New Method to Determine Hubble Constant

For Prelims: New Method to Determine Hubble Constant, Gravitational Lensing, Expansion of Universe, **Big Bang**, Cosmic Microwave Background.

For Mains: Method to Determine Hubble Constant.

Source: TH

Why in News?

Recently, some researchers from India and the US have **proposed a novel method to determine the Hubble constant** and the Rate of Expansion of the Universe.

Note: About 13.8 billion years ago, a really small, really dense, and really hot spot lying beyond spacetime began to expand. Its expansion and cooling – in an event that scientists have called the Big Bang **– produced the universe as we know it**. The universe continued to expand, at first really rapidly before slowing down to a great degree. Then, about **five or six billion years ago, dark energy** – an unknown and largely uncharacterised form of energy – accelerated its expansion again.

What is Hubble Constant?

- **About:**
  - In 1929, Edwin Hubble formulated Hubble's law, providing the **first mathematical description of the universe's expansion.**
  - The precise rate of this expansion, termed the Hubble constant, remains a contentious issue in cosmology.
- **Measurement:**
  - Two details are required to calculate the value of the Hubble constant:
    - The distance between the observer and astronomical objects,
    - The velocity at which these objects are moving away from the **observer as a result of the expansion of the universe.**
  - So far, scientists have used **three methods to get these details:**
    - They compare the observed brightness of a stellar explosion, called a supernova, with its **expected brightness to figure how far away it** could be. Then they measure how much the wavelength of the light from the star has been **stretched by the expansion of the universe** – i.e. the redshift – to figure how much it's moving away.
    - They use changes **to the Cosmic Microwave Background (CMB)** – radiation leftover from the Big Bang event – to estimate the Hubble constant.
      - The CMB is a faint, nearly uniform glow of microwave radiation that fills the observable universe. It is often referred to as the **"afterglow" of the Big Bang.**

        - They use gravitational **waves, ripples in spacetime produced** when massive astronomical objects – like neutron stars or black holes – collide with each other. Detectors that observe **gravitational waves record the data in the form of curves.**
    - Using the shape of these curves, astronomers can calculate the amount of energy that the collision released. Comparing this with the amount of energy the waves had when they reached earth **allows researchers to estimate the distance between these objects and earth.**
- **Discrepancy in Measurement:**
    - Measurements from the first method have reported a Hubble constant about two units higher than the one derived by the second method; the third method **hasn't yet matured enough to provide a precise measurement.**
    - The discrepancy **could be due to a mistake in the methods used** – or it could indicate that the Hubble constant is itself evolving with time.
    - This possibility arises because the three methods estimate the Hubble constant today based on information from different stages of the universe.
    - The CMB way is based on a much younger universe while the other two are based on an older universe (i.e. closer to the one today).

What is the New Approach for Estimation of Hubble Constant?

- Researchers proposed analyzing a **collection of lensed gravitational waves** and their time delays to derive information **about the universe's rate of expansion.**
    - Gravitational lensing is a phenomenon in which the gravitational field of a massive object, such as a galaxy or a cluster of galaxies, bends and distorts the light from objects located behind it.
- This method offers an independent **estimation of the Hubble constant** and could help determine other cosmological parameters such as matter density.
    - Experts in the field find the study **fascinating and see it as a significant cosmological application** of gravitational waves.

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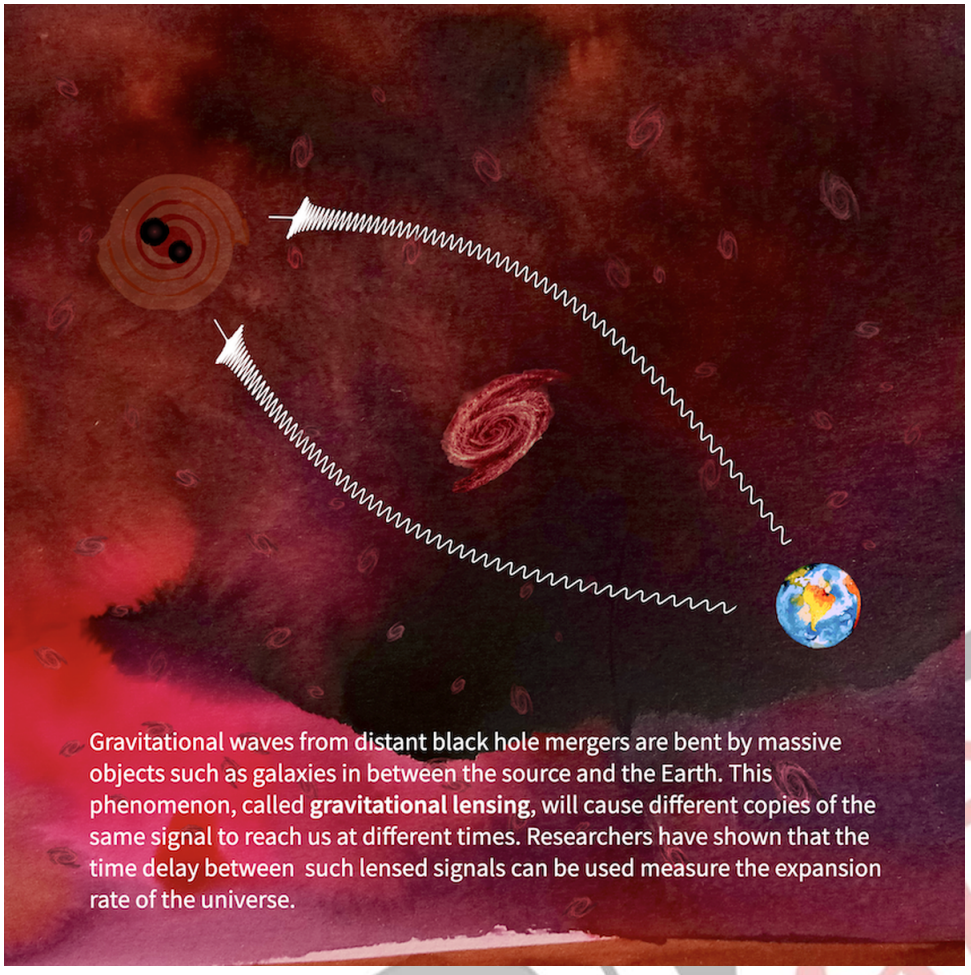


