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Way to a Bright Future

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Index

Subject -Indian History, Heritage and Culture

Khwaja Moinuddin Chishti: The Saint Who Shaped Sufism in India

Sub Topic- *Important personalities*

Context:

An Ajmer court admitted a Hindu Sena petition seeking an archaeological survey to verify claims of a Shiva temple beneath the Ajmer Sharif dargah, the mausoleum of Sufi saint Khwaja Moinuddin Chishti, pivotal to Sufism's spread in the subcontinent.

Khwaja Moinuddin Chishti:

- Khwaja Moinuddin Chishti, also known as ***Garib Nawaz*** (Friend of the Poor), was a **12th-century Sufi saint** whose teachings of **love**, **equality**, and **service to humanity** profoundly influenced the religious and cultural fabric of India.
- His life and work played a pivotal role in **spreading the Chishti Sufi order across the Indian subcontinent**, transcending religious and social boundaries.

Early Life and Spiritual Awakening:

- **Birth and Early Years**: **Born in 1141 CE in Sistan, Persia** (present-day Iran), Moinuddin **was believed to be a descendant of Prophet Muhammad**.
  - Orphaned at the age of 14, his quest for spiritual meaning began early.
- **Key Encounter**: His spiritual journey was ignited by a meeting with Ibrahim Qandozi, a wandering mystic, who inspired him to seek deeper truths beyond worldly suffering.
- **Education and Travel**: By his twenties, Moinuddin had **studied theology, philosophy, ethics, and religion in seminaries at Bukhara and Samarkand**, regions renowned for their scholarship.

Mentorship Under Khwaja Usman Harooni:

- **Initiation into Sufism**: Moinuddin became a disciple of **Khwaja Usman Harooni, a revered master of the Chishti order near Herat**, Afghanistan.
- **Spiritual Discipline**: Years of rigorous training under his mentor shaped his spiritual practices and prepared him for his mission.
- **Missionary Path**: After completing his training, Moinuddin was instructed by his mentor to spread the teachings of the Chishti order.

Arrival in Ajmer and Service to the People:

- **Move to Ajmer**: Moinuddin arrived in **Ajmer in 1191, during the twilight of the Chauhan dynasty**, which soon fell **after Muhammad of Ghor's conquest**.
- **Role Amidst Suffering**: Witnessing the devastation of Ajmer, Moinuddin dedicated himself to alleviating the misery of the people.
- **Acts of Generosity**: Alongside his wife, **Bibi Ummatulla**, he established a ***langarkhana*** (community kitchen) to serve free meals to the needy, regardless of religion or social status.
- **Title of Garib Nawaz**: His selfless service earned him the title *Garib Nawaz*, or Friend of the Poor.

Teachings and Interfaith Engagement:

- **Core Teachings**: Moinuddin emphasised **divine love**, **equality**, and **service to humanity**, rejecting sectarianism and orthodoxy.
- **Interaction with Hindu Mystics**: He studied Sanskrit, conversed with Hindu scholars, and found common ground with sages who shared his devotion to the divine.
- **Inclusivity**: His teachings fostered harmony between communities during a period of political and religious upheaval.

Legacy and Spread of the Chishti Order:

- **Prominent Disciples**: His disciples, including Qutbuddin Bakhtiyar Kaki, Baba Fariduddin, and Nizamuddin Auliya, ensured the Chishti order's growth in India.
  - **Qutbuddin Bakhtiyar Kaki**: Established the Chishti base in Delhi and became a spiritual guide to Sultan Iltutmish.

- **Baba Fariduddin**: Spread the order in Punjab, earning the title *Ganj Shakr* (Treasure of Sweetness).
- **Nizamuddin Auliya**: Renowned Sufi saint of Delhi, carried Moinuddin's message of compassion and inclusivity.

- **Integration into Indian Culture**: The Chishti order blended Indian cultural practices with Islamic spirituality, fostering interfaith understanding.

Mughal Patronage and Ajmer Sharif:

- **Mughal Reverence**: Emperors like Akbar visited Moinuddin's shrine, beautifying it and ensuring its prominence.
- **Ajmer Sharif**: The dargah became a major pilgrimage site, attracting people from diverse backgrounds, and symbolising unity and devotion.
- **Cultural Impact**: The shrine contributed to Ajmer's growth as a spiritual and cultural hub.

Transcendental Influence:

- **Sufism in India**: Moinuddin played a central role in popularising Sufism, which emerged between the 7th and 10th centuries as a mystical and ascetic form of Islam.
- **Teachings of Love and Compassion**: His emphasis on inclusivity and service resonated deeply in India's religiously diverse society.
- **Legacy of Unity:** Moinuddin's integration of local traditions helped bridge gaps between communities and inspired countless followers.

Ancient Resilience to Climate Change

Sub Topic- *Ancient History*
GS Paper III - Climate Change

Context:

A recent review of scientific studies has revealed that ancient societies in South Asia, including the **Indus Valley Civilisation**, were able to develop resilience to climate change over the past 5,000 years.

More on News:

This review examined historical and archaeological studies, highlighting the adaptive strategies and urban planning techniques that helped these societies thrive despite environmental challenges.

Case Studies of Ancient Resilience:

- **Indus Valley Civilisation**: The civilisation, which **thrived around 2600-1900 BC**, developed sophisticated water management systems, including reservoirs and canals, to cope with variable rainfall patterns. These innovations allowed them to maintain agricultural productivity even during periods of drought.
- **Ancient South Asian Societies**: Recent studies have shown that ancient South Asian societies, including the Indus Valley people, developed urban planning and water management techniques to adapt to the variability in the monsoon.
  - This included **strategies to manage water resources efficiently** and **ensure agricultural stability**.
- **Toba Super-Eruption**: Around **74,000 years ago**, the **Toba super-eruption caused** significant **climatic changes**. Archaeological evidence suggests that humans in the Indian subcontinent adapted to these changes by developing new toolkits and adopting mobile lifestyles.

Adaptive Strategies:

- **Urban Planning and Resilience**: Flexible farming strategies employed by the Harappan people and the role of rural settlements in ensuring socio-economic resilience.
  - Large urban settlements in the Indus River Basin were rare, and rural areas played a critical role in resilience.
- **Diverse Cropping**: Cultivating a variety of crops helped ancient civilisations mitigate the risks associated with climate variability and ensure food security.
- **Mobility**: Some societies adopted mobile lifestyles, allowing them to move to more favourable environments when necessary.

Implications:

- The resilience of ancient civilisations offers valuable lessons for modern society. **By adopting sustainable practices** and innovative solutions, we can better prepare for and respond to climate change.
- The review emphasises the importance of understanding long-term resilience dynamics and the need for holistic studies in **climate resiliology**.

Conclusion:

Studying ancient civilisations' resilience to climate change provides us with a wealth of knowledge and

inspiration. By learning from their adaptive strategies, we can develop more effective and sustainable solutions to address the environmental challenges of our time.

Polity, Governance, Constitution

Pennaiyar River Water Dispute

Sub Topic- *Co-operative Federalism*

Context:

Recently, the **Supreme Court directed the Union government to submit the report prepared by a committee negotiating the water-sharing dispute between Tamil Nadu and Karnataka over the Pennaiyar river.**

More on News

- The Bench, comprising Justices Hrishikesh Roy and S.V.N. Bhatti, **granted the Union two weeks to produce the report.**
- The **committee had been constituted under the Inter-State River Water Disputes Act, 1956,** following the court's directive in January 2024.
- The **negotiation committee was formed to mediate a resolution** between the two States.
- The **process gained momentum after Karnataka's new government**, formed in May 2023, initiated discussions to resolve the long-standing dispute.

Pennaiyar River

Also known as the **Then Pennai or Dakshina Pinakini,** it is a significant river in southern India, flowing through the states of **Karnataka and Tamil Nadu.** The Pennaiyar River originates in the **Nandi Hills of Karnataka,** specifically from the **Chennakesava Hills**. It flows southward for about 80 kilometres through Karnataka before entering Tamil Nadu, where it continues for an additional 320 kilometres to **empty into the Bay of Bengal near Cuddalore.** The river has a total length of 497 kilometres, making it the **second-longest river in Tamil Nadu after the Kaveri**. Its catchment area spans approximately 3,690 square kilometres, with around 77% located in **Tamil Nadu and the remainder in Karnataka and a small portion in Andhra Pradesh**. The Pennaiyar River is fed by several tributaries, including Markandanadhi, Kambainallur, Pambar, Vaniyar and Kallar.

Background of the Dispute:

- The conflict stems from **Tamil Nadu's objection to Karnataka's construction of check dams and diversion structures** on the Pennaiyar river.
- Tamil Nadu contends that these activities **violate an 1892 agreement** governing water-sharing rights.
- **Tamil Nadu moved the Supreme Court in 2018,** arguing that Karnataka had no unilateral right to utilise the waters of the Pennaiyar river to the detriment of Tamil Nadu's residents.
- Tamil Nadu **emphasised that the flowing water of an inter-state river is a national asset** and cannot be claimed exclusively by any single State.
- The State **also argued that the 1892 agreement**, which includes tributaries like the Markandeya river, **is binding.**
- Tamil Nadu maintained that Karnataka's constructions obstructing the flow of the Markandeya river fall under the agreement's purview and are therefore impermissible.
- **Karnataka**, on the other hand, **asserted its right to build diversion structures or dams across the Markandeya river,** a stance that Tamil Nadu deemed untenable under the agreement.

Constitutional Provisions and Legal Framework:

- **Article 131:** It **grants the Supreme Court original jurisdiction** in disputes between states or between the Union and a State.
- **Inter-State River Water Disputes Act, 1956:** The IRWD Act **was enacted under Article 262 of the Indian Constitution,** which **allows Parliament to make provisions for the adjudication of disputes relating to waters of inter-state rivers and river valleys.** The Act provides a structured approach for resolving disputes when states cannot reach an amicable agreement. Key components include:
  - **Request for Tribunal:** If a state government requests intervention regarding a water dispute and the central government believes it cannot be settled through negotiation, it is required to establish a **Water Disputes Tribunal within one year.**
  - **Tribunal Composition:** The tribunal typically consists of a **chairperson, judicial members, and expert members**

appointed by the central government.

- **Finality of Decisions:** The **decisions made by the tribunal are final and binding** on the parties involved, although they **cannot be challenged in the Supreme Court.**

- **Article 262:** This article **empowers Parliament to legislate on inter-state water disputes and establishes the legal basis for the IRWD Act.**
  - It also stipulates that the **Supreme Court cannot interfere with the awards made by the tribunal,** ensuring that decisions are upheld without judicial review.
- **Article 263:** Under this article, the President can establish an **Inter-State Council** to facilitate discussions among states to resolve disputes amicably.
  - This council can play a significant role in **preempting conflicts** before they escalate to formal disputes requiring tribunal intervention.

Way Forward:

- The Pennaiyar dispute **highlights the criticality of maintaining equitable and sustainable sharing of inter-state river waters.**
- The Supreme Court's intervention and the Union's facilitation of negotiations aim to ensure **an amicable resolution in line with constitutional principles and legal precedents.**
- At its core, the dispute emphasises the **need for cooperative federalism,** balancing the rights and responsibilities of the States while adhering to national commitments to water management as a shared resource.

Mutualism: a critique of Capitalism and Authoritarianism

Sub Topic- *Rights & Duties*

Context:

Mutualism coined by **French philosopher Pierre-Joseph Proudhon** is seen as a form of **libertarian socialism**, **balancing individual freedom with collective well-being**.

- It offers a radical alternative to both capitalism and state socialism, promoting voluntary cooperation and mutual respect.

Origin of the Theory:

The term "mutualism" was coined by French philosopher **Pierre-Joseph Proudhon** in the **mid-19th century** as part of his critique of capitalism and authoritarianism.

His seminal work, **What is Property? (1840),** introduced a vision of property rooted in fairness and collective well-being.

Core Principles of Mutualism:

- Mutualism is a **socio-economic theory** that emphasises voluntary cooperation, reciprocity, and the fair exchange of goods and services.
- It advocates for **collective ownership and decentralised management of resources** such as land and tools to benefit all members of society.
- This **framework promotes equality and fairness** while prioritising need over profit, making it an alternative to exploitative economic systems.

Key Features, Goals, and Vision: Mutualism's core features and goals are rooted in fostering equality, fairness, and sustainable economic relations-

- **Ownership and Exploitation:** Ownership of tools or land is legitimate only if it serves individual and collective well-being without enabling exploitation.
- **Worker-Centric Economy:** Worker cooperatives and voluntary associations form the backbone of the production system.
- **Reciprocity and Decentralisation:** Emphasis on fair exchanges and decentralised management ensures mutual benefit and reduces hierarchical control.
- **Vision for Society:** A **decentralised, cooperative society** that balances personal freedom with collective solidarity, rejecting both state control and capitalist hierarchies.

Views on Property, Workers, and the Individualism-Collectivism Debate:

- **Property and Exploitation :** Proudhon distinguished between:
  - **Property:** Control over resources that exploit others.
  - **Possession:** Use of resources to meet needs without exploiting others.
  - He argued for ownership based on use rather than profit or accumulation, promoting fairness and discouraging monopolies.

- **Worker Empowerment:** Mutualism places workers at the center of production. Through worker cooperatives, individuals collectively own and manage resources, ensuring equitable distribution of benefits.
- **Individualism vs. Collectivism:** Proudhon sought to balance individual autonomy with mutual cooperation. His mutualism integrates elements of:
  - **Individualist Anarchism:** Emphasising personal freedom from state control.
  - **Social Anarchism:** Advocating collective resource management and societal equality.

Debate on Anarchism and the State:

- Mutualism **shares strong ties with anarchism, rejecting state-enforced property rights** and coercive governance.
- Proudhon envisioned a **stateless society where free contracts, voluntary exchanges, and cooperative principles** govern interactions. However, interpretations of mutualism vary:
  - **Individualist Lens:** Highlighting personal ownership of tools and land.
  - **Socialist Lens:** Emphasising collective management and mutual aid.

Critiques of Mutualism: Despite its visionary ideals, mutualism faces criticism-

- **Small-Scale Focus:** Its emphasis on small-scale property ownership may fail to address structural inequalities in modern capitalism.
- **Impracticality of Voluntary Cooperation:** Critics argue that the concept of a society solely based on voluntary cooperation is overly idealistic, especially on a large scale.
- **Wealth Concentration:** Mutualism is seen as ineffective in countering the concentration of wealth and power in contemporary economies.

Differences Between Mutualism and Socialism:

While both mutualism and socialism critique capitalism, their approaches differ:

- **Mutualism:** Advocates decentralised, cooperative management, balancing personal ownership with collective solidarity.
- **Socialism:** Typically supports state intervention or central planning for redistributing resources.

Mutualism's rejection of centralised authority and focus on voluntary cooperation sets it apart from state-oriented socialism.

Mutualism as an Alternative to Capitalism:

- Mutualism stands in direct contrast to capitalism by **rejecting labor exploitation, hierarchical power structures,** and the pursuit of profit at the expense of workers.
- Instead, it **advocates for worker-controlled production** through cooperatives or voluntary associations.
- The focus is on **meeting human needs** rather than generating surplus profit, thus dismantling the inherent inequalities of capitalist systems.

- **Marxist Critique:** Marxists contend that mutualism overlooks critical capitalist issues, such as exploitation and class struggle, and is vulnerable to domination by larger corporations.

Present-Day Relevance and Nation-States Following Mutualism:

While **no nation-state fully embraces mutualism,** elements of the theory are reflected in:

- **Worker cooperatives and mutual credit** systems in modern economies.
- **Grassroots movements** and decentralised community-based initiatives promoting self-management and economic equity.

Countries with strong cooperative traditions, such as **Spain (Mondragon Corporation)** or regions emphasising participatory economies, embody mutualist principles to some extent.

Conclusion

Mutualism presents a compelling vision for an egalitarian society built on voluntary cooperation and reciprocity. While it faces challenges in implementation and criticism from both capitalist and socialist perspectives, its principles remain influential in shaping discussions about decentralised, non-exploitative economic systems.

Indian Constitutional Provisions Advocating Mutualism

Fundamental Rights and Directive Principles of State Policy (DPSP)

- **Article 19(1)(c):** Right to form associations/unions enables cooperatives and worker-led organisations.
- **Article 39(b):** Equitable resource distribution for the common good.
- **Article 39(c):** Prevents wealth concentration.
- **Article 43:** Living wage, humane conditions, and worker cooperatives.
- **Article 43B:** Promotes voluntary and democratic cooperatives.

Panchayati Raj and Decentralised Governance

- **Article 40:** Encourages self-governing village communities (Gram Swaraj).
- **73rd and 74th Amendments:** Strengthen grassroots democracy.
- **97th Amendment:** Recognises cooperatives as self-reliant institutions.

Gandhian Principles in the Constitution

- **Article 48:** Promotes village industries.
- **Article 46**: Protects marginalised communities.

Economic and Social Justice

- **Preamble:** Emphasises justice—social, economic, and political.
- **Socialist Ideals:** Advocates collective welfare and equitable resource distribution.

Examples

- **Amul and Cooperatives:** Reflect cooperative production and fair distribution.
- **MGNREGA:** Ensures economic security, rooted in Articles 39 and 43.
- **Panchayati Raj Institutions:** Decentralised resource management.

Code of Conduct for Judges

Sub Topic- *Judiciary*

Context:

Remarks made by Allahabad High Court judge, Justice Shekhar Kumar Yadav, at an event have drawn widespread criticism.

More on News

- Speaking at the High Court premises, Justice Yadav stated that **India should function according to the wishes of the majority.**
- He further claimed that **children from one community are taught kindness and tolerance,** whereas those of **"another community" are exposed to practices such as animal slaughter, affecting their values.**
- On the issue of the **Uniform Civil Code,** he **contrasted Hindu reverence for women with practices like polygamy, Halala, and triple talaq in the Muslim community.**
- These remarks have been noted by the Supreme Court, which stated that it has sought details from the Allahabad High Court, adding that the **"matter is under consideration."**

Judicial Ethics and Conduct

- The judiciary derives its power from **public trust in its authority and integrity.**
- The **'Restatement of Values of Judicial Life,'** adopted by the Supreme Court in 1997, **outlines ethical standards for judges.**
  - The first rule of this code states that **a judge's behavior must reaffirm public faith** in the judiciary's impartiality, cautioning against actions that erode credibility.
  - It also emphasises that **judges must remain mindful of being under public scrutiny.**
- The **Bangalore Principles of Judicial Conduct 2002**, another key framework, highlights the importance of **maintaining public confidence in the impartiality of judges.**
  - While acknowledging a judge's **right to freedom of expression**, it stresses that judges **must preserve the dignity of their office and uphold judicial independence.**
  - The principles also require judges to **understand societal diversity and ensure equal treatment for all.**

Process for Judicial Impeachment

- The Constitution provides for the removal of Supreme Court and High Court judges on grounds of ***"proved misbehavior or incapacity."***
- This requires **an order from the President** following a successful impeachment process in Parliament.
- A removal **motion must be supported by a special majority**—*two-thirds of the members present and voting in each House.*
- **Except for such motions, the Constitution prohibits legislative discussions on judicial misconduct.**
- However, the Supreme Court has established an **in-house procedure** for addressing serious allegations against judges.

In-House Mechanism

- **Complaints** against High Court judges **can be addressed to the President, the CJI, or the Chief Justice of the relevant High Court.**
- If deemed serious, the **High Court Chief Justice may seek a response from the judge and forward the matter to the CJI.**
- The **CJI may appoint a fact-finding committee** of senior judges to investigate the allegations.
  - If the findings support removal, the **CJI may ask the judge to retire voluntarily.**
  - If refused, the **CJI can forward the report to the President and Prime Minister, initiating the impeachment process.**
- **Adopted formally in 1999 and published in 2014,** this mechanism provides an **alternative to public impeachment,** aiming to protect the judiciary's reputation while addressing misconduct.

Right to Disconnect and India

Sub Topic- *Rights & Duties*

Context:

The recent **tragic death of an Ernst & Young (EY) employee** in September, allegedly due to work-related stress, has **reignited the debate over workplace well-being in India.**

More on News

- **MP Shashi Tharoor** expressed his concern, stating that **he would address the issue in Parliament,** adding that ***"inhumanity at the workplace must be legislated out of existence."***
- This incident, alongside alarming statistics, **underscores the urgency of legislating the *right to disconnect*.**
- A **report by The Hindu** reveals that **Indian women in professional fields** like auditing, information technology, and media **often work over 55 hours a week.**
  - The **toll is even higher for marginalised communities** in unorganised sectors.
- A study by the **ADP Research Institute** found that **49% of Indian workers report workplace stress** adversely affecting their mental health.

What Is the Right to Disconnect?

- The right to disconnect **empowers employees to detach from work-related communication outside working hours.**
- **Several countries** have enacted laws to uphold this right.
  - In **France**, a landmark 2001 ruling by the Labour Chamber of the Supreme Court declared that **employees are not obligated to work from home or be reachable after hours.**
  - Similarly, **Spain's Organic Law** 3/2018 guarantees **public workers the right to switch off work devices**, preserving their personal time and privacy.
  - **Australia and Ireland** have also recognised this right, ensuring better work-life balance for employees.

India's Legislative Gap

- India **lacks a dedicated law guaranteeing the right to disconnect.**
- While the Constitution, **Directive Principles of State Policy,** and various court rulings **emphasise workers' welfare and dignity, implementation remains limited.**
  - **Article 38** of the Constitution mandates that the **state strive to promote the welfare of its people,** while **Article 39(e)** directs policies toward **safeguarding workers' health and strength.**
- Judicial interventions, such as ***Vishakha v. State of Rajasthan (1997),*** established **workplace dignity as a fundamental right.**
- However, **prolonged working hours and workplace stress** remain pervasive issues.
- A notable legislative attempt came in 2018 when **MP Supriya Sule introduced a Private Member Bill** advocating for the **right to disconnect.**
  - The bill **proposed penalties for non-compliant companies.**
  - Yet, **no significant progress has been made** in recognisng this right in recent years.

The Impact of Overwork

- Research consistently links overwork to **adverse health outcomes,** including stress and coronary heart disease.
- Contrary to the belief that longer working hours boost productivity, **a study by the University of Oxford and BT** showed a **strong correlation between employee happiness and productivity.**
- Employers must consider **psychological well-being as integral** to workplace management.

Way Ahead

- As India aspires to become the **world's third-largest economy by 2030,** fostering workplace well-being is crucial.
- **Recognising the right to disconnect** is not only a step toward protecting employees' health but also a driver of productivity and sustainable growth.
- A **legislative framework** addressing this need can ensure a balanced, dignified, and humane work environment for all.

POSH Act and Political Parties

Sub Topic- *Issues Related to Women, Pressure Groups, Representation of People's Act, Statutory Bodies*

Context:

On December 9, the Supreme Court heard a **Public Interest Litigation (PIL)** seeking the **application of the Sexual Harassment of Women at Workplace (Prevention, Prohibition, and Redressal) Act, 2013 (POSH Act) to political parties.**

More on News

- The **court directed the petitioner**, advocate Yogamaya M G, **to approach the Election Commission of India (ECI),** stating it was the **appropriate authority** to urge political parties to establish internal mechanisms for addressing sexual harassment complaints, consistent with the POSH Act.

Applicability of the POSH Act

- The POSH Act **mandates both public and private workplaces to establish Internal Complaints Committees (ICCs)** to address sexual harassment.
- It **applies to any workplace** and protects women from sexual harassment under Section 3(1).
- The Act **defines a workplace broadly,** covering public and private sector organisations, hospitals, sports venues, and even locations visited by employees during their work.
- However, **applying this law to political parties poses challenges**, as they **often lack traditional workplace structures.**
- This issue came under **scrutiny in the Kerala High Court's 2022 ruling** in Centre for Constitutional Rights Research and Advocacy v State of Kerala & Ors, which found that **political parties, with no employer-employee relationship with their members, were not obligated to establish ICCs under the POSH Act.**

POSH Act

The **Protection of Women from Sexual Harassment Act, 2013,** commonly known as the POSH Act, is a significant piece of legislation in India aimed at preventing sexual It was enacted to create a safe and conducive work environment for women and to provide protection against sexual harassment at workplaces across India. It aims to uphold women's dignity and ensure their right to work without fear of harassment.

Definition of Sexual Harassment: The **Act defines sexual harassment broadly,** including unwelcome acts such as: Physical contact and advances, Requests for sexual favors, Making sexually colored remarks, Showing pornography and Any other unwelcome physical, verbal, or non-verbal conduct of a sexual nature.

Key Provisions

- **Applicability:** The POSH Act **applies to all workplaces in India**, including public and private sectors, educational institutions, and even informal settings where work is conducted.
- **Internal Complaints Committee (ICC):** Every organisation with ten or more employees must establish an Internal Complaints Committee to handle complaints of sexual harassment.
- **Complaint Mechanism:** Aggrieved women can file a written complaint with the ICC within three months of the incident. The **ICC is required to complete its inquiry within 90 days and can recommend corrective** actions if the complaint is upheld.
- **Penalties for Non-Compliance:** Employers who fail to comply with the provisions of the POSH Act may face penalties, including fines up to ₹50,000. Repeated offenses can lead to more severe consequences.

- **Annual Reporting:** Organisations must submit an annual report on complaints received and actions taken to the District Officer, who oversees compliance at the district level.

Challenges in Applying the POSH Act to Political Parties

- Political parties, **registered under the Representation of People Act, 1951 (RP Act)**, operate through a network of members, office-bearers, and field workers, **often without a defined workplace.**
- **Determining the "employer" responsible** for setting up ICCs is another hurdle.
- While the Act includes temporary, contract-based, and voluntary workers under its definition of "employees," **applying it to the decentralised and varied nature of party work remains complicated.**
- **Party constitutions,** such as those of the BJP and Congress, outline hierarchical structures that **could potentially help identify "employers."**
  - However, **internal disciplinary mechanisms** in parties **often lack provisions aligned with POSH Act requirements,** such as mandatory inclusion of women or external members on committees.

ECI's Role in Enforcing Laws on Political Parties

- The ECI derives its authority from **Article 324 of the Constitution and the RP Act**, overseeing elections to Parliament, State Legislatures, and other constitutional offices.
- However**, its mandate to enforce other laws on political parties is less defined.**
  - For instance, **despite a 2013 Central Information Commission (CIC) order applying the Right to Information (RTI) Act to national political parties, compliance remains elusive.**
- The **ECI typically issues advisories to political parties** to encourage adherence to broader laws.
  - For example, **ahead of the 2024 Lok Sabha elections,** it advised parties **against involving children in campaigning,** in line with the **Child Labour (Prohibition and Regulation) Act, 1986.**

Way Forward

If the POSH Act is to apply to political parties, **key clarifications will be required on the definition of "workplace" and "employer"** in the context of party operations. Strengthening the ECI's role and revising party structures to incorporate POSH-compliant mechanisms could pave the way for greater accountability and protection for women within political organisations.

Section 6A of the Citizenship Act

Sub Topic- *Indian Constitution, Government Policies & Interventions*

Context:

In a 4:1 majority ruling, the **Supreme Court** of India's **Constitution Bench upheld the constitutional validity of Section 6A of the Citizenship Act, 1955,** in October 2024.

More on News:

- This provision establishes a **unique framework for migrants from the erstwhile East Pakistan** (now Bangladesh) who settled in Assam, **granting Indian citizenship** to those who arrived before March 25, 1971.
- While the **ruling aligns with the historical Assam Accord of 1985,** the **judgment raises significant constitutional and practical concerns** that merit critical examination.

*The **Assam Accord** is a significant **Memorandum of Settlement** signed on August 15, 1985, **between the Government of India, the Government of Assam, and leaders of the All Assam Students' Union (AASU)** and the **All Assam Gana Sangram Parishad (AAGSP).** This agreement marked the conclusion of a six-year agitation that began in 1979, primarily aimed at addressing concerns over illegal immigration from Bangladesh and its impact on the political, social, and cultural landscape of Assam.*

Key Takeaways from the Ruling:

- The then Chief Justice of India, D.Y. Chandrachud, **justified Section 6A under Article 14,** citing **rational distinctions between Assam and other border states** such as West Bengal, Meghalaya, Tripura, and Mizoram.
- He argued that the **demographic impact of migration on Assam**, given its smaller population and land area, **was more severe.**

- However, when **tested against Article 29,** which **safeguards cultural and linguistic rights,** the Court paradoxically held that **the influx of migrants did not hinder the Assamese people's ability to preserve their culture.**
- This contradictory reasoning has **drawn criticism for appearing to prioritise upholding the provision over evaluating its constitutional validity.**

The Assam Accord and Section 6A:

Section 6A was introduced **to implement the Assam Accord**, which sought to address the challenges posed by migration from East Pakistan. The Accord established a timeline for granting citizenship:

- Migrants who arrived before January 1, 1966, were granted Indian citizenship.
- Those arriving between January 1, 1966, and March 25, 1971, were eligible for citizenship after 10 years of residence.
- Migrants who entered after March 25, 1971, were deemed illegal and subject to detection and deportation.
- While this framework initially aimed to balance national integrity with the preservation of Assam's unique cultural identity, its continued application has revealed critical flaws.

Constitutional Concerns and Flaws in Reasoning:

- **Violation of Article 29:** Article 29 **guarantees the right of citizens to conserve their distinct culture, language, and script.** The Court held that **Section 6A did not violate this right,** arguing that the law does not prevent Assamese people from actively conserving their culture. However, this reasoning **overlooks the broader impact of unchecked migration on Assam's linguistic and cultural identity.**
  - **Between 1951 and 2011,** the proportion of **Assamese-speaking people** in the state **declined dramatically from 69.3% to 48.38%,** while the **Bengali-speaking population rose from 21.2% to 28.91%.** These demographic shifts represent **not mere coexistence but cultural displacement,** undermining Article 29's protective intent.
- **Manifest Arbitrariness and Temporal Unreasonableness:** Section 6A's indefinite applicability highlights its temporal unreasonableness, **violating the doctrine of manifest arbitrariness.**
  - More than four decades after the cut-off date of March 25, 1971, the law **continues to allow migrants to claim citizenship,** failing to address the original concerns it sought to resolve.

Operational and Practical Challenges:

- The **implementation mechanism** under Section 6A is another area of concern.
  - It **places the burden of initiating proceedings on the state,** with **no provision for voluntary self-identification** by migrants.
  - Referrals to foreigners' tribunals for determining citizenship status lack a clear deadline, resulting in a **backlog of cases** that hampers effective enforcement.
- Moreover, the **foreigners' tribunals face overwhelming case volumes**, with even ineligible individuals attempting to exploit Section 6A, further delaying the process and creating widespread confusion.

Impact on Assam's Indigenous Population:

- The ruling has significant implications for Assam's indigenous communities.
- The continued application of Section 6A has **facilitated demographic changes** that **threaten the linguistic and cultural identity** of the Assamese people.
- This erosion **undermines the constitutional guarantees of Article 29**, as well as the Assam Accord's objective of preserving the state's unique cultural heritage.

Conclusion:

The Supreme Court's ruling on Section 6A appears to **prioritise justifying the provision over addressing its constitutional and practical shortcomings.** The judgment's contradictory reasoning and neglect of critical concerns such as cultural displacement and temporal unreasonableness perpetuate outdated policies that fail to serve their intended purpose.

Indian Economy & Agriculture and Banking

Legalising MSP

Sub Topic- *Direct & Indirect Farm Subsidies, Public Distribution System (PDS), Buffer Stocks & Food Security, Agricultural Marketing*

Context:

Justice (Retired) Nawab Singh, heading a Supreme Court (SC) appointed committee, has made sweeping observations regarding India's agrarian crisis, emphasising the **need to seriously consider granting legal sanctity to minimum support prices (MSP).**

More on News

- While the committee's **recommendations may not be binding,** they **could influence the Supreme Court's perspective** as it deliberates on resolving the ongoing farmers' protests.
- The viability crisis in India's agrarian economy—tragically epitomised by farmer suicides—is well-documented.

