Freedom UPSC

TOGETHER WE SCALE HEIGHTS

Daily Current Affairs

To The Point

by Dhananjay Gautam

Table Of Content

25 Feb 2025

GS Paper 3 – Science & Technology

1 Microsoft's Majorana 1: A Quantum Leap in Computing with Topological Qubits

Context: Microsoft has unveiled **Majorana 1**, a groundbreaking quantum computing chip engineered using a **new state of matter**. This innovation could fast-track the development of powerful quantum computers, bringing them to industrial-scale problem-solving by **2027-2029**, instead of waiting decades. However, Microsoft has yet to release any performance benchmarks for this new technology.

Microsoft's Unique Quantum Computing Strategy:

For over **two decades**, Microsoft has been pioneering **topological qubits**, a highly stable form of qubits that require **less error correction** than conventional quantum bits.

What Are Topological Qubits?

- **More stability**: Unlike regular qubits, which are prone to errors, topological qubits store information in the **arrangement and braiding** of exotic particles called **anyons**, rather than in the particles themselves.
- **Anyons** are unique two-dimensional quantum particles that are neither fermions nor bosons, possessing special statistical properties.

Challenges in Developing Topological Qubits:

The journey to creating these qubits was steep, as it required the discovery of **Majorana fermions**, particles that are their **own antiparticles**—a concept first theorized over **80 years ago** by **Ettore Majorana**.

What Are Majorana Zero Modes (MZMs)?

- **Majorana zero modes** are special quantum states appearing at the ends of certain **topological superconductors**.
- These states exist at **zero energy**, acting as both **matter and antimatter** simultaneously.
- Due to their unique properties, they are promising candidates for **fault-tolerant quantum computation**.

Building a New Quantum Material: Topoconductors:

To manufacture these advanced qubits, Microsoft developed **topoconductors**, a hybrid material combining **indium arsenide** (a semiconductor) and **aluminum** (a superconductor).

Why Are Topoconductors Important?

- Just as **semiconductors** enabled the rise of modern electronics, **topoconductors** could lay the foundation for scalable quantum systems.
- They could help scale up quantum computers to **one million qubits**, allowing them to tackle real-world industrial and scientific challenges.
- When cooled to **near absolute zero** and exposed to **magnetic fields**, these materials enable the creation of stable **topological qubits**.

Majorana 1: Microsoft's Breakthrough Quantum Chip

Microsoft's **Majorana 1** is an **eight-qubit** chip, making it smaller than rivals like **Google's Willow (106 qubits)** and **IBM's R2 Heron (156 qubits)**. However, its **Topological Core Architecture** holds the potential to scale quantum computers to the necessary **one million qubits** for solving **real-world problems**.

Design of Majorana 1:

- The chip features **aluminum nanowires** arranged in an **"H" shape**.
- Each **"H" structure** contains four **controllable Majorana particles**, forming **a single qubit**.

Potential Applications of Quantum Computing:

Microsoft envisions that Majorana 1 could drive **major scientific and industrial breakthroughs**, such as: **Breaking down microplastics** into harmless byproducts.

Developing **self-healing materials** for construction, manufacturing, and healthcare.

Accelerating AI research by using quantum computing to generate **synthetic data** for AI model training. Designing **new materials and molecules** using **natural language input** in AI-driven quantum simulations.

Challenges Ahead:

Despite its potential, quantum computing still faces significant hurdles:

- **Environmental interference** can introduce errors.
- Scaling up stable qubits remains a **technological challenge**.

Quantum Computers vs. Supercomputers vs. Classical Computers:

Classical Computers:

- Process information using **binary code (0s and 1s)**.
- Use **logic gates** like AND, OR, and NOT to manipulate data.

Quantum Computers:

- Use **qubits**, which can exist in **multiple states at once (superposition)**.
- Utilize **quantum gates** (like the **Hadamard and Pauli gates**) for computation, which are **reversible** in nature.

Supercomputers:

- Utilize **advanced GPUs and multi-core processing** to enhance **calculation speeds**.
- Still operate under **classical computing principles**.

Quantum vs. Supercomputers:

- **Supercomputers** only **speed up classical computations**, whereas **quantum computers** solve **entirely new classes of problems** that **classical and supercomputers cannot**.
- **Quantum gates** enable computing processes **beyond the scope of classical logic gates**.