Q. Which of the following is/are cited by the scientists as evidence/evidences for the continued expansion of universe? (2012)

1. Detection of microwaves in space
2. Observation of redshift phenomenon in space
3. Movement of asteroids in space
4. Occurrence of supernova explosions in space

Select the correct answer using the codes given below:

(a) 1 and 2
(b) 2 only
(c) 1, 3 and 4
(d) None of the above can be cited as evidence

Ans: (a)

Exp:

- Arno Penzias and Robert Wilson in 1963 found mysterious microwaves coming equally from all directions. The radiation called the Cosmic Microwave Background Radiation was the radiation predicted years earlier by Gamow, Herman, and Alpher. This convinced most astronomers that the Big Bang theory was correct and provided an evidential base for continued expansion of the universe. **Hence, 1 is correct.**
- Edwin Hubble in 1929 measured the redshifts of a number of distant galaxies. On ploting redshift against relative distance, the redshift of distant galaxies increased as a linear function of their distance. Astronomers measure the movement of objects relative to us using Doppler shift. Light from distant objects in the universe is redshifted (shift in the frequency of light towards red

colour), which tells us that the objects are all receding away from us. **Hence, 2 is correct.**
- Movement of an asteroid in space may provide information regarding the type of material in early universe, but as such no evidence regarding expanding universe is provided. **Hence, 3 is not correct.**
- The supernova explosion occurs when there is a change in the core, or centre, of a star. It happens in either binary star system or at the end of a single star's lifetime. It helps in studying the distribution of elements throughout the universe. These elements travel on to form new stars, planets and everything else in the universe. However, it does not provide evidence for expanding universe. **Hence, 4 is not correct.**
- **Therefore, option (a) is the correct answer.**

Indian Economy and Impossible Trinity

For Prelims: Impossible Trinity, Reserve Bank of India**,** Monetary Policy**,** Foreign exchange reserves

For Mains: Challenges in making impossible trinity possible, India's currency dynamics

Source: BL

Why in News?

The **Reserve Bank of India(RBI)** and Indian investors are facing a challenge in overcoming the **"impossible trinity".**

What is the Impossible Trinity?

- **About:**
  - The impossible trinity, or the trilemma, refers to the idea that an economy cannot pursue **independent** monetary policy**, maintain a fixed exchange rate, and allow the free flow of capital across its borders** all at the same time.
    - In a fixed exchange rate regime, the domestic currency is tied to another foreign currency such as the U.S. dollar, Euro, the Pound Sterling or a basket of currencies.
  - An able policymaker can, at best, **achieve two of these three objectives at any given time.**
  - The idea was proposed independently by **Canadian economist Robert Mundell and British economist Marcus Fleming in the early 1960s.**
  - The Impossible Trinity is a **fundamental concept in international economics and monetary policy.**
  - It describes the inherent challenges countries face when trying to simultaneously achieve three specific policy objectives related to their exchange rate and capital flows.
- **Challenges Involved:**
  - When a country **prioritizes free capital flow and a fixed exchange rate, it loses control over its monetary policy,** making it susceptible to external economic pressures.
  - If a country chooses to **maintain a fixed exchange rate and independent monetary policy, it must impose capital controls** to limit the flow of funds across its borders.
  - Opting for **independent monetary policy and free capital flow requires accepting exchange rate fluctuations,** potentially leading to volatility.
- **Examples of the Impossible Trinity in Action:**
  - Various countries have faced the challenges of the Impossible Trinity, with some notable

examples being the **Asian Financial Crisis in 1997** and the **European Exchange Rate Mechanism crisis in 1992.**

- These crises were partly attributed to the inability of affected countries to maintain fixed exchange rates, independent monetary policies, and free capital flows simultaneously.

How is India Struggling with the Impossible Trinity?

- **Strategies and Actions to Address the Impossible Trinity:**
  - **Managing Interest Rates:**
    - The RBI has been **cautious in raising interest rates compared to the US Federal Reserve.**
      - The reluctance to raise rates is driven by the fear of causing a **recession,** especially with the upcoming elections in 2024.
    - A lower interest rate arbitrage signifies a flight of capital back to the US (the world's reserve currency) and an impending **depreciation of the Indian rupee.**
  - **Composition of Foreign Exchange Reserves:**
    - India's **foreign exchange reserves** primarily consist of **'hot money'** (from **Foreign Institutional Investors (FIIs) investing in domestic debt or equity markets to cash in on arbitrage opportunities)** and corporate borrowing (for example, Adani Green Energy, Vedanta, etc.), not money earned from trade.
      - Relying on reserves not earned through trade poses challenges for maintaining currency stability.
  - **Implementing Capital Controls:**
    - India has implemented various measures to **control capital flows, but their effectiveness remains uncertain.**
    - **Policy Measures to Control Capital Outflows:**
      - **Import Bans and Licensing Policies:**
        - India **imposed import bans**, **particularly on electronic goods**, as a quick response to limit capital outflows.
        - These bans were later transformed into **license-based import policies** due to domestic manufacturing limitations.
        - However, these measures may inadvertently contribute to supply-pull inflation rather than preventing capital outflows.
      - **Tax Changes:**
        - India has also increased tax rates on outbound remittances from 5% to 20% as a means to restrict capital outflows.
        - The effectiveness of this tax increase in managing the 'Impossible Trinity' is under scrutiny.
- **Influence of China on India's Economic Situation:**
  - **China's deflation** and rate cuts aim to stimulate economic growth. The Chinese consumer price index fell by 0.3% in July year-on-year. Additionally, the INR has appreciated by 4% against the Chinese yuan.
  - A stronger Indian rupee can lead to increased imports from China, **affecting India's trade balance and currency dynamics.**
  - The depreciating Chinese yuan can make India's exports less competitive in global markets.
- **Foreign Institutional Investors (FIIs) and Indian Debt:**
  - FIIs are selling holdings of Indian debt **securities and seeking more profitable investments abroad,** increasing the demand for foreign currency and weakening the Indian rupee in the foreign exchange market.