Agrarian Crisis in Data

Farmer Suicides: In **2022,** a total of **11,290 individuals involved in agriculture** (5,207 farmers and 6,083 agricultural laborers) **committed suicide** in India. This figure represents **6.6% of the total suicides** in the country for that year. The states with the highest number of suicides in the farming sector included: **Maharashtra (4,248), Karnataka (2,392), Andhra Pradesh (917), Tamil Nadu (728) and Madhya Pradesh (641).** These five states **accounted for approximately 80% of all farmer suicides** in India.

Trends Over Time: Between 1995 and 2014, approximately **296,438 farmers committed suicide.** From **2014 to 2022,** an additional **100,474 suicides were reported**.

Economic Factors: The **agricultural sector contributes about 15% to India's GDP** and **employs around 45.5% of the country's labour force**.

About Minimum Support Price (MSP)

- **Definition:** MSP is the **minimum price at which the government purchases specific agricultural products directly from farmers.** It aims to prevent distress sales and ensure a stable income for farmers, especially during periods of bumper production when market prices may fall below production costs.
- **Crops Covered:** The government announces MSP for **22 major agricultural commodities,** which include both Kharif, Rabi and commercial crops.
- **Determination:** The **Commission for Agricultural Costs and Prices (CACP)** plays a pivotal role in **recommending MSPs.** It considers various factors, including: Cost of production, Changes in input prices, Demand and supply dynamics, Trends in market prices, Inter-crop price parity and Effects on the cost of living and inflation.
- **Government Approval:** The final MSP recommendations from the CACP are approved by the **Cabinet Committee on Economic Affairs (CCEA),** chaired by the Prime Minister.
- **Annual Announcement:** MSPs are **announced twice a year,** before the sowing seasons for Kharif (summer) and Rabi (winter) crops, allowing farmers to plan their production accordingly.

Pros of Legalising MSP

- **Income Security for Farmers:** Legalising MSP would provide a guaranteed minimum price for farmers' produce, protecting them from market fluctuations and ensuring stable incomes.
- **Reduction of Debt Burden:** A legally guaranteed MSP could alleviate the rising debt burden on farmers by ensuring they receive fair compensation for their crops.
- **Support for Small Farmers:** Legalising MSP would particularly benefit small and marginalised farmers who are more vulnerable to market uncertainties.
- **Encouragement of Agricultural Investment:** With a legal guarantee, farmers may feel more secure in investing in their agricultural practices, knowing they have a fallback option if market prices drop.
- **Addressing Disparities:** Currently, **only about 6% of farmers benefit from MSP** due to systemic issues.

Cons of Legalising MSP

- **Financial Burden on Government:** Implementing a legal MSP could impose a substantial fiscal burden on the government, potentially requiring an allocation of **up to ₹11 lakh crore annually for procurement alone.**
- **Market Distortion:** A legally binding MSP might distort market dynamics by discouraging private investment in agriculture.
- **Risk of Crop Overproduction:** Farmers may prioritise growing crops with higher MSPs, leading to overproduction of certain commodities while neglecting others that may be more suitable for their regions or beneficial for crop diversity.
- **Increased Food Inflation:** Higher procurement costs associated with legalising MSP could lead to increased food prices, negatively impacting consumers, particularly those from lower-income backgrounds.
- **International Trade Implications:** Legalising MSP might **conflict with World Trade**

Organisation (WTO) rules regarding subsidies, potentially leading to trade disputes and affecting India's agricultural exports if domestic prices exceed international market rates.

Way Forward

- **Balanced Approach:** Develop a comprehensive policy framework that balances the interests of farmers, consumers, and the government.
- **Incorporation of Global Best Practices:** Learn from international models of agricultural support systems that effectively balance farmer welfare with fiscal responsibility.
- **Pilot Programs:** Initiate pilot programs in select states to test the feasibility and effectiveness of legalising MSP for various crops.
- **Enhance Infrastructure:** Invest in improving agricultural infrastructure, including storage facilities and transportation networks, to facilitate efficient procurement processes.
- **Digitalisation of Transactions:** Promote digital platforms for procurement to ensure transparency and reduce corruption.
- **Budgetary Provisions:** The government needs to assess the financial implications of legalising MSP, which could require substantial budget allocations.
- **Establish Monitoring Mechanisms:** Create robust monitoring systems to ensure compliance with MSP regulations among private buyers and government agencies.
- **Awareness Campaigns:** Launch awareness campaigns to educate farmers about their rights under a legalised MSP system and how they can benefit from it.

Shift From Paddy to Perennial Crops

Sub Topic- *Agriculture*

Context:

The **coastal areas of Pattukottai and Peravurani in Tamil Nadu's Thanjavur district** are increasingly **transitioning** from **traditional rice cultivation to coconut farming**.

Understanding the Problem: Paddy Cultivation:

- **Traditional Paddy Cultivation:** Paddy (rice) cultivation, particularly **in regions** like **South Asia, Southeast Asia,** and **parts of Africa**, is a staple farming practice that has **sustained millions of farmers for centuries**.
  - However, paddy farming is **notorious for its heavy reliance on water**, with large amounts required for irrigation.
- **Environmental and Economic Challenges**: Paddy fields also **contribute to methane emissions,** a potent greenhouse gas, due to anaerobic conditions in flooded fields. Furthermore, paddy cultivation is a labour-intensive and seasonal practice.
  - It **requires land preparation, sowing, transplanting,** and **harvesting**, all of which come with associated **risks due to weather patterns, pests,** and **crop diseases.**

Importance of Shift:

- As **climate change exacerbates** these **challenges**, the **need for more resilient, long-term farming systems becomes critical**.
- **Unlike annual crops** that **need to be replanted each year, perennial crops grow back year after year**, maintaining their root systems and minimising the need for soil disturbance.

Factors Driving the Shift:

- **Water Scarcity**: Due to declining surface water supply and the increasing dependence on groundwater for paddy cultivation, farmers are turning to coconut farming. Coconuts require less water, with only two irrigations per month.
- **Lower Costs**: Compared to paddy, coconut farming involves lower annual maintenance costs and provides a continuous income once the trees start bearing fruit, unlike paddy which requires seasonal labour and investment.
- **Labour Shortages**: The high labour demand for paddy farming has made coconut farming, which requires less labour, an attractive alternative.

Advantages of Coconut Farming:

- **Perennial Crop**: Coconut trees are low-maintenance once established, have a long lifespan (50+ years), and can be harvested multiple times a year (up to six times). **Hybrid coconut trees** provide quicker returns, yielding fruit by the third year.
- **Coastal Adaptability**: Coconut is a coastal plant, thriving in **sandy and saline soils**, and

even in salty groundwater, making it well-suited to the region's soil conditions.

- **Sustainability**: Coconut farming offers farmers financial stability as it is a year-round crop, unlike seasonal crops like paddy.

Challenges in Coconut Farming:

- **Pests and Diseases**: Coconut trees are susceptible to beetles, diseases like **Tanjore Wilt**, and infestations such as **Whitefly** and **Eriophyd**, which require attention and pest control measures.
- **Extreme Weather Events**: Natural disasters, like **Cyclone Gaja (2018)**, have caused extensive damage to coconut plantations, uprooting trees and affecting soil and groundwater quality, resulting in financial losses.
- **Labour Shortages**: The availability of labour for tasks like climbing trees to harvest coconuts has diminished, partly due to competition from the **MGNREGA scheme** which draws workers away.
  - This has made it harder for farmers to manage coconut orchards, particularly those who grow organically or face labour constraints.
- **Market Instability and Falling Prices**: The price of coconuts has been volatile, with recent prices falling to as low as **Rs 6-8 per coconut**. Before **Cyclone Gaja**, coconuts were sold for **Rs 22-25**, but the supply has increased, further driving down prices.

Future Prospects and Policy Recommendations:

- **Improved Market Linkages**: Direct procurement by the government, especially for surplus production, could help stabilise income.
  - Farmers suggest that **coconuts should be used in government nutrition programs** and public distribution systems (**PDS**), which could provide a steady demand.
- **Climate Resilience Measures**: Investing in **climate-resilient varieties** and better disaster preparedness strategies. Governments could assist farmers with **subsidies or insurance schemes** to mitigate the risks of natural calamities.
- **Enhanced Irrigation Infrastructure**: Support for small farmers to **access affordable irrigation solutions**, like **community borewells or subsidised water conservation technologies**, could help address the challenge of water scarcity and ensure more equitable access to resources.
- **Labour Management and Automation:** Solutions to address the labour shortage, such as training women and youth in coconut tree climbing or introducing mechanised harvesting tools, could ease the burden on farmers and reduce reliance on seasonal workers.

Cooperatives and Dairy Sector

Sub Topic- *Economics of Animal-Rearing, Agricultural Marketing*

Context:

The Union Minister for Home and Cooperation announced in Parliament that **newly established cooperatives engaged in manufacturing activities** will enjoy a **reduced tax rate of 15%,** similar to the rate available to new manufacturing firms.

More on News

- **Milk cooperatives**, crucial to India's dairy sector, are **now allowed to accept cash payments exceeding ₹2 lakh on bank holidays for milk price payments.**
  - Typically, under **Section 269 ST of the Income Tax Act, cash receipts above ₹2 lakh are prohibited and subject to penalties.**
- **Section 269 SS of the Income Tax Act restricts cash deposits or loan advances above ₹20,000,** with penalties equal to the transaction amount for violations.
  - For **primary agricultural cooperatives**, the limit has been **raised to ₹2 lakh per member**, allowing flexibility in providing financial support to members.

The Role of Cooperatives in India

- Cooperatives are **member-owned grassroots enterprises** that **share profits and losses equally.**
- With a history spanning over a century, the sector is a **vital source of livelihood for millions,** especially women, across industries such as dairy, fisheries, finance, housing, and agriculture.
- Prominent examples include **Amul,** India's largest dairy brand, and **IFFCO,** the country's leading fertilizer cooperative.
- The cooperative model also **supports a vast network of urban and rural banks**, emphasising its significance in India's economic fabric.

Legal Framework

The Constitution of India: Part IXB, introduced by the **97th Amendment (2011),** this part provides a **constitutional status to cooperative societies**, outlining their governance and regulation.

The Multi-State Cooperative Societies Act, 2002: This act governs cooperatives that operate in more than one state. It is **administered by the Central Registrar of Cooperative Societies** and aims to promote cooperative societies and ensure their democratic functioning.

The **Multi-State Cooperative Societies (Amendment) Bill, 2023**, aims to enhance governance, transparency, and accountability in multi-state cooperatives by incorporating provisions from the 97th Constitutional Amendment.

The Cooperative Societies Act, 1912: One of the earliest acts, it provides the framework for the **registration, regulation, and management** of cooperative societies in India.

State Cooperative Societies Acts: Each state in India has its own cooperative societies act that governs cooperatives operating within its jurisdiction.

Dairy Sector

India's dairy sector is the **largest in the world**, with significant contributions to the economy and livelihoods of millions.

- **Milk Production:** In 2022-23, India produced approximately 230.58 million tonnes of milk, accounting for about **22% of global production,** which is **more than three times that of China.**
- **Per Capita Availability:** The per capita availability of milk in India is **around 459 grams per day,** which is higher than the global average.
- **Major Milk-Producing States:** Uttar Pradesh, Maharashtra, Himachal Pradesh, Madhya Pradesh, Punjab, Rajasthan and Tamil Nadu.
- **Economic Contribution:** The dairy sector contributes approximately **5% to India's national economy and supports over 80 million farmers**, primarily smallholders.
- Export Potential: India's dairy exports reached about 63,738.47 MT valued at approximately ₹2,260.94 crores (USD 272.64 million) in 2023-24, with major destinations including the UAE, Saudi Arabia, USA, Singapore, and Bhutan.

Steps taken by Government

- **National Programme for Dairy Development (NPDD):** Aim to enhance the quality of milk and increase organised milk procurement, processing, and marketing.
- **White Revolution 2.0:** Launched in September 2024, this initiative **aims to increase milk procurement by dairy cooperatives by 50% over five years.**
- **Animal Husbandry Infrastructure Development Fund (AHIDF):** Relaunched with an increased budget of ₹29,610 crore to incentivise investments in dairy processing and value-addition infrastructure.
- **Subsidy Schemes:** Various subsidies are provided for purchasing milch animals, constructing dairy infrastructure, and expanding milk processing facilities.
  - The **Rashtriya Gokul Mission** supports the genetic improvement of milch animals and promotes indigenous breeds.
- **Kisan Credit Card (KCC) Scheme:** Extended to dairy farmers to provide working capital loans up to ₹2 lakh, facilitating easier access to credit.
- **Tax Incentives for Cooperatives:** Income tax exemptions under **Section 80P** for primary cooperative societies supplying milk.
- Reduction in surcharges and alternate minimum tax rates for cooperative societies.

Private Sector and India's Global Infra Push

Sub Topic- *Growth & Development, Infrastructure*

Context:

On November 20, U.S. federal prosecutors charged senior officials of the Adani Group with allegations of graft and fraud related to securing a renewable energy project in India.

More on News:

- The business conglomerate has vehemently **denied the charges and pledged to exhaust all legal avenues** to defend its green energy arm, Adani Green.
- While the **case's merits remain to be established**, its **implications for India's global reputation are significant.**

The Fallout:

- **Credibility:** The indictment casts a **shadow on the credibility of the Indian private sector and threatens to undermine India's strategic global objectives.**
- **France:** Notably, **French oil giant TotalEnergies has halted financial contributions** to its investments with the Adani Group.
- **Kenya:** Similarly, **Kenyan President William Ruto has revoked an airport renovation and operational contract,** alongside a $736 million energy partnership Adani had secured just weeks earlier.
- **USA:** The **U.S. International Development Finance Corporation (DFC)** has **reopened its due diligence on Adani's Colombo Port** redevelopment project in Sri Lanka.
- **Bangladesh: Bangladesh's caretaker government**, led by Nobel laureate Mohammad Yunus, is **reassessing long-term energy contracts with Adani Group**, amounting to 5 GW of power generation over 15 years.

Global Reach and Strategic Importance of Adani Group:

- **Connectivity:** The Adani Group plays a **pivotal role in India's global connectivity strategy,** with **projects spanning Tanzania, Israel, Greece, Indonesia, Nepal, Vietnam, and Australia.**
  - These include **seven ports, four airports, and three metals and mining projects.**
- **Foreign Policy:** Its initiatives align **closely with India's foreign policy frameworks**, such as **Neighbourhood First, Act East, and the vision of a Free, Open, and Inclusive Indo-Pacific.**
  - These policies aim to foster regional and international infrastructure development while positioning **India as a strategic connector between East and West.**
- **Respecting Sovereignty:** India's overseas partnerships emphasise **sustainable, affordable, and resilient infrastructure,** promoting economic growth and trade while **respecting sovereignty and local ownership.**
  - This approach **contrasts sharply with China's Belt and Road Initiative (BRI),** criticised for fostering financial instability through **predatory lending, corruption, and dual-use infrastructure projects.**
  - As a counterweight to BRI, **India has sought to build trust and credibility in the developing world** by offering a transparent and inclusive alternative.

Risks to India's Connectivity Strategy:

- The indictment **threatens to derail India's development partnerships,** with several nations reconsidering their agreements with Indian firms.
  - **Kenya, Bangladesh, Sri Lanka, and the United States are already reassessing** their collaborations, and other countries like **Greece, Australia, and Tanzania may follow suit.**
  - This could lead to **increased scrutiny of Indian projects,** delays in execution, and **potential loss of trust in India as a reliable development partner.**
- India's connectivity strategy is **vital for its aspirations to become a key player in the emerging East-West corridor,** particularly in the context of the Indo-Pacific.
- However, with the Adani Group representing a major share of Indian private sector engagement in international infrastructure, the **current controversy could harm India's credibility as an alternative to China's BRI.**

Structural Challenges in India's Private Sector:

- **This episode highlights a deeper structural issue:** the **underrepresentation of Indian private companies** in international development.
- **India's connectivity goals are overly reliant on a small number of firms**, such as the Adani Group, which exposes the country to significant risks when these entities face challenges.
- The **lack of a diversified private sector** presence limits New Delhi's ability to advance its foreign policy objectives.
- For India to maintain its global positioning and achieve its connectivity ambitions, a more **robust and diversified private sector engagement is essential.**
- Companies must step up to **share the burden of developing critical infrastructure and reinforce India's credibility as a partner in sustainable development.**

The Road Ahead:

- The Adani indictment underscores the **need for introspection and reform.**

- **Both the government and the private sector must work together** to ensure that India's strategic ambitions are not jeopardised by reliance on a few stakeholders.
- **Expanding the pool of companies** involved in international development projects will strengthen India's connectivity strategy and reinforce its standing as a reliable and transparent partner in the global arena.

India's future as a global connector depends on the resilience and adaptability of its private sector. The current challenges offer an opportunity to recalibrate and strengthen its foundations for a more inclusive and sustainable approach to global connectivity.

First Offshore Mineral Auction

Sub Topic- *Mineral & Energy Resources*

Context:

The **Ministry of Mines** is set to **launch its first-ever auction of offshore mineral blocks**, marking a significant step in **India's strategy** to tap into the **blue economy.**

Broader Context: Onshore Critical Mineral Auctions

This offshore auction follows a series of **onshore critical mineral auctions** that the government has initiated, starting in **November 2023**. Over the past year, **four rounds** have been held, offering **22 blocks** for minerals like **lithium**, **vanadium**, **graphite**, **cobalt**, and **manganese**. This is part of the government's broader push to secure critical minerals essential for **energy transition** and **technological innovation**.

Overview:

- **Mineral Blocks**: The auction will feature **13 carefully selected mineral blocks** across the Arabian Sea and the Andaman Sea. These blocks contain construction sand, lime mud, and polymetallic nodules.
  - These nodules are rich in essential metals such as **manganese**, **nickel**, and **cobalt**, which are crucial for industries like **battery production** and **electronics**.
- **Exclusive Economic Zone (EEZ)**: India's EEZ spans over **2 million square kilometres**, extending 200 nautical miles from the baseline of its territorial waters. This will significantly expand the **geological potential** of the country, which currently stands at around **688,000 square kilometres**.

What is the National Critical Mineral mission?

- The National Critical Mineral Mission **aims to address India's heavy reliance on importing critical minerals** like lithium, cobalt, and rare earth elements, primarily from China, **which negatively impacts the economy** and domestic production.
- Increasing demand for electronic gadgets and clean energy technologies has intensified the need for a stable and sufficient supply of these essential minerals.
- The **Economic Survey 2023-24** emphasised the **strategic risks of dependence on China for critical minerals**.
- This mission seeks to **secure these resources to support industries ranging from electronics to electric vehicles**.

Objectives:

- **Economic Development**: The initiative aims to bolster domestic industries and ensure supply chain security by reducing reliance on mineral imports.
- **Green Energy Transition**: The minerals, including cobalt, nickel, and rare earth elements, are critical for renewable energy technologies and electric vehicles.
- **Key Focus Areas:** Nuclear energy, renewable energy, space exploration, defense, telecommunications, and advanced electronics.
- **Strategic Interests**: Offshore minerals are critical for reducing dependence on imports and stabilising supply chains.

Regulatory Framework:

- **Amendment to the Offshore Areas Mineral (Development and Regulation) Act, 2002**: Amended in **August 2023**, introducing an **auction-based approach** for allocating mineral blocks in offshore areas.
  - This reform aims to streamline the **granting of production leases** and **composite licenses** for exploration and extraction.

Challenges and Resolutions:

- Offshore mining presents specific challenges such as **high operational costs, complex environmental concerns,** and **technical hurdles**.
- To mitigate this, the **Offshore Areas Operating Right Rules, 2024** have been introduced, allowing lessees to **surrender**

lease areas after 10 years if operations are deemed uneconomical.

- These **measures aim to enhance the long-term viability** of offshore mining projects.

Future Prospects:

- **Private Sector Participation**: The auction aims to attract private sector investment and leverage advanced technologies for sustainable resource utilisation.
- **Global Leadership**: This initiative is a significant **step towards achieving self-reliance** and sustainable growth **in India's mineral sector**.

New Offshore Mining Framework

- **Exploration and Production Permission**: **Mineral exploration and production** in offshore areas will only be permitted after an official **gazette notification** by the administering authority.
- **Priority for Government Entities**: The rules prioritise **government bodies**, **state-owned companies**, and **corporations** in securing rights for offshore zones. **Production leases** for government entities can last up to **50 years**.
- **Composite Licenses**: For both **exploration and production** will be granted for **three years**. **Private entities** will be eligible to participate in **competitive auctions** to secure rights in offshore zones.
- **Auction Process**: The **Offshore Areas Mineral (Auction) Rules, 2024** allow the auction process to proceed even if only **one technically qualified bidder** remains after the initial round of bidding.
  - If no bids are placed in the second round, the auction can be **restarted from scratch** in a **'de novo' process**, offering **fresh opportunities** for bidders.

India: Trends in Energy Intensity

Sub Topic- *Energy Sector*

Context:

While India's GDP growth typically leads to higher energy consumption, the country's carbon and energy intensities have decreased over the past decade, now falling below the global average. Understanding the current energy landscape and predicting future trends are crucial steps in shaping long-term policies for sustainable economic growth in India.

Energy Sector Analysis and its Role in Sustainable Economic Policies:

- The energy sector lies at the heart of sustainable economic growth and environmental protection, making its analysis essential for long-term planning.
- Understanding the interconnection between energy consumption, economic growth, and environmental sustainability can shape robust strategies to meet developmental goals while minimising ecological impacts.

Why Energy Sector Analysis is Needed:

Energy sector analysis is indispensable for:

- **Economic Planning:** Energy is a key input for industrial, transport, and service sectors, directly influencing productivity.
- **Environmental Sustainability:** Energy consumption is a major contributor to greenhouse gas emissions, necessitating analysis to mitigate climate change impacts.
- **Resource Optimisation:** Efficient energy use and alternative energy sources reduce dependency on finite resources, ensuring economic stability.
- **Policy Design:** Data-driven insights on energy trends help formulate policies that balance growth with environmental goals.

Stages in Energy Intensity Reduction of the Developing World:

Energy intensity refers to energy consumption per unit of GDP and its reduction typically occurs in two stages:

- **Stage 1: Rapid Reduction**
  - Driven by **energy-saving technologies and structural changes** such as a shift from manufacturing to the service sector.
  - **Developing nations often achieve exponential declines** in energy intensity during this phase.
- **Stage 2: Slower Decline**
  - Marked by **limited additional energy-saving potential** due to unchanged underlying technologies.
  - Energy intensity reduction becomes **linear,** necessitating breakthroughs

in innovation or alternative energy adoption.

Energy Consumption Trends in India:

India's energy consumption trajectory reflects its economic growth, development patterns, and policy initiatives:

- Over the **past three decades, major sectors like industry, transport, and buildings have embraced energy-efficient technologies.**
- Rising energy consumption has been accompanied by a **significant reduction in energy and carbon intensity,** highlighting progress in sustainable development.

Energy Intensity Trends in the World:

Energy intensity trends in 2023 reveal regional disparities:

- **Global Average:** Declined by just 1%, below the 2010-2019 average of 1.8%.
- **OECD Countries:** Achieved a 3.1% decline, led by the EU (4.7%), Japan (5.3%), and South Korea (4.1%).
- **Non-OECD Regions:** Varied results with China witnessing a 1.3% increase and the Middle East recording a 2.3% rise, while Russia, Africa, and Latin America saw reductions of 3.2%, 2.7%, and 1.2%, respectively.

Energy Intensity and Carbon Intensity:

- **Global Definitions:**
  - **Energy Intensity:** Measures **energy use per GDP unit,** reflecting economic energy efficiency.
    - **High energy intensity**: Indicates greater energy consumption for the same level of GDP, suggesting lower energy efficiency.
    - **Low energy intensity**: Reflects more efficient energy use or a shift toward less energy-intensive activities (e.g., services sector growth).

A decline in energy intensity suggests that an economy is producing more output with less energy, often through advancements in technology, structural economic changes, or energy-saving measures

- **Carbon Intensity:** Measures **CO_2 emissions per GDP unit or energy consumed,** indicating the environmental footprint of economic activities.
  - **High carbon intensity:** Indicates reliance on carbon-heavy energy sources (e.g., coal, oil) for economic activities.
  - **Low carbon intensity:** Suggests a transition to cleaner energy sources (e.g., renewables, natural gas) or improved energy efficiency.

A decline in carbon intensity demonstrates progress in reducing the carbon footprint of an economy, often through adopting cleaner technologies or shifting to renewable energy.

- **In the Indian Context:** India has made significant strides in reducing both:
  - **Energy Intensity: Declined by 57%** over three decades due to energy-efficient technologies and economic restructuring toward services.
  - **Carbon Intensity: Declined by 36%** due to shifts to renewables and cleaner technologies, although reliance on coal persists.

Reasons for Energy and Carbon Intensity Trends in India and the World:

India:

- **Policy Interventions:** Initiatives like Perform, Achieve, and Trade (PAT) and renewable energy targets.
- **Economic Restructuring:** Growth of the service sector reduces energy demand.
- **Technological Adoption:** Efficient industrial and transport technologies.
- **Renewable Energy Expansion:** India's renewable energy capacity has grown significantly.

World:

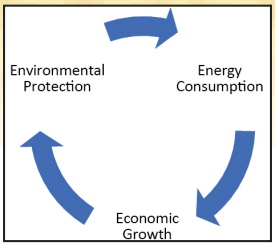
- **Developed Economies:** Advanced technologies and service-oriented economies drive steep declines.
- **Emerging Economies:** Industrialisation leads to higher energy consumption despite efficiency gains.
- **Energy Source Transitions:** Slow global adoption of renewables affects carbon intensity trends.

Relationship Between Energy Consumption, Economic Growth, and Environmental Protection:

Interdependence:

Energy consumption is integral to economic growth, yet it contributes to environmental

degradation. The challenge lies in balancing these dynamics for sustainable development.



Validity of the Relationship:

- **India:** Rising energy consumption with declining energy and carbon intensity indicates progress towards sustainable growth. Mutual causality between GDP and energy consumption is evident.
- **World:** Regional disparities persist, with some regions achieving decoupling (economic growth without proportional energy consumption rise), while others continue to grapple with high emissions.

Dichotomy:

In some cases, economic growth and environmental protection remain at odds due to:

- Overreliance on fossil fuels.
- Limited scalability of renewables in emerging economies.
- Policy and technological gaps.

PLI Scheme for Semiconductors

Sub Topic- *Growth & Development, Industrial Policy*

Context:

Launched in December 2021 with an allocation of ₹76,000 crore (~US$ 10 billion), the **Production Linked Incentive (PLI) scheme for semiconductors** is India's most ambitious effort to date **to establish a strategic foothold in this critical industry.**

More on News

- This initiative underscores the **government's intent to boost domestic manufacturing** capabilities by providing performance-linked financial incentives.
- Applied across **14 economic sectors,** the semiconductor PLI scheme represents the largest investment among them, outpacing allocations for the automobile (₹25,938 crore) and advanced chemistry cell (₹18,100 crore) sectors.
- The scheme has **attracted major investments and initiated five projects,** marking significant progress.

Key Features of the Scheme

- The semiconductor PLI scheme **aims to enhance manufacturing capabilities** in semiconductor foundries, **Assembly, Testing, Marking, and Packaging (ATMP)/ Outsourced Semiconductor Assembly and Test (OSAT)** facilities, and display fabrication plants.
- It provides **fiscal support covering up to 50% of the project cost,** with some states offering additional incentives.
- Projects are **selected based on criteria such as investment size, revenue potential, technological capabilities, and capacity.**
- Once approved, **subsidies are disbursed on a pari-passu basis**, where funds are deposited into a designated **"No-Lien Account" (NLA) to prevent misuse.**
- **Disbursements are made in instalments,** contingent upon the submission of progress reports and compliance with timelines.
- **Beneficiaries must commit to maintaining production for at least three years** post-commercial operations and ensure the project is operational within six years of approval.

Challenges and Recommendations

- **Limited Focus on Research and Development (R&D):** While the scheme **allocates 2.5% of its budget to R&D,** this investment is insufficient given the semiconductor industry's reliance on continuous innovation.
- **Recommendations:**
  - Establish **clear R&D priorities,** such as advanced packaging, testing technologies, and workforce development.
  - **Increase funding and foster partnerships** with academic and research institutions.
  - Create a **national research hub** akin to the **U.S. National Semiconductor Technology Center** to centralise and strengthen R&D efforts.
- **Strategic Gaps in Manufacturing Focus:** The scheme equally incentivises various stages of semiconductor manufacturing, despite differences in feasibility and strategic importance.
- **Recommendations:**
  - **Prioritise ATMP/OSAT facilities,** which offer lower entry barriers and align with India's cost advantages.
  - Explore **advanced packaging opportunities** within ATMP/OSAT to add higher value and compete globally.

- Follow examples from **South Korea and Taiwan**, which transitioned to complex value chains after mastering ATMP processes.

- **Capacity Constraints of the India Semiconductor Mission (ISM):** The ISM, a small team of 18 members, is tasked with extensive responsibilities, including project assessments, claim verifications, monitoring, and liaising with stakeholders.
- **Recommendations:**
  - Expand the ISM team to meet operational demands.
  - Engage external experts for technical evaluations and compliance audits.
  - Streamline responsibilities to focus on critical tasks and reduce bottlenecks.
- **Absence of Time-Bound Goals and Milestones:** While the PLI scheme outlines broad objectives, it lacks specific, measurable milestones to track progress.
- **Recommendations:**
  - Introduce clear, time-bound, and quantitative milestones for every phase of the scheme.
  - Enhance transparency and accountability through regular progress reports and public disclosures.
  - Establish mechanisms to evaluate and adapt strategies based on milestone performance.

Conclusion

The PLI scheme for semiconductors represents a transformative step in positioning India as a global manufacturing hub. Addressing its current shortcomings—by strengthening R&D, refining manufacturing priorities, increasing ISM's capacity, and incorporating measurable goals—will be critical to its success.

Obstacles in Steel Import

Sub Topic- *Growth & Development, Industrial Policy*

Context:

The **Ministry of Steel's** implementation of **non-tariff barriers (NTBs) for importing steel** is posing significant **challenges for manufacturers and service providers,** particularly those involved in infrastructure development.

Ministry's Measures

- One key hurdle arises from the **government's quality control orders (QCOs)**, which apply to approximately 800 items across various sectors, including consumer goods, construction materials, food products, chemicals, automotive parts, textiles, and metals such as steel.
- These measures **aim to safeguard consumer interests by restricting imports** to suppliers licensed by the **Bureau of Indian Standards (BIS).**
- However, this **licensing requirement has deterred many foreign suppliers from participating in the Indian market,** citing the complexity and time-consuming nature of the process.
- While **exemptions exist for advance license holders,** export-oriented units, and those in **Special Economic Zones (SEZs),** these are subject to specific conditions tied to export production.
- In addition to QCOs, the government has introduced several **import monitoring systems,** such as the **Steel Import Monitoring System (SIMS), Paper Import Monitoring System (PIMS),** and **Non-Ferrous Metals Import Monitoring System (NFMIMS)**.
  - Recently, the Ministry of Steel rolled out an **updated version, SIMS-2,** which adds further complexity for importers.

India's Steel Sector

Current Status

- **Production and Consumption:** As of 2023, India produced approximately **140.2 million tonnes of crude steel**, making it the **second-largest steel producer globally, after China.** The country also ranks as the **second-largest consumer of finished steel, following China**.
- **Economic Contribution:** The steel industry contributes **about 2% to India's GDP and employs around 2.5 million people directly and indirectly.** Its **output has a multiplier effect on the economy**, significantly impacting related sectors such as construction, automotive, and engineering.

Historical Context

- **Post-Independence Growth:** The Indian steel industry saw significant expansion after independence in 1947. Key players like **Tata Iron and Steel Company (TISCO) and Hindustan Steel Limited** were established to meet domestic demand. **The Steel Authority of India Limited (SAIL)** was formed in 1973 to manage major steel plants.

- **Expansion Over the Years:** From producing just 16.9 lakh tonnes of pig iron in the early 1950s, India's production has surged over the decades, with a notable increase of **75% since 2008**.
- **Key Players:** Steel Authority of India Limited (SAIL), Tata Steel, JSW Steel, AM/NS India and Jindal Steel & Power Limited.

