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Institute for CSE Examination

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4<sup>th</sup> DEC 2024

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## Rise and Challenges of India's Gig Economy

Why in News?

According to a white paper by the **Forum for Progressive Gig Workers**, the **gig economy in India** is projected to grow at a **compounded annual growth rate (CAGR) of 17%**, reaching **USD 455 billion by 2024**, driving significant economic growth and employment opportunities.

What is the Gig Economy?

- **About:** The gig economy refers to a labor market characterized by **short-term, and flexible jobs** often facilitated through digital platforms.
  - It involves individuals or companies offering **services on a temporary** or task-by-task basis, rather than through traditional full-time employment contracts.
  - In the gig economy, **gig Workers** (also known as independent contractors or freelancers) are paid for each task or gig they complete.
  - Popular gig economy activities include **freelance work**, food delivery services, and freelance digital work.
- **Key Features:** The gig economy offers flexibility, allowing workers to choose their schedules and work location.
  - Digital platforms connect service providers with consumers for short-term, task-based jobs.
- **Perspectives on Gig Economy :**
  - **For Gig Workers:** Gig work offers diverse opportunities, and the ability to balance personal and professional lives, **especially benefiting women in the labor market.**
    - It allows for skill enhancement, with workers able to take on various tasks that broaden their expertise and increase income potential.
  - **For Businesses:** Companies benefit from cost-effective labor, with the ability to scale the workforce as needed based on demand.
    - Gig work enables businesses to select workers with specific skill sets for short-term projects, optimizing productivity without long-term commitments.



What is the Status of the Gig Economy in India?

- **Market Size:** The gig economy in India is rapidly expanding. In **2020-21, there were about 7.7 million gig workers**, projected to grow to **23.5 million by 2029-30**.
  - This sector includes a **mix of low, medium, and high-skilled jobs**, with a significant portion in medium-skilled roles.
  - Key sectors driving the growth of the gig economy include **e-commerce, transportation, and delivery services**, all benefiting from the increasing demand for flexible work arrangements.
- **Driving Factors:**
  - **Digital Penetration:** India has over **936 million internet subscribers in India**, with rapid growth in rural areas. This widespread internet access provides a strong foundation for the gig economy.
    - Around **650 million smartphone users**, with decreasing smartphone prices making it accessible to lower-income groups and expanding internet usage.
  - **Startup and E-commerce Growth:** The rise of **startups and e-commerce** requires flexible workers for content creation, marketing, logistics, and delivery, fueling gig economy growth.
  - **Consumer Demand for Convenience:** Increased demand for quick services like **food delivery and e-commerce** in urban areas creates opportunities for gig workers in delivery and customer service roles.
  - **Low-Cost Labor:** A **large pool of semi-skilled and unskilled labor** willing to take gig work, driven by a **lack of formal employment opportunities**, allows platforms to offer low wages and poor working conditions.

- High unemployment, underemployment, income disparities, **rising living costs, and limited social security** drive people towards gig work as a **survival and growth strategy**.
- **Changing Work Preferences:** Younger generations prefer work-life balance and flexibility, **opting for gig work that allows project selection, flexible hours, and remote work**.

What Role Does the Gig Economy Play in Employment Generation in India?

- By 2030, the Gig Economy is expected to **contribute 1.25% to India's GDP and generate around 90 million jobs** in the long term.
  - By 2030, gig workers are expected to make up **4.1% of the total workforce**, becoming a crucial segment of India's labor market.
- The gig economy offers alternate revenue streams for workers, especially in **Tier-II and Tier-III cities, where growth is accelerating**.
- **Women stand to benefit from increased earnings opportunities**, providing them with greater financial independence and workforce integration.
- Initially Gig Economy was dominated by high-income earners and consultants, **gig work has become increasingly popular among entry-level workers and freshers** seeking flexible work options and skill development.
- The gig economy is poised to be a major driver of job creation and economic growth, particularly through the integration of **Artificial Intelligence (AI)**, predictive analytics, and digital innovation.





## Gig worker segments in India

Perceived level of skill



### High-skill



**Purpose Fulfillers:** Hair and beauty professional, cook, tutor. Jobs chosen on the basis of **flexible hours, nearby location and safe work environment. Personality development** is a key driver too



**Aspiring Entrepreneurs:** Mechanic, technician, carpenter, electrician. Having trust in their skill set, they seek **job regularity or continuity and learning opportunities** to master skill sets



### Moderate-skill



**Ambitious Hustlers:** Data entry operator, telecaller, LIC agent. Determined to make a career in their current field of work, they aspire for **growth** in terms of **learning and rising in designation** with promotions



**Hopeful Balancers:** Cab driver, auto driver. Though driven by the need to earn a **good pay, salary growth potential** and **non-monetary benefits like medical/life/vehicle insurance** too play a key role



### Semi-skill



**Financial Contributors:** Domestic help, health care worker. Motivated to earn a **good salary** to provide a helping hand to fund household expenses and also build a savings corpus. **Flexible schedule** and **nearby work location** are also critical



**Financially Strapped Solo Earners** Construction worker, food delivery agent. With low-skill level and high dependency for household income, their key job choice drivers are a **good salary** and **regularity or continuity of job**. Also seek **non-monetary benefits** like **health insurance** to save money in long term