What are the Implications of the Impossible Trinity for Indian Investors?

- **Shielding Against Rupee Depreciation:**
  - Investing in sectors like **IT and Pharma that primarily earn in dollars can shield against rupee depreciation.**
    - As the rupee weakens, these companies may experience increased competitiveness and offer attractive returns.

- **Diversifying Investments Abroad:**
    - Investors must acknowledge the challenges posed by the 'Impossible Trinity' and adapt accordingly.
        - Investing in international assets becomes crucial for protecting investments in a complex economic environment.

Way Forward

- India should focus on effectively implementing capital control measures. These measures should strike a balance between **maintaining a stable currency and encouraging foreign investment.**
- The country should actively **diversify its foreign exchange reserves and aim to earn money through trade rather than relying heavily on 'hot money' from foreign investors.**
    - Additionally, attracting foreign direct investment (FDI) **can contribute to currency stability and strengthen the rupee.**
- The RBI should adopt a balanced approach to interest rates, considering **inflation control and attracting foreign investment.** Gradual interest rate adjustments can help achieve this balance.

Central Bank Digital Currency

For Prelims: Central Bank Digital Currency, Reserve Bank of India (RBI), Cryptocurrencies, Fiat currency, Informal economy, Cyber Security.

For Mains: Central Bank Digital Currency, its significance and Challenges.

Source: IE

Why in News?

Recently, the **Reserve Bank of India (RBI)** Governor has highlighted the potential of **Central Bank Digital Currency (CBDC)** or **E-rupee** in improving cross-border payments' efficiency.

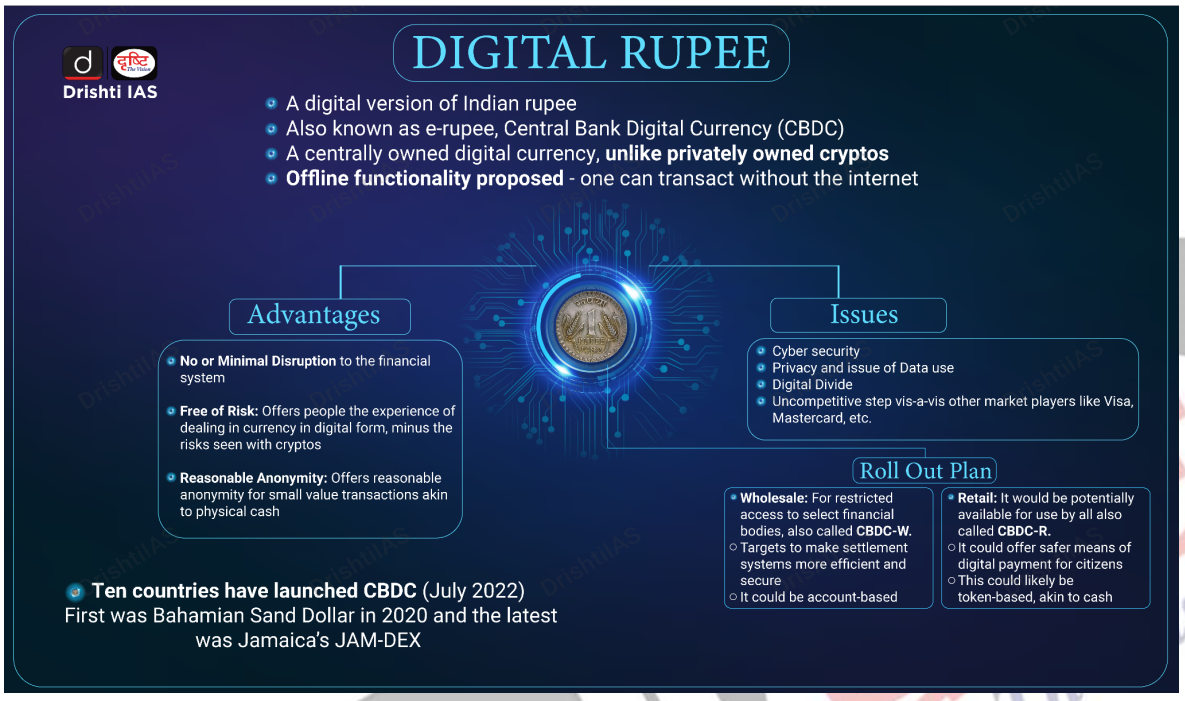
- RBI is gradually expanding its CBDC pilots to include more banks, cities, diverse use cases, and a broader audience.
- The RBI launched pilots for **digital rupee in the wholesale in November 2022** and in the retail segment in December 2022.

What is Central Bank Digital Currency (CBDC)?

- **About:**
    - CBDCs are a digital form of a **paper currency and unlike** cryptocurrencies that operate in a regulatory vacuum, these are **legal tenders issued and backed by a central bank.**
    - It is the same as **a** fiat currency and is exchangeable one-to-one with the fiat currency.
        - A fiat currency is a national currency that is not pegged to the price of a commodity such as gold or silver.
    - The digital fiat currency or CBDC can be transacted using wallets backed by **blockchain.**
    - Though the concept of CBDCs was directly **inspired by** Bitcoin, it is different from decentralised virtual currencies and crypto assets, which are not issued by the state and lack the ‘legal tender’ status.
- **Objectives:**

- The main objective is to mitigate the risks and trim costs in handling physical currency, costs of phasing out soiled notes, transportation, insurance and logistics.
- It will also wean people away from cryptocurrencies as a means for money transfer.

