NEXT IAS

DAILY EDITORIAL ANALYSIS

TOPIC

IMPROVING DIVERSITY OF SUBSEA CABLES

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Context

- Submarine cable networks are constantly expanding, evolving, and being reconfigured to meet the exponential growth in data demands.

About Submarine Cable Networks

- **Subsea cables** (*aka* **submarine communications cables)** are **fiber-optic cables** laid on the ocean floor to **carry digital data between continents.**
  - They consist of optical fibers, copper or aluminum sheathing, steel wire armor, and polyethylene coating.
- These cables form the **core infrastructure of the global Internet**, transmitting more than **99% of international digital communication** including Internet, phone, and financial transactions.

Global Subsea Network

- The world hosts **over 550 active and planned subsea cable systems**, spanning more than **1.5 million kilometers**, enough to circle the Earth nearly 40 times.
- They carry more than **6,400 Terabits per second (TBPS)** of global digital information, and they remain **faster, cheaper, and more reliable** for high-volume data transfer despite the rise of satellites.
  - At intervals of 50–100 km, **repeater stations (amplifiers)** boost the optical signal to maintain speed and integrity over long distances.
- **Major global cable systems include:**
  - **SEA-ME-WE 6** (Southeast Asia–Middle East–Western Europe)
  - **Marea** (US to Spain, backed by Microsoft and Meta)
  - **Dunant** (US.to France, built by Google)
  - **Equiano** (Portugal to South Africa, by Google)
  - **2Africa Project** (Africa's largest cable system, by Meta and partners)

Subsea Cables and India

- India is a major hub in the global subsea cable network, with **18 operational systems** and **four more in development**. The primary **Cable Landing Stations (CLS)** are located in **Mumbai, Chennai, and Kochi**.
- Key upcoming developments include:
  - **Visakhapatnam Open CLS**, a **carrier-neutral** landing station being developed as a future regional hub.
  - **Island CLS expansion**, connecting **Andaman & Nicobar** and **Lakshadweep** to the mainland through **BSNL's local loop networks**.
- These initiatives aim to improve **redundancy**, **resilience**, and **network diversity** for India's rapidly expanding digital economy.

Why Subsea Cables Matter?

- **Economic Backbone:** Every international digital service, from banking to cloud storage depends on subsea connectivity.
- **Latency Advantage**: Optical fiber cables transmit data faster and with lower delay than satellites.
- **Security and Resilience:** Redundant routes and diverse CLS locations reduce risks from natural or human-induced disruptions.
- **National Strategy:** Countries view subsea cables as **critical information infrastructure**, essential for digital sovereignty and defense.

Challenges and Vulnerabilities

- **Concentration Risks:** The concentration of global **subsea (undersea) cable infrastructure** in a small number of geographic chokepoints is a **strategic vulnerability** for the modern digital world.

- Their geographic clustering creates risks across **digital sovereignty, economic resilience, and national security**.
- Key chokepoints include the **Suez Canal / Red Sea corridor, Strait of Malacca, English Channel, and Cable Landing Clusters (CLS)** in places like **Singapore**, **Egypt**, and **Marseille.**
- A single physical disruption in these areas can affect **dozens of countries simultaneously**.

- **Digital Sovereignty At Risk: Digital sovereignty** refers to a state's ability to control and protect its data, communications, and digital infrastructure. **Key issues:**
  - **Foreign Ownership & Control**: Many cables are owned or operated by multinational consortia or large tech firms, limiting national oversight.
  - **Jurisdictional Exposure**: Data often transits through countries with different legal regimes, surveillance laws, or intelligence alliances.
  - **Dependence Asymmetry**: Smaller or developing nations rely heavily on infrastructure located in or controlled by a few hub states.
- **CLS Vulnerabilities:** Natural disasters, anchor drags, or deliberate sabotage at a single point can cause widespread disruptions.
  - For digital economies like **India and Australia**, diversification of cable routes is essential for **national security and economic stability**.
- **National Security Implications:** These include:
  - **Espionage**: Cables can be tapped for intelligence gathering.
  - **Hybrid warfare**: Damage to cables can occur in 'gray zone' conflicts—below the threshold of open war.
  - **Attribution difficulty**: It is often unclear whether damage is accidental, criminal, or state-sponsored.
  - **Military dependence**: Armed forces rely heavily on civilian-owned cable networks for logistics and communications.
- **Economic Vulnerabilities:**
  - **Single-point failures**: Cable breaks (from anchors, earthquakes, or sabotage) can slow or sever connectivity.
  - **Repair delays**: Fixing cables can take weeks, especially in deep water or contested regions.
  - **Cascading effects**: Even temporary latency spikes can disrupt stock exchanges, payment systems, and cross-border business operations.
- **Other concerns** include **natural hazards** such as earthquakes or undersea landslides, a**ccidental damage** from fishing trawlers or ship anchors, and **geopolitical risks**, including sabotage or espionage.

Cable Landing Stations (CLS)

- CLS locations are being recognized as **critical infrastructure w**ith the increasing dependence on digital connectivity.
  - Countries worldwide are expanding their CLS networks to strengthen Internet resilience and reliability.

Global Moves

- Globally, about **500,000 km of new subsea cables** are planned, expected to add nearly **20,000 TBPS** of capacity in the coming years.
- Global trends include:
  - **New regional routes** avoiding congested chokepoints.
  - **Open-access CLS models** to democratize cable landing.
  - **Public-private collaboration** to secure and manage critical infrastructure.
  - **Environmental and sustainable installation practices** to reduce ecological impact.
- **Australia** is diversifying beyond its main CLS hub in **Sydney**. Its external territories are being explored as new landing points to enhance resilience.

- **Christmas Island**, located in the Indian Ocean, is set to become a **major CLS hub**, with **Google planning four new cables** and a connectivity hub there.

CLS and India

- **Bharat Sanchar Nigam Limited (BSNL)** is spearheading efforts to connect the mainland with the **Andaman & Nicobar** and **Lakshadweep Islands**, **transforming them into potential CLS hubs** for international connectivity.
- Simultaneously, **Visakhapatnam** is emerging as a **strategic data centre hub** and a proposed **Open CLS location** for global tech giants such as **Meta, Google, and Amazon**.

Policy and Security Initiatives

- In India, the **Telecommunications Regulatory Authority of India (TRAI)**, in its report on 'Licensing Framework and Regulatory Mechanism for Submarine Cable Landing'**,** recommended granting **Critical Information Infrastructure** status to subsea cables to enhance their protection.
  - The forthcoming **National Telecommunications Policy 2025** reiterates the same emphasis on security and resiliency.
- Similarly, Australia's **Department of Foreign Affairs and Trade (DFAT)** has established a **Cable Connectivity and Resilience Centre** to promote regional collaboration and build technical capacity across the **Indo-Pacific**.

Building a Resilient Future: Diversity by Design

- Submarine cable systems are the **lifelines of the digital economy**, yet their security and resilience have long been underestimated.
- As the world becomes more dependent on seamless connectivity, **India and Australia** have an opportunity and a responsibility to lead in building **redundant, secure, and diverse submarine networks**.
- The principle of **'diversity by design'** needs to guide future cable deployments, ensuring that these vital conduits of digital communication continue to support the world's societies, economies, and security systems without interruption.

Source: BL

Daily Mains Practice Question

[Q] The growing concentration of global subsea cable infrastructure in a few geographic chokepoints poses risks to digital sovereignty, economic resilience, and national security. Comment.

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