### Student



**Earn to Burn:** Telecaller, data entry operator. Students seeking to **earn salary** for discretionary spending. Job choice primarily driven by a **flexible schedule**, potential for **personality development** (soft skills, confidence, etc.) and **respectable job title**



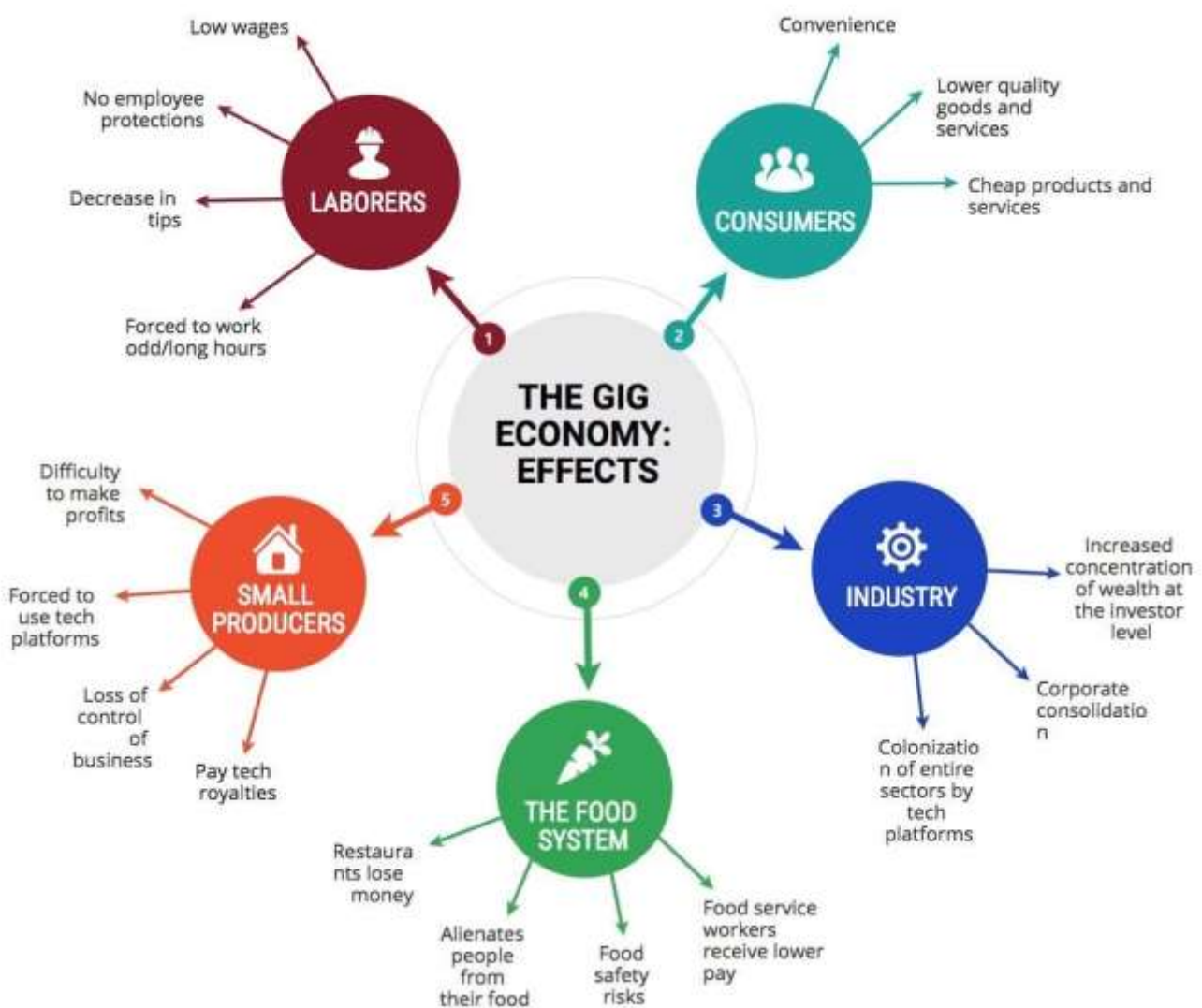
**Millennial Providers:** Food delivery agent, package delivery agent, data entry operator. Students financially supporting families as well as funding own education look for jobs that **pay well. A flexible schedule** is important too

Life stage

## What are the Challenges Faced by Gig Workers in India?

- **Job Insecurity:** Lack of work stability is a major concern, with **20% of dissatisfied gig workers identifying it as the top issue**. This is particularly prominent among unskilled workers, with over 30% citing it as their most critical job driver. Workers like security guards face financial instability due to irregular income.
- **Income Volatility:** Earnings are unpredictable, dependent on demand, competition, and seasonal trends, making financial planning difficult and limiting access to loans or credit.
- **Regulatory Gaps:** Absence of a comprehensive legal and regulatory framework, leaving gig workers vulnerable to exploitation without protection for fair wages, rights, or working conditions.

- Gig workers often find themselves in a **grey zone between organized and unorganized labor**, limiting access to benefits like healthcare, pensions, and insurance.
- **Timely Payments:** Over 25% of gig workers face dissatisfaction due to delayed payments, stressing the need for timely, transparent, and shorter payment cycles to avoid financial strain.
- **Learning and Personality Development:** Gig workers, especially Ambitious Hustlers and Earn to Burn, report a lack of skill-building opportunities, expressing a desire for jobs that help advance their careers.



