTERPOL-United Nations Security Council Special Notice is issued for individuals and entities that are subject to sanctions imposed by the United Nations Security Council. Its principal function is to alert national law enforcement authorities that sanctions such as assets freeze, arms embargo, and travel ban apply to designated individuals and entities.

Exchequer incurs losses due to restricted trade in rosewood

The Indian exchequer is incurring huge losses due to restricted global trade in the rosewood (*Dalbergia sissoo*) from 2016 onward after it was listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

According to the Government data, exports of furniture and handicrafts made of the species have fallen by almost 50 percent from an estimated Rs 1000 crore (USD 129 million) since the restriction imposed in 2016.

India has once again submitted its proposal before the CITES, a multilateral treaty to protect endangered plants and animals, seeking its exclusion from Appendix II. Under Appendix II the species are not necessarily threatened with extinction, but in which trade must be controlled to avoid utilization incompatible with their survival. India has been opposing the move to include rosewood under a controlled trade ambit. The proposal has been sent to the CITES ahead of the nineteenth meeting of the Conference of the Parties to be held in Panama City (Republic of Panama) in November. "The decrease in exports of rosewood products has affected the livelihoods of around 50,000 artisans who work with the species.

Rosewood

- The Indian rosewood, or *Dalbergia latifolia* (synonym *Dalbergia emarginata*), is a valuable timber species. Its natural habitat is low-elevation tropical monsoon forests in south-east India. Rosewood, Bombay blackwood, roseta rosewood, East Indian rosewood, reddish-brown rosewood, Indian palisandre, and Java palisandre are some of the common names in English. Beete and satalal are two Indian popular names for it. The tree can reach a height of 40 metres (130 feet) and is evergreen, though in drier subpopulations it can become deciduous.
- The importation of lumber products from wild harvested *D. latifolia* is prohibited by the Indian Forest Act of 1927. Due to its exceptional attributes

of having a long straight bore, strength, and high density, the wood has a high international demand and price. The tree, however, is slow-growing.

- Plantations in Java began in the late 1800s, but because to its slow growth, plantations have not spread beyond Java and India. For economic reasons in cottage industries, several once common uses for *D. latifolia* wood have now been supplanted with *Dalbergia sissoo* wood and manufactured rosewoods.
- *D. latifolia* is native to India and Indonesia, but it is widely planted as an ornamental plant in Nigeria, Kenya, Vietnam, the Philippines, and other tropical African and Asian countries. It can reach a height of 40 metres and develops swiftly in the correct conditions.
- *D. latifolia* is recognised for producing extremely hard and durable wood with a long straight bore, making it quite valuable on the worldwide market. In its natural habitat, its bark is also used for medicinal purposes.
- The average price of *D. latifolia* timber in India is greater than teak. Furniture, plywood, veneer, decorative wood items, construction, musical instruments, and other wood products are all made with it. However, the species is slow-growing and is endangered due to overexploitation of its timber and illegal logging. To accommodate the demand for Indian rosewood, large plantations have been built in Java and India. It is classified as "vulnerable" on the IUCN Red List.

Shisham or Indian rosewood scientifically known as *Dalbergia sissoo* is a fast-growing, hardy, deciduous tree belonging to Fabaceae (peas, legumes family). The plant is native to the foothills of the Himalayas of India, Pakistan, Nepal, Myanmar and possibly also neighboring countries. It is mostly found growing along riverbanks below 900 m elevations, but can range naturally up to 1500 m.

Uses

- When properly planted, the tree produces a robust, sturdy, heavy wood that is resistant to decay and insects.
- In both India and Java, it is grown as a plantation wood, frequently in thick, single-species trees, to produce its extremely coveted long straight bore.
- Tree wood is used to make high-end furniture and cabinets, as well as guitar bodies and fretboards, exotic veneers, sculptures, boats, skis, and reforestation.

Dalbergia sissoo

- *Dalbergia sissoo*, often known as North Indian rosewood or sheesham, is a deciduous rosewood tree native to the Indian subcontinent and southern Iran. *D. sissoo* is a crooked, tall tree with long, leathery leaves and pink or pale blooms.

- Dalbergia sissoo is found in the Himalayan foothills from Afghanistan in the west to Bihar, India in the east. It can also be found in Iran. It grows predominantly along river banks over 200 metres (700 feet) elevation, but it can naturally reach 1,400 metres (4,600 ft).
- **D latifolia (Indian rosewood)**, which is native to southeast India, is classified as "vulnerable," while **D sissoo, also known as sheesham** or North Indian rosewood, is considered a **species of least concern** by the International Union for Conservation of Nature (IUCN).