- **Global Trends:**
  - Bahamas has been the first economy to launch its nationwide CBDC — Sand Dollar in 2020.
  - Nigeria is another country to have roll out eNaira in 2020.
  - China became the world's first major economy to pilot a digital currency e-CNY in April 2020.



What is the Significance of CBDC?

- **Cross-Border Transactions:**
  - CBDCs possess unique attributes that can **revolutionize cross-border transactions.**
  - Instant settlement feature of **CBDCs as a significant advantage,** making cross-border payments cheaper, faster, and more secure.
    - Faster, cheaper, transparent, and **inclusive cross-border payment services can yield substantial benefits** for individuals and economies worldwide. These improvements can support economic growth, international trade, and financial inclusion on a global scale.
- **Traditional and Innovative:**
  - CBDC can gradually **bring a cultural shift towards virtual currency** by reducing currency handling costs.
  - CBDC is envisaged **to bring in the best of both worlds:**
    - The convenience and security of digital forms like cryptocurrencies
    - The regulated, reserved-backed money circulation of the traditional banking system.
- **Financial Inclusion:**
  - The increased use of CBDC could be explored for many other financial activities to push the **informal economy** into the formal zone to ensure better tax and regulatory compliance.
  - It can also pave the way for furthering financial inclusion.

What are the Challenges in Adopting CBDC Across India?

- **Privacy Concerns:**
  - The first issue to tackle is the **heightened risk to the privacy of users**—given that the central bank could potentially end up handling an enormous amount of data regarding user transactions.

        - This has serious implications given that digital currencies will not offer users the level of privacy and anonymity offered by transacting in cash.
    - Compromise of credentials is another major issue.
- **Disintermediation of Banks:**
    - If sufficiently large and **broad-based, the shift to CBDC can impinge** upon the bank's ability to plough back funds into credit intermediation.
    - If e-cash becomes popular and the Reserve Bank of India (RBI) places no limit on the amount that can be stored in mobile wallets, weaker banks may struggle to retain low-cost deposits.
- **Other Risks are:**
    - Faster **obsolescence of technology could pose a threat to the CBDC** ecosystem calling for higher costs of upgradation.
    - Operational risks of intermediaries as the staff will have to be retrained and groomed to work in the CBDC environment.
    - **Elevated** cyber security risks, vulnerability testing and the costs of protecting the firewalls.
    - Operational burden and costs for the central bank in managing CBDC.

Way Forward

- Central banks should continue their efforts to **research, develop, and pilot CBDCs.** Collaboration with financial institutions, technology experts, and other stakeholders is essential to ensure the successful implementation of CBDCs.
- Central banks and financial authorities from different countries **should collaborate closely on CBDC initiatives.** Cross-border payments inherently involve multiple jurisdictions, so international cooperation is vital to address regulatory, security, and technical challenges.
- CBDCs must prioritize security and privacy. Robust cybersecurity measures should be in place to protect against hacking and fraud. Simultaneously, mechanisms for ensuring user privacy and data protection should be established and maintained.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Q. With reference to Central Bank digital currencies, consider the following statements : (2023)

1. It is possible to make payments in a digital currency without using US dollar or SWIFT system.
2. A digital currency can be distributed with condition programmed into it such as a time-frame for spending it.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: (c)

Adopt a Heritage 2.0 and e-Permission Portal

For Prelims: Adopt a Heritage, Monument Mitras, AMSAR ACT 1958, Indian Heritage App

For Mains: Objectives and rationale for Adopt a Heritage scheme

Source: PIB

Why in News?

Archaeological Survey of India (ASI) launched **the "Adopt a Heritage 2.0"** program to come forward and help in better upkeep and rejuvenation of India's rich cultural heritage, in line with the vision of **'Virasat Bhi, Vikas Bhi'.**

- An easy-to-use mobile application called **'Indian Heritage'** has been introduced, alongside the launch of an **e-permission portal.**

What is the Indian Heritage App and e-Permission Portal?

- **Indian Heritage App:**
  - It will showcase the heritage monuments of India.
  - The app will feature state-wise details of monuments along with photographs, a list of public amenities available, geo-tagged locations, and feedback mechanism for citizens.
- **e-Permission Portal:**
  - An e-permission portal is for obtaining permission for photography, filming, and developmental projects on monuments.
  - The portal will fast-track the process of obtaining various permissions and solve operational and logistical bottlenecks.

What is the Adopt a Heritage 2.0 Programme?

- The programme is a revamped version of the earlier scheme (Adopt a Heritage Scheme) launched in 2017 and clearly defines the amenities sought for different monuments as per the **Ancient Monuments and Archaeological Sites and Remains Act (AMASR), 1958.**
- The stakeholders can apply for adopting a monument or specific amenities at a monument through a dedicated web portal that contains details of monuments sought for adoption.
- Adopt a Heritage 2.0 programme seeks to **foster collaboration with corporate stakeholders through which they can contribute to the preservation of these monuments** for the next generations.
  - The term of the appointment will be for a period of five years initially, which may be further extended up to five years.

What is the Adopt a Heritage Scheme?

- **About:**
  - It is a collaborative effort between the Ministry of Tourism, Ministry of Culture ASI, and State/UTs governments.
  - It was launched on **27 September 2017 (**World Tourism Day**)** by the President of India.
- **Aim:**
  - The Project aims to develop synergy among all partners to effectively promote 'responsible tourism'.
  - It aims to involve public sector companies, private sector companies, and corporate citizens/individuals to take up **the responsibility for making our** heritage **and tourism more sustainable.**
  - It is to be done through the development, operation, and maintenance of **world-class tourist infrastructure and amenities at ASI/ State heritage sites** and other important tourist sites in India.
- **Monument Mitras:**
  - Agencies/Companies would become **'Monument Mitras'** through the innovative concept

of ‘Vision Bidding’, where the agency with the best vision for the heritage site will be given an opportunity to associate pride with their **CSR (Corporate Social Responsibility)** activities.