Final Thoughts:

Microsoft's **Majorana 1** chip could be a **game-changer** in quantum computing, pushing the world closer to practical, large-scale quantum applications. With **topological qubits** showing promise in overcoming **error-prone limitations**, the future of **quantum computing** looks more **transformative** than ever.

GS Paper 2 – International Relations

2 Bay of Bengal Inter-Governmental Organisation: Strengthening Regional Fisheries Cooperation

Context: India has taken over the **Chairmanship** of the **Bay of Bengal (BOB) Inter-Governmental Organisation** from **Bangladesh** at the **13th Governing Council Meeting** held in **Malé, Maldives**. This marks a significant step in fostering regional collaboration in the **fisheries sector**.

Understanding the Bay of Bengal Inter-Governmental Organisation:

Established in **2003**, the **Bay of Bengal Inter-Governmental Organisation** is a **regional fisheries body** committed to supporting its member nations in enhancing **livelihood opportunities** and improving the **quality of life** for **small-scale and artisanal fisherfolk** in the **Bay of Bengal region**.

Historical Background:

- The organisation evolved from the **Bay of Bengal Programme**, initiated by the **Food and Agriculture Organization (FAO)** of the **United Nations (UN)** in **1979**.
- Over the years, it has established **international benchmarks** in **fisheries management**, delivering **tangible benefits** to member nations.

Member Nations:

- **Full Members**: **Bangladesh, India, Maldives, and Sri Lanka**.
- **Cooperating Non-Contracting Parties**: **Indonesia, Malaysia, Myanmar, and Thailand**.

Key Objectives:

The **Bay of Bengal Inter-Governmental Organisation** is dedicated to promoting **sustainable fisheries management** and **regional cooperation** through:

- **Raising awareness** about the importance of **marine fisheries management**.
- **Enhancing skills** through **training and education** programs.
- **Facilitating technology transfer** for the growth of **small-scale fisheries**.
- **Establishing a regional information network** for effective collaboration.
- **Encouraging women's participation** in the **marine fisheries value chain**.

Final Thoughts:

With **India at the helm**, the **Bay of Bengal Inter-Governmental Organisation** is set to strengthen **regional partnerships**, enhance **fisheries management**, and uplift **coastal communities**. The focus remains on **sustainability, innovation, and inclusivity**, ensuring a **prosperous future** for the **Bay of Bengal's marine ecosystem** and the people who depend on it.

GS Paper 3 – Environment & Ecology

3 Powering a Sustainable Future: Embracing Clean Energy Solutions

Context: The widespread use of **coal-based electricity generation** has long been a major contributor to **air pollution**, posing severe threats to both **human and animal health**.

Recent research from the **Stanford Doerr School of Sustainability** highlights that **nitrogen dioxide and ozone emissions** from **coal-fired power plants** have led to a **10% reduction** in **wheat and rice yields** in **India**—a loss equivalent to nearly **six years of average yield growth**.

The Environmental Toll of Coal-Based Power:

Coal-fired power plants have been a part of **India's energy landscape since 1920**, starting with the **first plant in Hyderabad under the Nizam's rule**. Today, **India's Ministry of Coal** estimates that the country has enough reserves to last for the next **120 years**. However, coal dependency comes at a heavy price, causing:

- ✓ **Severe air pollution**, leading to respiratory diseases and environmental damage.
- ✓ **Reduction in agricultural productivity**, impacting food security.
- ✓ **Degradation of ecosystems**, harming biodiversity and water resources.

Exploring Sustainable Alternatives:

1. Wind Energy – Harnessing the Power of the Wind:

- Wind turbines convert **wind energy** into **electricity**.
- **India's nine windiest states** generate a total of **50 GW** of wind power.
- The country ranks as the **fourth-largest wind energy producer globally**.
- **Private sector investments** play a crucial role in boosting wind power capacity.

2. Solar Energy – Capturing the Sun's Potential:

- **Solar panels** absorb sunlight and transform it into **electricity**.
- Widely used in **rooftop installations** and **large solar farms**.
- The **Central and State governments** offer **subsidies**, making solar power more affordable and accessible.