India's Concern Regarding Sheesham (Dalbergia Sissoo)

- Rosewood (Dalbergia sissoo) has been considered for removal from Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), a multinational treaty aimed at protecting endangered plants and animals.
- Several African and Latin American countries expressed worry during the 17th COP (2016) about a "considerable rise in interest in Dalbergia wood in international markets, primarily in China." This, they claimed, was fueling an unlawful trade that was decimating Dalbergia populations.
- Despite the fact that CITES concentrates on the protection of specific species, COP 17 included the entire genus in Appendix II, which governs specie trading.

- Despite the fact that the majority of the 182 member countries agreed to the idea, India expressed reservations over the inclusion of all rosewood in Appendix II for the first time.
- Because all Dalbergia species are not threatened, India has proposed that CITES control each species' trade depending on their conservation status.
- According to India's suggestion, the Dalbergia sissoo species grows at a rapid rate, has the potential to become naturalised outside of its native region, and is even invasive in some areas.
- The inclusion of the Dalbergia genus on the list may cause unneeded hurdles in the trading of common species such as D sissoo, which are maintained and monitored under forest management plans and are protected under Indian forest regulations.
- The wood is valued for its distinct, blood-colored sheen, complicated grain, durability, and excellent polish. It's also used to make guitars because of its acoustic qualities.
- Since an international agreement controlling the trade in all 250 rosewood species went into force in 2017, the export market for rosewood handicraft, which was once a vibrant industry, has practically collapsed (under Dalbergia genus).

CITES

- It is a multilateral agreement between states aiming at ensuring that international trading in wild animal and plant specimens does not jeopardise their survival.
- The Convention on International Trade in Endangered Species (CITES) is an international treaty to which States and regional economic integration organisations voluntarily agree. Parties are states that have decided to be bound by the Convention ("joined" CITES).
- Although legally binding (i.e., they must execute the Convention), it does not replace national legislation. Rather, it establishes a framework that must be followed by each Party, which must enact domestic legislation to ensure that CITES is implemented on a national level.
- It works by imposing restrictions on international trading in specimens of specific species. All species covered by the Convention must be imported, exported, re-exported, and introduced from the sea through a licencing system.
- Each Convention Party must appoint one or more Management Authorities to oversee the licencing system, as well as one or more Scientific Authorities to advise them on the impacts of trade on the species' status.

CITES Listed Species

- The species covered by CITES are divided into three Appendices, each with a different level of protection.

- Appendix I contains extinction-threatened species. Only in unusual situations is it permissible to trade specimens of these species.
- Appendix II: covers species that aren't technically endangered, but whose trade must be regulated to avoid unsustainable use.
- Appendix III contains species that are protected in at least one country and have requested assistance from other CITES Parties in restricting trade. Changes to Appendix III are handled differently than changes to Appendices I and II because each Party has the authority to make unilateral changes to it.

Gangetic River Dolphins

A guide for the safe rescue and release of trapped Ganges River Dolphins was released by the Jal Shakti Ministry. The Turtle Survival Alliance's India Program and Uttar Pradesh's Environment, Forest and Climate Change Department (EFCCD) collaborated on the document. The guidance is based on the organization's years of experience rescuing 25 Ganges River Dolphins (GRDs) stranded in irrigation canals.

Since 2010, the GRDs have been designated as India's National Aquatic Animal, and they are classified as "Endangered" by the IUCN Red List, Schedule I of the Indian Wildlife (Protection) Act (1972), and Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

The Ganges River Dolphin, commonly known as "Susu," is India's national aquatic animal. It is one among India's national symbols. Gangetic Dolphins can be found in Nepal, India, and Bangladesh in the river systems of the Ganga, Brahmaputra, Meghna, and Karnaphuli- Sangu.

The Ganges River Dolphin was designated as India's National Aquatic Animal in order to safeguard it from extinction. The Ganges Dolphin is also seen as a barometer of the Ganga River's health. The declaration was made at the first meeting of the National Ganga River Basin Authority (NGRBA) in 2009.