#### India's Initiatives Related to Gig Workers in India

- **Code on Social Security, 2020:** This act recognizes gig workers as a separate category and envisages extension of social security benefits to them.
  - However, it has been criticized for lacking legal mandates, universal coverage, and accountability mechanisms for gig workers.

- **e-Shram Portal**
- **Pradhan Mantri Shram Yogi Maandhan Yojana**
- **Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY)**
- **State-level initiatives:**
  - **Rajasthan's Platform-Based Gig Workers (Registration and Welfare) Act, 2023.**
  - **Karnataka's Bill on Gig Workers:** This bill mandates formal registration, grievance mechanisms, and transparent contracts, though it has issues such as the classification of gig workers as independent contractors, which excludes them from key labor protections.

#### Way Forward

- **Legal reforms:** India could draw inspiration from countries like California, and the Netherlands, which have **reclassified gig workers as employees** to ensure they receive protections like minimum wages, regulated working hours, and access to healthcare.
- **Portable Benefits System:** A portable benefits system, where workers can access **health insurance, retirement plans, and unemployment benefits** regardless of their employer, would significantly improve the well-being of gig workers.
  - Companies like Amazon, Flipkart, Zomato, and Swiggy are improving worker conditions with **safety gear, resting areas, and water access**. Continued focus on welfare will ensure a **sustainable gig economy**.
- **Technology-driven solutions:** A robust feedback mechanism should be implemented to enable gig workers to report issues related to exploitation or discrimination by platforms to create a fairer environment.
- **Skill Development and Upskilling:** Promote skill-building initiatives and collaborations with **vocational institutes** to equip gig workers with the necessary skills to transition into higher-paying roles and entrepreneurial ventures.

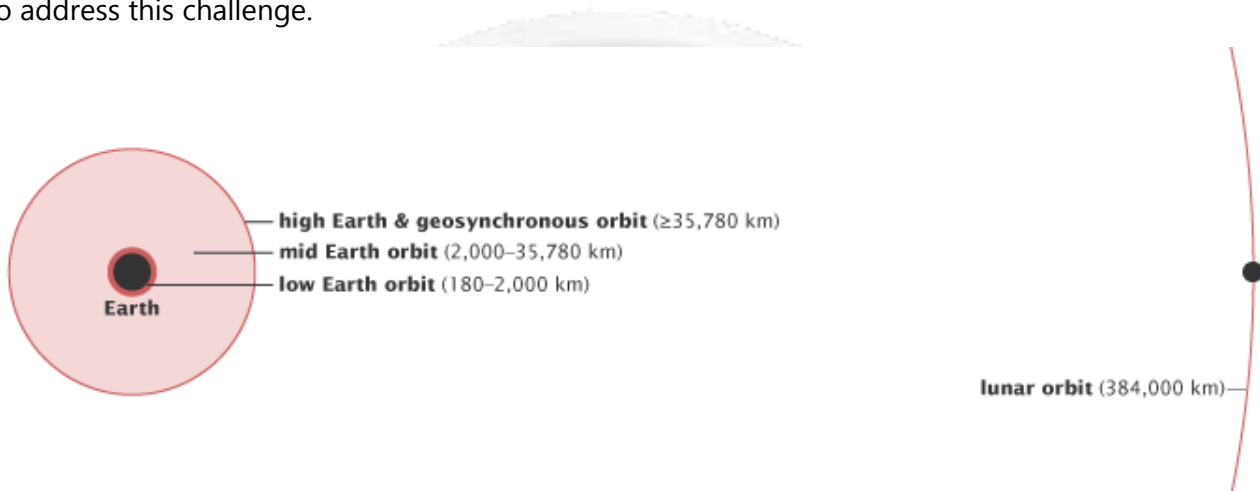


## Global Cooperation in Space Debris Management

Why in News?

Recently, the issue of increasing **satellites and space debris** in **Low Earth Orbit (LEO)** has gained international attention, with experts warning that without global cooperation, this vital region of space may become unusable.

- In October 2024, a **United Nations panel on space traffic coordination** called for urgent measures to address this challenge.