3. Hydroelectric Power – Energy from Flowing Water:

- **Dams** store and control **river water** to generate **electricity**.
- These projects also help in **irrigation**, ensuring water availability for **agriculture**.
- **India's top five hydroelectric dams** generate an impressive **50 GW** of power.

4. Osmotic Power – The Energy of River and Sea:

- Uses the **osmotic pressure difference** when **river water meets seawater**.
- Research from the **University of Sydney and Penn State** confirms its **feasibility**.
- With a **7,500 km coastline**, India has significant potential to harness **osmotic energy**.

5. Nuclear Power – A Reliable Energy Source:

- **Nuclear reactors** generate electricity through **nuclear fission**.
- **India currently operates eight nuclear power plants**, producing **3.5 GW** of electricity.
- Used primarily for **peaceful energy production**, ensuring **energy security**.

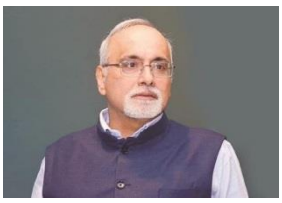
Conclusion:

The transition from **coal-based power** to **clean energy sources** is crucial for reducing **pollution**, improving **public health**, and preserving **the environment**.

India has access to multiple **sustainable alternatives**, including **wind, solar, hydroelectric, osmotic, and nuclear power**, which can collectively meet the country's growing energy demands. Encouraging **investment and innovation** in these sectors is essential to building a **clean, green, and sustainable future** for generations to come.

GS Paper 3 – Indian Economy

4 RBI Deputy Governor Warns Against 'Reckless Financialization'



Context: The **RBI Deputy Governor** has raised concerns over the **dangers of excessive financialization**, cautioning that the allure of **short-term gains** in financial markets can often overshadow the **long-term financial well-being** of individuals.

What is Financialization?

Financialization refers to the growing dominance of **financial markets, institutions, and instruments** in both **domestic and global economies**. It involves a shift in **investment preferences**, moving away from **traditional physical assets** like **real estate and gold** toward **financial assets** such as **mutual funds, stocks, and derivatives**.

While financialization can **enhance liquidity and investment opportunities**, **reckless financialization** poses serious **systemic risks**, including:

- **Market volatility**, leading to unpredictable price swings.
- **Increased debt burdens**, causing a rise in default risks.
- **Loss of investor confidence**, which can destabilize economies.
- A potential repeat of crises like the **2008 global financial meltdown**.

Key Drivers of Reckless Financialization:

1. **Unchecked Credit Availability:** Easy access to **unsecured loans** and **margin trading** encourages **excessive speculation**, leading to inflated asset prices.
2. **Obsession with Derivatives: Complex financial instruments** amplify market speculation, increasing **trading risks** and **price instability**.
3. **High-Frequency Trading (HFT) Boom: Algorithmic trading** accelerates market fluctuations, sometimes beyond **rational economic levels**.
4. **Lack of Financial Literacy:** Many **retail investors** enter the market without a solid understanding of **risks**, leading to **uninformed decisions**.
5. **Focus on Short-Term Profits:** The pursuit of **quick financial gains** often **overshadows long-term financial planning**, leading to reckless investment choices.
6. **Technology-Driven Risks: AI-powered trading systems** make investment decisions without transparency, increasing **systemic vulnerabilities**.
7. **Influence of Social Media and Herd Mentality: Retail investors**, influenced by **peer pressure** and **online trends**, often engage in **high-risk speculative trading** without proper analysis.

Final Thoughts:

While **financialization** has revolutionized the investment landscape, its **unregulated growth** can **destabilize markets** and **jeopardize individual financial security**. Investors must prioritize **informed decision-making**, while regulators must ensure **responsible financial innovation** to prevent potential crises. **A balanced approach is essential**—where financial markets drive economic progress without compromising stability.

GS Paper 3 – Economy

5 Dinesh Khara Committee: Reforming India's Insurance Sector

Context: The **Dinesh Khara Committee** is a high-powered panel established by the **Insurance Regulatory and Development Authority of India (IRDAI)** to **review the Insurance Act, 1938** and propose **necessary amendments**.

Objectives of the Committee:

- **Modernizing Insurance Laws**: Ensuring the Act meets the evolving needs of the **insurance industry**.
- **Enhancing Investment Opportunities**: Encouraging **foreign investment** to boost sector growth.
- **Strengthening Insurance Penetration**: Making insurance more **accessible and efficient**.
- **Aligning with Global Standards**: Updating regulations to match **modern economic and regulatory requirements**.