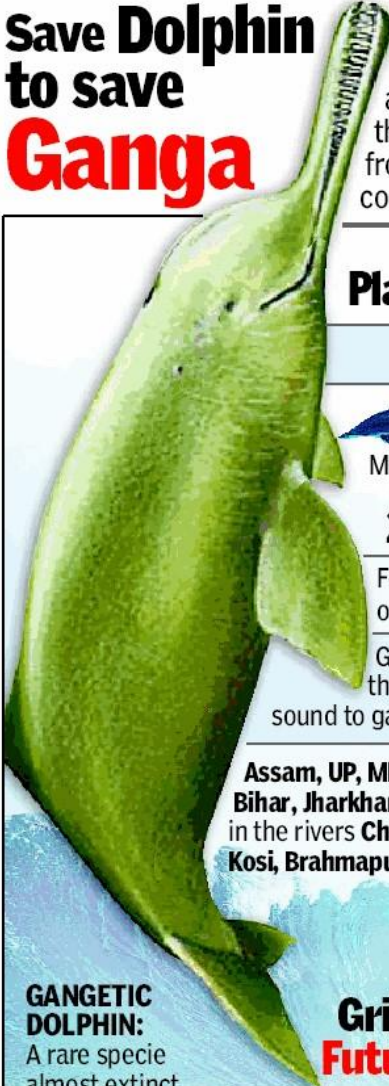
With big flippers and a low triangular dorsal fin, the Ganges river dolphin has a robust yet flexible body. It can weigh up to 150 kilogrammes. The calves are born chocolate brown and mature to a greyish brown colour with smooth, hairless skin. Females have a bigger body size than men. A female's maximum size is 2.67 m, whereas a male's maximum size is 2.12 m. Males and females reach sexual maturity at different ages. Females reach sexual maturity at the age of 10-12 years, whereas males mature earlier.

A female gives birth to only one calf once every 2-3 years after a 9-11 month gestation period. Dolphins, along with several turtle, crocodile, and shark species, are among the world's oldest vertebrates. The Gangetic Dolphins are mostly blind and have a unique way of catching their prey. They make an ultrasonic sound that

is picked up by the prey. The dolphin then stores this image in its mind and catches its prey as a result.


In 1801 the Ganges River Dolphin was first discovered.

Save Dolphin to save Ganga




The Centre has declared the dolphin a national aquatic animal to save the rare freshwater species from disappearing from the country's aqua map


Know about **Platanista gangetica**



1.67 m



Males grow up to **2.12m**




Females grow up to **2.67m**

Females give birth to only one calf, once in **2-3 yrs**

Generally blind, they catch their prey by emitting ultrasonic sound to gauge distance, mass etc

Assam, UP, MP, Rajasthan, Bihar, Jharkhand & W Bengal in the rivers **Chambal, Sone, Kosi, Brahmaputra**

Prefer deep waters, in & around Indian river confluences



GANGETIC DOLPHIN:
 A rare specie almost extinct
Lost cousin: The Yangtze dolphin, Baiji, of China

Grim Future
 Dwindling number due to killing, habitat fragmentation

Once counted in 10's of 1000's, the amount has reduced in last century to **1,500**
 "Endangered" & placed in **Schedule-I of Wildlife (Protection) Act, 1972**

In 2009, the Indian government designated it as the country's national aquatic animal.

The Wildlife Protection Act of 1972 makes it illegal to kill a Gangetic River Dolphin.

The Ganges River Dolphin has been classified as "Endangered" by the IUCN Red List of Threatened Species.

WWF-India recognized nine segments of eight rivers as excellent habitats for the Ganges river dolphin species, requiring immediate conservation intervention.

The areas include:

- Upper Ganga River (Brijghat to Narora) in Uttar Pradesh (Proposed Ramsar Site) Chambal River in Madhya Pradesh and Uttar Pradesh (up to 10 km downstream of Chambal Wildlife Sanctuary)
- Ghagra and the Gandak River are located in Uttar Pradesh and Bihar, respectively.
- The Ganga River flows through Uttar Pradesh and Bihar, from Varanasi to Patna.
- Bihar's Kosi River and Son
- Brahmaputra River from Sadia (Arunachal Pradesh's foothills) to Dhubri (Bangladesh Border)
- The Kushi River is a tributary of the Brahmaputra River.

Communities around the rivers conduct education and awareness programmes for fishermen and other riparian populations. With the support of the State Forest Department, a strategy and action plan for Ganges river dolphin conservation has been developed for Uttar Pradesh. In addition, a network of partners for Ganges River Dolphin Conservation is established in the country.