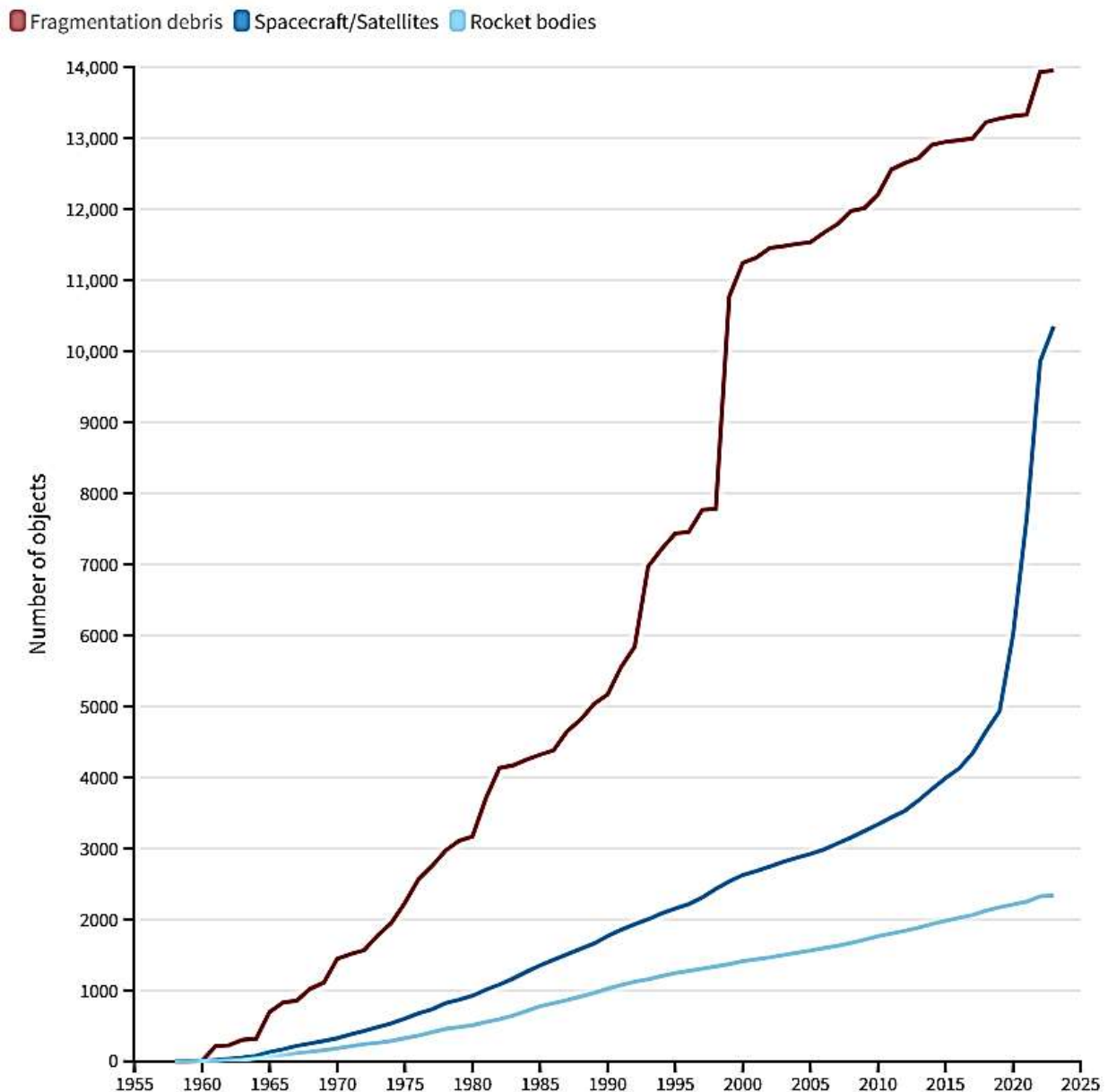
What is Lower Earth Orbit (LEO)?

- **About:**
  - **Low Earth Orbit (LEO)** refers to an orbit around Earth at altitudes typically ranging from **180 km to 2,000 km**.
  - This region is closest to the Earth's surface and is the most frequently utilized orbital region for satellites, including the **International Space Station (ISS)**.
- **Orbital Mechanics of LEO:**
  - For a satellite to remain in LEO, it must travel at a speed of approximately **7.8 kilometers per second**.
    - At this speed, the **centrifugal force** generated by the satellite's motion balances the **gravitational pull** of the Earth, enabling the satellite to maintain its orbit.
    - As a result, satellites in LEO take around **90 minutes** to complete one full orbit around Earth.
  - Unlike **suborbital objects**, which return to Earth, or objects exceeding escape velocity (25,000 mph), **LEO objects remain in orbit indefinitely** unless influenced by external forces like **atmospheric drag** or **orbital decay**.
- **Importance of LEO:**

- **Satellite Applications:** LEO is preferred for **Earth observation satellites**, as they provide **high-resolution images and data** due to their **proximity** to the Earth's surface.
  - Many communication satellites and scientific missions also utilise LEO for better transmission speeds and reduced latency.
  - LEO satellites are also crucial for **Global Positioning Systems (GPS)**.
- **International Space Station (ISS):** The **ISS** orbits in LEO, making it accessible for human space exploration and scientific research.
  - Its location allows for **regular resupply missions** and **ease of crew transport**.
- **Cost-Effectiveness and Accessibility:** Satellites in LEO are **easier and cheaper to launch** compared to those in higher orbits, such as **Geostationary Orbit (GEO)**.
  - The lower altitudes mean **reduced energy requirements** for reaching orbit.

What are the Challenges Associated with LEO?

- **LEO Congestion & Space Debris:** The increasing number of satellites in LEO has led to concerns about space debris.
  - **Decommissioned satellites, broken parts, and spent rocket stages** accumulate in this orbit, posing collision risks to active satellites and spacecraft.
  - Over **14,000 satellites**, including **3,500 inactive** ones, are in LEO, alongside roughly **120 million debris fragments**.
  - Recent incidents, like the **explosion of a Chinese rocket** and a **defunct Russian satellite**, have increased **space debris**, threatening satellites and astronauts aboard the **ISS**.



▪ **Collision Risk:**

- Increased congestion in LEO poses risks of **USD 556 million** in damages in between 2024-29, with a **3.13% collision probability**.

- There has also been a **17% increase in close encounters** per satellite in the past year.