Key Members of the Committee:

The **seven-member expert panel** is led by **Dinesh Khara**, the **former Chairman of the State Bank of India (SBI)**. Other prominent members include:

- **NS Kannan** – Former MD & CEO of **ICICI Prudential Life Insurance**.
- **Girish Radhakrishnan** – Former CMD of **United India Insurance**.
- **Rakesh Joshi** – Former Member of **IRDAI**.
- **Saurabh Sinha** – Former Executive Director of **RBI**.
- **Alok Misra** – MD & CEO of **MFIN (Microfinance Institutions Network)**.
- **L Vishwanathan** – **Legal Expert** specializing in financial regulations.

Key Recommendations of the Committee:

1. **Raising the Foreign Direct Investment (FDI) Limit:** Proposes allowing **100% FDI** in the **insurance sector**, attracting more **global players** and enhancing **competition**.
2. **Introduction of Composite Licences:** Recommends enabling insurers to operate across multiple **insurance categories** under a **single licence**, streamlining operations.
3. **Flexible Capital Requirements:** Suggests introducing **differential capital norms**, where capital requirements vary based on **business size and risk exposure**.
4. **Revising Solvency Regulations:** Advocates **relaxing solvency margin requirements** to improve **financial efficiency** while maintaining industry **stability**.
5. **Captive Insurance Licences:** Proposes granting **captive licences**, allowing businesses to **self-insure their risks**, reducing dependency on traditional insurers.
6. **Overhauling Investment Regulations:** Calls for a **review of investment policies**, simplifying **foreign insurer investment and repatriation** procedures.
7. **One-Time Registration for Intermediaries:** Suggests **simplifying the registration process** for **insurance brokers and intermediaries**, reducing regulatory burdens.
8. **Expansion of Financial Services:** Recommends allowing insurers to **distribute other financial products**, improving **market integration**.

Conclusion: The **Dinesh Khara Committee** is set to play a **transformative role** in shaping India's **insurance landscape**. By introducing **progressive reforms**, the committee aims to create a **more inclusive, competitive, and investment-friendly insurance sector**, aligning it with **global best practices**.

GS Paper 2 – Governance & Polity

6 Article 101(4) of the Indian Constitution: Ensuring Parliamentary Accountability

Context: Amritpal Singh, currently **detained under the National Security Act (NSA)**, has petitioned the **Punjab and Haryana High Court** seeking permission to attend the ongoing **Parliament session**. His request stems from concerns over possible **disqualification** under **Article 101(4) of the Indian Constitution** due to prolonged absence from the **Lok Sabha**.

Understanding Article 101(4) of the Indian Constitution:

Article **101(4)** outlines the conditions under which a **Member of Parliament (MP)** may lose their seat due to **continued absence** from legislative proceedings.

Key Provisions of Article 101(4):

- If an **MP** is absent from the House for **60 consecutive days** without approval, their seat may be declared **vacant**.
- The **counting of days** excludes periods when **Parliament is not in session**.
- The decision regarding **disqualification** is made by the **Speaker (Lok Sabha)** or **Chairman (Rajya Sabha)**.

Why is Article 101(4) Important?

This provision plays a crucial role in maintaining **parliamentary discipline** and ensuring that elected representatives **actively participate** in legislative functions.

Objectives of Article 101(4):

- Encourages MPs to **fulfill their legislative duties**.
- Prevents **neglect of parliamentary responsibilities**.
- Strengthens **democratic accountability** and **representation**.

Exceptions and Special Considerations:

Leave of Absence for Valid Reasons:

MPs can request **permission for absence** due to **illness, legal detention, or unavoidable circumstances**. If granted, they **retain their seat** despite their absence.

Judicial Intervention in Special Cases:

In situations where an **MP is detained**, the courts may step in to **facilitate attendance** if deemed necessary, balancing **legal proceedings** with **parliamentary rights**.

Final Thoughts:

Article **101(4)** upholds the **integrity of parliamentary democracy** by ensuring that **elected leaders** remain **actively engaged** in governance. However, it also provides **flexibility** for legitimate absences, ensuring a **fair and balanced approach** to parliamentary participation.