Government Initiatives

- **National Steel Policy 2017:** Aims for a **crude steel capacity of 300 million tonnes by 2030,** focusing on sustainable growth and enhanced domestic consumption.
- **Production Linked Incentive (PLI) Scheme:** Encourages investment in specialty steel production, targeting an additional capacity of **42 million tonnes by 2026-27**.
- **Quality Control Measures:** The introduction of the Steel Quality Control Order aims to ensure that **only high-quality steel products are available in the market**.

Difficulties in Compliance:

- For **steel items not covered by QCOs,** they **must obtain a no-objection certificate (NOC),** which requires declaring that the specific grade of steel is unavailable domestically and cannot be substituted by alternatives.
  - Many importers prefer obtaining inability letters from domestic manufacturers before submitting such declarations, **delaying the NOC process.**
- For **items under QCOs, SIMS-2 mandates detailed technical information**, such as product grade, category, chemical composition, and the supplier's BIS license number (Company Master List or CML number).
  - However, **errors in SIMS-2 frequently occur because the master database is not updated,** even when valid BIS licenses are provided.
  - Without SIMS-2 registration, importers cannot file bills of entry, leading to penalties and demurrage due to delays in clearing shipments.

Impact on Industries:

- Steel is a vital raw material for engineering and construction, and delays in imports are **disrupting production schedules and project execution.**
- **Import consignments often remain stuck** at ports, awaiting SIMS-2 registration.
- Recognising the urgency, the Ministry of Steel recently waived the NOC requirement for shipments already at ports with bills of lading issued before December 4.

The Way Forward:

- While the government's quality control measures aim to protect domestic consumers and industries, the **current processes for obtaining NOCs and SIMS-2 registrations have created unnecessary bottlenecks.**
- **Simplifying procedures, ensuring timely database updates,** and **addressing systemic inefficiencies** are crucial for reducing disruptions in steel procurement.
- Removing these obstacles will not only ease imports but also support critical infrastructure and manufacturing projects.

Greenwashing the Indian Railways

Sub Topic- *Growth & Development, Industrial Policy*

Context:

A recent report highlights that RITES Ltd., the consultancy arm of the Indian Railways, has **secured contracts to repurpose six broad-gauge diesel-electric locomotives for export to African railways.**

More on News

- These locomotives will be converted for Cape Gauge (1,067 mm) use from their original broad gauge (1,676 mm).
- While India has previously exported locomotives to Asia and Africa, this marks the **first time used locomotives are being exported after "gauge conversion."**
- This technical feat showcases **commendable re-engineering but also reveals a deeper issue—systemic wastage of valuable assets** due to questionable policy decisions.

Redundant Diesel Locomotives and Their Cost

- **Idle Locomoties:** The Indian Railways has **rapidly shifted toward electrification, leaving hundreds of diesel locomotives idle.**
  - As of March 31, 2023, data obtained under the **Right to Information (RTI) Act** revealed that **585 diesel locomotives were stored across the network.**

- **More than 60% of these had a residual service life of over 15 years.** This number has since grown to **760 locomotives.**

- **Aggressive Policy:** This redundancy stems from the **government's aggressive electrification policy, aiming for 100% coverage of the broad-gauge network.**
- **Efficiency:** While electrification aligns with broader environmental goals, its **rapid implementation raises concerns about financial and operational efficiency,** especially given the substantial service life remaining in many diesel engines.

Examining Policy Justifications

Electrification has been **justified on two main grounds: reducing diesel imports** to save foreign exchange and p**romoting environmental sustainability.** However, both claims deserve closer scrutiny.

- **Foreign Exchange Savings:** Diesel consumption by the Indian Railways represents a minor share of national fuel usage.
  - According to a 2014 study by AC Nielsen, when electrification was advancing at a moderate pace, railway traction accounted for only 3.24% of the country's diesel consumption. By 2021-22, this share dropped to about 2%.
  - Eliminating this small segment **does little to address the larger issue of diesel dependency,** particularly compared to sectors like trucking or agriculture.
- **Environmental Impact:** The environmental benefits of electrification are **less straightforward.**
  - **Nearly half of India's electricity is generated from coal-fired plants,** making coal one of the dirtiest fuels globally.
  - Indian Railways itself plays a key role in transporting coal, with freight earnings from coal transport comprising **40% of its total freight revenue in 2023-24.**
  - Replacing diesel locomotives with electric ones **merely shifts pollution from railway tracks to concentrated emissions at coal-fired power plants.**
  - Until renewable energy constitutes a significant portion of India's electricity generation—far beyond current levels—claims of a **"green railway" remain aspirational.**

The Real Costs of Electrification

- The aggressive push for 100% electrification has **not only sidelined serviceable assets but also risks financial and environmental inefficiency.**
- If all currently idle locomotives were lined up, they would stretch over 16 kilometers. Many of these are destined for the scrapyard, despite having significant residual utility.
- Adding to the paradox, **Indian Railways plans to retain 2,500 diesel locomotives for "disaster management and strategic purposes"** and keep another 1,000 operational to meet traffic commitments.
- This **undermines the narrative of achieving a fully electrified, green railway** while retaining substantial reliance on diesel engines and coal transport.

Jalvahak Scheme: Revolutionising Inland Waterways Cargo Transport in India

Sub Topic- *Growth & Development, Infrastructure*

Context:

The Indian government has launched the Jalvahak Scheme, an ambitious initiative to promote the use of inland waterways for cargo transportation. This scheme is designed to incentivise the movement of long-haul cargo via the country's National Waterways (NW) 1, 2, and 16, which include the Ganga, Brahmaputra, and Barak rivers, respectively. **The goal is to reduce logistics costs, alleviate congestion on roads and railways, and promote eco-friendly transportation alternatives.**

Key Components of the Jalvahak Scheme:

- **Incentive Component:** A primary feature of the **Jalvahak Scheme** is its **financial incentive** to cargo owners. The scheme provides a reimbursement of up to **35% of the total operating expenditure** incurred when transporting goods over 300 kilometers via National Waterways 1 (NW1), 2 (NW2), and 16 (NW16). This includes major routes such as:
  - **NW1 (Ganga River):** Haldia to Patna and Varanasi

- **NW2 (Brahmaputra River):** Kolkata/Haldia to Pandu/Agartala
- **NW16 (Barak River):** Pandu to Dibrugarh

This incentive encourages businesses to consider waterways as a cost-effective and sustainable transportation option.

- **Scheduled Services by CSL:**
  - Another key component involves the **introduction of scheduled cargo services operated by Inland & Coastal Shipping Limited (ICSL),** a subsidiary of the Shipping Corporation of India (SCI).
  - These services **will operate fixed routes across the designated waterways,** ensuring that cargo is transported efficiently and on time. The vessels will carry bulk and containerised cargo, enhancing the appeal of inland waterways as a reliable transport mode.

Objectives of the Jalvahak Scheme:

The primary objectives of the **Jalvahak Scheme** are:

- **Reducing logistics costs:** By offering financial incentives, the scheme aims to make inland waterways a competitive alternative to road and rail transport.
- **Decongesting roads and railways:** Shifting cargo to waterways will alleviate pressure on overburdened road and rail networks.
- **Promoting sustainable transportation:** Inland waterways offer an eco-friendly transport alternative, reducing carbon emissions and promoting environmental responsibility.

The scheme is expected to divert **800 million tonne kilometers (MTKM)** of cargo from rail and road transport to inland waterways, which represents about 17% of India's current freight movement capacity.

Scheme Funding and Duration:

- The **Jalvahak Scheme** is proposed with an investment of **₹100 crore** over five years. This funding will focus on developing the inland waterways sector and improving the country's logistics infrastructure. The scheme targets **shipping lines, freight forwarders, and trade bodies** handling bulk and containerised cargo.
- The scheme will be valid for **three years** initially, with the potential for extension based on its success.

Growth and Participation in Inland Waterways

India's inland waterways have been growing steadily, with the total navigable length expanding to **20,236 km.** This includes **17,980 km** of rivers and **2,256 km** of canals, suitable for mechanised vessels. However, freight transportation via waterways remains significantly underutilised compared to countries like the United States, China, and the European Union.

In **December 2024,** the government flagged off several cargo ships under the scheme, including:

- **MV AAI:** Transporting 1,000 tonnes of **gypsum** to Patna
- **MV Homi Bhaba:** Carrying 200 tonnes of **coal** to Varanasi
- **MV Trishul:** Transporting 1,500 tonnes of **cement** from Kolkata to **Pandu** in Guwahati via the Indo-Bangladesh Protocol Route (IBPR)

Target Growth and Vision for 2030 and 2047:

The Indian government has set ambitious targets for inland waterway cargo movement. The total volume of cargo transported via national waterways has grown substantially, from **18.07 million tonnes (MT) in FY2013-14 to 132.89 million MT in FY2023-24,** representing a **700% increase over the past decade.** By **2030,** the government aims to achieve **200 million MT** of cargo movement via waterways, and by **2047,** the goal is to reach **500 million MT,** contributing significantly to India's economic growth and the vision of **Atmanirbhar Bharat.**

Challenges for Inland Waterway Cargo Operators:

Despite significant growth in the sector, there are still several challenges that hinder the full utilisation of India's inland waterways:

- **Inadequate infrastructure:** Many inland ports and terminals lack the necessary facilities and equipment for efficient operations.
- **Water depth limitations:** The **Least Available Depth (LAD)** along some stretches affects the cargo load capacity and increases transportation costs.
- **Dredging requirements:** Regular dredging is needed to ensure sufficient water depth and facilitate **year-round operations** and **night navigation.**

To overcome these obstacles, experts suggest developing key stretches, such as the **Patna-Prayagraj or Faralda-Haldia routes,** as viable alternatives to road transport.

Subject -Geography

Himalayan Glacial Lakes Expand by 10.81% in 13 Years, Pose Flood Risks

Sub Topic- *Physical Geography, Water Resources, Geographical Features and their Location*

Context:

The **Himalayan region** has seen an **increase in the area of glacial lakes** and other water bodies, growing by 10.81% between 2011 and 2024.

- This expansion raises concerns about the risk of floods caused by the bursting of these lakes. Such floods occur when the natural barriers of the lakes break, releasing large volumes of water.
- A report by the **Central Water Commission** (CWC) has highlighted this alarming trend.

Key Findings from the Report

- **Increase in Lake Area:** Due to climate change, the total area of glacial lakes and water bodies in the Himalayan region has increased from 533,401 hectares in 2011 to 591,108 hectares in 2024.

- **Impact on Rivers:** This expansion could significantly affect the water flow in major rivers like the Ganga, Brahmaputra, and Indus.

Growing Threat of GLOFs

- **Increased Frequency of Events**: Data from the **International Centre for Integrated Mountain Development** (ICIMOD) shows **over 70% of the 700 recorded GLOF events since 1833 occurred in the past 50 years**.
  - The **highest number of GLOF incidents occurred in 1980** (15 events), followed by **2015 (13 events)**.
  - Other notable years include **1973, 1974, 2002, and 2010**, each with **10 incidents**.
- **Triggers for GLOFs**: **ICIMOD identifies mass movements** (avalanches and landslides) **as the primary trigger for 54% of GLOF events**.
  - Extreme rainfall accounted for 18% of the incidents.

Human and Environmental Impact:

- Since 1833, GLOFs have caused over 7,000 fatalities in the Hindu Kush Himalayan region.
- These events threaten lives, infrastructure, and ecosystems downstream.

Threats to Neighboring Countries: The report also highlights the potential risks to neighboring countries like **Bhutan, Nepal, and China**, which share river systems originating in the Himalayas.

- It recommends collaborative efforts with these countries to monitor, share data, and plan for potential floods. Suggestions include:
  - **Early Warning Systems:** Developing and implementing early warning mechanisms.
  - **Disaster Management Plans:** Enhancing disaster response strategies.
  - **Community Awareness:** Promoting awareness initiatives to safeguard vulnerable populations.

Glacial Retreat and Lake Expansion: The primary reason for the expansion of these lakes is the rapid melting of glaciers, driven by rising temperatures.

- This change poses risks to:
  - **Communities living in lower areas.**
  - **Infrastructure and biodiversity.**
  - **Wildlife in the region.**
- The retreat of glaciers and the growth of lakes are clear indicators of climate change. The CWC is developing advanced technologies to identify and mitigate risks effectively.

Importance of Monitoring: The CWC emphasises the critical need to monitor these lakes closely.

- **Advanced satellite technologies**, such as **Sentinel-1 Synthetic Aperture Radar** (SAR) and **Sentinel-2 Multispectral Imagery**, are being used to detect changes in lake sizes with 10-meter accuracy, even under cloudy conditions.
- These technologies can provide timely warnings to mitigate disasters.

NGT's Intervention: The **National Green Tribunal** (NGT) has taken suo moto cognisance of the issue, issuing notices to the central government and other relevant bodies.

- **Growth of Glacial Lakes:** The NGT noted a 33.7% increase in the surface area of glacial lakes in India between 2011 and 2024.

- **High-Risk Lakes Identified:** Sixty-seven lakes have shown over 40% surface expansion and are classified as high-risk for Glacial Lake Outburst Floods (GLOFs).
  - These lakes are primarily located in **Ladakh**, **Himachal Pradesh**, **Uttarakhand**, **Sikkim**, and **Arunachal Pradesh**.

Potential Hazards and Recommendations: The NGT has highlighted the risk of sudden floods caused by the bursting of these lakes, which could devastate communities, infrastructure, and biodiversity. Recommendations include:

- **Enhanced Monitoring:** Increasing surveillance of glacial lakes.
- **Flood Management Strategies:** Improving flood management and early warning systems.
- **Legal Compliance:** Addressing violations under biodiversity, water pollution, and environmental protection laws.

Government Accountability: The NGT has issued notices to the Ministry of Environment, Forest and Climate Change, the Director of the **GB Pant Himalayan Institute**, and the **Central Pollution Control Board**. These bodies are required to respond by March 10, ahead of the next hearing.

Subject - Indian Society

India's Demographic Dividend as a Global Public Good

Sub Topic- *Population and Associated Issues*

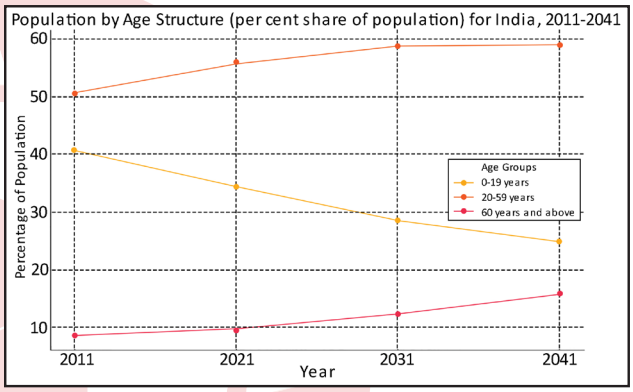
Context:

India's demographic dividend has the potential to influence global labour markets positively, addressing labour shortages while enhancing productivity worldwide. This opportunity requires strategic policies to build a globally competitive workforce.

Magnitude of India's Demographic Dividend: India's demographic dividend represents a vast pool of young, potential workers, significantly impacting domestic and global economies.

- India is adding **9.7 million potential workers annually** through the 2020s, which can enhance global productivity.
- With a projected **working-age population of 1.04 billion by 2030**, India's **dependency ratio** will reach its lowest point, marking an economic advantage.
- Beyond 2030, India will continue adding **4.2 million workers annually**, positioning it as a major contributor to global labour markets.
- Proper utilisation of this **workforce can drive growth** both within India and across the globe.

Labour as a Global Common vs. Global Public Good: Recognising labour as a universally shared resource can redefine its role in global economic dynamics.



- **Labour as a global common:** Labour mobility can be compared to shared resources like oceans and outer space, being **non-excludable** but **rivalrous**.
- **Labour as a public good:** Free international mobility of labour, when coupled with skill-matching, generates **positive externalities** like improved productivity and enhanced welfare.
- **Challenges:** Legal restrictions and market pricing differentiate labour from traditional public goods.
  - **Treating labour as a public good can maximise welfare**, provided institutional interventions are in place.

Addressing Global Labour Shortages: Labour shortages and unemployment coexist globally due to mismatches in skills and demographic shifts.

- **Current shortages:** The EU and Australia faced **1 million and 400,000 job vacancies**, respectively, in 2023, despite unemployment rates of **5.9% and 4.1%**.
- **India's opportunity:** By addressing its own skill-mismatch issues, India can supply a **high-skilled workforce** to fill gaps in sectors like **healthcare, logistics, and manufacturing** in ageing economies.

- **Bridging the skill divide** can make India a **global provider of talent**, benefiting both labour-deficient economies and Indian workers.

India's Comparative Advantage in Skilled Labour: India's economic growth since the 1990s, driven by the services sector, has created a reservoir of skilled talent.

- India exports **4.6% of global services**, showcasing its capability in **Information and Communication Technology (ICT)** and software services.
- With the **largest pool of science, technology, engineering, and mathematics(STEM) graduates**, India can address skill shortages in the **Global North** by supplying **medium- to high-skilled workers**.
- India's skilled workforce **can reduce global skill mismatches**, **enhancing productivity** and **fostering economic interdependence**.

Resolving Skill-Mismatch in India: India faces internal challenges of skill mismatches, necessitating reforms in education and vocational training.

- Lack of **market-relevant skills** among workers highlights the need for **curriculum updates** and **vocational programs**.
- Enhancing **human capital** through targeted policies can ensure better employment opportunities and higher individual productivity.
- A **robust training framework** will not only empower workers but also prepare them for global markets, improving livelihoods and capabilities.

Benefits of Labour Globalisation: Transforming India's labour into a globally accessible resource creates a win-win scenario for all stakeholders.

- **For India:**
  - Generates remittances as a significant source of income.
  - Reduces domestic pressure on employment, optimising productivity.
- **For the World:**
  - Addresses **ageing population crises** in regions like the EU and the US.
  - Resolves global **labour shortages** in critical industries.
- India's **strategic focus on labour globalisation ensures mutual benefits**, securing its place as a global economic player.

Policy Recommendations for Leveraging Demographic Dividend: Timely interventions are critical to unlocking the full potential of India's demographic advantage.

- **Skill enhancement:** Invest in **vocational training**, **education reform**, and **skill-matching programs**.
- **Labour mobility:** Facilitate **legal frameworks** and **bilateral agreements** for international worker migration.
- **Human capital formation:** Promote policies that organically enhance workers' capabilities while aligning with market needs.
- **Institutional support:** Strengthen institutions to streamline migration and ensure ethical treatment of Indian workers abroad.
  - These policies can convert **India's demographic dividend into a global asset**, enhancing global productivity and welfare.

Conclusion

India's demographic dividend represents an unparalleled opportunity to reshape global labour markets and economic patterns. By addressing skill mismatches, enhancing labour mobility, and fostering international collaboration, India can emerge as a leader in creating a global workforce, benefiting both its citizens and the world. However, swift and effective policy implementation is essential to harness this potential.

Subject - Social Justice

Unequal Contraceptive Responsibility

Sub Topic- *Issues related to women & children, Health*

Context:

In 1952, India became a pioneer in launching a national family planning program, which initially focused on improving maternal and child health but later shifted its focus to population stabilisation. As the program evolved, so did the adoption of permanent methods of contraception.

More on News:

- **Between 1966 and 1970, vasectomies accounted for approximately 80.5% of all sterilisation procedures** in India.

- However, **this figure has declined over the years** due to changing policies and other factors that **de-emphasised male sterilisation.**
- Data from the five rounds of the **National Family Health Survey (NFHS) reveal a steady decline in male sterilisation** over the last three decades across all states.
- In NFHS-4 (2015-16) and NFHS-5, the percentage of vasectomies **remained stagnant at a mere 0.3%.**

Gender Disparity in Sterilisation:

- This trend stands in stark contrast to **Section 4.8 of the National Health Policy 2017,** which **aimed to raise male sterilisations to at least 30%.** Currently, **India falls significantly short of this target.**
- Official statistics highlight a glaring disparity between **female and male sterilisation rates—37.9% versus 0.3%, respectively—** underscoring the **disproportionate burden borne by women.**
- This imbalance poses a **significant barrier to achieving Sustainable Development Goal 5**: *achieving gender equality and empowering all women and girls by 2030.*
- To address this disparity, the **third Friday of November** is observed as *Vasectomy Day* globally (this year on November 15).
  - India also initiated a *"Vasectomy Fortnight"* in 2017 to raise awareness, dispel myths, and encourage men to consider vasectomy as a viable contraceptive option.

Despite these efforts, **policy gaps and ground realities have kept male sterilisation rates low.**

Challenges and Ground Realities:

- For instance, a recent survey conducted in March 2024 in a village in Chhatrapati Sambhaji Nagar, Maharashtra, revealed that **women viewed sterilisation as their sole responsibility.**
  - They believed that **men should not bear this "burden" because of their role as primary breadwinners.**
- Additionally, **many women were unaware of the government's cash incentives** to offset wage losses for men undergoing vasectomy.
- **Misconceptions about vasectomy**—such as its **impact on libido—male egos, illiteracy, and family opposition** further hinder its acceptance.
- The **unavailability of skilled medical providers,** particularly in rural areas, exacerbates the problem.
- Compounding this issue, **many trained community health workers lack adequate knowledge about no-scalpel vasectomies.**

Solutions:

- **Early Sensitisation: Awareness programs and peer-group discussions** in schools can instil the idea of **shared responsibility** in family planning from an early age.
  - **Sustained social and behaviour change communication** campaigns are essential to debunk myths and destigmatise vasectomy.
  - Notably, **vasectomy is a safer and simpler procedure compared to tubectomy**, which involves operating on women's fallopian tubes.
- **Enhanced Incentives: Financial incentives** can significantly increase male participation.
  - A 2019 study in Maharashtra found **higher vasectomy uptake among men in rural tribal areas when conditional cash incentives were offered.**
  - Similarly, Madhya Pradesh's 2022 decision to increase incentives by 50% is a commendable step in this direction.
- **International Lessons:** India can learn from countries like **South Korea, Bhutan, and Brazil.**
  - **South Korea's** high vasectomy prevalence is attributed to **progressive societal norms and gender equality.**
  - **Bhutan normalised vasectomies through high-quality services** and government-run camps, while **Brazil leveraged mass media campaigns** to raise awareness, increasing vasectomy prevalence **from 0.8% in the 1980s to 5% in the past decade.**
- **Strengthening the Health System:** The government must **align its national health system with policy objectives** by investing in training more healthcare providers, promoting non-scalpel vasectomy techniques, and ensuring high-quality services.

Flood Vulnerabilities in India: A Gendered Perspective

Sub Topic- *Issues related to Health*

Context:

India is one of the most flood-affected countries globally, with annual flooding affecting millions

of people, particularly in flood-prone areas. With approximately 40 million hectares of land vulnerable to floods, these disasters severely disrupt daily life, causing widespread damage to infrastructure, especially **water, sanitation, and hygiene (WASH)** systems. The destruction of WASH facilities exacerbates public health risks and leaves vulnerable populations, particularly women and girls, facing additional hardships.

Gendered Impact of Flood Vulnerability:

- **Women's Challenges with Water Access**
  - During floods, women, who are typically responsible for collecting water in many communities, struggle to find clean and safe water.
  - Flooding often contaminates water sources, forcing women and girls to rely on unsafe water, increasing the risk of waterborne diseases.
- **Inadequate Sanitation Facilities**
  - Floods disrupt sanitation infrastructure, leaving women and girls without access to safe toilet facilities. Many toilets are either submerged or damaged, pushing women and girls to defecate in the open, which exposes them to risks of violence and harassment.
- **Menstrual Hygiene Challenges**
  - Access to menstrual hygiene products becomes limited during floods, adding to the health risks faced by women and girls.
  - The lack of privacy and proper sanitation facilities in emergency shelters makes it even more challenging for women to manage menstrual hygiene.
- **Maternal Health Risks**

About WASH:

Water, Sanitation, and Hygiene (WASH) are fundamental to maintaining public health, especially in disaster-prone areas. Safe access to water, adequate sanitation, and proper hygiene practices are vital for preventing disease and ensuring health during emergencies. In flood-prone areas, the resilience of WASH systems is key to safeguarding the health and dignity of women and other vulnerable populations.

  - Floods disrupt healthcare services, particularly maternal health services. Pregnant women often struggle to access prenatal and postnatal care, and healthcare facilities lack proper WASH amenities, further endangering their health.

Why Is There a Gendered Impact of Flood Vulnerabilities?:

- **Socio-Cultural Roles and Responsibilities**
  - In many parts of India, **women are responsible for water collection and sanitation.** These traditional roles leave them disproportionately affected when these systems are disrupted by floods.
- **Gender Blind Policies and Disaster Management**
  - A key reason for the gendered impact of floods is the lack of gender-sensitive policies in disaster management and WASH planning.
  - Many state climate action plans and disaster management strategies overlook the specific needs of women and girls, resulting in interventions that fail to address the unique challenges they face during floods.
- **Lack of Gender-Specific Provisions:** Nearly 43% of state climate action plans in India fail to include specific provisions for addressing women's needs related to water, sanitation, and hygiene during floods. This gap in policy planning leads to insufficient responses to the challenges faced by women and girls during these crises.

Key Challenges to Address WASH Requirements of Women During Floods

- **Inadequate Infrastructure:** Many flood-prone areas lack resilient infrastructure that can withstand the impacts of floods. This includes flood-resistant toilets, water storage systems, and other critical WASH infrastructure that can ensure access to safe water and sanitation during floods.
- **Gender Insensitivity in Policies:** Current disaster management and WASH policies often fail to account for the specific needs of women and girls. This oversight results in inadequate and gender-insensitive responses to flood disasters, making it harder for women to access safe water, sanitation, and healthcare services.
- **Cultural and Social Barriers:** In some communities, traditional cultural norms prevent women from voicing their specific needs during floods. These norms can hinder the provision of safe sanitation, water,

and healthcare services, exacerbating the challenges faced by women and girls during disasters.

Way Forward to Address WASH Challenges for Women:

- **Gender-Segregated Sanitation Facilities:**
  - To ensure women's safety and privacy, flood-resilient sanitation facilities must be prioritised.
  - Short-term solutions like portable toilets and long-term infrastructure such as flood-resistant toilet blocks should be implemented. Solar-powered lighting around sanitation facilities will enhance safety.
- **Ensuring Access to Clean Water:**
  - To provide continuous access to clean water, portable water purification kits should be distributed, especially in women-led households and to pregnant or lactating mothers.
  - Long-term solutions include decentralised water kiosks managed by women's self-help groups and raised hand pumps to prevent contamination.
- **Menstrual Hygiene Management (MHM):**
  - Emergency relief kits must include **menstrual hygiene products.** Shelters should have designated MHM corners with washing stations, privacy curtains, and disposal facilities.
  - **Mobile health units** can deliver supplies and promote safe menstrual hygiene practices.
- **Strengthening Maternal Health Services:**
  - Flood-prone areas need more mobile health clinics with basic WASH facilities. Long-term solutions should focus on flood-resilient healthcare infrastructure and strengthening telemedicine services.
  - Training more **Accredited Social Health Activist (ASHA) workers** will support maternal care during floods.
- **Promoting Women's Participation in WASH and Disaster Management:**
  - Women should be included in decision-making regarding WASH and disaster management. Training women in basic sanitation, creating Women's WASH Committees, and ensuring at least 33% female representation in disaster management committees will help address their needs.

Key Actions Moving Forward:

- **Gender-Sensitive Disaster Planning:** Policies should account for the specific needs of women and girls in disaster management and recovery efforts.
- **Inclusive Participation:** Women's active involvement in disaster planning and WASH infrastructure is essential.
- **Training and Awareness:** Enhancing awareness on menstrual hygiene, maternal health, and gender-sensitive disaster responses will improve preparedness and resilience.

Snakebites to Be Made a Notifiable Disease

Sub Topic- *Issues related to Health*

Context:

The **Union Health Ministry** has recently **urged states to classify snakebites** as a **notifiable disease**.

What is a Notifiable Disease?

- Notifiable diseases are those that must be reported to the government due to their potential to cause outbreaks, lead to fatalities, or require quick investigation and public health action.
- The diseases commonly classified as notifiable include infections like **tuberculosis, HIV, cholera, malaria, dengue, and hepatitis**, which may pose significant health risks to the population.

Why are Snakebites Considered a 'Disease'?

- **Medical emergency: Snakebites** can **result** in **serious health issues** like **paralysis, haemorrhage,** and **tissue damage**. Immediate treatment with antivenoms is crucial to prevent fatalities.
- **Public health challenge:** In India, snakebites are a leading cause of death, with an **estimated 58,000 deaths annually**.
- Fatal Snakes in India: India has over **310 species of snakes**, of which **66 are venomous**. Among them, **four species**—the **Indian cobra, common krait, Russell's viper**, and **saw-scaled viper**—are responsible for the majority (90%) of fatal snakebites.
  - The commercially available polyvalent antivenom works against venom from all four species, covering about **80% of snakebite cases**.

Challenges in Treating Snakebites:

- **Delayed Treatment**: Victims often fail to seek medical treatment in time, sometimes opting for traditional or faith-based healers instead of reaching healthcare facilities.
- **Inadequate Training**: Many healthcare providers are not adequately trained to treat snakebites, and diagnostic tests to confirm a snakebite are often unavailable.
- **Antivenom Shortages**: **Antivenoms** used to counteract snake venom in India are primarily produced using venom from snakes caught by the **Irula tribe**, who collect venom in Tamil Nadu, Karnataka, and Kerala.
  - However, the venom from different geographical areas may have different biochemical properties, affecting the effectiveness of the antivenom.
  - Additionally, **venom potency** can vary by age of the snake, with **neonate Russell's vipers** exhibiting higher toxicity than adults. This creates inconsistencies in antivenom effectiveness.
- **Regional Snake Species**: There are also regional snake species, particularly in the **Northeast**, such as the **banded krait**, **monocled cobra**, and **green pit viper**, for which commercially available antivenoms may not be effective.
- **Antivenom Reactions**: Even when antivenom is available, it can cause adverse reactions, complicating treatment further.

The National Action Plan for Prevention and Control of Snakebite Envenoming (NAPSE):

- Earlier this year, the government launched NAPSE with the **goal of halving snakebite deaths by 2030**.
- One of the key objectives of this plan is **to enhance the surveillance of snakebite cases** and deaths.
- By making snakebites notifiable, the **government aims to gather accurate data** on the burden of snakebites, **identify high-risk areas,** and **improve clinical management**.

Future Directions:

- **Artificial antibodies and peptides:** To address the limitations of current antivenoms, researchers are working on artificially produced antibodies and peptides that could neutralise toxins from a variety of snake species.
- There are also suggestions to set up **venom collection banks** across the country to better address regional venom differences and produce more effective antivenoms. However, the **Wildlife (Protection) Act of 1972** restricts access to snakes, which poses a significant obstacle to establishing such banks.

Subject - International Relations

Strengthening India's Defence Networks in Asia

Sub Topic- *International Treaties & Agreements, Important International Institutions, Effect of Policies & Politics of Countries on India's Interests, Groupings & Agreements Involving India and/or Affecting India's Interests*

Context:

Recent defence agreements highlighted during Defence Minister Rajnath Singh's participation in a **Southeast Asian defence ministerial forum** in Laos underscore the **untapped potential of India's security cooperation with like-minded Asian countries.**

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- With **China's growing military capabilities** and the urgent need for India to modernise its defence industrial base, forging strong defence networks with Asian allies has become a strategic necessity.

Expanding Defence Partnerships

- India's recent **agreements with Australia and Japan** reflect this strategic shift.
- The **arrangement with Australia** facilitates **air-to-air refuelling between the two nations'** military aircraft, significantly enhancing operational reach and interoperability.
- Meanwhile, **discussions with Japan have led to a Memorandum of Understanding (MoU) on jointly producing stealth technology** for Indian warships, signaling deeper industrial collaboration.
- While these initiatives are **currently limited in scope,** they lay a **foundation for more robust cooperation to address shared security challenges** in the region.