▪ **Orbital Saturation:**

- The rapid growth in satellite constellations, driven by companies like **SpaceX's Starlink (6,764 satellites)** has intensified competition for orbital space, making effective regulation and international collaboration crucial.

▪ **Management Challenges:**

- **Commercial Interests:** Private companies, like **SpaceX's Starlink**, often guard proprietary satellite data, hindering transparency and data sharing. This limits the ability to track satellites and space debris effectively.
- **Lack of Standardization:** Current **collision avoidance methods** are informal, relying on inconsistent data formats and protocols.
  - This fragmented approach results in **accountability issues** and **complicates the development of universal standards** for satellite operations.
- **Strategic Concerns:**
  - **Geopolitical Tensions:** Countries are often reluctant to share satellite data due to **national security concerns**, especially regarding dual-use satellites with both civilian and military functions.
    - This reluctance complicates international cooperation and the creation of a centralized space traffic management system.
  - **Weaponisation of LEO: Anti-satellite (ASAT) missile** tests by nations like China, USA, India (2019, **Mission Shakti**), and Russia (2021, **destruction of Cosmos 1408**) have significantly **increased space debris**, posing long-term risks to LEO operations.
    - China's SC-19 test generated over 3,000 trackable fragments.

**Space Debris:** Space debris refers to **fragmented natural objects in Earth's orbit** that no longer serve any functional purpose.

- This includes **defunct satellites, spent rocket stages, and fragments** resulting from collisions or other incidents.

What are the Threats Posed by Space Debris?

- **Hazard to Operational Satellites:** Space debris is a significant risk for operational satellites, as **collisions can render them nonfunctional**, disrupting vital services.
- **Reduction of Orbital Slots:** The accumulation of debris in specific orbital regions **limits the availability of prime orbital slots for future space missions**.
- **Challenges in Space Situational Awareness:** The rising volume of space debris **complicates efforts to track and predict the movements of objects in space**, making it harder for satellite operators and space agencies to maintain situational awareness.
- **Kessler Syndrome:** The growing number of objects and debris in space can lead to the Kessler Syndrome, a scenario where the **density of debris in orbit increases, leading to a higher likelihood of collisions** and **further debris** generation.

- For example, in 2009, a defunct Russian satellite collided with an American weather satellite, producing thousands of debris fragments.
- **Kessler Syndrome** counters the **Big Sky Theory (1978)** proposed by **NASA** which suggested that **space debris would not pose a long-term issue** due to **space's vastness**.

What are the Initiatives to Address Space Debris Challenges?

▪ **India's Initiatives:**

- **ISRO's System for Safe and Sustainable Operations Management (IS 4 OM):** It was established in 2022 to continuously monitor objects that pose collision risks.
  - It predicts space debris evolution, and develops strategies to mitigate associated threats.
- **Collision Avoidance Maneuvers:** In 2022, ISRO successfully carried out 21 collision avoidance maneuvers to prevent potential impacts between Indian operational space assets and other space objects.
- **Centre for Space Debris Research:** It was established by ISRO as a **dedicated center to monitor and develop mitigation strategies** for space debris.
- **Project NETRA:** Project NETRA is an early-warning system to detect space debris and other hazards. It aims to protect Indian satellites from collisions.

▪ **Global Initiatives:**

- **Inter-Agency Space Debris Coordination Committee (IADC):** **Inter-Agency Space Debris Coordination Committee (IADC)** was established in 1993 as an international forum that **coordinates efforts among spacefaring nations** to address the growing issue of **space debris**.
- **United Nations Committee on the Peaceful Uses of Outer Space (COPUOS):** COPUOS develops guidelines for the **long-term sustainability of outer space activities**, including measures for space debris mitigation.
- **European Space Agency's Clean Space Initiative:** The **Clean Space initiative** by ESA aims to **reduce space debris and promote sustainable space activities** by encouraging the development of technologies to avoid generating debris and by removing existing debris.

UN's Five Treaties on Space Activities

- **Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space (1967)**
- **Agreement on the Rescue of Astronauts, the Return of Astronauts, and the Return of Objects Launched into Outer Space (1968)**



- **Convention on Liability for Damage Caused by Space Objects (1972)**
- **Convention on Registration of Objects Launched into Outer Space (1976)**
- **Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979)**
  - **India has signed all five treaties** but has **not ratified the Moon Agreement**.

#### Way Forward

- **Improved Monitoring: Upgrading tracking technologies** and improving orbit models are vital for accurate debris detection and management.
- **Enhanced Coordination:** As space traffic grows, **international collaboration and the creation of automated systems** or "rights of way" in space can help reduce congestion and prevent collisions.
- **Reducing Debris Generation:** Using **reusable rockets** instead of single-use launch vehicles and enforcing international regulations can limit new debris production.
  - India recently launched its first reusable hybrid rocket, **RHUMI-1** developed by the Tamil Nadu-based start-up Space Zone India.
- **Active Debris Removal:** Technologies like **harpoons, magnets, and lasers** are being explored to capture and remove defunct space objects.
  - For example, ISRO successfully deorbited **Megha Tropiques-1 in 2023**.
    - **Harpoons** are specialised devices used to "hook" onto space debris for capture and deorbiting.
    - Spacecraft equipped with **strong magnets** to attract and move debris with magnetic components.
    - **Directed laser beams** provide small thrust to alter the trajectory of space debris, enabling controlled movement.
- **Graveyard Orbit:** Satellites nearing the end of their lifespan in Geostationary Orbit (GSO) should be moved to a **graveyard orbit beyond 36,000 km** using the last of their fuel to reduce space debris.
- **International Guidelines Compliance:** Strict adherence to guidelines, such as those from the ***International Association for the Advancement of Space Safety (IADC)***, is essential for managing space debris and ensuring sustainable space activities.