- **Rationale Behind ‘Adopt a Heritage:**
  - The heritage sites are facing common challenges primarily related to the operations and maintenance of the various infrastructural as well as service assets.
  - There is a need to develop a robust mechanism for the provision of basic amenities on an immediate basis and advanced amenities on a long-term basis.

What are the Previous Attempts for Corporate Involvement in Heritage Management?

- **National Culture Fund:** The government of India in 1996 formed a National Culture Fund. Since then, 34 projects have been completed under it through public-private partnerships.
- **Campaign Clean India:** ‘Campaign Clean India,’ in which the government had identified 120 monuments/destinations.
  - Under this scheme, the India Tourism Development Corporation (ITDC) adopted Qutab Minar as a pilot project in 2012, while ONGC adopted six monuments — Ellora Caves, Elephanta Caves, Golkonda Fort, Mamallapuram, Red Fort, and Taj Mahal — as part of its CSR.

Note:

Experience of Italy: Italy has the largest number of **UNESCO** Heritage Sites in the world. The cash-strapped government has been successfully collaborating with corporations since 2014 for heritage maintenance after shunning them for decades.

UPSC Civil Services Examination Previous Year Question (PYQ)

Mains

Q.1 Safeguarding the Indian Art Heritage is the need of the moment. Discuss. **(2018)**

Q.2 Indian Philosophy and tradition played a significant role in conceiving and shaping the monuments and their art in India. Discuss. **(2020)**

National Mission for Clean Ganga

For Prelims: National Mission for Clean Ganga, Sustainable Development, Namami Gange Programme, Ganga Action Plan, National River Ganga Basin Authority (NRGBA).

For Mains: National Mission for Clean Ganga, and Related Challenges.

Source: TH

Why in News?

In the last seven years, while some progress has been made by India's **National Mission for Clean Ganga (NMCG)**, there are still significant challenges ahead in achieving the mission's goals.

What is the Progress of Sewage Treatment under the NMCG?

- The NMCG has **installed treatment plants capable of treating just 20%** of the sewage estimated to be generated in the five major States that lie along the Ganga River.
    - These states are Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, and West Bengal.
- The NMCG has projected that the treatment capacity for sewage will increase to **33% of the estimated amount generated by 2024**, and further increase to **60% by 2026.**
- The NMCG plans to set up **Sewage Treatment Plants (STPs)** capable of treating about **7,000 MLD of sewage by 2026.**
- As of **July 2023, STPs** with a total capacity of **2,665 MLD have been commissioned and are operational.** The progress has picked up significantly in recent years, with 1,455 MLD capacity completed in the last financial year (2022-23).
- **STPs and sewerage networks** are at the heart of the **Namami Ganga Mission** and account for about 80% of the overall project outlay.

What is the National Mission for Clean Ganga (NMCG)?

- **About:**
    - On 12th August 2011, the NMCG was listed **as a society** under the **Societies Registration Act, 1860.**
    - It acted as the implementation arm of the **National Ganga River Basin Authority (NGRBA)** which was constituted under the provisions of the **Environment (Protection) Act (EPA),1986.**
        - **NGRBA** was dissolved in 2016 and **replaced by the National Council for Rejuvenation, Protection, and Management of River Ganga.**
- **Objective:**
    - The objective of the NMCG is to **reduce pollution and ensure the rejuvenation** of the Ganga River.
        - **Namami Gange** is one of the Coveted Programmes of NMCG to clean Ganga.
    - This can be achieved by promoting intersectoral coordination for comprehensive planning & management and maintaining minimum ecological flow in the river, with the aim of ensuring water quality and environmentally **sustainable development.**
- **Organization Structure:**
    - The Act envisages a five-tier structure at the national, state, and district levels to take measures for prevention, control, and abatement of environmental pollution in river Ganga as below:
        - **National Ganga Council under** the chairmanship of the Hon'ble Prime Minister of India.
        - Empowered Task Force (ETF) on river Ganga under the chairmanship of Hon'ble Union Minister of Jal Shakti (Department of Water Resources, River Development and Ganga Rejuvenation).
        - National Mission for Clean Ganga (NMCG).
        - State Ganga Committees
        - District Ganga Committees in every specified district abutting river Ganga and its tributaries in the states.

What are the Challenges Faced by NMCG?

- **Land Acquisition:**
    - Several plants took time to be commissioned as **there were problems with land acquisition.**
    - In many instances, the Detailed Project Reports (which prescribe all the steps necessary to execute a project, and the roles of agencies) needed revision.

- **Lack of Local Initiatives:**
    - State Governments are under the impression that **building treatment plants was entirely the Centre's responsibility.**
    - Waste management, especially MSW segregation and recycling, is most effective when handled at the source.
    - While there were plans to create a cadre of village and town-level volunteers to monitor water quality and support local bodies, the mission has faced challenges in effectively implementing these initiatives.
- **Improper Funding:**
    - Though NMCG is a ₹20,000 crore mission, the government has so far given in-principle approval for projects worth ₹37,396 crore, of which only ₹14,745 crore has been released to States for infrastructure work, as of June 2023.
- **Municipal Solid Waste Management:**
    - The mission faced criticism for not adequately addressing the problem of municipal solid waste flowing into the Ganga.
    - Many towns and cities along the river lack proper waste treatment infrastructure, allowing untreated waste to enter the river.
- **Inadequate Sewerage Coverage:**
    - Much of India's urban population resides outside sewerage networks, resulting in a substantial portion of waste not reaching STPs.
- **Improper Waste Disposal**:
    - The study by the Quality Council of India revealed that rubbish heaps are found near ghats in numerous towns along the river, indicating improper waste disposal practices. This poses a threat to the cleanliness of the Ganga.

What are the Effects of the NMCG?