The Challenge of Chinese Assertiveness

- A **major driver for India's defence partnerships is China's assertive stance** on territorial disputes and its rapidly expanding military capabilities.
- Despite Beijing's recent efforts to soften its diplomatic tone after years of aggressive unilateral actions, the **fundamental concern lies in the scale of its military power.**
- China's defence expenditure dwarfs that of its regional neighbors combined, including India and Japan.
- China's **vast industrial infrastructure,** coupled with **three decades of modernisation and significant investment in defence research and development,** has resulted in an unparalleled surge in military production.
  - For instance, China **commissioned 70 submarines between 1995 and 2020**—an unprecedented pace since World War II.

The Regional Response

- **No single Asian nation,** including India, **can counter China's growing military dominance** alone.
- This reality has **driven many countries in the region to deepen security cooperation with the United States.**
- While **China promotes the narrative of** ***"Asia for Asians,"*** arguing against external powers' military presence, **most Asian nations see this rhetoric as a veiled attempt to consolidate Beijing's primacy in the region.**
- **China's assertiveness** has, in fact, **bolstered regional support for the U.S. military presence.**
- However, the **question today is** less about the legitimacy of American military involvement in Asia and **more about its sustainability and effectiveness.**

America's Evolving Role

- The U.S. **no longer enjoys uncontested military dominance** in East Asia.
- While its **armed forces remain qualitatively superior,** the **quantitative growth of China's People's Liberation Army (PLA) is shifting the regional balance.**
- Compounding this challenge is the **U.S.'s need to divide its military resources across Europe, the Middle East, and Asia.**
- **Geopolitical developments** in Europe and the Middle East have **further strained America's strategic focus.**
- **NATO commitments remain robust due to Russia's invasion of Ukraine,** and ongoing conflicts in the Middle East have drawn the U.S. back into the region.
- These **multi-theatre obligations limit Washington's ability** to fully concentrate on countering China's rise in Asia.
- Adding to this strain is the **U.S. military-industrial complex's inability to meet the growing demand for weapons and ammunition.**
- **Outdated production facilities,** a **shortage of skilled personnel,** and reliance on external partners like Japan and South Korea further complicate the U.S.'s efforts to maintain military competitiveness.

India's Opportunity for Transformation

- For India, this evolving geopolitical landscape **presents both challenges and opportunities.**
- Addressing the **massive gap in defence capabilities with China** requires **urgent reforms and modernisation** of its defence production ecosystem.
- India has begun taking steps in this direction by **signing defence industrial roadmaps with the US and France** and exploring **similar collaborations with Italy.**
- **Emphasis on private sector involvement in defence production** and increased focus on arms exports signal **a shift towards self-reliance.**
- A high-level committee has also recommended restructuring the Defence Research and Development Organisation (DRDO) to enhance efficiency and innovation.

India's Cautions about Events in Syria

Sub Topic- *Effect of Policies & Politics of Countries on India's Interests*

Context:

The **ousting of Syrian President Bashar al-Assad** has sent waves of jubilation through the streets of Damascus, marking the end of his decades-long rule.

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- However, as **Islamist rebels led by Hayat Tahrir al-Sham (HTS) assume control** of the capital, global powers, including India, are adopting a cautious stance, wary of the

complexities in Syria's evolving political and social landscape.

Assad's Rise and Fall:

- Assad, who **ascended to power in 2000** after inheriting the presidency from his father, Hafez al-Assad, **initially held promise.**
- Known for his **informal style and approachable demeanor**, he was once regarded as a popular leader, with a 2009 CNN poll showing a 68% approval rate among Arabs.
- However, **his economic liberalisation policies widened social inequalities**, leaving lower-income groups increasingly marginalised.
- The **2011 Arab Spring**, which swept through the Middle East and Nort h Africa, **ignited protests in Syria that were met with a brutal crackdown** by Assad's regime.

*The **Arab Spring** refers to a series of anti-government protests and uprisings that swept across the Arab world beginning in late 2010 and continuing through 2011 and beyond. This movement sought to address wide-spread issues such as government corruption, economic stagnation, and lack of political freedom.*

- This response **plunged the country into a civil war**, turning Syria into a battleground for global powers.
- While the **United States backed the rebels, Assad received support from Russia, Iran, and Hezbollah.**
  - His **regime was accused of atrocities,** including chemical weapons attacks, while extremist groups like the Islamic State exploited the chaos to seize territory.

The Rise of HTS:

- **HTS's march into Damascus marks a pivotal shift in Syria's power dynamics.**
- Led by Abu **Muhammad al-Jawlani,** HTS has evolved significantly since its inception in 2012 as **Jabhat al-Nusra**, a branch of the Islamic State of Iraq.
- Over time, **Jawlani distanced the group from global jihadist ideologies,** disavowing both ISIS and al-Qaeda to focus on Syria's internal conflict.
- Western analysts now describe **HTS as "political jihadists,"** emphasising pragmatic strategies over ideological rigidity.
- HTS **capitalised on the weakened positions of Syria's key allies**.
- **Russia's involvement in Ukraine, Iran's conflict with Israel, and Hezbollah's recent setbacks** left Assad's forces vulnerable.
- Turkey's alleged support further bolstered HTS's advance, culminating in the fall of the Assad regime.

Global Perspectives and Concerns:

- While HTS portrays itself as a **nationalist force prioritising stability,** its **Islamist underpinnings remain a cause for concern.**
- Al-Jawlani has sought to **reassure minorities,** emphasising the protection of lives and property while advocating for a governance system based on institutions rather than authoritarian rule.
- However, **skepticism persists, particularly in New Delhi,** where policymakers recall the **chaos that followed similar uprisings in Libya and Egypt during the Arab Spring.**
- **Hadi al-Bahra,** head of the Syrian opposition abroad, hailed the fall of Assad, declaring **Damascus "liberated."**
- Meanwhile, HTS has emphasised **security and inclusivity,** with Jawlani urging observers to judge the group by its actions, not words.

Syria's Uncertain Future:

- The world now watches as HTS navigates the **transition from rebellion to governance.**
- The **parallels with Afghanistan under the Taliban are stark,** and the international community remains vigilant.
- For nations like India, the stakes are high, with concerns about regional stability, the resurgence of extremist ideologies, and the broader implications for West Asia.

Switzerland suspends MFN clause with India

Sub Topic- *Effect of Policies & Politics of Countries on India's Interests*

Context:

Starting January 1, 2025, **Switzerland's suspension of the Most-Favoured-Nation (MFN) clause in its Double Taxation Avoidance Agreement (DTAA) with India**, originally signed in 1994 and amended in 2010, could lead to higher taxes on Indian companies operating in Switzerland and impact Swiss investments in India.

Most Favoured Nation (MFN)

It is a **principle in international trade that ensures equal treatment among trading partners.** Under this principle, **if one country grants favorable trade terms** (such as lower tariffs) to another country, **it must extend the same terms to all other countries with MFN status.** This non-discriminatory approach aims to **promote fair competition and prevent preferential treatment** among nations.

Key aspects of MFN include:

- **Equal Trade Advantages:** Countries must treat all MFN partners equally, ensuring that no single nation receives preferential treatment over others.
- **WTO Framework:** The World Trade Organisation **(WTO) incorporates MFN as a foundational principle**, requiring member countries to adhere to it in their trade agreements.
- **Exceptions:** There are **exceptions for regional trade agreements and preferential treatment for developing countries**, allowing certain flexibility within the MFN framework.

More in News

- This decision was announced in a **Swiss government** statement dated December 11, 2024.
- The move follows a **2023 ruling by the Indian Supreme Court**, which held that the **DTAA cannot be enforced unless explicitly notified under the Income Tax Act.**
- This judgment **overturned an earlier Delhi High Court ruling** that had **prevented double taxation for companies and individuals working with foreign entities.**
  - Consequently, Swiss companies like Nestlé may now face increased taxes on dividends.

Potential Implications

- Tax experts warn that this **suspension could hinder investments in India,** as dividends will now attract **higher withholding taxes.**
- This poses **risks to the $100 billion investment commitment under the European Free Trade Association (EFTA) trade pact,** signed in March 2024 by Iceland, Liechtenstein, Norway, and Switzerland.
- The **Swiss government justified** its decision, citing a **lack of reciprocity in the DTAA implementation by India.**
- From January 1, 2025, the source state's residual tax rate on dividends will be capped at 10%.

Background and Rationale

- The Swiss competent authority acknowledged that its interpretation of **paragraph 5 of the DTAA protocol differs from India's stance.**
- As a result, the **unilateral application of the MFN clause will be suspended**, and taxes will be imposed based on the original treaty rates, irrespective of the MFN provision.
- **Amit Maheshwari,** tax partner at AKM Global, explained that the **suspension stems from the Supreme Court's Nestlé ruling,** which clarified that the **MFN clause's benefits are not automatic and require explicit notification from India.**
- Switzerland's stance reflects **concerns about unequal treatment** compared to countries with more favorable treaties with India.
- Switzerland had earlier reduced its tax rate on dividends from 10% to 5% under the MFN clause, effective retroactively from July 5, 2018.
- However, the 2023 ruling invalidated this adjustment, leading Switzerland to reassess its application of the clause.

Broader Impact on International Taxation

- Sandeep Jhunjhunwala, M&A Tax Partner at Nangia Andersen, noted that the suspension **underscores the increasing emphasis on reciprocity and mutual agreement** in treaty interpretations.
- It **could raise tax liabilities for Indian companies** operating in Switzerland, illustrating the **complexities of navigating international tax treaties.**
- This move also **aligns with a global trend of countries asserting stricter interpretations of tax provisions** to safeguard domestic revenues.
- The **Supreme Court ruling clarified that treaty benefits could be claimed only from the treaty's effective date, not retroactively.**
  - It also addressed the **applicability of the MFN clause when a third country was not an OECD member at the time of signing.**

Mineral Diplomacy

Sub Topic- *Effect of Policies & Politics of Countries on India's Interests*

Context:

As India strives to expand its manufacturing and technological capabilities, the demand for critical minerals has surged, making **mineral security a national priority.**

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- These **essential resources,** such as lithium and cobalt, are **key to powering sectors like renewable energy, electric vehicles, and advanced electronics.**
- However, **India remains heavily reliant on imports, particularly from China**, raising strategic concerns.
- Highlighting this challenge, Defence Minister Rajnath Singh recently pointed to the **"weaponisation"** of resources by certain nations, emphasising the **need for India to address its mineral vulnerabilities.**
- India's mineral diplomacy aims to **reduce dependence and boost autonomy** through global collaborations and partnerships in the critical mineral supply chain.

Building Global Partnerships

- The first pillar of India's mineral diplomacy focuses on **developing bilateral ties with countries rich in critical minerals.**
- Post-2019, the government established **Khanij Bidesh India Ltd. (KABIL),** a joint venture mandated to secure a consistent supply of strategic minerals through agreements and acquisitions.
  - **Australia:** In March 2022, **KABIL partnered with Australia** in a critical mineral investment pact, targeting lithium and cobalt projects.
  - **Latin America:** The **Lithium Triangle of Argentina, Chile, and Bolivia** has become a focal point.
    - In January 2024, India signed a $24 million agreement with Argentina for lithium exploration across five brine blocks. Efforts are also underway to acquire assets in Bolivia and Chile.
  - **Central Asia:** India has **collaborated with Kazakhstan to form IREUK Titanium Limited**, a joint venture for producing titanium slag.
    - This aligns with India's **vision of establishing a Central Asia Rare Earths Forum** to leverage the region's resources.
- These bilateral initiatives have not only boosted government efforts but also opened doors for private players.
  - For instance, **Altmin Private Limited** secured a raw material supply chain agreement for lithium-ion batteries in Bolivia.

Strengthening Multilateral Engagement

- The second pillar focuses on **building India's presence in global forums addressing critical mineral security.**
- Through **multilateral initiatives** like the **Quad, the Indo-Pacific Economic Framework for Prosperity (IPEF)**, and the **Mineral Security Partnership (MSP)**, India aims to align itself with international best practices across the mineral supply chain.
- **Collaborative agreements** with partners such as the **United States, the European Union, South Korea, and Australia** facilitate knowledge sharing, capacity building, and policy alignment.
  - For example, the Ministry of Mines signed an MoU with the International Energy Agency to streamline India's policies and investment strategies in the critical minerals sector.

Challenges Hindering Progress

Despite the progress, India's mineral diplomacy faces **three significant hurdles:**

- **Limited Private Sector Involvement:** The private sector's role remains underutilised due to the absence of a clear supply chain strategy and roadmap.
- **Weak Diplomatic Capacity:** India lacks a dedicated framework for mineral diplomacy, which hampers its ability to effectively engage with global partners.
- **Lack of Sustainable Partnerships:** While bilateral agreements exist, there is a need for more strategic and trusted long-term collaborations, particularly with partners like the EU, South Korea, and Quad members.

Strengthening Mineral Diplomacy

To address these gaps, India must adopt a more comprehensive approach:

- **Engage the Private Sector:** A critical mineral supply chain strategy aligned with

India's growth and security priorities is essential. This will encourage private sector participation across the supply chain.

- **Build Diplomatic Capacity:** Establishing a dedicated mineral diplomacy division within the Ministry of External Affairs, akin to the **New and Emerging Strategic Technologies (NEST) division**, can bolster international engagement.
- **Forge Sustainable Partnerships:** India must focus on building trusted, long-term relationships with key global players. Enhanced collaboration with EU nations, South Korea, and Quad partners will be critical for advancing mineral security.

Multilateral Cooperation in India-Russia Ties:A Decadal Review of BRICS and SCO

Sub Topic- *Groupings & Agreements Involving India and/or Affecting India's Interests*

Context:

BRICS and SCO are crucial non-Western platforms for India and Russia, reflecting shifts in their foreign policies. Both organisations have expanded their agendas to address regional and global issues, including a multipolar world order. As membership grows, India and Russia's converging and diverging approaches become more apparent.

Russia's and India's Foreign Policy Evolution:

- **Russia's Shift**: The annexation of Crimea in 2014 and the 2022 invasion of Ukraine marked a pivot in Russia's foreign policy, shifting its focus towards non-Western alliances, particularly with China, as it increasingly distanced itself from the West.
- **India's Rise**: Narendra Modi's 2014 victory reshaped India's foreign policy, blending continuity with a more assertive global stance. India adopted a **multi-alignment approach,** balancing growing ties with the US and tensions with China, which culminated in the 2024 de-escalation agreement.

Multilateral Engagement: India and Russia - Shared Goals and Pragmatic Cooperation

- **New multipolar world order :** Both India and Russia seek to shape a new, multipolar world order by reforming global governance structures. Their pragmatism **allows for coordination on shared goals, such as managing China's rise,** while securing economic and strategic interests in multilateral platforms like the SCO and BRICS.
- **Evolving National Interests and Multilateral Cooperation of India and Russia in BRICS and SCO:** Both nations' evolving priorities reflect their changing geopolitical and economic needs. While **Russia focuses on countering Western influence** and integrating with China's initiatives, **India seeks to balance regional stability with strategic autonomy,** navigating its engagements within both BRICS and the SCO.

India's Approach to BRICS Institutionalisation:

- **Balancing Trade Finance:**India seeks to reduce dollar dependence by trading in its national currency but **avoids supporting initiatives that could strengthen China's position.**
- **Cautious Stance on BRICS Currency:**India has refrained from supporting a BRICS currency to prevent alienating the US and due to concerns about China's influence.
- **Alternative Payment System:** India is cautious about backing an alternative payment system, maintaining a balance in its multilateral engagements.

- **India's Approach to BRICS and SCO Institutionalisation:** India prioritizes **gradual institutional reforms within BRICS and the SCO.** Despite dissatisfaction with existing global governance structures, India **advocates for a more flexible, non-dominant framework,** ensuring that both organisations remain responsive to the interests of all member states.
- **Russia's and India's Engagement with the SCO: Russia's Engagement**: Russia's initial engagement with the SCO focused on **combating terrorism and extremism.** Over time, it has shifted to promoting regional integration through frameworks like the **Collective Security Treaty Organisation (CSTO) and the Eurasian Economic Union (EAEU).** Russia's deepening ties with China have strengthened its role within the SCO.
- **India's Engagement**: India's SCO membership was driven by concerns over **regional security,** particularly **terrorism and instability in Afghanistan.** India has used the platform to enhance ties with Central

Asia, although challenges persist due to China's growing influence within the SCO and its opposition to the Belt and Road Initiative (BRI).

India and Russia's Role in BRICS:

- **Russia's Role**: Russia has been pivotal in shaping BRICS as a platform for challenging Western financial dominance, particularly post-2014 sanctions. Despite efforts, proposals like a **BRICS currency and alternatives to SWIFT remain unrealized.**
- **India's Role**: As a founding member, India has championed reforms in global financial institutions, contributing to the establishment of the **New Development Bank (NDB).** However, the NDB's impact has been limited, and challenges persist in advancing BRICS' institutional goals.

Divergence and Convergence Between India and Russia in SCO and BRICS:

- **Convergence**: Both India and Russia align on the goal of a **multipolar world,** with shared concerns about the dominance of Western powers, and emphasize the **need for economic and security reforms in international systems.**
- **Divergence**: India remains cautious about China's growing influence within both BRICS and the SCO, particularly concerning the BRI and Russia's alignment with Beijing. Tensions over expansion and institutionalization reflect these differences.

Subject - Science & Technology

Proba-3

Sub Topic- *Achievement in the field of Space Technology*

Context:

The **Indian Space Research Organisation (ISRO)** is **set to launch the European Space Agency's (ESA) Proba-3 mission** on December 4 using its **PSLV rocket from Sriharikota.**

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- The mission **aims to study the solar corona,** the Sun's outermost and hottest atmospheric layer.
- It will **also attempt a groundbreaking "precision formation flying" experiment,** where two satellites will maintain a fixed formation in space.

About Proba-3

- Proba-3 is the latest mission in ESA's Proba series, **following Proba-1 (launched in 2001) and Proba-2 (launched in 2009), both of which were also launched by ISRO.**
- Scientists from **Spain, Belgium, Poland, Italy, and Switzerland collaborated** on the project, developed at an estimated cost of €200 million.
- With a **mission life of two years,** Proba-3 will o**perate in a highly elliptical orbit** (600 x 60,530 km) with an **orbital period of 19.7 hours.**
- This mission involves **two satellites,** launched together, which **will separate and fly in tandem to create a solar coronagraph.**
  - This instrument **blocks the Sun's bright light,** enabling detailed observation of its outer atmosphere.

Objectives of Proba-3

- The **solar corona**, with temperatures reaching up to 2 million degrees Fahrenheit, is **challenging to observe but critical for understanding solar phenomena like solar storms and winds.**
- These events **influence space weather,** which can disrupt satellite communications, navigation, and Earth's power grids.
- Proba-3 will study the corona **using three instruments:**
  - **ASPIICS (Association of Spacecraft for Polarimetric and Imaging Investigation of the Corona of the Sun):** A coronagraph with a 1.4-meter diameter occulting disk to block sunlight, enabling detailed study of the Sun's outer and inner corona, typically visible only during solar eclipses.
  - **DARA (Digital Absolute Radiometer):** Measures the Sun's total energy output, known as total solar irradiance.
  - **3DEES (3D Energetic Electron Spectrometer):** Tracks electron fluxes as the satellites pass through Earth's radiation belts, contributing to space weather research.

What Makes Proba-3 Unique?

- **Proba-3 consists of two satellites:** the **Occulter Spacecraft** (200 kg) and the **Coronagraph Spacecraft** (340 kg).

- These satellites **will mimic a natural solar eclipse** by maintaining a precise formation where one satellite casts a shadow on the other.
- This **artificial eclipse will allow the study of the solar corona for six hours at a time**— equivalent to the observation potential of 50 natural eclipses annually, compared to the 10-minute window provided by natural eclipses.
- The satellites **will maintain an exact distance of 150 meters** during observations, autonomously aligning to block the Sun's intense light while exposing the corona to the coronagraph.

Benefits for India

- Proba-3 **highlights India's growing stature in space exploration,** with ISRO being chosen to launch this cutting-edge mission due to its reliable and cost-effective space services.
- **Indian solar physicists have contributed to the mission's scientific goals** alongside European teams and may gain exclusive access to its data.
- Post-launch, India plans to **host discussions with ESA to explore collaboration** between **Proba-3 and India's Aditya L1,** its first solar mission (launched in 2023).
- This partnership **could enable significant advancements in solar physics** and enhance India's contributions to global research on the Sun.

Electrophoresis

Sub Topic- *Achievement in the field of science*

Context:

Innovative advancements in biomedical engineering have led to the development of **hand-held "electric labs"** that can rapidly identify pathogens. These portable devices utilise a technique called **electrophoresis**, which separates molecules based on their electrical charge.

***Electric fields** are **invisible forces** that play a crucial role in many areas of science, from powering modern life to **advancing research in biology** and **medicine**. While we often associate electric fields with the devices that **power our homes or gadgets**, they also have significant **applications** in the **study of molecular biology**, particularly through a technique called **electrophoresis**.*

Electrophoresis Overview:

- Electrophoresis is a technique that **uses electric fields to separate molecules**, such as **DNA** and **proteins, based on their charge**.
- This **principle, rooted in** the work of scientists in the **19th century**, is now **widely used in biology and clinical labs** to analyse DNA, proteins, and pathogens.
- **How It Works:** In electrophoresis, an electric field is created between two electrodes (positive and negative) in a container with conductive water and salt, which pushes charged particles toward the oppositely charged electrode.
- **Factors Affecting:**
  - **Strength of Electric Field**: Higher voltage increases the migration speed.
  - **Molecular Size and Shape**: Smaller molecules move faster through the gel matrix.
  - **Buffer Composition**: The ionic strength and pH of the buffer can affect the charge and mobility of the molecules.
  - **Temperature**: Higher temperatures can increase the mobility of molecules but may also affect the stability of the gel

Types:

- **Gel Electrophoresis**: It involves the separation of molecules through a gel matrix, such as agarose or polyacrylamide. The gel acts as a sieve, allowing smaller molecules to move faster than larger ones.
- **Capillary Electrophoresis**: In this method, the separation occurs in a small capillary tube filled with a buffer solution. It is highly efficient and used for separating small quantities of molecules with high resolution.
- **Paper Electrophoresis**: This technique uses filter paper as the supporting medium. It is simple and cost-effective but less commonly used compared to gel electrophoresis.
- **Free Boundary Electrophoresis**: Developed by Arne Tiselius in 1937, this method involves the separation of charged particles in a free solution without a supporting medium.

Advancements in Electrophoresis:

- **Nonlinear Electrophoresis**: **Discovered in 1972**, this variation of electrophoresis not only separates particles by charge but also by their size and shape, providing a more advanced method for particle separation.
- **Electric Fields and Pathogen Detection: In 1999**, it was discovered that tiny

electrophoresis systems could separate bacteria by their electrical charge, enabling identification of different species in under 20 minutes.

- Microfluidic systems are smaller, portable, and much faster (2-3 minutes) compared to conventional systems (40-50 minutes), allowing for more efficient pathogen detection.

Applications:

- **Applications in Medicine**: **Microfluidic electrophoresis** could revolutionise fields like **antibiotic testing** and **infection control** by allowing for quick detection of whether bacteria are dead after treatment and distinguishing between normal and antibiotic-resistant bacteria.
  - Additionally, the technique is being explored for **purifying bacteriophages** for infection treatment.
- **Rapid Disease Detection**: They can quickly identify pathogens in clinical and field settings, aiding in the timely diagnosis and treatment of infectious diseases.
- **Research and Development**: Scientists can use these devices to study the genetic material of various organisms, advancing our understanding of biology and genetics.
- **Environmental Monitoring**: They can detect harmful microorganisms in water, soil, and air, helping to monitor and address environmental contamination.

Future Prospect:

- These **small, fast, and portable devices** have wide-ranging potential, especially in medicine, where they **can replace conventional methods** with quicker, more cost-effective results.
- **Continued development** can enhance the ability to rapidly detect and fight pathogens, improving diagnostic and treatment options.

Global Collaboration in Quantum Technology

Sub Topic- *IT & Computers, Nanotechnology, Indigenization of Technology*

Context:

The global push to develop **Quantum Technology (QT)** has been accelerating, driven by its transformative potential in fields like computing, communication, and sensing. However, the pursuit of QT is both cost-intensive and highly specialised, requiring significant international cooperation.

*Quantum technology lies at the intersection of several complex fields, including **quantum theory**, **condensed matter physics**, and **computer science engineering**. This makes it particularly difficult to train the necessary talent and secure the significant investment required for QT's development. However, the potential applications of QT – ranging from breakthroughs in **medicine**, **healthcare**, and **agriculture** to advancing **quantum simulations** that could revolutionise our understanding of the universe – underscore its global significance.*

Key Initiatives and Collaborations:

- **Quantum Technologies Flagship**: Launched by the European Union in 2018, this initiative aims to consolidate European leadership in quantum technologies with a budget of about 1 billion euros. It brings together research, private, and public institutions to drive innovation and development.
- **AUKUS Quantum Arrangement**: Established in 2021 between Australia, the United Kingdom, and the United States, this arrangement focuses on developing advanced quantum capabilities and maintaining strategic technological advantages.
- **Open Quantum Institute (OQI)**: Incubated by the Geneva Science and Diplomacy Anticipator (GESDA) and hosted by CERN, OQI brings together stakeholders from around the world to leverage quantum computing in support of the United Nations' Sustainable Development Goals (SDGs).

Benefits of Global Collaboration:

- **Shared Resources and Expertise**: Collaborating globally allows for the sharing of resources, knowledge, and expertise, accelerating the development and deployment of quantum technologies.
- **Innovation and Problem-Solving**: International cooperation fosters innovation by bringing together diverse perspectives and approaches to tackle complex problems.
- **Economic Growth**: Quantum technology has the potential to drive economic growth by creating new industries and enhancing existing ones.

Challenges in Global Collaboration:

- **Export Controls**: Countries like the **US**, **China**, **UK**, and **EU** have enacted export control

regulations due to QT's potential military applications (e.g., quantum communication, quantum sensors) and security concerns (e.g., breaking encryption protocols).

- **US export controls** (2024) include restrictions on quantum computers with 34+ physical qubits, imposing national security measures.
- Military-related regulations, such as the **International Traffic in Arms Regulations (ITAR)**, restrict cross-border investment and technology transfer.
- The **China-US** security rivalry exacerbates concerns, with fears over China's advancing quantum capabilities.

- **Intellectual Property Protection**: Variations in national IP laws further complicate global collaboration, particularly for technologies needing specialised materials.
  - The **US private sector** leads in QT but is wary of IP theft, exacerbated by initiatives like China's **"Thousand Talents Plan"**, which recruited scientists and led to allegations of IP theft.
- **Supply Chain Constraints**: QT hardware development requires rare and exotic raw materials like semiconductors and rare earth metals, which are limited in supply.
  - **China processes 80%** of the **world's rare earth metals**, and other critical materials are produced only in a few countries (e.g., quantum communication materials produced mainly in China).

Efforts to Overcome Challenges:

- The **Quad (Australia, India, Japan, US)** has been instrumental in promoting international QT collaboration through initiatives like the **Quad Critical and Emerging Technology Working Group (2021)**, **Quad Investors Network (2023)**, and **Quantum Center of Excellence (2023)**.
- The **Quantum Economic Development Consortium (QED-C)** in the US and the **Quantum Ecosystems Technology Council of India (QETCI)** are working to enhance collaboration.
- **US-India Initiative on Critical and Emerging Technology (iCET)** and the **CHIPS and Science Act (2022)**, as well as the **European Chips Act (2023)**, aim to strengthen semiconductor supply chains critical for QT development.

Way Forward:

- **Need for Policy Changes**: Harmonising **export control regulations** and **IP laws** is vital for smoother collaboration. Continued collaboration through joint **R&D**, **publications**, and organisations like the **Quad** will foster progress in QT.
- **Need for Evolving Norms**: Rapid technological advancements necessitate updates to **international norms** and agreements regulating QT. Further efforts are required to overcome collaboration barriers, ensuring QT's growth and cementing its role in humanity's progress.

India's Undersea Warfare Capabilities

Sub Topic- *Achievement in the field of Defence Technology*

Context:

The year 2024 marked a significant chapter for the Indian Navy, beginning with **Operation Sankalp's expansion** from the **Strait of Hormuz to the Red Sea.**

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- This initiative ensured the **safety of international shipping from piracy and attacks**, such as those by the Houthis, reaffirming India's status as a reliable security partner and first responder in the maritime domain.
- While operational readiness across various fronts underscored the Navy's capabilities, undersea warfare stood out as an area of pivotal development.

Major Milestones

- **Commissioning INS Arighaat:** In August 2024, India commissioned its second indigenous **nuclear-powered ballistic missile submarine (SSBN), INS Arighaat.**
  - The vessel, a critical asset in **India's nuclear triad**, boasts advanced sonar and propulsion systems alongside upgraded acoustic dampening.
  - Representing a step forward in indigenisation compared to its predecessor, **INS Arihant, Arighaat enhances India's deterrence capabilities.**
  - A significant achievement came with the successful testing of the **K-4 submarine-**

launched ballistic missile (SLBM) from INS Arighaat.

- This missile, with a range of 3,500 kilometers, brings nearly all of China within striking range, bolstering strategic depth. Though the firing results are still under evaluation, its potential inclusion in SSBNs as a composite weapon package would be transformative.

- **Greenlighting Project-77 (P-77):** Soon after INS Arighaat's commissioning, the Cabinet Committee on Security approved Project-77, clearing the **construction of two nuclear-powered attack submarines (SSNs)** at a cost of ₹40,000 crore.
  - These submarines, featuring over **90% indigenous content,** are expected to be **delivered by 2036-37.**
  - The SSNs will not only enhance undersea combat capabilities but also safeguard deployed SSBNs, ensuring comprehensive maritime security.
  - With these developments, **India is poised to become the only non-P5 nation to operate both SSBNs and SSNs**, a testament to its growing strategic maritime stature.

Progress in Conventional Submarines

- While nuclear-powered submarines (SSNs and SSBNs) open new strategic frontiers, **conventional submarines remain indispensable.**
- In this context, **India's Project-75**, in collaboration with France, is set to commission its **sixth Scorpene-class submarine, INS Vaghsheer,** shortly.
- To offset the retirement of aging submarines, the Navy plans to **procure three additional Scorpene-class boats**, featuring an impressive 60% indigenous content.
- The **efficacy of non-nuclear submarines has increased** with **air-independent propulsion (AIP) technology,** extending their underwater endurance.
- India's Project 75(I) aims to induct AIP-enabled boats, with **Spain and Germany competing to construct these submarines.**
- Initial builds are expected to feature a minimum of 45% indigenous content, scaling up to 60% in later iterations.
- Another promising development is the approval to **build 100-tonne Unmanned Underwater Vehicles (UUVs) for ₹2,500 crore.**
  - These UUVs will add **cost-effective, high-return capabilities** to India's undersea arsenal, showcasing the strategic focus on leveraging niche technologies to address evolving maritime threats.

Overcoming Challenges

- The Navy's efforts to build a **balanced blue-water force,** encompassing undersea, surface, and aerial assets, reflect the government's emphasis on maritime stability.
- However, challenges such as **budgetary constraints,** prolonged **project timelines, and delays in acquisition processes** persist.
- Addressing these hurdles will require **sustained funding, streamlined procurement, and efficient tender evaluation** to align modernisation efforts with operational requirements.

A Vision for the Future

- Enhanced cooperation with strategic partners and maritime nations will play a crucial role in supporting India's **Security and Growth for All in the Region (SAGAR)** vision and promoting a free, open, and inclusive Indo-Pacific.
- These efforts, coupled with advancements in undersea warfare, position India to not only safeguard its maritime interests but also emerge as a formidable maritime power in the decades to come.

Subject - Environment, Bio-diversity and Disaster management

The High Seas Treaty: A Step Towards Global Ocean Governance

Sub Topic- *Water resources, Conservation*

Context:

The High Seas Treaty, formally the Biodiversity Beyond National Jurisdiction (BBNJ) Agreement, is a historic step under UNCLOS to protect marine biodiversity in international waters, covering two-thirds of the global oceans.