## Theory of Mutualism

### Context

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

### Mutualism

- **Cooperative Ownership:** It is an economic and social theory that emphasises **voluntary cooperation, reciprocity, and the fair exchange of goods and services**.
  - It advocates for a society where individuals and communities engage in **cooperative ownership**, decentralising and collectively managing productive resources like land or tools for the benefit of all.
- **Free From Authority:** Such systems would be **free from central authority and capitalist exploitation**.
- **Mutualism and Property:** It did not call for the complete elimination of ownership.
- It emphasises a form of ownership based on usage rather than accumulation and profit.
- Ownership of tools or land is acceptable, provided it **does not lead to exploitation of others**.

### Mutualism and Anarchism

- **Anarchism:**
  - **Individual anarchists** emphasise **personal autonomy and freedom**, focusing on the liberation of the individual from state control.
  - **Social anarchists** advocate for the **collective management of resources** and the organisation of society to promote equality and fairness.
- **A mutualist society** could be organised without a state, based on cooperative principles where people freely enter into contracts and mutual exchanges, thus **blending both individual freedom and collective responsibility**.

### Critiques of the Mutualism

- **Weak Theory to Challenge Capitalism:** Its reliance on small-scale property ownership may not sufficiently challenge the capitalist system’s broader structural inequalities.
  - It fails to address the concentration of wealth and power that is intrinsic to modern capitalist economies.
- **Too Idealistic:** Critics question the feasibility of creating an egalitarian society based on voluntary cooperation, suggesting that it may be too idealistic or difficult to implement on a large scale.

- **Overlooking the Class Struggle:** The theory overlooks the realities of class struggle, where small producers are squeezed out by larger corporations.

### **Conclusion**

- Despite these criticisms, mutualism remains a radical theory that offers an alternative to both capitalist exploitation and authoritarianism.
- These ideas aim to foster economic and social environments based on mutual aid and cooperation, rather than competition and exploitation.
- Mutualism seeks to build a society where individuals are free to pursue their own interests while maintaining a sense of community and mutual respect.



## Donald Trump Threat to BRICS Over Currency

### In News

- US President-elect Donald Trump warned the **BRICS nations (Brazil, Russia, India, China, South Africa) with 100% tariffs** if they create a new BRICS currency or replace the US dollar as the global reserve currency.

### BRICS Currency and US Dollar Dominance:

- The BRICS nations, in light of rising geopolitical tensions and the shortage of US dollars, are exploring alternatives to the US dollar for global trade.
  - Diverging economic structures, different monetary and trade policies, and other complexities make the creation of a common BRICS currency a long-term goal.

### Global Currency Trends:

- The IMF's COFER report shows a decline in the US dollar's share in global reserves, while non-traditional currencies (e.g., Australian dollar, Chinese renminbi) are gaining market share.
- Renminbi internationalization efforts by China are also advancing, but its share of reserves has stalled.

### India's Approach:

- India is exploring integration into the recently launched BRICS Pay Card, designed to facilitate token retail payments, enhance tourism, and promote financial integration.
- India does not aim to displace the US dollar but seeks to address practical challenges like trade partners' currency shortages, blocked financial channels, and issues related to "weaponized" currencies.
- **Focus on Economic Diplomacy:** India advocates for practical solutions such as settling trade payments in rupees, especially with countries facing dollar liquidity issues or sanctions.
- India acknowledges the stability provided by the US dollar and does not seek immediate de-dollarization.
- India's Prime Minister Narendra Modi stressed that BRICS should not aim to replace global institutions.

### Initiatives for Rupee Internationalisation

- **Special Vostro Accounts:** To facilitate rupee-based trade settlements, India has introduced special vostro accounts to mitigate exchange rate risk, reduce transaction costs, and bolster forex reserves.
- **Targeting Global South:** India aims to support countries with dollar shortages (e.g., Sri Lanka, Maldives) and those facing Western sanctions (e.g., Russia, Venezuela).

- **Central Bank Digital Currency (CBDC):** India is advancing its CBDC initiative to streamline cross-border payments, enhance security and transparency, reduce reliance on intermediary banks, and keep pace with the global digital economy.

#### **Approach on US Dollar**

- India's External Affairs Minister Jaishankar stated that **avoiding the US dollar is not part of India's policy** but efforts are made to find alternatives in specific cases due to US policies complicating trade with some countries.
  - India does not have malicious intent towards the dollar, but supports a multipolar world reflected in currencies and economic dealings.

#### **Challenges in Bilateral Trade with Russia**

- Despite efforts, India's trade with Russia in rupees remains low due to Indian banks' fear of US sanctions and an imbalanced trade relationship with Russia.
- Russia has large reserves of rupees but uses them for investment in Indian stocks and bonds instead of settling trade.
- **China's angle :** Trade between Russia and China in domestic currencies (rouble and yuan) has surged, with over 90% of trade now settled in these currencies.