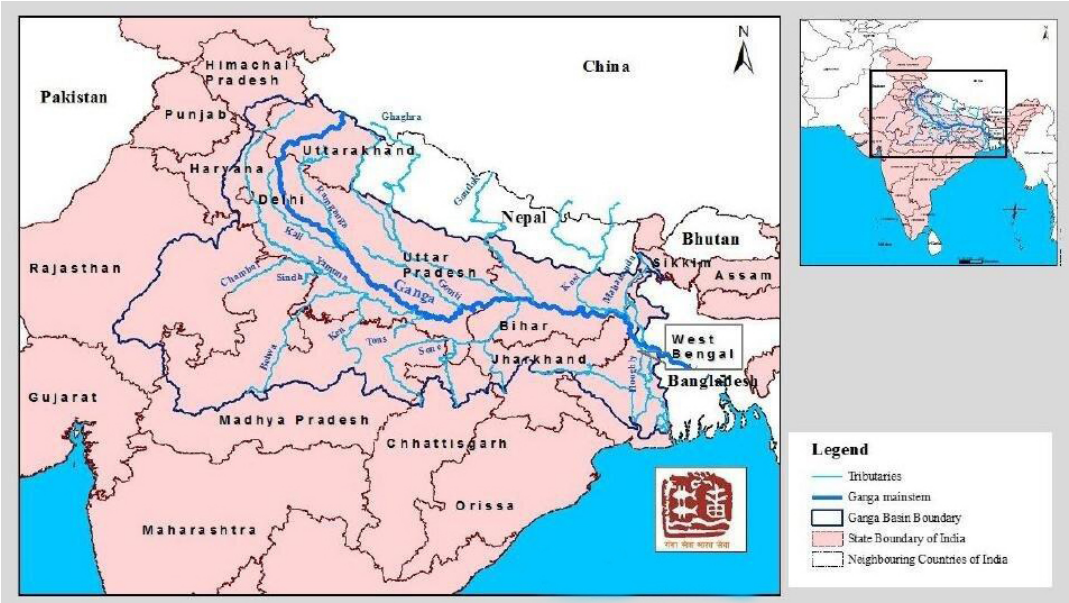
- The river's water quality is now within prescribed limits of notified primary bathing water quality.
- There is a conspicuous sign of the improvement in water quality along the Ganga was a rise in the dolphin population — both adult and juvenile — from 2,000 to about 4,000.
    - Dolphins can be seen in new stretches of the river as well as in tributaries.
- Fishermen are also reporting the increased presence of Indian carp (a fish species) that only thrives in clean water. So we have nature's verdict on river improvement.
- The typical parameters used by the Central Pollution Control Board (such as the levels of dissolved oxygen, biochemical oxygen demand, and faecal coliform) vary widely along various stretches of the river.
- The NMCG is now working to develop a **water quality index,** on the lines of the air quality index, to be able to better communicate about river-water quality.

What are the Initiatives Related to Ganga?

- **Namami Gange Programme**
- **Ganga Action Plan**
- **National River Ganga Basin Authority (NRGBA)**
- **Clean Ganga Fund**
- **Bhuvan-Ganga Web App**
- **Ban on Waste Disposal**

What is the Ganga River System?

- The headwaters of the Ganga called the **'Bhagirathi' are fed by the Gangotri Glacier** and joined by the Alaknanda at Devprayag in Uttarakhand.
- At Haridwar, **Ganga emerges from the mountains** to the plains.
- The Ganga is joined by many tributaries from the Himalayas, a few of them being major rivers such as the Yamuna, the Ghaghara, the Gandak, and the Kosi.



Pacific Weather Changing: More Multi-Year El Nino and La Nina

For Prelims: El Nino and La Nina, Walker Circulation, Tropical Pacific Ocean, El Nino-Southern Oscillation, Extreme Weather Events.

For Mains: Impacts of Rising Multi-year El Nino and La Nina Events

Source: DTE

Why in News?

A recent study has raised concerns about the **impact of human activities on the duration and behaviour of** El Nino and La Nina **events.**

- It found that **Walker Circulation** has changed its behavior since the industrial era and **multi-year El Nino and La Nina events could become more frequent.**

What do the Recent Studies Suggest?

- The **Walker Circulation**, a key atmospheric component of ENSO, drives weather patterns worldwide. Researchers aimed to assess whether greenhouse gas emissions **had influenced this critical climate driver.**
- The study's findings revealed that the transition from El Nino to La Nina has slightly slowed over time. This suggests that **multi-year** climate patterns may become more frequent in the future, posing heightened risks of **droughts, fires, heavy rainfall, and floods.**
- While the overall strength of the **Walker Circulation has not yet decreased,** researchers speculate that **elevated** carbon dioxide **levels could weaken it.**
    - Many climate models also predict a **decline in the Walker Circulation by the end of the century.**
- The study also highlighted a **connection between volcanic eruptions and the**

weakening of the Walker Circulation. This phenomenon often leads to El Nino-like conditions.
        - The research identified three significant **El Nino events in the twentieth century that followed volcanic eruptions: Mount Agung in 1963, El Chichón in 1982, and Mount Pinatubo in 1991.**