Conservation Status

- Indian Wildlife (Protection), Act 1972: Schedule I.
- International Union for the Conservation of Nature (IUCN): Endangered.
- Convention on International Trade in Endangered Species (CITES): Appendix I (most endangered).
- Convention on Migratory Species (CMS): Appendix II

Steps taken by the government

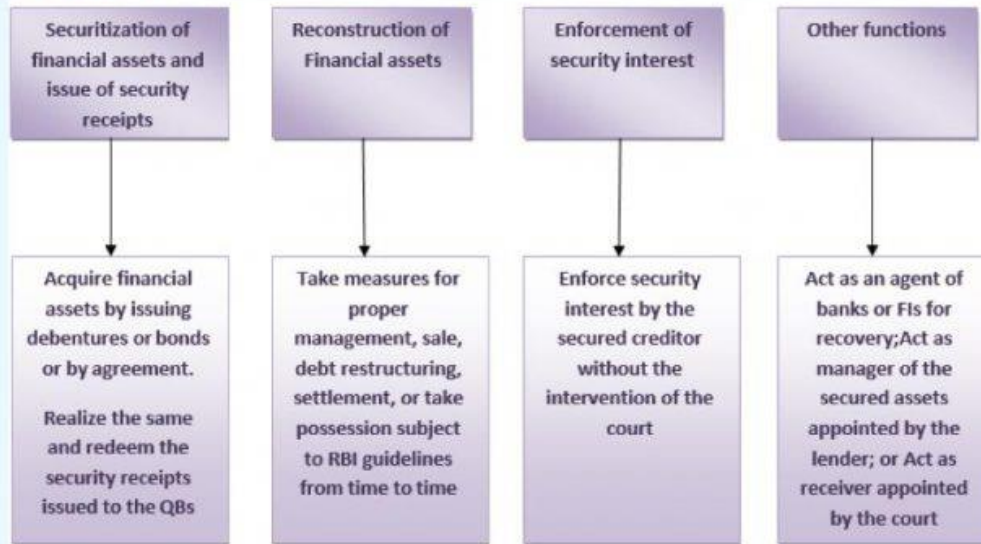
- The International Union for Conservation of Nature has designated the Indus and Ganges River dolphins as "Endangered" species (IUCN).
- It is the country's official aquatic animal, and the government gave it non-human personhood status in 2017.
- The Wildlife Protection Act's (1972) Schedule I also protects it.
- The Vikramshila Gangetic Dolphin Sanctuary (VGDS) in Bihar is the only Gangetic dolphin sanctuary in India.
- The IUCN has classified it as endangered on the Red List of Threatened Species.
- Project Dolphin: In his Independence Day Speech 2020, the Prime Minister announced the government's plans to launch a Project Dolphin. It will be similar to Project Tiger, which has aided in the increase of tiger populations.
- The Ganges River Dolphin Conservation Action Plan 2010-2020 "identified threats to Gangetic Dolphins and the impact of river traffic, irrigation canals, and depletion of prey-base on Dolphin populations," according to the plan.
- National Ganga River Dolphin Day is observed on the 5th of October by the National Mission for the Clean Ganga.

Sarfaesi Act

Banks have invoked the **Securitisation and Reconstruction of Financial Assets and Enforcement of Security Interest (Sarfaesi) Act** against telecom infrastructure provider GTL to recover their pending dues.

The recovery action has been initiated by **IDBI Bank** on behalf of lenders, whose total exposure to GTL stood at Rs 7,250 crore as of 31 December 2021, a report in The Financial Express said.

Role of SARFAESI Act, 2002



What is the Sarfaesi Act?

The **Sarfaesi Act of 2002** was brought in to **guard financial institutions against loan defaulters**. To recover their **bad debts**, the banks under this law can take control of securities pledged against the loan, manage or sell them to recover dues without court intervention. The law is applicable throughout the country and covers all assets, movable or immovable, promised as security to the lender.

Why was such a law needed?

Before the law was **enacted in December 2002**, banks and other financial institutions were forced to take a **lengthy route to recover their bad debts**. The lenders would appeal in civil courts or designated tribunals to get hold of **'security**

interests' to recovery of defaulting loans, which in turn made the recovery slow and added to the growing list of lender's non-performing assets.

What powers do banks have under the law?

The Act comes into play if a **borrower defaults** on his or her payments for more than six months. The lender then can send a notice to the borrower to clear the dues within 60 days. In case that doesn't happen, the financial institution has the **right to take possession** of the secured assets and sell, transfer or manage them.

The defaulter, meanwhile, has recourse to move an **appellate authority** set up under the law **within 30 days of receiving a notice from the lender**. According to a 2020 Supreme Court judgment, **co-operative banks can also invoke Sarfaesi Act**. According to the Finance Ministry, the **non-banking financial companies (NBFCs)** can initiate recovery in Rs 20 lakh loan default cases.