#### **Future of BRICS Currency and Global Financial Landscape:**

- China might dominate BRICS currency initiatives, which could shift the power balance within the bloc.
- India should diplomatically engage with the US to explain its position and promote multipolarity.
- India should support financial reforms within BRICS but maintain strong ties with the US to balance its strategic and economic priorities.
  - Efforts to promote digital currencies (CBDCs) and platforms like UPI could position India as a leader in the BRICS currency initiatives.



## Coastal Crisis: 33.6% of India's Coastline Threatened by Erosion

### Context

- In a recent Lok Sabha session, the Union Environment Ministry revealed that about one-third of India's coastline is threatened by erosion, highlighting the urgent need for comprehensive coastal management strategies.

### About the Coastal Erosion

- It is a significant environmental issue affecting India's extensive coastline, which spans **over 7,500 kilometers**.
- The Indian mainland coast includes **9 coastal states and 2 Union Territories (UTs)** having 66 coastal districts.
- Morphology** of the coast consists of **43% sandy beach, 11% rocky coast, 36% of muddy flats, 10% of marshy coast**, 97 major estuaries and 34 lagoons.

Sl. No	State	Landforms and features
<b>East coast of India</b>		
1	Tamil Nadu	Deltas, long narrow beaches, spits, tidal flats, mangroves, coral reefs, sand dunes, Ridge swale complex etc.
2	Andhra Pradesh	Deltas, long narrow beaches, spits, mangroves, cliffs, long sand dunes, Ridge swale complex etc.
3	Odisha	Deltas, long beaches, spits, tidal flats, long sand dunes, ridges etc.
4	West Bengal	Large delta, very thick mangroves, tidal channels, islands, dunes, tidal flat, beaches etc
<b>West Coast of India</b>		
5	Kerala	Estuaries, lagoons, barriers, spits, dunes, tombolo, cliff, beaches etc
6	Karnataka & Goa	Estuaries, spits, sand dunes, tombolo, cliff, wave cut platforms, beaches etc
7	Maharashtra	Estuaries, cliffs, small sand dunes, tombolo, cliff, wave cut platforms, pocket beaches etc
8	Gujarat	Marshy land, tidal flats, estuaries, cliffs, mud flats, mangroves wave cut platforms, beaches etc.

- According to the **National Centre for Coastal Research (NCCR)** (an attached office of the Ministry of Earth Sciences), approximately **33.6% of India's coastline is vulnerable to erosion**, 26.9% is experiencing accretion (growth), and 39.6% remains stable.

### States Prone To Coastal Erosion

- **Karnataka:** The data presented in the Lok Sabha was particularly focused on **Karnataka's Dakshina Kannada district**, where nearly 48.4% of the 36.66 km coastline has been eroded over the past three decades.
  - This region's plight is a **microcosm of the broader national issue**, with varying degrees of erosion observed across different states.

### Other States

- **West Bengal:** Approximately 60.5% of the state's coastline is affected by erosion, with significant impacts on the Sundarbans.
- **Kerala:** Nearly 46.4% of Kerala's coastline faces erosion, with severe consequences for local communities and ecosystems.
- **Tamil Nadu:** Erosion affects 42.7% of the coastline, posing a threat to coastal infrastructure and livelihoods.

### Causes of Coastal Erosion

- **Natural Factors:**
  - **Wave Action:** Continuous wave action erodes the shoreline, especially during high tides and storms.
  - **Sea-Level Rise:** Climate change-induced sea-level rise increases the frequency and intensity of coastal flooding and erosion.
  - **Storm Surges:** Cyclones and storm surges cause significant erosion, particularly in low-lying coastal areas.
- **Anthropogenic Factors:**
  - **Coastal Development:** Infrastructure projects like ports, harbors, and seawalls disrupt natural sediment flow and exacerbate erosion.
  - **Sand Mining:** Illegal sand mining from beaches and riverbeds reduces the natural replenishment of sand along the coast.
  - **Deforestation:** Removal of mangroves and coastal vegetation weakens the natural defense against erosion.

### Impacts of Coastal Erosion

- **Loss of Land:** Coastal erosion leads to the loss of valuable land, affecting agriculture and settlements.
- **Displacement of Communities:** Erosion forces coastal communities to relocate, leading to socio-economic challenges.

- **Damage to Infrastructure:** Roads, bridges, and buildings near the coast are at risk of damage or destruction.
- **Biodiversity Loss:** Coastal habitats, including mangroves, coral reefs, and wetlands, are degraded, impacting marine biodiversity.

### Related Initiatives and Mitigation Measures

- **Integrated Coastal Zone Management Project (ICZMP):** Implemented in Gujarat, Odisha, and West Bengal, this World Bank-assisted project aims to protect and conserve coastal and marine environments through sustainable practices.
- **Coastal Regulation Zone (CRZ) Notification (2019):** It aims to conserve and protect coastal stretches, ensuring livelihood security for fisher and local communities while permitting erosion control measures.
  - It provides for **No Development Zones (NDZ)** along various categories of coastal areas to protect India's coastline from encroachment and erosion.
- **Coastal Vulnerability Index (CVI):** The Indian National Centre for Ocean Information Services (INCOIS) has developed the CVI **to assess and map the vulnerability** of different coastal regions based on various parameters.
- **Multi-Hazard Vulnerability Maps:** INCOIS has developed detailed maps to identify areas vulnerable to coastal hazards.