Signing of The BBNJ Agreement:

- On March 4, 2024, after nearly two weeks of negotiations, UN member states reached a consensus on The High Seas Treaty. **This agreement, over a decade in the making,** reflects a global commitment **to address biodiversity loss and the degradation of marine ecosystems.**
- It emerged amidst mounting concerns over climate change, overfishing, and industrial exploitation of marine resources, which threaten ocean health and humanity's future.

About The Agreement:

The High Seas Treaty is The third implementing agreement under UNCLOS, following those on **seabed mining (1994) and fish stocks (1995).** It expands upon UNCLOS to specifically address The governance of marine biodiversity in areas beyond national jurisdiction. Key features include:

- **Marine Protected Areas (MPAs):** A commitment to protect **30% of The world's oceans by 2030 under The Kunming-Montreal Global Biodiversity Framework.**
- **Marine Genetic Resources (MGRs):** Equitable benefit-sharing from the commercial use of resources, including mechanisms for access and oversight.
- **Environmental Impact Assessments (EIAs):** Mandatory evaluations of planned activities to prevent harm to marine ecosystems.
- **Capacity Building and Funding:** Support for developing nations, including financial assistance and technology transfers.

Objectives of The Agreement:

- **Marine Biodiversity Conservation:** Safeguard ecosystems in international waters.
- **Equitable Sharing of Benefits:** Ensure fair distribution of profits from marine genetic resources.
- **Environmental Safeguards:** Mandate EIAs to regulate human activities in vulnerable marine zones.
- **Sustainable Development:** Promote peaceful and scientific use of high-seas resources.

Why Did It Take So Long to Conclude The Agreement?:

The journey to this agreement was arduous due to:

- **Geopolitical Divides:** Diverging priorities between developed and developing nations over funding and benefit-sharing mechanisms.
- **COVID-19 Delays:** The pandemic disrupted critical negotiations, delaying progress.
- **Technical Complexities:** Addressing The interconnectedness of marine ecosystems required reconciling science, law, and policy.
- **Industry Pushback:** Resistance from fishing, oil, and gas industries, whose interests often conflicted with conservation goals.

Risks Associated with The Agreement:

- **Limited Scope: Excludes critical activities like fishing and deep-sea mining,** which are major contributors to marine degradation.
- **Weak Enforcement Mechanisms: Absence of a robust international enforcement** agency undermines compliance.
- **Social Inequities: Risk of marginalising vulnerable coastal communities** reliant on marine resources.
- **Jurisdictional Ambiguities:** Overlapping claims and unclear legal frameworks may fuel disputes.

Challenges with The Agreement:

- **Ratification Hurdles:** Only **14 of The 104 signatories have ratified The treaty,** well below The required 60.
- **Capacity Gaps:** Developing countries **lack resources and technology** to enforce or benefit from The treaty.
- **Fragmented Governance:** Ineffective integration of high-seas regulations with existing coastal management frameworks.
- **Industry Resistance:** Profit-driven sectors may exploit loopholes to evade compliance.

Way Forward for The Agreement to Succeed:

- **Enhanced Funding:** Wealthier nations must contribute to a global fund supporting treaty implementation.
- **Capacity Building:** Facilitate technology transfer and skill development for equitable participation.
- **Unified Governance:** Align domestic and international legal frameworks to bridge gaps.
- **Robust Enforcement:** Establish an international oversight body to monitor compliance and resolve disputes.

- **Collaborative Approach:** Engage all stakeholders, including coastal states, industries, and indigenous communities, to ensure inclusivity.

What Does This Agreement Mean for India and The World?:

India's Role

India's ratification highlights its dedication to global maritime governance. As a coastal state with a rich maritime heritage, India must:

- Align its domestic policies with treaty mandates.
- Advocate for equitable benefit-sharing mechanisms.
- Leverage The treaty to strengthen regional cooperation in The Indian Ocean.

Global Impact

The treaty is a critical step toward achieving The UN Sustainable Development Goal 14 (Life Below Water) by promoting conservation and sustainable use of marine resources. If implemented effectively, it could:

- Mitigate The adverse effects of climate change.
- Enhance biodiversity conservation.
- Set a precedent for collective global action in addressing transboundary environmental challenges.

Role of Rivers Oceans in the Fight Against Climate Change

Sub Topic- *Water resources, Conservation*

Context:

The ocean, often referred to as the Earth's vast **blue lung,** plays a pivotal but frequently overlooked role in regulating the planet's climate.

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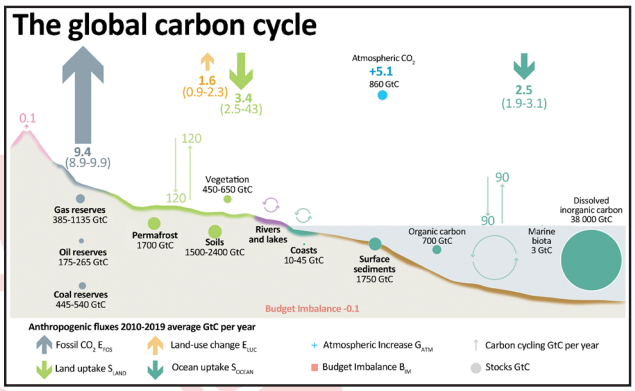
- It **absorbs approximately 25% of anthropogenic carbon dioxide emissions** and over **90% of the excess heat** generated by greenhouse gases, buying humanity valuable time to address the escalating climate crisis.
- However, this remarkable capacity to buffer climate impacts **comes at a cost.**
- The **consequences of ocean acidification,** disrupted biogeochemical cycles, pollution, and damage to marine ecosystems are becoming increasingly evident.
  - **Acidification endangers calcifying organisms** such as corals and shellfish, **while warming disrupts ocean circulation and depletes oxygen** in critical habitats.
- These changes ripple through ecosystems, threatening fisheries, carbon sequestration, and other essential services.



Exploring Marine Carbon Dioxide Removal

- As the urgency to reduce carbon emissions and enhance climate resilience grows, **marine carbon dioxide removal (mCDR)** is emerging as a **complementary strategy to emissions reduction.**
- Unlike **terrestrial solutions,** which have dominated climate interventions so far, **oceans, seas, rivers, and lakes offer a unique suite of options** for carbon removal.
- Studies suggest that **land-based carbon capture systems are nearing saturation due to soil and rock degradation**, limiting their efficacy.
- **Deep water bodies,** on the other hand, **possess the ability to remove excess carbon swiftly** from the atmosphere and transport it to depths where it binds with minerals.
- Marine carbon capture strategies fall into **two categories:**
  - **Biotic Approaches:** These leverage living systems such as mangroves, macroalgae, or river ecosystems to sequester carbon through biomass burial at sea.
  - **Abiotic Approaches:** These involve manipulating physical or chemical properties, such as through **ocean alkalinity enhancement (OAE)**, which chemically neutralises carbon dioxide in seawater.

Comparing Biotic and Abiotic Methods

- **Biotic methods,** or nature-based solutions, **capitalise on ecosystems' inherent ability**

to sequester carbon while supporting biodiversity and coastal protection.

- These solutions are **well-established and integrated into some national climate strategies.**
- However, their **carbon capture potential is modest,** typically under one billion tonnes of carbon dioxide annually, with storage durations limited to hundreds or thousands of years.

- **Abiotic techniques**, by contrast, **offer scalability and longer-term storage.**
  - For example, **carefully managed biomass burial at sea could sequester 7–22 billion tonnes of carbon dioxide annually,** while OAE could lock away 1–15 billion tonnes per year for tens of thousands of years.
    - These figures far **surpass the potential of biotic methods.**

Challenges and Risks

- Techniques like **ocean iron fertilisation**, which promotes phytoplankton blooms to capture carbon, **may disrupt ecosystems and deplete oxygen** in deeper waters.
- Similarly, **macroalgae cultivation can alter local chemistry** when decaying biomass accumulates.
- Even the scalable **OAE method raises concerns about its impact on marine biodiversity** and the energy-intensive processes it entails.
- **Public perception** further complicates the adoption of abiotic methods.
  - Many view these techniques as **artificial or potentially harmful,** favoring biotic or land-based solutions like direct air capture.
- Moreover, measuring and verifying the effectiveness of carbon capture in vast, turbulent oceans remains a **logistical and financial challenge.**

The Role of Oceans in Climate Solutions

- Importantly, **mCDR is not a substitute for reducing emissions.**
- The **current scale of fossil fuel combustion**—over 40 billion tonnes of carbon dioxide annually—**cannot be offset solely by these methods.**
  - Instead, **mCDR can complement emissions reductions** as the world transitions to **net-zero.**
- India, with its **vast coastline and the expansive Arabian Sea and Bay of Bengal,** holds **immense potential for leveraging oceans** in carbon removal.
  - The **Indian Ocean alone could potentially capture 25–40% of global marine carbon dioxide.**
  - However, **India has yet to fully explore the transformative opportunities** its seas and rivers offer in combating climate change.
  - Harnessing the power of oceans and other water bodies could provide a critical edge in mitigating climate change. However, the success of marine interventions hinges on rigorous scientific research, robust governance frameworks, and societal trust.

Coastal Erosion in India: An Alarming Environmental Crisis

Sub Topic- *Conservation, Climate Change*

Context:

India's coastal regions are increasingly threatened by erosion, with 33.6% of the coastline affected due to a combination of **natural** and **human-induced factors**. The recent Lok Sabha reply highlights the pressing need for coordinated efforts to mitigate the issue and protect coastal ecosystems and communities.

Extent of Coastal Erosion

- **National Impact**: 33.6% of India's coastline is eroding, 26.9% is growing (accretion), and 39.6% remains stable.
- **Karnataka's Scenario**: Karnataka fared better nationally with 50% stability.
  - Dakshina Kannada district is the worst affected, with 48.4% (17.74 km) of its 36.66 km coastline eroded.
- **Neighboring Districts**:
  - Udupi: 34.7% (34.96 km of 100.71 km) eroded.
  - Uttara Kannada: 12.3% (21.64 km of 175.65 km) eroded.

Causes of Coastal Erosion

- **Rising Sea Levels**: Amplified by **climate change**, causing storm surges and flooding.
- **Sand Mining and Infrastructure**: Unregulated activities disrupt **sediment flow**.

- **Mangrove Depletion**: Loss of natural barriers exposes coasts to wave action.
- **Increased Cyclonic Activity**: Frequent storms destabilise coastal ecosystems.

Consequences of Erosion

- **Livelihood Risks**: Fishing communities and coastal economies are severely impacted.
- **Infrastructure Damage**: Threats to roads, housing, and ports.
- **Ecosystem Collapse**: Biodiversity hotspots like **estuaries** and **mangroves** are at risk.

Mitigation Efforts in Karnataka

- **Shoreline Management Plan**: Implemented under the **Coastal Regulation Zone (CRZ) Notification, 2019**.
- **K-SHORE Project**: World Bank-funded initiative to strengthen coastal protection, tackle **marine plastic pollution**, and promote sustainable practices.
- **Restoration Measures**:
  - Mangrove replantation.
  - Sand dune protection.
  - Use of artificial reefs and eco-friendly breakwaters.

Challenges and Expert Recommendations

- **Ineffective Past Strategies**: Concrete seawalls and boulders have failed to address long-term erosion.
- **Engineer Warnings Ignored**: Advisories against habitation in vulnerable areas overshadowed by **political interests**.
- **Natural Phenomenon Perspective**: Marine geologists emphasise erosion as part of a natural balance disrupted by man-made structures.

Call for a Paradigm Shift

- **Rethink Spending**: Invest in **safe townships** away from vulnerable areas rather than ineffective coastal structures.
- **Adopt Innovative Approaches**: Combine **AI-driven monitoring** and community-driven conservation for long-term solutions.
- **Focus on Sustainability:** Prioritise restoration of natural defenses like mangroves over concrete-based solutions.

Warming Oceans and Changing Marine Habitats

Sub Topic- *Environmental Pollution & Degradation*

Context:

Human activities release billions of tonnes of greenhouse gases into the atmosphere annually, trapping heat from the Sun and causing the Earth's temperature to rise.

More on News

- Over **90% of this additional heat is absorbed by the oceans**, leading to alarming increases in marine temperatures.
- Estimates suggest that **since the onset of the Industrial Revolution over 250 years ago, ocean temperatures have risen by more than 1.5°C.**

The Impact on Marine Life

- Marine organisms are **highly sensitive to temperature changes** due to their **narrow *"thermal safety margins,"*** which represent the small difference between the environmental temperature and the maximum temperature they can tolerate.
- With **limited ability to escape rising temperatures,** such as migrating to cooler depths—which is not always feasible—thousands of marine species face unsafe conditions as the planet continues to warm.
- This **could impair their survival and reproduction**, leading to **population declines or even local extinctions.**
- Simultaneously, warming oceans are **creating thermal opportunities, allowing some species to move into areas previously too cold for them.**
- However, this shift **can disrupt ecosystems and cause mismatches between fish stock locations and fishing communities**, potentially affecting local economies and food security.

Understanding Thermal Changes

- As scientists studying the effects of climate change on species, ecosystems, and humans, they **analysed data from 21,000 marine species** alongside future climate projections. Their model examined **two key aspects:**

- The emergence of thermal opportunities.
- The risks posed by exposure to warmer waters.

Key Findings

- **Thermal Opportunities:** These emerge earlier and more gradually, primarily in temperate and polar regions, allowing species to **colonise new habitats.**
  - These opportunities are **expected to increase until 2050**, even with rapid reductions in greenhouse gas emissions, and persist through the century.
- **Thermal Threats:** Risks from exposure to unsafe temperatures arise later but more abruptly, particularly in tropical ecosystems.
  - After 2050, these risks could escalate significantly, especially if global warming exceeds the 2°C threshold set by the Paris Agreement.
- Even under rapid warming, **new suitable habitats could remain available for decades,** providing species time to migrate and adapt.
  - This **could prevent declines or extinctions** for some species and offer economic or food security benefits to humans.

Potential Downsides

The **arrival of new species in previously uninhabitable areas could:**

- Introduce predators, competitors, or diseases that threaten native species.
- Disrupt existing ecosystems, even in regions with relatively stable temperatures.

Solutions and Mitigation

Climate change is poised to reshape marine ecosystems, but the extent of disruption depends on our actions:

- **Limiting Warming:** Keeping global warming below 2°C could halve the number of species forced to migrate by 2100 and reduce those exposed to unsafe temperatures by a factor of 100.
- **Uncontrolled Warming:** Without intervention, rising temperatures could disrupt three in five marine ecosystems globally, significantly increasing ecological risks.
- Every fraction of a degree of avoided warming is critical. By limiting emissions and curbing climate change, we can significantly reduce the number of species at risk, preserve marine biodiversity, and protect ecosystems vital to human livelihoods.

Supreme Court's Directive on Wetland Conservation: A Step Towards Safeguarding Ecosystems

Sub Topic- *Conservation*

Context:

Recently, The Supreme Court has ordered states to protect wetlands beyond the 2.01 lakh wetlands already under conservation as per a 2017 directive.

More in News:

The Supreme Court's recent directive is a **critical step in addressing the lackluster efforts to conserve wetlands**, which are essential for ecological and environmental sustainability.

Protection of Additional Wetlands:

- The Court has mandated the **conservation of 30,000** more wetlands beyond the already identified 2.01 lakh.
- States must complete the **demarcation of boundaries** and **ground-truthing of satellite data** for these wetlands within three months.
- High courts have been instructed to **suo motu oversee** the conservation of **Ramsar sites**, wetlands of international importance designated **under the 1971 Ramsar Convention.**

About the Wetlands (Conservation and Management) Rules, 2017:

Introduction

The **Wetlands (Conservation and Management) Rules, 2017**, notified by the Ministry of Environment, Forest, and Climate Change (MoEF&CC), provide a regulatory framework for wetland conservation under the **Environment (Protection) Act, 1986**.

Objectives of the Rules

- To conserve and manage wetlands' ecological character.
- To enable sustainable use of wetlands under the **wise-use principle**.

Key Features of the Rules

- **State-Level Management**:
  - The rules shifted the focus of wetland management from the central

government to **State/UT Wetland Authorities**.

- **Institutional Mechanisms**:
  - Established a **National Wetland Committee** for guidance and oversight.
  - The committee advises state bodies on wetland management and reviews the progress of Ramsar sites.
- **Regulatory Provisions**:
  - Defines activities that are restricted or **permitted within wetland zones.**

Other Legal Provisions for Wetland Conservation:

- **Constitutional Provisions**
  - **Article 21:** Guarantees the right to a healthy environment, essential for ecological balance.
  - **Article 48-A:** Mandates the state to protect and improve the environment.
  - **Article 51(A)(g):** Imposes citizens' duty to protect the environment, including wetlands.
  - **Article 31-A:** Empowers land acquisition for public welfare, useful for wetland management.
- **International Framework**
  - **Ramsar Convention (1971):** Obligates sustainable wetland use and national conservation policies.
- **Environmental Protection Act, 1986:** Empowers the government to prevent environmental degradation, including wetlands.
- **National Biodiversity Act, 2002:** Conserves biodiversity, including wetland ecosystems, through sustainable resource use.
- **Forest Conservation Act, 1980:** Regulates deforestation impacting adjacent wetlands.
- **Coastal Regulation Zone (CRZ) Notification:** Protects coastal wetlands from unregulated development and pollution.

Present Status of Wetland Conservation in India:

Progress Since the 2017 Directive

- **Ground-Truthing**: Efforts to validate satellite data have been completed for **less than half of the wetlands listed under the 2017 order.**
- **Boundary Demarcation**: Only a small percentage of these ecosystems have been demarcated, including the 85 Ramsar sites recognised as wetlands of international importance.

India's Ramsar Sites

- India has **85 Ramsar sites** as of now.
- These sites are a small but critical fraction of India's vast wetland ecosystems and play a pivotal role in conservation efforts.

Significance of Wetlands:

Wetlands are unique ecosystems vital for ecological balance and biodiversity. Their importance spans environmental, economic, and social dimensions.

Environmental Importance

- Integral to the **water cycle,** wetlands contribute to water storage and purification.
- Influence microclimates, providing localized climate stabilisation.
- Act as **natural buffers against floods**, soil erosion, and saline ingress in coastal areas.

Social and Economic Importance

- Wetlands **replenish groundwater reserves,** a critical resource for agriculture and drinking water.
- Provide sustenance to **local communities through fishing, agriculture, and other activities.**

Threats to Wetlands:

Despite their importance, wetlands in India face numerous threats due to human activity and administrative apathy.

Key Threats

- Wetlands in urban areas have been **encroached upon or completely destroyed,** exacerbating urban flooding and drainage issues.
- Many wetlands have been **converted into farmlands**, reducing their ecological function.
- In many areas, wetlands have **become garbage dumps**, leading to severe environmental degradation.

Challenges in Wetland Conservation

- Many states exhibit **lethargy in implementing conservation measures** despite clear policies.
- **Rapid urban expansion** often prioritises infrastructure development over ecological preservation.
- **Lack of rigorous monitoring** has allowed misuse and encroachments to persist.

Way Forward

- **Strict Enforcement of the Rules**:
  - States must ensure compliance with the 2017 Rules through better governance and accountability.

- **Regular Monitoring**:
  - High courts and the National Wetland Committee should actively monitor progress and address lapses.
- **Public Awareness and Participation**:
  - Educating communities on the importance of wetlands and involving them in conservation efforts.
- **Integrated Approach**:
  - Collaboration among environment, health, and finance ministries to address conservation challenges comprehensively.

Arctic Tundra: From Carbon Sink to Carbon Source

Sub Topic- *Environment Pollution & Climate Change*

Context:

The **Arctic tundra**, traditionally a **carbon sink** that stores vast amounts of carbon, has now become a **source of greenhouse gas emissions** due to the combination of rising temperatures and increased wildfires.

Key Highlights:

- This alarming transformation is highlighted in the **2024 Arctic Report Card** by the **National Oceanic and Atmospheric Administration (NOAA)**, showing that the **Arctic is warming at four times the global rate**.
- The **Arctic Report Card** suggests that it may still be possible to **reverse this trend**, but only through **aggressive reductions in global greenhouse gas emissions**. Lower levels of climate change would slow the thawing of permafrost, limiting the amount of carbon released.
- However, this is challenging as **global emissions continue to rise**, with projections showing a **slight increase** in CO2 emissions in 2024 compared to the previous year.
  - The **Global Carbon Project** reports that **CO_2 emissions from burning fossil fuels** and land-use changes like deforestation are set to increase.

The Role of Arctic Tundra in Carbon Storage:

- The **Arctic tundra** has historically been a **carbon sink**, storing **over 1.6 trillion metric tonnes** of carbon in its **permafrost** (soil that remains frozen for at least two years).
  - This carbon comes from organic matter, including plants and animals, that **decomposes slowly due to the cold climate**.
- The cold prevents microbes from breaking down this matter, thus trapping **carbon dioxide (CO_2)** and **methane (CH_4)** — potent greenhouse gases — in the ground.
- This carbon storage has been critical in regulating global atmospheric CO2 levels.

Why the Arctic Tundra Is Emitting More Carbon?

- The Arctic is experiencing **unprecedented warming**, with **2024 temperatures being the second warmest on record**.
  - This warming has led to **thawing permafrost**, which in turn has activated **microbes** that start to break down the trapped organic matter, releasing **CO2 and methane** into the atmosphere.
- **Wildfires** have also become more frequent and intense in the Arctic, further contributing to **carbon emissions**.
  - In 2024, the Arctic saw the second-largest wildfire season on record.
  - Wildfire smoke releases carbon into the air while also accelerating the thawing of permafrost, creating a **feedback loop** where thawing leads to more carbon release, which in turn accelerates climate change.

*The **feedback loop** caused by thawing permafrost and wildfires is alarming because it exacerbates the **global warming crisis**. Between **2001 and 2020**, the Arctic tundra began to emit **more carbon than it absorbed** for possibly the first time in millennia. This shift from a carbon sink to a carbon source has the potential to **accelerate climate change**, adding to the atmospheric load of greenhouse gases.*

Implications:

- **Climate Change**: The transition of the Arctic tundra from a carbon sink to a carbon source is a significant concern for climate scientists. It highlights the urgent need to reduce fossil fuel pollution and implement effective mitigation strategies.
- **Ecosystem Impact**: The changes in the Arctic are forcing plants, wildlife, and Indigenous communities to rapidly adapt to a warmer, wetter, and less predictable environment. Declines in caribou herds and other wildlife are already being observed.
- **Global Impact**: The increased carbon emissions from the Arctic contribute to the overall rise in atmospheric greenhouse gases, further driving global climate change.

Subject - Indian History, Heritage and Culture

Aurobindo Ghosh

Sub Topic- *Important Personalities*

Aurobindo Ghosh, commonly known as **Sri Aurobindo**, was a **prominent Indian philosopher**, **nationalist**, and **spiritual leader** born on **August 15**, **1872**, in **Calcutta** (now **Kolkata**). His early education in England exposed him to **Western literature** and **philosophy**, which significantly influenced his later thoughts and writings. Upon returning to India in 1893, he became involved in the Indian nationalist movement and played a crucial role in the struggle for independence from British rule.

Role in India's Freedom Movement:

- He was associated with the **Bengal National College** and the **Anushilan Samiti**, a revolutionary group advocating for India's independence.
- Aurobindo's writings in newspapers such as ***Bande Mataram*** and ***Karmayogin*** articulated a vision of complete freedom (Swaraj) from colonial rule and inspired many young Indians to join the nationalist cause124.
- His political activism peaked during the **Anti-Partition Movement of 1905**, which protested against the British decision to partition Bengal.
- Aurobindo called for **boycotts of British goods and institutions**, promoting a **form of nationalism** that combined spiritual ideals with political action.
- However, his revolutionary activities led to his arrest in 1908 during the **Alipore Bomb Case**, where he faced charges related to bombings aimed at British officials. Although acquitted due to lack of evidence, this period of imprisonment profoundly impacted his worldview.

Transition to Philosophy and Spirituality:

- Following his release from prison, Aurobindo experienced a significant transformation.
- During his solitary confinement, he had **mystical experiences** that shifted his focus from **political activism to spiritual exploration**.
- In 1910, he moved to **Pondicherry** (now **Puducherry**), where he dedicated himself entirely to spiritual pursuits, developing what he called **Integral Yoga**. This approach is aimed at achieving a divine life on earth through personal spiritual evolution.
- Aurobindo's philosophical works, such as ***The Life Divine and Synthesis of Yoga***, reflect his belief that human beings could evolve spiritually to attain higher states of consciousness.
- He proposed that this evolution was essential not only for individual liberation but also for societal transformation.
- His teachings emphasised that true nationalism was rooted in spirituality rather than mere political ideology, asserting that "***nationalism is a spiritual thing***" rather than simply a political programme.

Examples of His Philosophical Influence:

- **Integral Yoga:** Aurobindo's Integral Yoga integrates aspects of various yogic practices with an emphasis on personal and collective transformation. This holistic approach encourages practitioners to engage with all facets of life—physical, mental, and spiritual—to realise their full potential.
- **Literary Contributions:** His literary works often blend poetry with profound philosophical insights. For instance, ***Savitri: A Legend and a Symbol*** is an epic poem that explores themes of love, death, and the quest for immortality, reflecting his belief in the transformative power of spiritual consciousness.
- **Sri Aurobindo Ashram:** Founded in 1926 in Pondicherry, the ashram became a centre for spiritual seekers worldwide. Under Aurobindo's guidance and later that of **Mirra Alfassa** (**The Mother**), it fostered a community dedicated to spiritual growth and practical applications of his teachings.

Vyas Samman

Sub Topic-*Literature*

Context:

Renowned **Hindi author Suryabala's** novel **Kaun Des Ko Vasi: Venu Ki Diary** has been **selected**

for the prestigious 34th Vyas Samman, 2024, the KK Birla Foundation announced in an official statement.

Suryabala and her Work

- Suryabala, born in 1943 in Varanasi, Uttar Pradesh, holds an **MA in Hindi literature from Kashi Vishwavidyalaya and a PhD.**
- Over a career spanning decades, she has **authored more than 50 novels, biographies, children's books, and other works,** many of which have been adapted into TV serials.
- Her writing often focuses on social issues.
- Published in 2018, **Kaun Des Ko Vasi: Venu Ki Diary explores the aspirations of Indian youth who view America as a land of promise,** delving into the challenges, temptations, and cultural conflicts they face.
  - It reflects on the spiritual alienation, cultural estrangement, and identity struggles experienced by individuals caught between two worlds, unable to reconnect with their roots or fully assimilate abroad.

About the Vyas Samman

- Instituted in 1991, the Vyas Samman is **awarded to an exceptional Hindi literary work by an Indian citizen published within the last 10 years.**
- The honor includes a **cash prize of ₹4 lakh, a citation, and a plaque.**
- A **selection committee** comprising **distinguished literary figures and scholars** is responsible for choosing the awardee.
- If no work meets the expected standard in a given year, the award may not be presented**.**
- **Notable Winners:** In 1991, Ramvilas Sharma received the award for his work **Bharat ke Prachin Bhasha Parivar aur Hindi.** In 2020, Prof. Sharad Pagare was honored for his novel **Pataliputra ki Samrajni.** Most recently, in 2023, Pushpa Bharti won the award for her book **Yaadein, Yaadein aur Yaadein.**

Alongside the Vyas Samman, the KK Birla Foundation also presents the Saraswati Samman, with a cash prize of ₹15 lakh, for outstanding literary works in any language listed in Schedule VIII of the Indian Constitution, and the Bihari Puraskar.

Yuga Yugeen Bharat National Museum

Sub Topic- *Art & Culture*

Context:

India and France signed a Memorandum of Understanding (MoU) to develop a new National Museum, named **Yuga Yugeen Bharat** National Museum in New Delhi.

More on News:

- The museum will be modelled on the **Louvre** in Paris and will be located in the historic **North Block** and **South Block** of the national capital.
- Once completed, it is expected to be the **largest museum in the world**.

Vision and Purpose:

- The museum is envisioned as a celebration of **India's unbroken civilizational history** and aims to blend India's rich cultural heritage with modern narratives.
- It was first announced by Prime Minister Modi at the **International Museum Expo** in May 2023 and highlighted during the inauguration of **Bharat Mandapam** in July 2023.

Key Highlights:

- This project is a key component of the **Central Vista Redevelopment Project** and will cover approximately **1,55,000 square meters** in the North and South Blocks in New Delhi.
- India and France will collaborate on a **comprehensive feasibility study**, including museum case studies, interpretive planning, and building programming.
- The initiative underscores **India's commitment to sustainable and adaptive reuse**, ensuring that the historic buildings retain their architectural value while serving modern cultural purposes.

Adaptive Reuse Approach:

- The museum will be developed using **adaptive reuse** of the historic **North and South Blocks**, preserving their **architectural heritage** while transforming them into vibrant cultural spaces.
- This approach draws on France's experience with similar projects, such as the **Louvre**, **Grand Palais**, and **Hotel de la Marine**, under its **Grand Projects** initiative, which transformed government buildings into cultural landmarks.

Significance:

- **Cultural Significance**: This partnership strengthens the ongoing **cultural cooperation** between **India and France**, reaffirming both countries' commitment to **heritage preservation** and **cultural exchange**.
- **Strategic Importance:** It builds upon the **Letter of Intent** signed in **2020** and the subsequent Letter of Intent during **Prime Minister Modi's visit to France in 2023**, which laid out specific areas for technical collaboration.

Subject - Polity, Governance, Constitution

UK's Assisted Dying Bill

Sub Topic- *Government Policies & Interventions*

Context:

On November 29, the UK House of Commons passed the **Terminally Ill Adults (End of Life) Bill** by a majority of 330 to 275 votes, with 38 MPs abstaining.

More on News:

- This *"free vote"* allowed MPs to vote **based on personal conscience rather than party lines.**
- The Bill will **now be reviewed by a public bill committee,** followed by another vote in the House of Commons.
- **If approved**, it will proceed to the House of Lords for **further scrutiny before a final decision.**

Why Was the Bill Introduced?

- The Bill was introduced **to address the needs of terminally ill patients seeking control over the timing and manner of their death.**
- **In the UK, assisted dying and euthanasia are currently illegal,** with assisted suicide **punishable by up to 14 years in prison.**
- However, there has been **increasing debate over the past decade,** with proponents advocating for the ***autonomy and dignity*** of terminally ill individuals, and detractors warning of potential misuse and risks to vulnerable populations such as the elderly and disabled.

Key Provisions of the Bill:

- **Eligibility: Terminally ill individuals** aged 18 or older with the mental capacity to decide.
  - The **illness must be irreversible** and expected to lead to **death within six months.**
  - **Excludes individuals with disabilities or mental disorders.**
- **Procedure:** The patient submits a *"first declaration"* witnessed by a coordinating doctor and another individual.
  - A **coordinating doctor and an independent doctor** assess the patient's eligibility.
  - If both doctors agree, the **request is referred to the High Court**, which ensures all legal requirements are met.
  - Following court approval, a **14-day *"second reflection period"*** begins, after which the patient signs a ***"second declaration."***
  - An ***"approved substance"*** is then provided, to be **self-administered by the patient.** Doctors are prohibited from administering the substance themselves.

Comparison with Indian Law:

In India, **passive euthanasia**—withdrawing life support to allow natural death—**has been legal since 2018,** recognised as **part of the constitutional *right to die with dignity*** under **Article 21.**

However, it **differs significantly from the UK's proposed law:**

- **Active Role of Patient:** The UK Bill allows patients to actively choose when to die by self-administering medication. **India permits only the withdrawal of medical interventions.**
- **Regulation and Oversight:** In India, passive euthanasia requires **multiple approvals,** including medical boards and judicial oversight. Despite revised guidelines in 2023 to simplify the process, **implementation remains limited due to low awareness and practical challenges.**
- **Draft Guidelines:** In 2024, India's Ministry of Health and Family Welfare issued draft guidelines on withdrawing medical support, seeking stakeholder feedback to streamline the process.
- The UK's Bill marks a shift toward providing terminally ill patients with greater agency, while India's approach remains more conservative, emphasising passive measures and extensive safeguards.