- **Walker Circulation:**
    - The Walker Circulation is a **large-scale atmospheric circulation pattern** in the tropical Pacific region of the Earth.
        - It is a system of winds that plays a crucial role in shaping climate and weather patterns in the tropics and beyond.
    - The **Walker Circulation is primarily associated with the Pacific Ocean** but has global impacts.
        - A **weaker Walker Circulation is associated with El Nino**, while a **stronger circulation signals La Nina.**
- **El Nino:**
    - **El Nino** is a climate pattern that describes the **unusual warming of surface waters in the Tropical Pacific Ocean.** It means Little Boy in Spanish and it occurs more frequently than La Nina.
        - It is known to **suppress** monsoon **rainfall in India.**
    - It occurs due to the weakening or reversal of trade winds in the tropical Pacific.
        - Normally, **trade winds blow from east to west,** pushing warm surface waters towards the **western Pacific.**
- **La Nina:**
    - La Nina is a pattern that describes the **unusual cooling of the Tropical Pacific Ocean.** It means "**Little Girl**" in Spanish and is sometimes called **El Viejo, anti-El Niño, or simply "a cold event."**
        - It is known to aid rainfall over India.
    - It occurs as a result of the **strengthening of the trade winds in the tropical Pacific Ocean.**
        - During La Nina events, these trade winds become **even stronger, intensifying the normal east-to-west flow** of warm surface waters across the equatorial Pacific.
        - This strengthening of the trade winds leads to cooler-than-average sea surface temperatures in the **central and eastern equatorial Pacific.**
- **El Nino-Southern Oscillation (ENSO):**
    - It is a climate phenomenon resulting from the interaction between ocean and atmospheric conditions.
        - The **"southern oscillation"** component refers to **differences in sea-level air pressure over the western and eastern Pacific Oceans.**
    - **El Nino and La Nina** represent the warm and cool phases of the **El Nino-Southern Oscillation (ENSO) cycle.**
        - El Nino and La Nina episodes typically occur every 2 to 7 years. La Nina events may last **between one and three years.**
            - However, it is rare for El Nino events to last longer than a year.
        - Multi-year El Niño and La Nina events are those that persist for more than one year without returning to normal conditions in between.
            - In 2023, **La Nina concluded a three-year period,** and El Nino made its presence felt. Such long-lasting ENSO phases are unusual.

El Niño and La Niña

El Niño

- **Warming** of the ocean surface/ Above average **sea surface temp.** (SST)
- **Easterly winds either weaken** or start blowing in the **opposite direction**
- First noticed by **Peruvian fishermen** in the 1600s
- **More frequent than La Niña**

Impacts

- **Drastically higher rainfall in S. America** (coastal flooding and erosion)
- **Droughts in Indonesia and Australia**; wildfires
- **Weaker monsoons** and even **droughts** in **India and SE Asia**
- **Reduces the upwelling** of cooler, nutrient-rich waters from the deep - along the west coast of South and Central America.

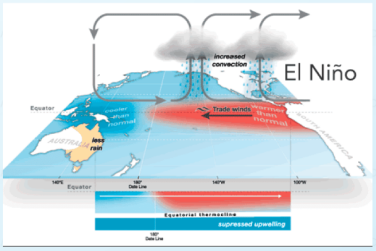


Fig. 1 - Depiction of El Niño Phenomenon

La Niña

- Also called **El Viejo, anti-El Niño, or simply "a cold event"**
- **Normal easterly winds** along the equator **become even stronger**
- **May last 1-3 years,** unlike El Nino (which usually lasts no more than a year)

Impacts

- **Heavier rains in SE Africa**, catastrophic **floods in Australia**
- **Drier-than-normal conditions** in S. America
- **Summer Monsoon rainfall** - greater than normal rainfall in **India**; beneficial for agriculture dependent Indian economy
- Off the west coast of the Americas, **upwelling increases**, bringing cold, nutrient-rich water to the surface.

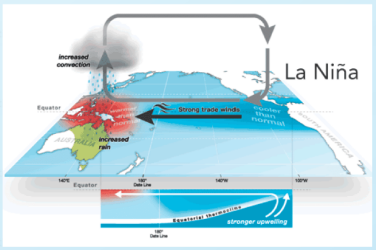


Fig. 2 - Depiction of La Niña Phenomenon

Oceanic Nino Index (ONI)

- It is a measure of the departure from normal sea surface temperature in the east-central Pacific Ocean.
- It is the **standard means by which each El Nino episode is determined,** gauged, and forecast.

Drishti IAS

What can be the Impacts of Rising Multi-year El Nino and La Nina Events?

- **Increased Frequency of Extreme Weather Events:** Multi-year El Niño and La Niña events can alter the patterns of precipitation, temperature, wind, and atmospheric pressure across the globe, leading to more frequent and **severe droughts, floods, heat waves, cold snaps, storms, and wildfires.**
- **Natural Disasters:**
  - **Floods and Droughts:** Multi-year **El Nino events can amplify the risk of prolonged droughts** followed by severe flooding events in different regions.
    - Conversely, multi-year La Nina events can lead to excessive rainfall and flooding in some areas, followed by extended periods of drought in others.
  - **Tropical Cyclones**: The frequency and intensity of tropical cyclones can be influenced by ENSO events.
    - Multi-year events can result in **variations in cyclone activity in different ocean basins, affecting coastal regions' vulnerability.**
- **Agriculture and Food Security:** Multi-year El Nino-induced droughts can lead to **reduced crop yields**, affecting global food supplies and prices.
  - In contrast, multi-year La Nina events may enhance crop production in some regions but also **lead to excessive rainfall and** waterlogging**, damaging crops.**
- **Economic and Societal Impacts:**
  - **Economic Costs:** The combined impacts of multi-year ENSO events can result in significant economic costs due to **damage to infrastructure, increased energy demand, and disruptions to global trade** in commodities such as food and minerals.
  - **Health Risks:** Changing weather patterns can affect the spread of diseases, with **increased risks of** waterborne diseases during flooding and vector-borne diseases during

prolonged droughts.

- **Environmental Consequences:**
  - **Ecosystems**: Multi-year events can **stress terrestrial and marine ecosystems,** leading to coral bleaching**, forest fires, and habitat disruptions.**
    - Ecosystems may struggle to adapt to the rapid and persistent changes in temperature and precipitation.
  - **Biodiversity**: Shifts in environmental conditions can **impact the distribution and survival of species,** particularly those sensitive to climate variations. This can have cascading effects on biodiversity.

UPSC Civil Services Examination, Previous Year Question (PYQ)

Mains

Q. Most of the unusual climatic happenings are explained as an outcome of the El-Nino effect. Do you agree? **(2014)**

India, that is Bharat: The Ongoing Debate

For Prelims: Article 1, Origin of the Name Bharat and India, Vishnu Purana, **Constituent Assembly.**

For Mains: Historical Perspectives on the Names "India" and "Bharat"

Source: IE

Why in News?