NASA's James Webb Space Telescope gives the clearest image

The **United States space research agency NASA** said in a release on 11 July 2022 that its **James Webb Space Telescope (JWST)** has produced the deepest and sharpest **infrared image of the distant universe** that has ever been seen, heralding

a major event in astronomy. The **JWST is the largest and most powerful telescope** ever built.

Thousands of galaxies — including the **faintest objects ever observed in the infrared** — have appeared in Webb's view for the first time, all captured in a relatively small area. "This slice of the **vast universe** covers a patch of sky approximately the size of a grain of sand held at arm's length by someone on the ground," the release said.

US President Joe Biden unveiled the image at the White House, and said: "This is the **oldest documented light in the history of the universe from 13 billion** — let me say that again, **13 billion** — years ago... We can see possibilities no one has ever seen before... "We can go places no one has ever gone before."

The image released is billed as a "**preview**", and the other set of images will be released at 10.30 am 12 July 2022, Eastern Time (ET) or at 8 pm on 12 July 2022, Indian Standard Time (IST) on NASA's website (<http://www.nasa.gov/webbfirstimages>) and social media accounts. Here's what has been found so far.

What can be seen in the image?

Calling it "**Webb's First Deep Field**", NASA said the image shows galaxies that were once invisible to us. The image shows **shining objects packed together** in hues of blue and orange. Swirling, faraway galaxies — similar to how the Milky Way looks — are also visible.

“Light travels at 186,000 miles per second. And that light that you are seeing on one of those little specks has been travelling for over 13 billion years,” NASA administrator Bill Nelson said of the image, the BBC reported.

“And by the way, we’re going back further, because this is just the first image. They’re going back about 13 and a half billion years. And since we know the **Universe is 13.8 billion years old**, you’re going back almost to the beginning,” he added.

Taken by **Webb’s Near-Infrared Camera (NIRCam)**, the image was made by combining various images at **different wavelengths**. The image shows the galaxy cluster called **SMACS 0723**, as it appeared **4.6 billion years ago**.

The **combined mass of the galaxy cluster** acts as a **gravitational lens**, magnifying much more distant galaxies behind it. This will help researchers in learning more about the galaxies’ masses, ages, histories, and compositions, as Webb seeks out the earliest galaxies in the universe.

What is NASA’s James Webb Telescope?

The telescope has been in the works for years. NASA led its development with the **European Space Agency (ESA)** and the **Canadian Space Agency**. It was launched aboard a rocket on 25 December 2021, and is currently at a point in space known as the **Sun-Earth L2 Lagrange point**, approximately **1.5 million km beyond Earth’s orbit** around the Sun.

Lagrange Point 2 is one of the five points in the orbital plane of the Earth-Sun system. Named after **Italian-French mathematician Josephy-Louis Lagrange**, the points are in any revolving two-body system like Earth and Sun, marking where the

gravitational forces of the two large bodies cancel each other out. Objects placed at these positions are relatively stable and require minimal external energy or fuel to keep themselves there, and so many instruments are positioned here.

L2 is a position directly behind Earth in the line joining the Sun and the Earth. It would be shielded from the Sun by the Earth as it goes around the Sun, in sync with the Earth.

What is the mission of the James Webb Space Telescope?

NASA says the **James Webb Space Telescope** will be “**a giant leap forward in our quest to understand the Universe** and our origins”, as it will examine every phase of cosmic history: from the Big Bang to the formation of galaxies, stars, and planets to the evolution of our own Solar System.

The science goals for the Webb can be grouped into **four themes**. The first is to **look back around 13.5 billion years** to see the **first stars and galaxies forming** out of the darkness of the early universe. Second, **to compare the faintest**, earliest galaxies to today's grand spirals and understand how galaxies assemble over billions of years. **Third**, to see **where stars and planetary systems are being born**. And **fourth, to observe the atmospheres of extrasolar planets** (beyond our solar system), and perhaps find the building blocks of life elsewhere in the universe. The telescope will also study objects within our own Solar System.

The **JWST will be able to see right through** and **into massive clouds of dust** that are opaque to earlier generation **visible-light observatories** like the **Hubble Telescope**. Another difference is that the Webb is equipped with cameras and other instruments sensitive to infrared or “heat” radiation, and the Hubble is not. The

expansion of the universe causes the light that would normally be in wavelengths that are visible to be shifted to **longer infrared wavelengths**, normally invisible to human eyes, The New York Times said in a report.