Oilfields Amendment Bill

Sub Topic- *Government Policies & Interventions*

Context:

On December 3, the Rajya Sabha approved the **Oilfields (Regulation and Development) Amendment Bill, 2024,** aimed at **enhancing domestic production of petroleum and other mineral oils** while **attracting private investment** to reduce reliance on imports.

More on News

- The Bill introduces significant **changes to the Oilfields (Regulation and Development) Act of 1948**, clearly distinguishing it from the **Mines and Minerals (Development and Regulation) Act, 1957.**
- If enacted, the amended Act **will focus exclusively on the regulation of petroleum and mineral oil production.**

Key Features of the Bill

- **Defining Mineral Oil:** The Bill resolves a long-standing ambiguity by defining **"mineral oils" as naturally occurring hydrocarbons,** including crude oil, natural gas, and petroleum.
  - It **excludes coal, lignite, and helium associated with petroleum**, as these fall under the **Mines and Minerals Act.**
- **Introduction of Petroleum Leases:** The Bill **replaces "mining leases" with "petroleum leases,"** now defined as permits for prospecting, exploration, development, production, and disposal of mineral oils.
  - The regulation of these leases, along with the Centre's rule-making powers, will also be updated accordingly.
- **Encouraging Private Investment:** To attract private participation, the Bill ensures **existing leases remain valid and unaltered during their term.**
  - It also replaces **criminal penalties for violations with fines—up to ₹25 lakh,** and an additional ₹10 lakh per day for ongoing violations.
  - This shift aims to create a **more business-friendly environment** while maintaining accountability.
- **Environmental Provisions:** The Bill **expands the Centre's authority to make rules aimed at reducing carbon emissions**, managing greenhouse gases, and promoting renewable energy projects at oilfields.

Concerns and Criticisms

- **Impact on State Powers:** Opposition parties have expressed concerns about the Bill's **potential to undermine states' rights.**
  - By reframing petroleum leases as distinct from mining leases and focusing on mineral oils, the Bill **shifts jurisdiction to the Union List** under Entry 53 of the Constitution.
  - This **could limit states' authority to tax and collect royalties on these activities,** currently protected under Entry 50 of the State List.
- **Environmental Risks and Public Sector Prioritisation:** Critics have highlighted **potential environmental risks associated with increased private sector involvement**.
  - They argue that public sector enterprises like the Oil and Natural Gas Corporation (ONGC) should be prioritised to manage national resources responsibly.
- **Reassurances from the Government:** Union Minister assured that **states would retain control over granting petroleum leases,** addressing concerns about diminished state powers.
  - He also emphasised the Bill's role in **reducing dependency on imports and aligning domestic production with global environmental standards.**

Supreme Court's Directives on Places of Worship Act, 1991

Sub Topic- *Government Policies & Interventions, Judiciary, Indian Constitution*

Context:

The Supreme Court of India has issued a nationwide directive **prohibiting courts from entertaining new suits or issuing orders to survey mosques for underlying temple structures.**

More on News

- The directive **restrains courts from registering fresh suits** or issuing orders in ongoing cases related to mosque surveys.
- The bench emphasised that **trial courts cannot "overreach" the Supreme Court,**

especially while the apex court deliberates on the **Places of Worship (Special Provisions) Act,** 1991.

- The **next hearing** is scheduled for **February 17, 2025.**
- The **Union government has been granted four weeks** to clarify its stance on the Act, a response awaited for over two years.

Places of Worship Act, 1991

- Enacted **to preserve the religious character of places of worship** as they stood on **August 15, 1947.**
- The Act **prohibits altering the religious nature of sites, with penalties for violations.**
- **Exemptions were granted to the Ram Janmabhoomi-Babri Masjid site** due to ongoing litigation at the time.
- The court reiterated the significance of the Places of Worship Act in **protecting the secular fabric of the nation.**
- The 2019 Ayodhya verdict highlighted the Act's role in **ensuring equality and preventing the revisiting of settled issues.**

Recent Legal Challenges

- **Petitions have sought to challenge the constitutionality of the Act,** arguing it violates fundamental rights to reclaim historical religious sites.
- Cases such as the **Gyanvapi Mosque in Varanasi and the Shahi Idgah Mosque in Mathura** have fueled debates over historical grievances.

Conclusion

The Supreme Court's directive marks a critical intervention in a contentious issue involving religion, history, and law. By stalling fresh litigation and pending orders, the judiciary has prioritised communal harmony and the rule of law.

Speedy Trail vs UAPA

Sub Topic- *Judiciary, Indian Constitution*

Context:

The Supreme Court has reaffirmed that the **constitutional right to a speedy trial** takes precedence over stringent provisions in laws like the Unlawful Activities (Prevention) Act (UAPA).

More on News

Article 21 of the Indian Constitution states, *"No person shall be deprived of his life or personal liberty except according to procedure established by law."*

- In a landmark judgment, a bench comprising Justices Abhay S. Oka and A.G. Masih held that **prolonged incarceration without trial violates Article 21 of the Constitution**, which guarantees the **right to life and personal liberty.**
- The court emphasised that **statutory restrictions under UAPA cannot be the sole justification for denying bail,** especially when trials are unlikely to conclude within a reasonable time frame.
- This ruling comes as the court granted bail to **Athar Parwez,** an alleged member of the Popular Front of India (PFI), **accused of conspiring to disrupt public order during the Prime Minister's proposed visit to Patna in July 2022.**
- Parwez, arrested on July 12, 2022, has been **in custody for over two years and four months without trial,** with the prosecution failing to frame charges despite filing a chargesheet in January 2023.

Significant Precedents and Observations

- The judgment, authored by Justice Masih, builds on previous rulings, such as **Union of India Vs K.A. Najeeb (2021) and Thwaha Fasal Vs Union of India (2022)**, where the court held that **undue delay in trials could warrant bail,** even in cases involving serious allegations under UAPA.
- The bench underscored that **constitutional protections must not be overridden by the gravity of charges,** reaffirming the principle that an *accused is presumed innocent until proven guilty.*

The **Unlawful Activities (Prevention) Act (UAPA)** is an Indian law enacted in 1967 to prevent unlawful activities and associations that threaten the integrity and sovereignty of India. The Act **empowers the government to designate organisations and individuals as terrorists**, allowing for special procedures to deal with terrorist activities, including the seizure of property linked to terrorism and investigations by the National Investigation Agency (NIA). The most recent **amendment in 2019 expanded the government's authority to designate individuals as terrorists without a formal judicial process,** reflecting a significant shift in counter-terrorism measures in India.

Subject - Indian Economy & Agriculture and Banking

National Mission on Natural Farming

Sub Topic- *Agricultural Resources, E-Technology in the Aid of Farmers*

Context:

The Union Cabinet has recently approved the launch of the **National Mission on Natural Farming (NMNF)** as a standalone Centrally Sponsored Scheme under the **Ministry of Agriculture and Farmers' Welfare**.

More on News:

This ambitious initiative **aims to promote natural farming** across the country in a mission mode, with a focus on **reducing dependency on chemical fertilisers** and **promoting sustainable agricultural practices.**

What is Natural Farming?

- Natural farming is defined as a **chemical-free farming system** that relies on inputs produced using livestock and plant resources.

This method emphasises **local agro-ecological principles**, **diversified crop systems**, and the use of natural inputs like **Jeevamrit and Beejamrit**, which are prepared using livestock or procured from Bio-input Resource Centres (BRCs).

- **Background and Continuity:** The NMNF builds upon the **Bhartiya Prakritik Krishi Paddhti (BPKP)** launched in 2019 under the **Paramparagat Krishi Vikas Yojna (PKVY)**.
  - The initiative was further extended to the **Namami Gange scheme** in 2022-23, focusing on a **five-kilometer belt along the Ganga River**.

Objectives of NMNF:

- **Reduce Input Costs**: By promoting natural farming practices, the scheme seeks to lower the input costs for farmers and reduce their dependency on externally purchased inputs.
- **Promote Biodiversity**: Natural farming encourages diverse cropping systems, which help in maintaining healthy soil ecosystems and promoting biodiversity.
- **Enhance Climate Resilience**: The practices under NMNF are designed to build resilience against climate risks such as waterlogging, floods, and droughts.
- **Support Farmers**: The mission plans to train and support 1 crore farmers across the country in the next two years, with a focus on areas with high fertiliser consumption.

Budget and Support:

- The scheme has a total outlay of **₹2,481 crore**, with the Government of India contributing ₹1,584 crore and the states contributing ₹897 crore.
- The mission will be **supported by scientific institutions**, Krishi Vigyan Kendras (KVKs), Agricultural Universities, and experienced Farmer Master Trainers.

Implementation Plan:

- The NMNF will be implemented in **15,000 clusters in Gram Panchayats**, reaching out to 1 crore farmers and bringing an additional 7.5 lakh hectares under natural farming.
- The scheme also includes the establishment of **10,000 Bio-input Resource Centres (BRCs)** to provide easy access to natural farming inputs.

Environmental and Health Benefits:

- Natural farming improves **soil carbon content** and **water use efficiency**, enhances soil biodiversity, and fosters a **healthier environment** for future generations.
- It helps reduce dependency on external inputs and provides healthier, nutritious food while reducing health risks from fertilisers and pesticides.

India Signs Final Act of Riyadh Design Law Treaty

Sub Topic- *Intellectual Property rights*

Context:

After two decades of negotiations, the **World Intellectual Property Organisation (WIPO) finalised the landmark Design Law Treaty (DLT).**

Key Objectives of the Design Law Treaty:

- **Harmonising Procedures:** The treaty aims to standardise industrial design protection processes across different countries.

- **Making Design Registration Easier:** It simplifies registration processes, reducing administrative burdens for designers worldwide.
- **Supporting SMEs and Startups:** The treaty places a strong focus on helping small businesses, startups, and independent designers benefit from streamlined design protection.
- **Promoting Innovation and Creativity:** By making design protection more accessible, the treaty encourages creativity and ensures that its benefits are available to everyone.

Key Features of the Design Law Treaty:

- **Increased Flexibility for Applicants**
  - Provides relaxed time limits for procedural steps.
  - Allows reinstatement of rights that may have been lost.
  - Enables corrections or additions to priority claims.
  - Simplifies procedures for recording ownership changes or licenses.
  - Permits filing multiple designs in a single application.
- **Focus on Digital Solutions**
  - **Encourages countries to adopt electronic systems** for managing industrial design applications.
  - Promotes electronic **sharing of priority documents among member countries.**

Significance of the Deal:

- **Boost for Startups and SMEs:** The treaty works in synergy with Indian programs like **Startup India and the Startups Intellectual Property Protection (SIPP) scheme.** These provisions help startups and small businesses secure their design rights internationally, boosting their competitiveness and supporting market growth.
- **India's Commitment to Inclusive Growth:** By signing the Final Act, India has reaffirmed its commitment to fostering inclusive growth and ensuring fair access to intellectual property (IP) protection.
- **Alignment with Global Standards:** By adopting the treaty, India aligns its industrial design laws with international norms, making it easier for Indian designers and businesses to protect their creations globally.
- **Encouragement for Innovation:** Simplified and digitalised procedures under the treaty reduce barriers for designers, fostering a culture of creativity and innovation in India.

India's Progress in Design Protection

- **A Rich Heritage of Creativity:** India values design as a key driver of sustainable economic development.
- **Strong Policy Achievements**
  - The number of design registrations in India has **tripled over the past decade.**
  - Domestic filings increased by **120%** in the last two years.
  - Design applications grew by **25%** in the previous year alone.

States/Union Territories for Capital Investment Scheme

Sub Topic- *Growth & Development, Infrastructure*

Context:

The **Union Ministry of Tourism** has **approved 40 projects under** the Special Assistance to States/Union Territories for Capital Investment (**SASCI**) **scheme.**

- States will receive **interest-free loans** with a **50-year repayment period** under the SASCI scheme.

Project Details:

- The **projects, worth ₹3295.76 crore**, are spread across **23 states** and aim to **develop lesser-known destinations into iconic tourist sites**.
- **Objective:** To **enhance tourism, create employment opportunities**, and **boost local economies**.
- **Focus Areas**: The focus is on creating **impactful tourist destinations** with potential for both **domestic** and **international marketing**.
- **Project Scope**: The initiative includes a variety of projects such as the Chhatrapati Shivaji Maharaj Museum in Ponda, Goa, the Loktak Lake Experience in Manipur, and the International Convention Centre for MICE in Bhopal, Madhya Pradesh.

Significance:

- **Economic and Employment Impact:** The program is expected to **boost local economies** and create employment opportunities through **sustainable tourism development**.

- **Promotion of Alternative Destinations**: Part of the **government's broader effort to promote balanced tourism** across the country, reducing the strain on popular destinations while fostering growth in emerging areas.
- **Sustainability and Community Engagement**: The ministry emphasises eco-friendly designs and community-based tourism, ensuring long-term growth while preserving cultural and natural resources.

Implementation and Monitoring:

- **State Governments** will handle the implementation, operation, and management of the projects.
- The **finance ministry** has released **66% of the first instalment** directly to the states.
- The **tourism ministry** will monitor the progress of the projects, ensuring completion within two years and full disbursement of funds before **March 2026**.

Higher Capex Loans

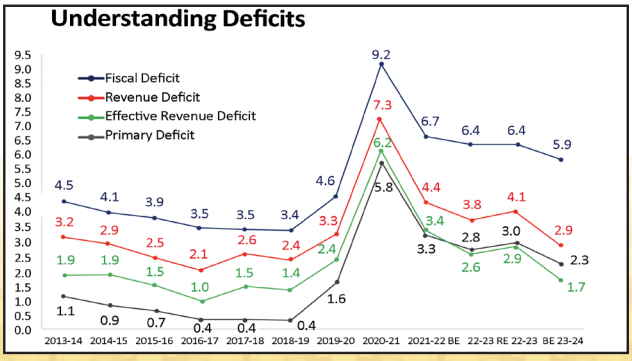
Sub Topic- *Growth & Development, Infrastructure*

Context:

During the pre-budget session, states demanded higher capex loans from the centre towards the state.

About:

- During FY2020-21, the Centre launched a programme to provide the state with **interest-free loans** for **50 years** for infrastructure development.
- The Centre's **Effective Revenue Expenditure** contains revenue expenditures made towards the state that are used for infrastructure development.



- The funds for infrastructure development come as additional financial support as observed by **Reserve Bank of India's** '*State Finances: A Study of Budgets of 2024-25*' report.
  - The report raises concerns that **free/ subsidised services**, **loan waivers**, and **other cash transfers** (included under revenue expenditure) reduce the funds available for infrastructure development.
- **Former Chief Economic Advisor Krishnamurthy Subramanian**, in the book "*India@100:Envisioning Tomorrow's Economic Powerhouse*" also stresses the importance of **capital expenditure** ("*capex*"), which has **3-fold benefits**.
  - It **increases demand and supply**, unlike revenue expenditure ("revex"), which merely enhances demand.
  - Capex allows "*crowding in*" of **private investment**, unlike revex, which leads to "*crowding out*" of private investment.
  - Capex provides a **farsighted policy**.
- **Benefits of Capital Expenditure:**
  - Better Infrastructure
  - Rise in Quality of Services
  - Seamless Logistics and Delivery of Goods and Services
  - Quality of Infrastructure (Ratio of Capex to Revex Increases)
  - Better Human Capital Development
  - Income & Employment Generation
  - More Revenues to the Government

What have been the major bottlenecks in state finances?

- The 15th Finance Commission has made recommendations regarding **tax devolution** through **Census 2011**. This has been a concern for the southern states that went through a **population growth control programme**, thus reducing their share of tax.
- **Centrally Sponsored Schemes** where the funds are operated jointly by the **Centres and state governments**. States run their **own welfare programmes**, along with these **Centrally-operated schemes**, which expand their expenditure.
- States also face issues of **tax distribution**, considering the rise in surcharges that are solely kept with the central government.
- State governments are taking the **toll of losses borne by the distribution companies** (**DISCOMs**).

- States are somewhere spending (according to the **Policy Review by the PRS Legislative Research**) **8-9%** (with states like **Punjab** making up to **17% of the revenue receipts**) of the revenue receipts on subsidies, popularly in the arena of economics as "***Revadinomics***" or "***Freebies***".

Subject Geography

Middle East and North Africa: Warming Faster than World

Sub Topic- *Geographical features*

Context:

The **Middle East and North Africa (MENA)** region is **warming at a rate significantly faster than the global average,** with hotspots such as the **Arabian Peninsula and Algeria experiencing the most pronounced increases,** according to a recent study.

More on News

- Published in the **Journal of Geophysical Research,** the study offers an in-depth analysis of historical and projected temperature changes in the MENA region **from 1850 to the end of the 21st century.**
- By employing dynamically downscaled climate models, researchers have **revealed stark regional disparities and biases in temperature projections**, with seasonal variations and distinct warming trends between coastal and inland areas.

Uneven and Accelerated Warming

- The study highlights that the warming rate in the MENA region, **particularly in the central Arabian Peninsula, rivals that of the Arctic** and is two to three times the global average.
  - The **Arabian Peninsula, already among the hottest regions on Earth,** is warming at an alarming pace.
- Other areas experiencing significant warming include **Algeria, Mauritania, and Iran's Elburz Mountains.**
- The **arid and semi-arid environments** characteristic of the MENA region make it a **climate-change hotspot,** with heightened vulnerability due to high greenhouse gas emissions and limited natural cooling mechanisms.
- Unlike humid equatorial regions, the **arid deserts of MENA lack sufficient soil moisture for evaporation, exacerbating the warming trend.**

Current and Projected Impacts

- Currently, the MENA region is **nearing an average warming of 2°C above pre-industrial levels**, a threshold that could render some areas uninhabitable without significant adaptation measures.
- **Summer hotspots** have been identified in the central Arabian Peninsula, including **Riyadh Province and Algeria,** while winter hotspots are concentrated in **Mauritania and Iran's Elburz Mountains.**
- By 2100, under high emission scenarios, **average temperatures in the Arabian Peninsula could rise by as much as 7.6°C.**
- However, **low-emission scenarios could limit warming to 2.6°C,** significantly reducing the pace of temperature increase by up to 38%.

Coastal and Urban Adaptation

- The study also notes that **coastal areas**, such as **Oman and the southern and western coasts** of the Arabian Peninsula, **are warming more slowly than inland regions** due to cooling effects from proximity to water.
  - Nevertheless, **inland areas and the eastern coast remain particularly vulnerable.**
- Adapting to the extreme heat in urban areas could **involve measures such as urban greening, architectural innovations, and sustainable city planning.**
- **Meeting global low-emission targets** would further alleviate the region's climate challenges.

Active Underwater Hot Spring

Sub Topic- *Geographical features*

Context:

Indian oceanographers have captured the first image of an active **hydrothermal vent** located **4,500 meters** below the surface of the **Indian Ocean**.

More on News:

- This discovery is part of India's **Rs 4,000-crore Deep Ocean Mission** under the Ministry of Earth Sciences.
- The AUV launched from the research vessel **Sagar Nidhi** captured images of an active hydrothermal vent, including the **vent chimney** and **black smokers**, with signs of

chemosynthetic organisms (microbes that rely on chemicals, not sunlight, for food).

Key Highlights:

- **Hydrothermal Vents**: Hydrothermal vents are **underwater springs formed in tectonically active regions** where cold seawater interacts with magma beneath the ocean floor. The water gets **superheated (up to 370°C)** and emerges as plumes rich in minerals and gases through vent chimneys.
- **Technological Achievement**: The National Centre for Polar and Ocean Research **(NCPOR) in Goa**, in collaboration with the National Institute of Ocean Technology **(NIOT) in Chennai**, used an automatic underwater vehicle (**AUV**) to capture the high-resolution image.
- **Mineral Exploration**: These hydrothermal vents are rich in minerals such as **copper, zinc, gold, silver, platinum, iron, cobalt,** and **nickel,** making them valuable for mineral exploration.
- **Duration of Activity**: Hydrothermal vents can remain **active for hundreds to tens of thousands of years**, providing a continuous source of minerals and supporting unique ecosystems.

Significance:

- This discovery will enhance **India's Deep Ocean Mission**, especially the **Samudrayaan mission**, which focuses on **mineral exploration** from inactive hydrothermal vents.
- The findings provide visual confirmation of previously detected hydrothermal vent sites, confirming their economic potential and supporting further exploration.

Implications:

- Hydrothermal venting can remain active for **hundreds to 30,000 years**, making them significant for both **economic** and **biological** studies.
- In the next phase, NCPOR plans **TV-guided grab sampling** to further study the associated features and economic potential of these vent deposits.

Subject - Social Justice

Third-Party Review of Smart Cities Mission

Sub Topic- *Government Policies & Interventions, Social Empowerment*

Context:

A **Parliamentary Standing Committee** on Housing and Urban Affairs has **urged the Ministry of Housing and Urban Affairs (MoHUA) to conduct a third-party assessment of the Smart Cities Mission projects.** This is essential to identify and address gaps before advancing to the next phase of the mission.

Concerns About Progress in Smaller Cities

- **Big-Small Cities Divide:** The panel highlighted a **disparity in the performance of projects**, noting that while **larger cities benefit** from robust organisational and financial structures, **smaller cities—especially in the northeastern states—lag behind.**
  - These smaller cities face **challenges due to limited administrative capacity and inadequate financial resources**, which hinder their ability to plan and execute the expensive projects envisioned under the mission.
- **Third-Party Review:** The committee reiterated its earlier **recommendation for a third-party review and expressed disappointment over the ministry's lack of response.**

Current Progress of the Mission

- As per data provided by MoHUA to the committee, **all 8,010 projects under the Smart Cities Mission,** valued at approximately ₹1.64 trillion, **have had work orders issued as of June 15.**
- Of these, **7,151 projects worth ₹1.43 trillion have been completed,** while the **remaining projects are at advanced stages of implementation.**
- Despite this progress, the panel stressed the **need to address delays in smaller cities by identifying root causes and formulating a plan** to strengthen the capacities of urban local bodies.

Smart Cities Mission (SCM)

It is an initiative launched by the Government of India on June 25, 2015, aimed at **developing 100 cities across the country to enhance urban infrastructure and improve the quality of life for residents.**

Objectives

- **Core Infrastructure:** To provide essential services such as water supply, sanitation, housing, and transportation.
- **Sustainable Environment:** To promote environmentally friendly practices and sustainable urban development.
- **Smart Solutions:** To utilise technology and innovative solutions for efficient urban management.

Implementation Approaches

- **Area-Based Development (ABD):** Each city selects specific areas for focused development, creating models that can be replicated in other parts.
- **Pan-City Solutions:** Implementation of technology-driven solutions across various sectors like waste management, energy management, and urban mobility.
- **Governance Structure:** Establishment of a **Special Purpose Vehicle (SPV)** in each city to oversee project implementation and decision-making.

Ministry's Efforts and Upcoming Assessments

- In its response, the **ministry acknowledged the delays and outlined ongoing initiatives to evaluate the mission's impact.**
- These include **50 theme-based impact assessment research studies** conducted by 29 nationally reputed institutes, which aim to analyse the outcomes of projects in 100 smart cities.
  - These studies are nearing completion and are expected to offer actionable insights for enhancing the capabilities of smaller cities.

Strengthening Capabilities for Future Phases

The panel underscored the importance of preparing smaller cities for the next phase of the Smart Cities Mission by strengthening their organisational and financial structures. A thorough assessment, coupled with targeted capacity-building measures, will be critical to ensuring that the mission's benefits reach all regions equitably.

Industrial Housing for Workers

Sub Topic- *Poverty, Welfare Schemes, Government Policies & Interventions, Issues Relating to Development*

Context:

NITI Aayog released a report outlining a **proposal** to address the growing **need for affordable housing for industrial workers**.

More on News:

- The plan suggests a **scheme to build mega housing projects near manufacturing plants**, offering **rental accommodations in dormitory-style setups** for as low as Rs 3,000 per month.
- This initiative is part of the **broader vision articulated by the Union Finance Minister** in her budget speech for the financial year 2025, which focused on rental housing for industrial workers through a public-private partnership (PPP) model.

The NITI Aayog report highlights that **China's manufacturing success** was not only driven by industrial estates but also by the development of housing for workers, pointing to the need for integrated planning in India. By improving housing availability, the scheme aims to address the challenges of workforce retention and stability, creating a more attractive environment for workers in India's manufacturing hubs.

Objective:

- The initiative is aimed at reducing **commuting costs** and improving **worker safety** by providing accommodation near manufacturing hubs.
- The scheme also intends to address **workforce instability**, high attrition rates, and **low productivity**, which are often caused by inadequate housing.

Key Features of the Scheme:

- The NITI Aayog proposal suggests providing **Viability Gap Funding (VGF)** of up to **40% of the total project cost** (excluding land) for the development of these housing projects.
- This VGF will be jointly provided by the **Department of Economic Affairs (DEA)** (20%) and the **sponsoring Ministry** (10%), with additional contributions from state governments.

- The VGF will also be used for **upgrading existing brownfield worker accommodation**.

Impact on Rent:

- According to the Niti Aayog report, with **zoning reforms** and applying residential tariffs for utilities like electricity, the **effective rent per bed** for migrant workers could be as low as **Rs 3,900**.
- With the central government's **30% VGF contribution**, rents could fall to **Rs 3,100**, and further corporate contributions could reduce it to **Rs 2,000 per bed** per month.

Significance:

- The **manufacturing sector** in India heavily relies on migrant workers. However, the lack of proper housing has made it challenging to retain workers, especially women, and limits **migration** for better job opportunities.
- It will also **boost industrial growth** by addressing the accommodation dilemma, which is crucial for the development of manufacturing hubs in India.
- Industry representatives at the conference proposed that contributions for worker accommodation could be treated as **Corporate Social Responsibility (CSR)** expenditure.

DNA Analysis and Levirate Marriages

Sub Topic- *Issues related to Social sector*

Context:

The CDFD's involvement in a recent case showcases the power of DNA technology to reveal personal truths, raising ethical concerns and challenging societal norms.

Centre for DNA Fingerprinting and Diagnostics (CDFD) is a government laboratory in Hyderabad that provides DNA-based investigative services to police, the judiciary, and hospitals, especially in organ transplant procedures.

The Case:

- **In a recent case, CDFD** was tasked with **generating DNA profiles** to **facilitate** an **organ transplant between** a **father** and his ailing **son**. The profiles of the mother and son confirmed their relationship, but the results between the father and son revealed an unexpected twist.
- The **analysis suggested** the **father was not** the **biological parent** but a close paternal relative, likely a brother.
  - This indicated the **family was practising levirate**, a traditional custom in which a **woman has children fathered by her deceased or incapacitated husband's brother**.
  - While this revelation did not impede the transplant, it inadvertently exposed a deeply personal aspect of the family's dynamics.
- The disclosure brought into focus the complex interplay between genetic truth and cultural practices, highlighting how DNA technology can sometimes disrupt traditional boundaries.

What Are DNA Profiles?

- A **DNA profile** is a unique representation of an individual's genetic information based on the number of times certain DNA sequences are repeated at specific locations (loci) on their chromosomes.
- **Creating a DNA Profile**: A **DNA profile** is created by analysing the **number of repeats** in specific STR loci across the 23 chromosomes.
  - **Polymerase chain reaction (PCR)** is used to create multiple copies of the DNA, and then **capillary gel electrophoresis** is used to separate the DNA fragments by size, allowing scientists to determine the number of repeats at each STR locus.
  - The **number of repeats** at each STR locus forms the unique DNA profile of an individual.
- **For Example**, If a locus shows 30 repeats from the father and 35 repeats from the mother, the son would inherit one of these values from each parent, resulting in a profile that can be used to establish biological relationships.

Levirate Marriages in India:

- **Historically**, **levirate marriage** has been a significant **practice in many cultures**, including India, **to address socio-religious obligations**.
- As **historian Projit Bihari Mukharji notes in his book Brown Skins, White Coats**, the practice was often rooted in the Hindu belief that a man owed debts to gods, sages, and ancestors, repayable only through specific offerings made by a son.
  - The emphasis was **less on genetic lineage and more on fulfilling these ancestral obligations**, even if it meant resorting to levirate unions.

- **Anthropologist Irawati Karve** also highlighted this distinction, where **descent and inheritance** were **viewed** through a **broader cultural and spiritual lens**, unconfined by the modern obsession with biological parentage.
- The **practice of levirate, though uncommon** in contemporary India, persists in some communities, **often shielded by societal discretion**.

One Nation One Subscription (ONOS) Scheme

Sub Topic- *Education, Government Policies & Interventions*

Context:

The Union Cabinet recently approved the **One Nation One Subscription (ONOS) scheme**, set to provide **unified access to top international journals** for all centrally and state-run higher education institutions (HEIs). The platform will become operational on January 1, 2025.

More on News

- Currently, **access to journals is fragmented across ten separate library consortia** managed by different ministries, along with individual institutional subscriptions.
- **ONOS aims to streamline access through a unified national subscription model.**

Key Highlights of the ONOS Scheme:

- **Centralised Access: All HEIs and research institutions under the Centre** will gain access to approximately 13,000 journals from 30 reputed international publishers through a single platform.
- **Coordination by INFLIBNET:** The initiative will be managed by the **Information and Library Network (INFLIBNET)**, an autonomous inter-university center under the University Grants Commission (UGC).
- **Funding and Coverage:** With an allocation of ₹6,000 crore over three years (2025–2027), the scheme will cover around 6,300 institutions, including research and development centers.

Participating Publishers:

- The scheme will include leading publishers such as **Elsevier ScienceDirect, Springer Nature, Oxford University Press**, and **Cambridge University Press.**
- **INFLIBNET will directly handle payments** to these publishers, though institutions can still use their budgets to subscribe to resources outside the scheme.

This initiative is expected to significantly enhance access to academic resources and reduce duplication of subscription efforts across institutions.

PRAGATI System

Sub Topic- *Education, Government Policies & Interventions*

Context:

A recent **study** by **Oxford University's** Saïd Business School (**SBS**) has praised the PRAGATI platform for its significant **impact on India's infrastructure development**.

Study Overview:

- The study, titled **"From Gridlock to Growth: How Leadership Enables India's PRAGATI Ecosystem to Power Progress,"** highlights how PRAGATI has accelerated 340 projects worth $205 billion across the country.
- It was **presented at** the **Indian Institute of Management-Bangalore symposium.**
- **Economic Impact**: The report highlights a **multiplier effect** in infrastructure investment.
  - Studies by the **Reserve Bank of India** and the **National Institute of Public Finance and Policy** show that for every rupee spent on infrastructure, India experiences a **GDP gain of ₹2.5 to ₹3.5**.

About PRAGATI System:

- The **PRAGATI (Pro-Active Governance and Timely Implementation)** system is an innovative **digital platform launched** by Prime Minister Narendra Modi **in 2015.**
- It is a platform designed for **monitoring infrastructure projects** to ensure their timely completion.
- It **integrates diverse stakeholders** from both **Central** and **State governments onto a single platform**, facilitating coordination and accountability.
- **Key Features**: PRAGATI uses **real-time data**, **drone feeds**, and **video conferencing** to monitor and fast-track projects, improving efficiency and accountability.
  - The platform has played a pivotal role in ensuring that the benefits of development reach even **remote areas** of the country.

Impact on Infrastructure and Governance:

- The system has addressed key issues like **bureaucratic inertia**, **land acquisition challenges**, and **inter-ministerial coordination** by bringing together stakeholders from both the **Central** and **State governments**.
- PRAGATI's fast-tracking of projects in sectors like **roads, railways, water, and electricity** has enhanced the **quality of life** for millions of people.
- It integrates **sustainability** into operations, promotes **green technologies**, and facilitates **faster environmental clearances**.

Significance:

- The report suggests that the lessons from PRAGATI are relevant for countries dealing with the **Middle-Income Trap**.
- It demonstrates that **strategic investments in infrastructure** and **governance innovation** can foster sustained economic growth and social progress.

Marburg Virus Disease

Sub Topic- *Issues related to Health*

Context:

The **recent outbreak** of the **Marburg virus in Rwanda** has raised significant global concern.