### Innovative Engineering Solutions

- **Artificial Reefs:** Constructing artificial reefs can dissipate wave energy and protect the shoreline.
- **Eco-friendly Breakwaters:** Using materials that blend with the natural environment can provide effective protection without harming marine ecosystems.
- **Geo-Tube Installation:** In areas like Pentha Village in Odisha, geo-tubes have been installed to create artificial barriers that protect the coast from erosion.
- **Mangrove and Shelterbelt Plantations:** Planting mangroves and other vegetation along the coast helps stabilize the shoreline and reduce the impact of waves and storm surges.

### Awareness

- **Community-Driven Conservation:** Local communities are encouraged to participate in conservation efforts, leveraging traditional knowledge and modern technology.
- **Education and Awareness Campaigns:** Raising awareness about the importance of coastal ecosystems and the impacts of erosion can foster community support for mitigation measures.

### Conclusion



- Addressing coastal erosion in India requires a multi-faceted approach that combines scientific research, community involvement, and sustainable development practices.
- By implementing effective mitigation measures and promoting awareness, India can protect its coastal regions and ensure the well-being of its coastal communities.



## 13th Edition of National Seed Congress (NSC)

### Context

- Scientists, policymakers and industry representatives participated in the 13th edition of the three-day **National Seed Congress (NSC)**.
  - NSC is an annual confluence of researchers, policymakers, farmers, and representatives to strengthen the agricultural sector in India and globally.

### About

- **Theme:** Innovating for a Sustainable Seed Ecosystem.
- **Major Highlights:**
  - To work more on innovative seed technologies for farmers in the country.
  - Fostering South-South Collaboration in the Seed Sector.
  - The focus will be on hybrid and biofortified crops, stress-tolerant varieties, and accelerated breeding cycles.
  - Public-Private Partnerships in the sector to promote sustainable seed production and distribution.
- The outcomes of these deliberations will be implemented with the full support of the State government to ensure food security, economic growth, and the welfare of farmers.

### Hybrid Crops

- Hybrid crops are created through the process of crossbreeding two genetically different plants, typically from different varieties or species, to combine desirable traits from both parent plants.
- **Aim:** To produce offspring that have superior qualities, such as increased yield, disease resistance, drought tolerance, or improved nutritional content.
- **Concern:** Hybrid crops often do not produce seeds that retain the same beneficial traits as the parent crop, so farmers need to purchase new seeds each year.

### Biofortified Crops

- **Biofortified crops** are those that have been specially bred to have higher levels of essential nutrients, such as vitamins, minerals, or amino acids, than their conventional counterparts.
  - This is done through traditional breeding techniques, genetic modification, or modern biotechnological methods.
- **Aim:** It aims to improve the nutritional value of crops, especially in regions where deficiencies in essential nutrients are widespread.



- **Golden Rice** has been genetically modified to produce higher levels of provitamin A (beta-carotene), aiming to reduce vitamin A deficiency.

**The biofortified varieties have been licensed to various private seed companies and Farmers Producer Organizations (FPOs)**

Sr. No.	Crop	Name of cultivar	No. of licenses
1.	Wheat	DBW 187	229
		DBW 303	204
		DBW 173	54
2.	Rice	DRR Dhan 45	4
		CR Dhan 310	2
3.	Maize	LQMH 1	2
4.	Pearl millet	HHB 299	5
		HHB 311	4
5.	Mustard	Pusa Mustard 30	6
		Pusa Double Zero Mustard 31	3
		Pusa Mustard 32	1
6.	Soybean	NRC 127	4
7.	Potato	Kufri Neekanth	5
		Kufri Manic	1
8.	Pomegrante	Sholapur Lal	7
<b>Total</b>			<b>531</b>

**Key Difference:**

- **Hybrid crops focus on improving traits** like yield, resilience, or growth characteristics by crossbreeding different varieties.
- **Biofortified crops focus on improving nutritional content** to address deficiencies in key micronutrients.

**Merits of biofortification:**

- It is regarded as the **most sustainable approach** to alleviate malnutrition.
- It provides **nutrients in natural form**.
- **Biofortified food is affordable** as it does not involve any additional price.
- 'Biofortified varieties' are as **high yielding** as 'traditional varieties', thus no loss is incurred to the farmers.
- It does **not require elaborate infrastructure** facilities as required in 'food fortification'.

- It does not involve **additional cost** on preparing the enriched food grains.

**Government Initiatives to Promote Sustainable Seed Production and Distribution:**

- **National Seed Policy (2002):** Encourages the private and public sectors to increase seed production, improve quality control, and facilitate the distribution of seeds.
- **National Gene Bank:** Maintains the genetic diversity of crops, conserving traditional and indigenous varieties for future use.
- **State Seed Banks:** Support local farmers by conserving native seeds and facilitating seed exchange.
- **National Food Security Mission (NFSM):** To increase the production of staple crops like rice, wheat, and pulses, with a focus on promoting the use of high-quality seeds.
- **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY):** It encourages the use of climate-resilient seeds for water-scarce regions.
- **National Mission on Organic Farming (NMOF):** Encourages organic seed production, providing subsidies for organic inputs and promoting seed-saving techniques.
- **Farmer-Producer Organizations (FPOs):** FPOs facilitate the production and distribution of locally adapted seeds, enhancing the involvement of farmers in seed systems and promoting seed diversity.