Recently, invitations for the upcoming **G-20 Summit** in New Delhi have introduced a noteworthy alteration. Instead of the conventional **"President of India," the invitations now bear the term "President of Bharat",** renewing a **broader conversation regarding the nation's nomenclature** and its historical connotations.

What are the Historical Perspectives on the Names "India" and "Bharat"?

- **Constitutionality:**
  - **Article 1 of the Indian Constitution** already uses both **"India" and "Bharat"** interchangeably, stating, **"India, that is Bharat, shall be a Union of States."**
  - The preamble of the Indian Constitution begins with "We the People of India," but the **Hindi version uses "Bharat" instead of India,** indicating interchangeability.
    - Additionally, some government institutions, such as the **Indian Railways,** already have Hindi variants that include **"Bharatiya."**
- **Origin of the Name Bharat:**
  - The term "Bharat" has deep historical and cultural roots. It can be traced back to **Puranic literature and the epic Mahabharata.**
  - Vishnu Purana describes **"Bharata" as the land between the southern sea and the northern snowy Himalayan mountain.**
    - It signifies a religious and socio-cultural entity more than a mere political or geographical one.

- **Bharata is also the name of a legendary ancient king**, considered the ancestor of the **Rig Vedic tribes of Bharatas,** symbolizing the progenitor of all subcontinent's people.

- **Origin of the Name India:**
  - The name India is derived from the word **Indus**, which is the name of a river that flows through the northwestern part of the subcontinent.
    - The ancient **Greeks** called the people living beyond the **Indus as Indoi,** which means **“the people of Indus”**.
    - Later, the Persians and the Arabs also used the term Hind or Hindustan to refer to the land of Indus.
  - The Europeans adopted the **name India from these sources**, and it became the official name of the country after the British colonial rule.

- **Constitutional Assembly Deliberation Regarding India and Bharat:**
  - The debate surrounding the country's name is not new. When the **Constituent Assembly** was framing the **Constitution in 1949**, there was a division of opinions regarding the name.
    - Some members felt that **"India" was a reminder of colonial oppression** and sought to prioritize "Bharat" in official documents.
      - **Seth Govind Das from Jabalpur advocated for placing "Bharat" above "India,"** emphasizing that the latter was merely a translation of the former in English.
      - **Hari Vishnu Kamath** cited the example of the Irish Constitution, which changed the name of the country upon achieving independence, as a **precedent for using "Bharat."**
      - **Hargovind Pant** argued that the people wanted "**Bharatvarsha**" and rejected the term "India" imposed by foreign rulers.
- **Recent Development:**
  - In 2015, **Centre opposed a name change,** stating that the issue had been extensively deliberated upon during the Constitution's drafting.
    - The **Supreme Court** has twice rejected pleas to rename **'India' to 'Bharat', once in 2016 and then in 2020,** reaffirming that **"Bharat" and "India" both find mention in the Constitution.**

What is the Historical Significance of the Name “Hindustan”?

- The term "Hindustan" has historical significance and was popular in Punjab. Sikh founder Guru Nanak Dev mentioned **"Hindustan" in Gurbani, and Guru Teg Bahadur is known as the protector of "Hind" and religion.**
- Shah Muhammad documented conflicts between the British and Sikhs as a war between "Hind" and Punjab.
- The **Ghadar Party and freedom struggle activists used "Hindustan"** in their movements, making it relevant in Punjab's history.

Legal Insight: Legal Perspectives of Renaming India to Bharat

(https://www.drishtijudiciary.com/**)**

Rapid Fire Current Affairs

Ministry of Tourism and UNWTO Unveil G20 Tourism and SDG Dashboard

- The Ministry of Tourism in collaboration with the **United Nations World Tourism Organization (UNWTO)**, unveiled the G20 **Tourism and** Sustainable Development Goals (SDGs) **Dashboard**
  - It showcases the **best practices, case studies, and insights from G20 countries for achieving the SDGs.**
- The UNWTO is an **intergovernmental organization based in Madrid, Spain, and has 159 Member States.**
- UNWTO promotes tourism as a **driver of economic growth, inclusive development, and**

environmental sustainability and offers leadership and support to the sector in advancing knowledge and tourism policies worldwide.

Read more: United Nations World Tourism Organization (UNWTO)

Hong Kong's Top Court Rules to Recognise Same-Sex Partnerships

- Hong Kong's top court has ruled in favour of recognising same-sex partnerships but **stopped short of granting full marriage rights to the city's** LGBTQ community**.**
- The court gave the government two years to come up with a legal framework for legal recognition of same-sex partnerships.
- In 133 countries homosexuality decriminalised, but only in **32 of them same-sex marriage is legal.**

Read more: LGBTQIA+ Rights and Acceptance in India

Malaviya Mission: Teacher Training Program for Higher Education

The **Union Minister for Education** unveiled the **Malaviya Mission - Teacher Training Programme** initiated by the University Grants Commission **(UGC)** in collaboration with the Ministry of Education.

- The program aims to **enhance the quality of** education by providing customised training for teachers in higher educational institutions.
    - It aspires to equip **15 lakh teachers across India** with the skills needed to meet the goals of the National Education Policy (NEP).
- Renaming of **Human Resource Development Centres (HRDCs)** as Madan Mohan Malaviya **Teachers' Training Centres** was also announced.

Read more: Pt. Madan Mohan Malaviya

Integrating Personalised Adaptive Learning into DIKSHA Platform

The National eGovernance Division **(NeGD),** a branch of the Ministry of Electronics and Information Technology (MeitY), is embarking on a mission to **integrate Personalised Adaptive Learning (PAL)** into the **Digital Infrastructure for Knowledge Sharing (DIKSHA)** platform.

- DIKSHA, overseen by the **Ministry of Education**, serves as an **online repository of educational content for schools**, but it is currently static.
    - PAL, on the other hand, **employs AI to offer students personalised learning experiences** tailored to their individual needs and abilities.

Read more: DIKSHA