More on News:

- The virus, often referred to as the **"bleeding eye disease,"** has already **claimed 15 lives** and **infected at least 66 people**.
- This **outbreak** is particularly **alarming due to the virus's high fatality rates** and **rapid spread**.

Background

- **Disease Origin**: The disease referred to is the **Marburg virus**, first detected in **1967** during simultaneous outbreaks in **Marburg** and **Frankfurt** in Germany, and **Belgrade**, Serbia.
- **Laboratory Connection**: The outbreaks are believed to have originated from a laboratory while **working with African green monkeys (Cercopithecus aethiops)** imported from **Uganda**.
- **Global Occurrence**: Since 1967, **occasional cases** have been reported in countries such as **Angola, Democratic Republic of the Congo, Equatorial Guinea, Ghana, Guinea, Kenya, Rwanda, South Africa**, Tanzania, and **Uganda**.

About MVD:

- **Marburg virus belongs to the filovirus family**, which also includes the well-known Ebola virus. Both viruses are **clinically similar** and **cause outbreaks with high fatality rates**.
- **Initial Transmission**: MVD is initially transmitted through exposure to mines or caves inhabited by colonies of Rousettus bats, particularly the Egyptian fruit bat.
- **Human-to-Human Transmission**: It can also spread through direct contact with blood or bodily fluids of infected individuals and indirectly through contaminated surfaces, bedding, or clothing.
- **Symptoms:**
  - **Incubation Period**: Symptoms typically appear 2 to 21 days after exposure.
  - **Early Symptoms**: High fever, severe headache, muscle pain, and malaise.
  - **Third Day Onward**: Gastrointestinal symptoms like diarrhea, abdominal pain, cramping, nausea, and vomiting.
  - **Fifth Day Onward**: Hemorrhagic symptoms including blood in vomit and feces, and bleeding from the nose, eyes, ears, mouth, gums, or vagina. Orchitis (testicular inflammation) can also occur.
  - **"Ghost-like" Features**: Deep-set eyes and extreme lethargy in some patients.
  - **Critical Cases**: Death can occur between **eight to nine days** after symptoms start due to severe blood loss and shock.
- **Diagnosis**: Requires **advanced laboratory tests**, including antigen detection, RT-PCR, and virus isolation. Early and accurate diagnosis is essential for outbreak containment.
- **Treatment**: No approved vaccine or antiviral treatment. **Supportive care** (hydration, oxygen levels, symptom management) can improve survival.
  - **Experimental treatments** like monoclonal antibodies are under development.

Global Concerns:

- The **Marburg virus poses** a significant **threat to public health** due to its **high mortality rates**, which can range from **24% to 88%** depending on the strain and the availability of medical care.
- The **rapid onset of symptoms** and the **potential for human-to-human transmission** make it a formidable **challenge to contain**.

- The World Health Organization (**WHO**) has **classified Marburg** as one of the **pathogens that pose the greatest threat to public health.**

Response and Prevention:

- Rwanda has taken swift action to contain the outbreak, including **isolating infected individuals, conducting extensive contact tracing**, and **implementing strict hygiene practices**.
- Public health officials emphasise the **importance of protective equipment for healthcare workers** and **community education** about the virus's symptoms and transmission routes.
- Rwanda has sought experimental vaccines and treatments, with the Sabin Vaccine Institute providing 700 doses of an experimental Marburg vaccine to healthcare workers. The vaccine's efficacy is still unclear.

Bima Sakhi Yojana

Sub Topic- *Issues related to development and management of Social services and Women*

Context:

In a landmark event in Panipat, Haryana, Prime Minister Narendra Modi launched the **Bima Sakhi Yojana**, a Life Insurance Corporation (LIC) initiative aimed at empowering women and promoting financial inclusion.

More on News

- The Prime Minister also laid the foundation stone for the **Main Campus of Maharana Pratap Horticultural University in Karnal,** marking another significant stride in Haryana's development.

About Bima Sakhi Yojana

- The Bima Sakhi Yojana is a **transformative initiative designed to provide employment opportunities to two lakh women across India.**
- Women **aged 18-70 years,** who have **passed Class X**, will receive **specialised training and a stipend for three years.**
- The program aims to **create a new cadre of LIC agents**—Bima Sakhis—who will promote financial literacy and insurance awareness at the grassroots level.
- The **program aligns with** the government's **broader goal of "Insurance for All,"** ensuring social security and eradicating poverty.

Boost to Horticultural Research and Education

- The foundation stone for the **Main Campus of Maharana Pratap Horticultural University** marks a significant milestone in advancing horticultural research and education in Haryana.
- Spread over 495 acres, the ₹700-crore project will house a **College of Horticulture for undergraduate and postgraduate studies,** along with **five schools specialising in ten horticulture disciplines.**
- The **university aims to promote crop diversification** and world-class research in horticultural technologies, cementing Haryana's leadership in the sector.

Never Events (NE)

Sub Topic- *Issues related to Health*

Context:

The concept of **never events** refers to serious and largely preventable incidents that should never occur in healthcare settings if proper safety protocols are followed.

- There is concern that **accountability is disproportionately placed on frontline healthcare workers**, overlooking systemic failures like organisational inefficiencies, poor infrastructure, and communication gaps.

Understanding Never Events:

- The term was **introduced in 2002 by the National Quality Forum (NQF)** in the **United States**, the term has since been **adopted in the Western world**, including countries like the **USA, UK,** and **Canada**
- Never events are **incidents that result in severe patient consequences**, such as operating on the wrong body part, insulin overdose, or mismatched blood transfusion.
  - These events can **lead to disability, death, or great discomfort** for the patient.
- The concept of never events **overlaps** with **terms** like **"sentinel events"** and **"serious reportable events."**
- **The list of never events differs across organisations.** For example, the UK's NHS (2021) lists 16 events, while the US recognises 29 events.

Steps After a Never Event:

- **Apology**: The healthcare provider must offer a sincere apology to the patient, acknowledging the error.
- **Formal Reporting**: The event must be transparently reported to appropriate regulatory bodies and authorities.
- **Root Cause Analysis**: A thorough analysis is essential to identify the underlying factors that led to the incident. This helps in understanding the specific breakdowns in processes, communication, or systems that allowed the event to happen.
- **Waiving Costs**: Any additional costs incurred due to the incident should be waived, as a gesture of accountability and fairness.

Challenges in Prevention:

- While **achieving absolute prevention** is often seen as the **ultimate goal**, no consensus remains on whether it is practically possible.
- **Studies reveal** that **never events persist at a rate of 1 to 2 per 100 incidents**, with overall patient safety incidents occurring in 2 to 3 out of every 100 consultations.
- The **complexity of healthcare systems** and the interplay of various factors make it challenging to completely eliminate these events.
- The complexity of healthcare systems, involving numerous stakeholders and interactions between social, technical, human, organizational, economic, and regulatory components, makes the complete prevention of never events a challenging goal.

The Indian Context

- The term "never events" is not explicitly used in India. Instead, incidents are categorised under **medical negligence**, which applies to allegations of professional misconduct.
- **Medical Negligence**: Defined by the Bolam test, it occurs when a healthcare provider fails to meet the standard of care, leading to harm.
- **Medical Errors**: Unintended mistakes arising from misjudgments or incorrect treatment, not deliberate deviation from care standards.
- **Iatrogenic Events**: Harm caused by medical interventions, some of which are unavoidable (e.g., hair loss from chemotherapy), while others (e.g., retained surgical items) indicate negligence.
- **Medical Maloccurrences**: Outcomes that cannot be prevented even with proper care (e.g., rib fractures during CPR).
- **Medical Complications**: Expected risks inherent in medical procedures, which do not imply negligence, and are different from iatrogenic causes.

Subject - Indian Society

Falling Fertility Rate

Sub Topic- *Population and Associated Issues*

Context:

India's **total fertility rate (TFR)** has dropped **below the replacement level of 2.1,** signaling a potential future decline in population.

More on News

- According to data from the **National Family Health Surveys (NFHS)**, the TFR **remained at 2.2 between 2011 and 2015-16 but fell to 2.0 in 2019-21.**
- Despite this, projections by the **United Nations Department of Economic and Social Affairs (UN DESA)** indicate that **India's population will not start declining until 2062.**
- Meanwhile, the **population growth rate is expected to fall below 1% annually** starting in 2025, though the **country will still add approximately 13.1 million people that year.**

India's Demographic Dividend and Ageing Concerns

- India's population, currently at **1.46 billion** (as of December 2024, according to Worldometer), **benefits from a substantial demographic dividend.**
- UN DESA estimates that **68.7% of the population falls within the working-age group** of 15 to 64 years.
- However, concerns are mounting that the **country could age before fully capitalising on this advantage.**

- **Rising life expectancy**—71 years for men and 74 years for women in 2024 compared to 64.6 and 67.7 years in 2011—**alongside declining fertility rates, have sparked fears of a growing dependency ratio.**

Regional Disparities in Fertility Rates

- The fertility rate varies widely across India.
- **Southern states,** such as Kerala and Tamil Nadu, report **significantly lower TFRs compared to northern states** like Bihar and Uttar Pradesh.
- This imbalance has **led to concerns over ageing populations in the south**, where dependency rates are higher.
- **Easing migration restrictions within the country** could address these disparities.
- However, **some states have imposed barriers to migration, complicating efforts to balance demographic challenges.**

Economic and Social Challenges

- India's demographic dividend remains **underutilised due to limited access to quality employment and low female labour force participation.**
- In 2023-24, just over **one-fifth of employed individuals held regular wage or salaried positions,** according to the **Periodic Labour Force Survey (PLFS).**
- Experts emphasise the **need to upskill the workforce and create higher-quality jobs** to fully leverage the working-age population.
  - To address aging populations, **reskilling those over 60 years and boosting public investment in education, healthcare, and living conditions** are essential.

Debunking Myths Around Religious Fertility Rates

- Amid calls by some to encourage higher birth rates among certain religious groups to counterbalance others, experts have pointed out that **such fears are unfounded.**
- NFHS data reveals that **fertility rates across all communities, except Sikhs and Jains, have declined between 2015-16 and 2019-21.**
- While the **TFR among Muslims remains above replacement level, it has fallen significantly, from 2.62 to 2.36 during this period.**

The Road Ahead

India's population trajectory reflects a complex interplay of declining fertility rates, regional disparities, and economic challenges. Policymakers must focus on creating quality jobs, enhancing labour force participation—especially among women—and addressing regional imbalances to ensure that the country's demographic transition supports sustained economic growth.

Subject - International Relations

Iran to Hold Nuclear Talks with European Powers in Geneva

Sub Topic- *Bilateral relations, Effect of Policies & Politics of Countries on India's Interests*

GS Paper III - *Nuclear Technology*

Context:

Recently, Iran said that it would hold nuclear talks in the coming days with the three European countries that initiated a censure resolution against it adopted by the UN's atomic watchdog.

Context of the Talks:

- **UN Censure Resolution:** The UN's International Atomic Energy Agency (IAEA) recently passed a resolution criticising Iran for insufficient cooperation, supported by the UK, France, Germany, and the US.
- **Iran's Response:** Tehran announced measures including activating advanced centrifuges to enrich uranium at higher levels.

Key Issues to be Addressed:

- **Nuclear Program:** Discussions on limits to uranium enrichment and compliance with the 2015 nuclear pact.
- **Regional Topics:** Broader discussions will include issues related to Palestine and Lebanon.

Strategic Importance of Timing:

- **Trump's Return:** Talks are happening ahead of President-elect Donald Trump's inauguration in January 2025.

- **European Diplomatic Efforts:** European powers aim to engage Trump's administration by demonstrating willingness to negotiate tough measures with Iran.

Iran's Nuclear Program and Recent Developments:

- **Uranium Enrichment:** Iran continues enrichment to **60%, near the 90% level required for nuclear weapons,** exceeding the 3.67% limit in the 2015 deal.
- **Advanced Centrifuges:** Iran has activated 5,000 advanced centrifuges to expand its enrichment capacity.

Historical Context:

2015 Nuclear Deal: Signed between Iran and six major powers, easing sanctions in exchange for limits on Iran's nuclear program.

2018 US Withdrawal: Under Trump, the US withdrew, reimposed sanctions, and led to Iran breaching the deal's terms.

Challenges Ahead:

- **Distrust on Both Sides:** Iran criticises Europe for aligning with the US sanctions regime, while Western powers doubt Iran's peaceful intentions.
- **Broader Middle East Tensions:** Iran's regional actions and alliances complicate efforts to isolate the nuclear issue from geopolitical concerns.

Implications for the US:

- **Potential for New Deal:** Trump has signaled a need for a new deal, acknowledging the grave consequences of failure.
- **Impact on Middle East Stability:** The outcome of these talks could influence tensions in the region, including responses to Iran's nuclear advancements.

Next Steps:

- The meeting will mark the first direct talks in two years, but expectations are low for significant breakthroughs.
- The IAEA has been tasked to provide a comprehensive report within three months on Iran's compliance, potentially triggering broader sanctions if violations persist.

BRICS and Dollar

Sub Topic- *Global Groupings and Agreements involving India and/or affecting India's interests*

Context:

Donald Trump has issued a warning to the BRICS nations (Brazil, Russia, India, China, and South Africa), **threatening 100% tariffs on imports if they pursue creating a new currency or backing an alternative to the US dollar as the global reserve currency.**

More on News:

- The **global push to reduce dependence on the dollar has gained momentum** since the US barred Iran and Russia from the **Society for Worldwide Interbank Financial Telecommunication (SWIFT)**, a crucial system for international transactions.
- Countries, including India, are exploring alternatives to the US-led financial system.

The Society for Worldwide Interbank Financial Telecommunications **(SWIFT)** is a crucial entity in the global financial system, primarily functioning as a **secure messaging network that facilitates international money transfers and communications between banks and financial institutions.** SWIFT was founded in 1973 and is based in **La Hulpe, Belgium.** As of recent reports, SWIFT connects over 11,000 financial institutions across more than 200 countries, processing an average of approximately 44.8 million messages daily.

Rising Calls for a BRICS Currency:

- **Kazan Summit:** At the **BRICS summit in Kazan** in October, **Russian President Vladimir Putin criticised the use of the dollar as a weapon**, calling it a **strategic mistake**.
- **Johannesburg Summit:** Earlier, at the 2023 **BRICS summit in Johannesburg, Brazilian President Luiz Inácio Lula da Silva advocated for creating a BRICS currency** to expand payment options and mitigate vulnerabilities.

India's Steps Toward Currency Diversification:

- **Trade Settlements:** In 2022, the **Reserve Bank of India (RBI) enabled international trade settlements in rupees following Western sanctions** on Russia amid the Ukraine conflict.

- **Kazan Summit: Prime Minister Narendra Modi, speaking at the Kazan summit, supported financial integration among BRICS nations,** emphasising trade in local currencies.
  - However, **India's trade imbalance with Russia and fears of US sanctions have limited progress.**
  - Much of **Russia's rupee reserves have been redirected into Indian investments rather than bilateral trade.**
  - In contrast, **Russia-China trade**, settled primarily in rubles and yuan, now accounts for **over 90% of transactions between the two nations,** according to the Russian government.
- **Official Stand: External Affairs Minister S. Jaishankar clarified that India is not targeting the dollar**, stating that the country's initiatives aim to address practical trade needs, not challenge the global dominance of the dollar.

Implications of US Tariffs on BRICS:

- Trade experts caution that Trump's tariff threats **could backfire on the US.**
- **Such tariffs would likely lead to a shift in US imports to third countries, raising costs for American consumers** without reviving domestic manufacturing.
- **China might use the BRICS framework to challenge the US.**

Dollar's Declining Role in Global Reserves:

- Data from the **International Monetary Fund (IMF)** shows a **gradual decline in the dollar's share of official foreign exchange reserves,** with **non-traditional reserve currencies** like the Australian dollar, Canadian dollar, Chinese renminbi, and South Korean **won gaining ground.**
- The IMF has highlighted the **renminbi's rise,** which accounts for about a quarter of the dollar's decline.

Balancing Reform and Diplomacy:

- BRICS countries will likely continue exploring alternatives to the US dollar despite the tariff threat.
- For India, a balanced approach is crucial—**supporting financial reforms within BRICS while maintaining strong ties with the US** to protect broader strategic and economic interests.
- Diversifying trade mechanisms, they argue, is about fostering global financial stability, not opposing the dollar's dominance.

India and Latin America

Sub Topic- *Bilateral agreements involving India and/or affecting India's interests*

Context:

Before taking over the G20 presidency, Brazil's President Luiz Inácio Lula da Silva compared the group's annual summit to a **diplomatic "World Cup."**

Latin America

It is a diverse region that encompasses countries in Central America, South America, and the Caribbean, characterised by a rich cultural heritage and a variety of languages, primarily Spanish and Portuguese. There are **33 countries** recognised in Latin America, including major nations such as Mexico, Brazil, Argentina, and Colombia, as well as smaller Caribbean nations like Jamaica and Trinidad & Tobago. It can be divided among the following regions: Central America, South America and Caribbean.

More on News

- With members accounting for **85% of global GDP**, the host of the annual G20 summit often commands global attention.
- **Brazil's presidency focused on three key priorities**, outlined in the final declaration:
  - **Social inclusion and combating hunger and poverty.**
  - **Sustainable development**, energy transitions, and climate action.
  - **Reform of global governance institutions.**
- However, the **2024 G20 summit in Rio de Janeiro may be best remembered for symbolising the challenges of a shifting global order**, marked by disagreements over urgent issues such as climate change, war, and gender equality.

Brazil and India Find Common Ground

- Despite limited global consensus, the summit highlighted a strong alignment between Brazil and the previous G20 chair, India.
- The Indian Prime Minister emphasised **shared priorities**, including renewable energy, poverty eradication, hunger alleviation, and food security.
  - He also used the opportunity to **strengthen ties with key Latin American**

partners, including bilateral meetings with Argentina and Chile.

- **India's engagement with Chile** advanced discussions on **expanding their Preferential Trade Agreement into a Comprehensive Economic Partnership Agreement (CEPA).**
  - If realised, this agreement would elevate trade relations to the level of India's comprehensive agreements with nations like the UAE, South Korea, and Japan.

India's Outreach to the Caribbean and Guyana's Oil Boom

- Following the G20 summit, the Indian Prime Minister extended his **South American tour** with a visit to Guyana and participation in the **second India-CARICOM Summit.**
  - **CARICOM**, the **15-nation Caribbean Community**, exemplifies "small state diplomacy" by leveraging regional integration to engage with major global powers.
- While India shares deep cultural ties with the Caribbean, **economic relations remain underdeveloped, with bilateral trade reaching only $814 million in 2023.**
- During his visit to Guyana, he signed **10 agreements across sectors** like agriculture, defense, pharmaceuticals, and financial systems.
  - Yet, **oil dominated discussions.** Guyana, now the **world's fastest-growing economy, has become a significant oil producer,** surpassing even neighboring Venezuela.
  - Despite years of dialogue, **India has struggled to secure a stake in Guyana's oil production,** as much of it is managed by international giants like ExxonMobil.

India and UNGA Resolution in Gaza

Sub Topic- *Global Grouping and Agreements involving India and/or affecting India's interests*

Context:

India has voted in favor of a United Nations General Assembly **(UNGA) resolution calling for** an immediate, unconditional, and **permanent ceasefire in Gaza.**

More on News

- The resolution also demands the **unconditional release of all hostages** and **emphasises the need for urgent humanitarian assistance** in the conflict-torn region.

Key Highlights of the UN Resolution

- **Ceasefire and Hostage Release:** The resolution calls for an **immediate ceasefire** to be respected by all parties involved in the Gaza conflict.
  - It **reiterates the demand for the immediate and unconditional release of all hostages.**
- **Implementation of Security Council Provisions:** The resolution urges all parties to implement provisions from a June 2024 Security Council resolution, including:
  - Ceasefire enforcement.
  - Release of hostages and exchange of Palestinian prisoners.
  - Return of hostages' remains.
  - Resettlement of Palestinian civilians in Gaza.
  - Full withdrawal of Israeli forces from Gaza.
- **Humanitarian Access and Basic Services:** Demands immediate access to essential services and humanitarian aid for civilians in Gaza.
  - Rejects any efforts to starve the Palestinian population.
  - Calls for safe and unhindered delivery of humanitarian assistance under UN coordination, particularly to civilians in north Gaza.
- **Protection of Civilians:** Urges compliance with international law, especially concerning the protection of civilians, women, and children.
  - Demands the release of individuals arbitrarily detained.

India's Commitment to a Two-State Solution

- Reiterates support for the two-state solution, **envisioning Palestine and Israel as two democratic states** living peacefully within secure and recognized borders.
- **Rejects any demographic or territorial changes** in Gaza and stresses the importance of unifying Gaza with the West Bank under the Palestinian Authority.

Voting Outcomes

- **In Favor: 158 nations, including India,** supported the resolution.
- **Against: 9 nations**, including **Israel and the United States,** opposed it.
- **Abstentions: 13 nations,** including Albania and Ukraine, chose to abstain.

India's Consistent Stance

- India also recently supported another **UNGA resolution titled *"Peaceful settlement of the question of Palestine"***, which called for **Israel's withdrawal from territories occupied since 1967**, including East Jerusalem.
  - **Votes in Favor: 157 nations**, including India.
  - **Votes Against: 8 nations**, including Israel, the United States, and Hungary.
  - **Abstentions:** 7 nations, including Ukraine and Uruguay.
- This resolution highlighted the **need for a comprehensive, just, and lasting peace in the Middle East.**

Conclusion:

India's support for these resolutions underscores its commitment to peace, humanitarian values, and a two-state solution to the Israeli-Palestinian conflict. By backing these measures, India has reinforced its advocacy for international law, the protection of civilians, and a sustainable resolution to the ongoing crisis.

Subject - Science & Technology

The MACE Telescope

Sub Topic- *Achievement in the field of Space Technology*

Context:

India inaugurated the **Major Atmospheric Cherenkov Experiment (MACE)** telescope on **October 4** in **Hanle, Ladakh**.

More on News:

- The **MACE** was officially inaugurated by the **Secretary** of the Department of Atomic Energy (**DAE**) and **Chairman** of the **Atomic Energy Commission**.
- The inauguration was part of the **DAE's 75th anniversary celebrations**.

MACE Telescope Overview:

- **Location and Altitude**: It is the **highest-imaging Cherenkov telescope** in the world, located at an altitude of **4.3 km** above sea level.
- **Size and Structure**: MACE has a **21-meter-wide dish**, the **largest in Asia** and **second-largest in the world**.
- It was **built by several Indian institutions**, including Bhabha Atomic Research Centre (**BARC**), Tata Institute of Fundamental Research (**TIFR**), Electronics Corporation of India Ltd. (**ECIL**), and the Indian Institute of Astrophysics (**IIA**).
- **Objective:** To observe high-energy **gamma rays** from cosmic phenomena such as **supernovae**, **black holes**, and **gamma-ray bursts**.

Key Features:

- **High-Energy Gamma Rays**: MACE's primary goal is to study gamma rays with energies exceeding **20 billion electron volts (eV)**. These high-energy gamma rays are emitted by cosmic phenomena such as pulsars, blazars, and gamma-ray bursts.
- **Cherenkov Radiation Detection**: When gamma rays from cosmic sources enter the Earth's atmosphere, they interact with air molecules to produce a shower of electron-positron pairs.
  - These charged particles emit a faint blue light known as Cherenkov radiation, which MACE detects using its advanced mirrors and photomultiplier tubes.
- **Dark Matter Research**: In addition to studying gamma rays, MACE will also **explore one class of hypothetical dark-matter particles**, known as Weakly Interacting Massive Particles (**WIMPs**).

Significance:

- The MACE project will strengthen **India's role in space research** and enhance its **global scientific standing**.
- It also aims to foster **international cooperation** in scientific endeavours.
- MACE will inspire future generations of **Indian scientists** to explore new frontiers in **astrophysics** and **space research**.

AOMSUC-14

Sub Topic- *Achievement in the field of Space Technology*

Context:

The **14th Asia-Oceania Meteorological Satellite Users' Conference (AOMSUC-14)** will be held from **December 4-6, 2024**, in **New Delhi, India**.

Background

The **first AOMSUC** was held in **Beijing, China**, in **2010**, and has been hosted annually across various locations in the Asia-Oceania region.

The AOMSUC has grown to become a premier event for professionals involved in satellite applications for **weather, climate, and environmental studies**.

Objectives:

- **Promoting the importance of satellite observations** in weather and climate science.
- **Advancing satellite remote sensing science** for more accurate predictions.
- **Facilitating dialogue and collaboration** between satellite operators and users.
- Providing information about the **current status and future plans of international space programs**.
- Encouraging the development of **new technologies** for weather satellite sensing.
- Engaging **young scientists** in satellite applications for meteorology and climate research.

Event Overview:

- The conference is hosted by the **India Meteorological Department (IMD)**, Ministry of Earth Sciences.
- It will feature **oral and poster presentations**, **panel discussions**, and a **training workshop** focused on using satellite data for meteorological and climatological applications.
- **Participants**: Around **150 participants** from various countries, including **national participants**, will attend.
  - The conference will bring together **meteorologists, earth scientists, satellite operators, and students** from across the Asia-Oceania region and globally.

Key Highlights:

- **Training Workshop**: A two-day event (**December 2-3, 2024**, at IMD, New Delhi) focusing on the application of current satellite data for meteorological and climatological purposes.
- **Plenary and Scientific Sessions**: Three days of sessions addressing topical issues such as satellite data utilisation, weather analysis, climate monitoring, and disaster mitigation.
- **Joint Coordination Meeting:** A meeting of Regional Association RA-II and RA-V on December 7, 2024.

CE20 Cryogenic Engine Passes Critical Test

Sub Topic- *Achievement in the field of Space Technology*

Context:

The **Indian Space Research Organisation (ISRO)** has achieved a significant milestone in its space program with the successful **sea-level hot test** of the **CE20 Cryogenic Engine**, which has been developed indigenously.

More on News:

- The test was conducted on **November 29** in **Mahendragiri, Tamil Nadu**, and the results were confirmed after a thorough analysis.
- The test confirmed the successful performance of the engine, which powers the **upper stage** of ISRO's **LVM3 launch vehicle**.
- The CE20 engine has been instrumental in missions such as **Chandrayaan-2**, **Chandrayaan-3**, and will play a crucial role in ISRO's upcoming **Gaganyaan mission**, India's first human spaceflight attempt.

Key Highlights:

- **Engine Success**: The CE20 engine has successfully powered the upper stage of **six LVM3 missions** and will enhance the **payload capability** of future missions, including **Gaganyaan**.
- **Complex Testing**: Testing the engine at sea level is particularly challenging due to factors like **multi-element ignitor** and **water injection systems** at the nozzle divergent to prevent flow separation.
  - ISRO also developed an innovative **Nozzle Protection System**, which

enables a **cost-effective and less complex** acceptance testing procedure for cryogenic engines.

- **Restart Capability**: One of the significant challenges in cryogenic engine technology is restarting the engine. ISRO has overcome this by demonstrating **vacuum ignition** without nozzle closure in previous ground tests, showcasing its advanced engineering capabilities.

Significance:

- The successful test of the CE20 cryogenic engine is a testament to ISRO's advanced engineering capabilities and its **commitment to self-reliance in critical space technologies**.
- This milestone **paves the way for more efficient engine testing** and ensures the reliability of ISRO's launch vehicles for future missions.

Dedicated Space Parks

Sub Topic- *Achievement in the field of Space Technology*

Context:

The central government is exploring options related to the establishment of **dedicated spaces for the manufacturing and production of space components**.

About Dedicated Space Parks:

- It has been recommended by the **Indian Space Association** (**ISpA**), the apex industry body for **space and satellite companies**.
- Dedicated space parks would be used for the **Indigenous development of space-based components** that would reduce **import bills** and **dependence on foreign space agencies**.
  - The main areas within space technology include **satellite communications**, **earth observation**, **positioning and navigation**, **ground systems**, **launch vehicles**, **geospatial satellite services**, and **aerospace defence manufacturing**, among others.
- These parks would also serve as a nudge for **enhancing India's share** in the **global space economy**.
  - The global space economy is projected to grow almost three times between 2023 and 2035, nearly doubling the rate of **global GDP growth**, according to the **World Economic Forum**.
  - In contrast, **India's space economy** is valued at **2% of the global market**. The Indian government aims to increase this to **$44 billion by 2033**, with **$11 billion expected from exports**, representing a 7-8% share of the global space economy.
  - India currently has around **250 startups** operating in various sectors of the space economy.
  - In October, the **Cabinet** approved a **₹1,000 crore Venture Capital Fund** specifically for the space sector, managed by **IN-SPACe**.
  - This fund is expected to run over the **next five years**, supporting **40 startups with strategic investments** and helping to retain space companies based in India.
- In 2019, **Kerala** announced plans to establish a park in **Thiruvananthapuram** as part of a **public-private partnership project**. However, progress has been minimal, and the state has not yet issued the construction tender.

Private Space Parks:

Ananth Technologies has opened **India's largest private spacecraft manufacturing facility** in **Bengaluru**. The facility spans 15,000 square metres and consists of four separate modules. It is situated within the Aerospace Park managed by the Karnataka Industrial Areas Development Board.

Role of Private Sector Under Indian Space Policy 2023:

- **Non-governmental entities** (NGEs) will be permitted to engage in comprehensive activities within the space sector by **establishing and operating space objects**, **ground assets**, and related services such as **communication**, **remote sensing**, and **navigation**. Their operations will adhere to guidelines set by IN-SPACe. NGEs are encouraged to:
  - Provide national and international space-based communication services using their own, procured, or leased **Geostationary** (**GSO**) or **Non-Geostationary** (**NGSO**) **communication satellites**.
  - Set up and manage ground facilities for space operations, including **Tracking**, **Telemetry**, and **Command** (**TT&C**) **Earth Stations** and **Satellite Control Centres** (**SCCs**).
  - Utilise both **Indian and foreign orbital resources** to establish communication satellites for services within India and abroad.

- **Create and operate remote sensing satellite systems using their own**, procured, or leased satellites, both in India and internationally.
- **Manufacture and operate space transportation systems**, including launch vehicles and shuttles, while designing reusable and recoverable technologies for space transport.
- **Engage in the commercial recovery of resources from asteroids or other space sources**.

IIT Madras Brain Mapping Initiative

Sub Topic- *IT & Computers, Biotechnology*

Context:

Researchers at the **Indian Institute of Technology-Madras (IIT-Madras)** have developed a unique **cellular-level map** of growing **foetal brains**.

- This map, named **Dharini**, provides a detailed 3D visualisation of the developing human brain, created from cross-sections of stillborn babies in the second trimester of pregnancy.

Comparison with Global Projects:

- **Allen Brain Institute's human brain atlas (2016)**: A 3D map of a female adult brain.
- **BRAIN Initiative (USA)**: Aiming to map brain functions using advanced neurotechnologies.
- **European Human Brain Project**: Focused on digital brain research for understanding brain structure and function.
- **Brain/MINDS (Japan)**: Investigating higher brain functions and improving treatments for neurological disorders.

Key Highligts:

- **Granular Dataset**: The researchers utilised the brains of five stillborn babies at different stages of gestation (4, 17, 21, 22, and 24 weeks). The dataset comprises 5,132 plates of cross-sections at cellular resolution.
- **Technological Innovation**: IIT-Madras developed its own equipment and processes for this project, including a brain-freezing platform, automated slicing and staining systems, and high-resolution scanners.
- **Open Access**: The data is freely available to researchers, students, and others worldwide, fostering collaboration and advancing neuroscience research.

How This Helps Neuroscience?

- **Understanding Brain Development**: This dataset helps researchers study how the brain grows and its relation to **neurological diseases**.
- **Applications for Disorders**: Insights from the dataset could lead to understanding the causes of **developmental disorders** like autism or conditions like **cerebral palsy** caused by hypoxia.
- **Potential for Mental Health**: It could also help explore how **adult brain disorders** (e.g., depression, anxiety) develop and their relation to early brain development.

Significance:

- **Early Diagnosis**: The detailed mapping can aid in the early diagnosis of developmental disorders such as autism and learning disabilities.
- **Global Impact**: By making the data open access, IIT-Madras is contributing to global scientific progress and positioning India as a leader in brain mapping technology.

GenCast

Sub Topic- *IT & Computers, Indigenization of Technology, Scientific Innovations & Discoveries*

Context:

Google DeepMind's new weather prediction model, GenCast, has the potential to **outperform traditional forecasting systems** in certain situations.

- It uses a **diffusion model approach**, similar to AI image generators, to produce multiple forecasts, capturing the complexity of atmospheric behaviour.

Traditional Weather Forecasting:

- Traditional weather forecasting involves **numerical simulations** of the atmosphere, using **general circulation models (GCMs)**, which require substantial computing power and are run on high-performance supercomputers.
- These simulations predict weather by solving equations based on the fundamental physical laws of nature, with slight variations in initial conditions to account for measurement uncertainty

- **Limitations:** Typically use **neural networks** to learn patterns from historical data. However, they tend to produce **smoother** forecasts that lose detail over time, not reflecting the true variability observed in natural weather systems.

Overview of GenCast:

- **GenCast** mitigates the smoothing effect by generating **multiple forecasts**. These individual forecasts are more dynamic and resemble the complexity seen in actual weather systems.
- The model then averages the different forecasts to create the best estimate of future weather. The **variation between forecasts** shows the level of uncertainty in the predictions.
- **GenCast** has been **shown to produce more accurate forecasts than** the European Centre for Medium-Range Weather Forecasts (**ECMWF**), the best traditional forecasting system.

How GenCast Works?

- **Training Data and Method**: GenCast is trained using **reanalysis data** from 1979 to 2018, produced by general circulation models and adjusted to align with actual historical weather observations.
  - It predicts several atmospheric variables—temperature, pressure, humidity, and wind speed—across 13 different heights on a grid divided into **0.25-degree regions** of latitude and longitude.
- The model begins with **random noise** representing the future state of the atmosphere, then applies a neural network to identify patterns that align with the current and past weather conditions. Multiple forecasts can be generated by varying the initial random noise.
- **Faster and More Efficient**: Forecasts are produced up to **15 days** into the future, taking only **8 minutes** to complete using a **tensor processor unit (TPU)**.
  - This is vastly faster than general circulation models, which can take hours or even days to run on supercomputers. Training the GenCast model took just **five days** using 32 TPUs.

Applications and Impact:

- **Disaster Preparedness**: More accurate predictions of extreme weather events can help authorities issue timely warnings, potentially saving lives and reducing property damage.
- **Renewable Energy**: Improved forecasts for wind patterns can enhance the reliability of wind energy, supporting its broader adoption as a sustainable resource.
- **Climate Research**: GenCast provides valuable data for studying climate change and its impacts, contributing to global efforts to mitigate its effects.

Limitations for Climate Predictions:

- **Timeframe**: Weather forecasts deal with weeks or months into the future, assuming the environment (oceans, land, and ice) remains largely unchanged. Climate projections span decades, where such assumptions do not hold.
- **Data Dependence**: Weather prediction relies on current weather conditions for accurate forecasts, whereas climate predictions focus on statistical trends and future variables like carbon emissions, which have a broader impact over time.
- **Data Volume**: Weather forecasting is a "**big data**" problem, requiring vast observational data to train complex models. In contrast, climate projections are a "**small data**" problem, as relevant data for long-term climate change is limited and evolves slowly.

Implications:

- Techniques like **physics-informed neural networks** and using physics to set "ground rules" for models are potential solutions to the challenges in climate modelling.
- While machine learning is making strides in weather forecasting, **traditional physical laws** (fluid mechanics, thermodynamics) will remain crucial in both weather and climate prediction.

Extrachromosomal DNA

Sub Topic- *Achievement in the field of Biotechnology*

Context:

Recent studies have revealed that **extrachromosomal DNA (ecDNA)** is **present in up to 40% of cancer cell lines** and **90% of patient-derived brain tumour samples**, highlighting its **importance in cancer biology**.

More on News:

Published in the journal ***Nature*** by the **eDyNAmiC team**, these studies have shown that ecDNA challenges a fundamental law of genetics and

plays a crucial role in cancer progression and drug resistance.

Key Findings:

- **Prevalence of ecDNA**: In a study involving 15,000 cancer patients (from the **U.K.'s 100,000 Genomes Project**), ecDNA was found in **17%** of tumour samples, more prominently in liposarcomas, brain tumours, and breast cancers.
  - Its **prevalence increased post-chemotherapy** and **correlated with metastasis** and poorer outcomes.
- **ecDNA and Cancer Growth**: EcDNA often contains multiple copies of oncogenes, genes that drive cancer growth. These oncogenes are more active in ecDNA than in chromosomes, accelerating tumour growth and drug resistance.

What is ecDNA?

- Extrachromosomal DNA was **first identified 50 years ago** as small fragments in cancer cells, **initially thought to be unimportant** because it **appeared** in **only 1.4% of tumours**.
- **Formation**: EcDNA forms when DNA breaks away from chromosomes due to processes like chromothripsis or replication errors, creating circular structures that float in the nucleus.
- A study identified **environmental factors (smoking, exposure to certain substances)** and **genetic mutations** as **triggers for ecDNA formation**.

Challenging Mendel's Law:

- Traditionally, scientists have understood that genes located on the same chromosome are inherited together, while those on different chromosomes are distributed independently. This is known as Mendel's third law of **independent assortment**.
- However, the study revealed that **ecDNA behaves differently during cell division**.
  - Instead of being randomly distributed, **ecDNA clusters together** and is passed on to daughter cells as a group.
    - This clustering, referred to as the **"jackpot effect,"** allows cancer cells to **enhance gene interactions** and **preserve favourable genetic combinations** across multiple cell generations.
- This **discovery overturns the assumption** that gene **inheritance is random** when genes are located on different chromosomes, **providing cancer cells with an evolutionary advantage**.

Implications for Cancer Treatment:

- Understanding how ecDNA contributes to tumour growth and drug resistance can lead to the **development of targeted therapies** that specifically address these mechanisms.
- **Boundless Bio**, a biotech company is working on translating these findings into clinical treatments to target ecDNA vulnerabilities, especially for cancers like glioblastoma, ovarian, and lung cancers, where existing treatments often fail.

AI in the Fight Against Tuberculosis (TB)

Sub Topic- *Achievement in the field of Artificial Intelligence*

Context:

The fight against **tuberculosis (TB)**, a treatable yet underdiagnosed disease, could see significant improvements through the use of **artificial intelligence (AI)**, especially in countries like **India**, which accounts for about 25% of the global TB burden.

Current TB Burden in India:

- India reported **2.17 million TB cases** between January and October this year, highlighting the need for improved diagnosis.
- **Access to healthcare services** remains a challenge, especially in rural areas, contributing to the underdiagnosis of TB.

AI's Role in TB Diagnosis:

- **Salcit Technologies** has developed an AI product called **Swaasa**, which analyzes **cough sounds** to assess lung health and detect TB.
  - **Collaboration with Google:** Salcit Technologies is exploring the use of **Google's Health Acoustic Representations (HeAR)** bioacoustic foundation model to improve TB screening across India.
    - HeAR is designed to help build AI models that can **listen to human sounds** and detect early signs of

diseases, potentially extending TB screening.

- Swaasa can work on various devices like smartphones, tablets, and laptops, providing **cost-effective and accessible tests** for larger populations, especially in remote areas.
  - **Swaasa** has already been deployed in some districts by the **Karnataka Health Promotion Trust (KHPT)** to enhance the quality of **presumptive TB case screenings**.
  - The platform has conducted over **300,000 lung health assessments** and is being explored for broader deployment, including in **North East India**.

AI's Impact on Healthcare:

- AI is seen as a transformative technology in preventing, diagnosing, and treating diseases. Salcit Technologies and partners believe that AI can **radically change the healthcare landscape** by improving diagnostic and screening capabilities.
- **Google's AI models** are also being used in **mobile screenings** for **TB**, **lung cancer**, and **breast cancer**, assisting radiologists with image recognition.
- **Apollo Radiology International** (ARI) uses AI for mobile screenings, significantly improving diagnostic accessibility.

Challenges in TB Diagnosis:

- **Chest X-rays** are commonly used for TB screening, but there is a shortage of trained radiologists to interpret images, especially in rural or underserved areas.
- **Limited availability** of diagnostic tests in these regions furher complicates TB diagnosis.

Google's Impact in Other Health Areas:

- Google has also **licensed** its **diabetic retinopathy AI model** to partners like **Forus Health** and **AuroLab** in India.
  - The model supports **AI-assisted screenings** for diabetic retinopathy, aiming for **six million screenings** in India and Thailand over the next decade, with **no cost to patients**.

K9 Vajra-T

Sub Topic- *Achievement in the field of Defence Technology*

Context:

The **Ministry of Defence (MoD) signed a Rs 7,628.70 crore** (Rs 76.28 billion) **contract** with **Larsen & Toubro (L&T)** for the **procurement of 100 additional K9 Vajra-T** self-propelled tracked artillery guns for the Indian Army.

According to a report by the **Parliamentary Standing Committee on Defence**, **88%** of capital acquisition contracts (for defence equipment) signed between **FY20 to FY24** and **FY25** (up to September 2024) were with **Indian vendors**.

Key Highlights:

- This procurement is part of the **Aatmanirbhar Bharat** (self-reliant India) initiative and falls under the **'Buy (Indian)'** category.
- The contract will result in the procurement of **100 K9 Vajra-T guns**, which will form **five regiments**.
- The new batch of guns will **enhance the Indian Army's artillery capabilities**, improving firepower, precision strikes, and operational readiness.

About:

- The **K9 Vajra-T** is an advanced variant of the K9 Thunder, a state-of-the-art **155 mm/52 calibre Self-Propelled Tracked Artillery Gun** developed by Larsen & Toubro (L&T) in partnership with South Korea's Hanwha Defence.
- **Capabilities**:
  - **Versatile and mobile**: The K9 Vajra is described as a versatile artillery gun with **cross-country mobility**, able to operate across varied terrains.
  - **High firepower**: The gun is capable of **long-range precision strikes**, delivering **lethal fire with high accuracy** and a higher rate of fire.
  - **Extreme conditions**: The K9 Vajra can operate in **sub-zero temperatures** and high-altitude areas.
    - This makes them a critical addition to India's defence arsenal, particularly for deployment along the strategically sensitive Line of Actual Control (LAC).

Impact:

- **Enhanced Firepower**: The K9 Vajra will significantly boost the Indian Army's strike capabilities in all terrains.
- **Employment Generation:** The project is expected to generate over nine lakh man-days of employment over four years, involving active participation from Indian industries, including MSMEs.

Subject - Environment, Bio-diversity and Disaster management

Moths' Use of Plant Sounds for Egg Laying

Sub Topic- *Biodiversity*

Context:

A recent study conducted by a team of researchers from Tel Aviv University in Israel, the study titled ***"Female Moths Incorporate Plant Acoustic Emissions into Their Oviposition Decision-Making Process"*** sheds light on how these insects use acoustic signals to choose where to lay their eggs.

> ***Moths** are fascinating insects belonging to the **order Lepidoptera**, which they share with their **close relatives, butterflies**. While often overshadowed by butterflies, moths **play crucial roles** in **ecosystems as pollinators, prey for other animals,** and **indicators of environmental health.***

Key Findings:

- **Plant Sounds Influence Egg-Laying**: The researchers found that female moths of the species **Egyptian cotton leafworm** can hear sounds emitted by stressed plants. These sounds, which are undetectable to the human ear, play a crucial role in the moths' decision on where to lay their eggs1.

- **Preference for Healthy Plants**: In experiments, female moths showed a preference for laying eggs on healthy, hydrated plants rather than those emitting distress signals. This indicates that moths can distinguish between healthy and stressed plants based on acoustic cues.
- **Acoustic Interaction**: This study is the first to demonstrate an acoustic interaction between moths and plants, suggesting that plants emit various sounds that insects can interpret.

Implications:

- The findings highlight the **complexity of plant-insect interactions** and suggest that plants communicate with insects through sound, especially under stress conditions like dehydration.
- Understanding these interactions can provide **insights into ecological dynamics** and **help develop new strategies for pest management**.

Conclusion:

The study opens up new avenues for research into how insects perceive and respond to their environment. By uncovering the role of acoustic signals in moth behaviour, scientists can better understand the intricate relationships between plants and insects.

United States Eradicate 'Murder Hornets'

Sub Topic- *Biodiversity*

Context:

The **Northern giant hornet** (Vespa mandarinia) has been eradicated in the United States, according to the Department of Agriculture (USDA). It was first spotted in Washington state near the Canadian border in **2019**.

More on News:

The public played a crucial role in the eradication effort by reporting sightings and agreeing to place traps at their residences. This community involvement was instrumental in locating and eliminating the nests.

Understanding the Threat of Murder Hornets:

- **Murder hornets**, **native to Asia**, first appeared in the United States in 2019 when they were spotted in Washington state near the Canadian border.
- These hornets, which can **grow up to 2 inches long**, pose a significant **threat to bees and agriculture**.

- They are known for their **powerful sting**, which can deliver almost seven times the amount of venom as a honey bee, and their ability to **decimate entire beehives within 90 minutes**.

Eradication Efforts:

- A coordinated effort by **state, federal, and international agencies** was launched to eradicate the hornets.
- The first task was to locate the hornet nests, which proved challenging as they were typically found in **forested areas** and **underground cavities**.
- **Tracking the Hornets**: Entomologists used **radio tags** on live hornets to track them back to their nests.
- **Nest Destruction**: Upon finding the nests, the team used **foam** to plug the nest, wrapped the tree in **plastic**, and **vacuumed** out the hornets. **Carbon dioxide** was used to kill any remaining hornets.

Impact and Future Outlook:

- The USDA declared the eradication of murder hornets after three years without any confirmed sightings. While this is a significant achievement, officials remain vigilant, as the **hornets could potentially reappear**.
- The eradication of murder hornets is a testament to what can be achieved when agencies and communities unite towards a common goal. Continuous vigilance is necessary to prevent the re-introduction of these invasive insects.

BioE3 Policy

Sub Topic- *Conservation*

Context:

The policy aligns with India's vision of **Green Growth** (from the 2023-24 Union Budget) and the **Lifestyle for Environment (LiFE)** initiative, promoting sustainability.

More on News:

- The policy is also aligned with the **Prime Minister's vision** of a **Net-Zero** carbon economy.
- The **Biomanufacturing and Biofoundry initiative** was introduced as part of the **2024-25 Interim Budget**.

Policy Overview:

- The **BioE3 Policy** (Biotechnology for Economy, Environment, and Employment) is a comprehensive framework introduced by the Union Cabinet on **24th August 2024** to promote sustainable biomanufacturing and boost the bioeconomy.
- **Objective**: To promote cutting-edge biomanufacturing technologies, enhance sustainability, and improve the quality of bio-based products.
- **Purpose:** It focuses on fostering high-performance biomanufacturing across various sectors, boosting innovation and commercialising bio-based products.

Key Features:

- The BioE3 policy aims to position India as a global leader in **biomanufacturing** through the establishment of **Bio-Enablers**, such as **Bio-AI Intelligence Hubs**, **Biofoundries**, and **Biomanufacturing Hubs**.
  - **Bio-AI Hubs** will focus on data-driven research and AI-informed predictive analytics to support bio-based product technologies.
  - **Biofoundries** and **Biomanufacturing Hubs** will provide infrastructure for scaling up technologies related to bio-based products.
    - The BioEnablers will also **focus on training and internships to build a skilled workforce** with interdisciplinary technical expertise for biomanufacturing.
- **Thematic Areas**: The hubs will support six key areas:
  - Bio-based chemicals and enzymes
  - Functional foods and smart proteins
  - Precision biotherapeutics
  - Climate-resilient agriculture
  - Carbon capture and utilisation
  - Futuristic marine and space research
- **Marine and Space Research**: To develop **life support systems for astronauts** using biomanufactured organisms like **algae and plants** and **biomanufacturing** of novel compounds and **enzymes from marine organisms for use in pharmaceuticals and cosmetics**.

Achievements and Economic Impact:

- **Contribution to GDP**: Significantly **boost India's bioeconomy**, which already contributed **4.25% to the GDP**, reaching $151 billion in 2023.

- This growth is further evidenced by the **increase in biotech startups**, from **50 in 2014 to over 8,500,** marking a significant rise in innovation and entrepreneurship within the sector.

- Additionally, the Department of Biotechnology (**DBT**) and the Biotechnology Industry Research Assistance Council (**BIRAC**) have launched a joint call for proposals to set up **"मूलांकुर BioEnablers – Biofoundries and Biomanufacturing Hubs"**.

Significance:

- **Environmental Alternatives**: Biotechnology offers environmentally friendly alternatives to traditional products and industrial processes:
  - **Animal-free milk**: Produced using precision fermentation, offering lower carbon footprints, greater accessibility, and higher nutritional value.
  - **Bioplastics**: Polylactic acid bioplastics are made from renewable materials like corn starch or sugarcane, offering a biodegradable alternative to traditional plastics.
- **Carbon Capture**: Microorganisms, such as certain bacteria and algae, can capture and break down carbon dioxide from the atmosphere, converting it into useful compounds like **biofuels** instead of using traditional chemical processes.
- **Synthetic Biology**: The development of novel organisms and biologics (like proteins and enzymes) tailored for specific functions, which can be applied in areas like organ transplantation or pharmaceuticals.
- **Organ Engineering:** Growing organs in laboratories through organogenesis could reduce reliance on organ donors for transplants.

Ratapani Wildlife Sanctuary

Sub Topic- *Conservation*

Context:

The **Ratapani Wildlife Sanctuary** in Madhya Pradesh was officially declared a **tiger reserve** after receiving in-principle approval from the **Ministry of Environment, Forest, and Climate Change** through the **National Tiger Conservation Authority (NTCA)**.

More on News:

- The notification was issued under **Section 38V of the Wildlife (Protection) Act, 1972**, recognising the **core area** as a **critical tiger habitat.**
- This declaration follows the **Madhav National Park** also receiving approval to be declared a tiger reserve. The formal notification for Madhav is expected within 15 days of **December 1**.

About Ratapani Wildlife Sanctuary:

- **Location and Geography:**
  - Ratapani Wildlife Sanctuary is situated in the **Raisen and Sehore districts of Madhya Pradesh**, within the **Vindhya Range**, less than 50 kilometres from Bhopal.
  - It spans a **total area of 1,271.4 square kilometres**, including a **core area of 763.8 square kilometres** and a **buffer area of 507.6 square kilometres**.
  - The sanctuary runs parallel to the **northern side of the Narmada River**, with the **Kolar River forming its western boundary**.
- **Tiger Reserve Status:**
  - Ratapani is the **eighth tiger reserve in Madhya Pradesh, home to over 60 tigers**.
  - This status brings funding from the **National Tiger Conservation Authority** (NTCA), ensuring better management and conservation efforts.
- **Biodiversity:**
  - The sanctuary hosts a wide range of wildlife, including the apex predator **tiger, panthers, hyenas, jackals, wild dogs,** and **chinkaras**.
  - **Endangered species like the chinkara** and a **variety of aquatic and terrestrial fauna**, including **crocodiles**, thrive here.
- **Flora and Landscape:**
  - Ratapani features **dry and moist deciduous forests**, with about **55% of the area covered** by **teak** and other mixed dry deciduous species.
  - **Its rugged terrain** includes **hills, valleys, plateaus, plains**, and **significant water bodies** like the **Ratapani** and **Dahod reservoirs**.
- **Historical and Cultural Significance:**
  - The sanctuary encompasses the **Bhimbetka Rock Shelters**, a **UNESCO**

World Heritage Site, showcasing rock paintings over 30,000 years old.

- Other notable landmarks include **Ginnourgarh Fort**, **POW camp**, **Keri Mahadeo**, and **Ratapani Dam**.

- **Economic and Ecotourism Impact:** Tiger reserve status is expected to boost **eco-tourism, attract visitors, and provide employment** opportunities for local communities.

Impact on Local Villages:

- The reserve includes **nine revenue villages** covering **26.947 square kilometres**.
- These villages are integrated into the **buffer zone**, ensuring that the **rights of local villagers** remain unaffected by the tiger reserve status.

World Soil Day: The Importance of Soil Health and Nutrient Circularity

Sub Topic- *Conservation*

Context:

World Soil Day (5, December 2024) emphasises the need to address India's soil health crisis to ensure sustainable ecosystems, food security, and climate resilience. Nutrient circularity offers a promising solution by turning organic waste into a resource.

- This year's **theme**, "**Caring for Soils: Measure, Monitor, Manage**," highlights the critical role of accurate soil data and information in understanding soil properties and enabling informed decisions for sustainable soil management, which is essential for ensuring food security.

India's Soil Health Crisis

- **Widespread Nutrient Deficiencies**: Around 90% of India's topsoil is deficient in nitrogen and phosphorus, while 50% lacks potassium.
- **Major Challenges**: Soil erosion, degradation, and low nutrient and carbon content affect long-term agricultural sustainability.

Nutrient Circularity: A Multi-Solving Strategy

- **Definition**: The process of collecting, processing, and returning nutrients from urban organic waste to agricultural soil.
- **Key Benefits**: Replenishes soil nutrients, reduces waste, and supports circular economies at various scales.

Challenges with Waste-to-Energy (WtE) Technologies

- **Dominance of Incineration Plants**
  - **Prevalence**: Incineration accounts for 81% of WtE technologies, such as Delhi's reliance on it for waste management.
  - **High Costs and Failure Rates**: Plants have high capital and operational expenses, with 50% failing over time.
  - **Environmental and Health Concerns**: Emit significant greenhouse gases (1707 g CO_2e/kWh) and toxic byproducts.
  - **Regulatory Issues**: Lack of stringent standards and real-time monitoring.
- **Biomethanation Plants**
  - **Challenges**: High failure rates due to poor waste segregation and maintenance.
  - **Methane Leakages**: Risks of significant greenhouse gas emissions.
  - **Minimal Contribution**: WtE plants generate only 0.1% of India's renewable energy.

Reimagining Waste Management with Nutrient Circularity

- **Organic Waste and Nutrient Flows**: Urban waste represents lost nutrients that can be recovered and returned to rural soils.
- **Composting**: Converts organic waste into compost, rich in organic carbon (~20%), enhancing soil fertility and reducing reliance on chemical fertilisers.
- **Cost Efficiency**: Composting with fertilisers reduces production costs by 15–20% per hectare.

Policy Support and Shortcomings

- **2016 City Compost Policy**: Introduced subsidies for compost but lacked quality assurance, testing standards, and public demand creation.
- **Policy Withdrawal in 2021**: Allocations for composting were reduced to zero, focusing solely on bio-methanation.

Successful Models of Nutrient Circularity

- **City-Farmer Partnership (Chikkaballapur, Karnataka)**: Converted 759 tonnes of waste into compost for 109 farmers across 17 villages.

- **Hub and Spoke Model (Alappuzha, Kerala)**: Facilitates compost transfer from urban hubs to rural areas.

Way Forward: Scaling Nutrient Circularity

- **Top-Down Policy Push**: National-level policies to promote compost quality, testing standards, and certifications.
- **Bottom-Up Public Demand**: Encourage farmer and community participation to increase compost adoption.
- **Gradual Phase-Out of Chemical Fertilisers:** Nutrient circularity can reduce dependence on chemical inputs over time.

Subject - Internal Security

RBI is leveraging AI to crack down on 'mule bank accounts'

Sub Topic- *Money Laundering, Challenges to Internal Security Through Communication Networks*

Context:

The Reserve Bank of India **(RBI) is leveraging artificial intelligence (AI)** to combat the growing issue of "mule" bank accounts, used by criminals for laundering illicit money.

About RBI's Initiative:

- The **RBI's innovation subsidiary, the Reserve Bank Innovation Hub (RBIH),** has **developed MuleHunter.AI,** an advanced AI-powered model to detect and address this problem effectively.
- The model has shown **promising results in a pilot with two large public sector banks,** and banks have been encouraged to collaborate with RBIH to enhance its capabilities.

What Are Mule Bank Accounts?:

- Mule accounts are **bank accounts co-opted by criminals to facilitate illegal activities such as money laundering.** These accounts are often purchased from individuals, typically those from lower-income groups or with limited technical knowledge.
- The **term "money mule" refers to individuals unknowingly** used by criminals to move stolen or illicit funds. When these cases are discovered, the account holders often face scrutiny while the actual perpetrators evade detection.

Magnitude of the Problem in India:

Mule accounts are central to most financial frauds in India. Recently, the **government froze 4.5 lakh** such accounts involved in laundering proceeds of cybercrimes. Key statistics include:

- 40,000 accounts detected in the State Bank of India (SBI).
- 10,000 in Punjab National Bank.
- 7,000 in Canara Bank.
- 6,000 in Kotak Mahindra Bank.
- 5,000 in Airtel Payments Bank.

Measures by RBI and the Government:

The RBI has been actively addressing the issue by issuing guidelines to strengthen cybersecurity and fraud prevention in banks. The **MuleHunter. AI** system is a cornerstone of these efforts, enabling efficient identification of mule accounts. Additionally, the RBI has launched a **"Zero Financial Frauds"** hackathon to encourage innovative solutions targeting mule accounts.

Government initiatives have included:

- Regular meetings with stakeholders like the **Indian Cybercrime Coordination Centre (I4C), NABARD, and banks to discuss strategies against digital fraud.**
- Encouraging **banks to adopt AI/ML** tools for real-time mule account detection.
- Training bank staff on fraud prevention.
- Exploring restrictions on suspicious withdrawals, such as limits on dormant accounts that suddenly see significant activity.

The **Department of Financial Services has emphasized adopting cutting-edge technology,** fostering inter-bank collaboration, and using solutions like MuleHunter to bolster fraud detection.

Species in News

Indian Star Tortoise

Context:

Researchers from the **Wildlife Institute of India and Panjab University** have **identified two genetically distinct groups** of **Indian star tortoises: northwestern India** and **southern India**.

More on News:

- Researchers **collected tissue samples from 14 locations**, including 38 from northwestern India and 44 from southern India.
- The study involved **mitochondrial gene sequencing (cytochrome B and NADH dehydrogenase 4)** and microsatellite markers to analyse genetic diversity and population relationships.

Key Findings:

- **Northwestern group**: Largely genetically unchanged despite poaching and illegal activities.
- **Southern group**: Highly genetically diverse.
- Confirmation of two distinct evolutionary units (ESUs) for conservation.
- **Conservation Impact**: The study provides reliable genetic evidence to **support better conservation efforts** for the Indian star tortoise, **benefiting both national** and **international wildlife agencies**.

Historical Evolution:

- The Indian star tortoise group (Geochelone) **spread** across the subcontinent **after its separation from the Gondwana supercontinent** and **collision with Eurasia**.
- **Evolution led to genetic divergence** due to changing habitats (arid savannahs in the north and humid forests in the south).

About the Indian Star Tortoise:

- **Scientific Name:** *Geochelone elegans*
- **Appearance**: The Indian star tortoise has an obsidian shell with yellow star patterns.

- **Habitat:** Native to arid regions in northwest India, South India, and Sri Lanka.
- **Diet**: Herbivorous, They feed on grasses, leaves, flowers, fruits, and occasionally insects, carrion, and dung.
- **Lifespan**: 25-80 years
- **Size**: 15-38 cm (6-15 inches) in length
- **Conservation Status**: The species is endangered and listed in **Appendix I of CITES** and **Schedule I of the Wildlife (Protection) Act 1972**, offering it the highest protection under Indian law.
- **Illegal Pet Trade**: The Indian star tortoise is in high demand as an exotic pet, contributing to a global wildlife trafficking network.
  - It is **illegally trafficked across international borders**, including through airports in **Chennai** and **Singapore** and the **India-Bangladesh border**.
- **Threat of Unscientific Releases**: The release of confiscated tortoises into the wild could worsen their survival, according to wildlife biologists.
- **Challenges in Captivity**: Tortoises bred in captivity may develop pyramid-shaped shells (due to nutritional deficiencies), complicating breeding and survival in the wild.
- **Call for Public Awareness**: Need for greater awareness regarding the legality of keeping exotic species as pets and adhering to conservation laws.

Conservation Recommendations:

- **Do not mix** the **northwestern and southern populations** when releasing confiscated tortoises to preserve genetic diversity and improve breeding.
- Caution against the problem of shell pyramiding in captive-bred tortoises, caused by nutritional deficiencies, which can affect breeding.

Wroughton's Free-tailed Bat

Context:

A **Wroughton's Free-tailed Bat** has been **sighted at the Yamuna Biodiversity Park (YBP) in north Delhi**, marking the first-ever record of this rare species not just for Delhi-NCR, but for northern India as well.

More on News:

- This sighting adds a **15th unique bat species to the region**.
- The capital already hosts **14 bat species**, though **four species** — the **Indian False Vampire**, **Black-bearded Tomb Bat**, **Egyptian Free-tailed Bat**, and **Indian Pipistrelle** — have been considered **locally extinct**.

About:

- **Scientific Name:** *Otomops wroughton*
- The species is easily identifiable by its **large size**, **huge ears** extending beyond its muzzle, and **bicoloured velvet fur**.

- It typically roosts in **dark, damp, and slightly warm caves** in moderate colony sizes.
- The species plays an **ecological role** by regulating **insect populations** and also **assists in pollination**.
- **Conservation Status:** Initially, the species was considered **critically endangered** due to its limited population in the **Western Ghats**. However, following the discovery of other colonies in **Meghalaya**, **Cambodia**, and other areas, its status was changed to **data deficient** on the **IUCN Red List** in 2000.

Conservation Efforts and Impact:

- The discovery highlights the success of **two decades of ecological restoration** in the region, which have contributed to the establishment of **specialised ecological niches**.
- Notably, the **Aravali Biodiversity Park**, another area managed by the DDA, has become the only known roosting site for the **Blyth's Horseshoe Bat** in Delhi.

Conclusion:

This sighting of the **Wroughton's Free-tailed Bat** is a testament to the success of scientific interventions and **ecological restoration** efforts in **Delhi**. It demonstrates how **re-wilding** and restoration can help species reclaim their historical habitats, providing hope for the return of more rare species in the future.

Puffin Bird

Context:

The puffin, a seabird, is recently in the news for **being the fastest-hunting bird, surpassing even the eagle.**

- It is known for **catching multiple fish** at once and carrying them in its beak.

About the Puffin Birds:

- **Nicknames:** Known as **"sea parrots" or "clowns of the sea"** due to their large, parrot-like beaks and comical appearance.
- **Size:** Puffins are **small seabirds**, measuring about **25 cm in length.**

- **Habitat**: Puffins spend most of their lives **out at sea and are found along the eastern coast of Canada and the United States**, extending to the western coast of Europe.

Features:

- **Beak Colour**: The puffin's **beak changes colour, turning dull grey** in winter and bright **orange in spring**, possibly to attract mates.
- **Diet**: Puffins are **carnivores**, feeding on **small fish such as herring, hake**, and sand eels.
- **Flying Skills**: Puffins are excellent flyers, **flapping their wings up to 400 times per minute** and reaching speeds of 88 km/h.
- **Swimming Abilities**: Puffins can **dive 60 meters underwater**, using their webbed feet as rudders to chase fish.
- **Breeding**: Puffins **nest in burrows on coastal cliffs, laying one egg.** Both parents incubate the egg for 36-45 days. Puffins often mate with the same partner for many years.

- **Lifespan**: They live for **about 20 years**, though their main predators include gulls that can snatch puffins mid-flight.

Other Related Species:

- **Common Puffin**: Found along Atlantic coasts, **about 30 cm in length**, with black above, **white below, and a colourful beak.**
- **Horned Puffin: Found in the Pacific**, similar to the common puffin but with distinct features.
- **Tufted Puffin** A southerly Pacific species with **red legs, a white face, and unique straw-colored plumes.**

IUCN Status:

- **Common Puffin**: Vulnerable (IUCN Red List)
- **Horned Puffin**: Least Concern (IUCN Red List)
- **Tufted Puffin**: Vulnerable (IUCN Red List)

Threats:

While not endangered, **puffin populations are declining due to overfishing and pollution**, especially oil spills that damage their waterproof feathers.

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