2. Dam Safety - Internal Security

A recent study reveals India's aging dams are losing significant storage capacity due to sedimentation, posing a major threat to water security and flood control. The solution involves robust implementation of the Dam Safety Act 2021, proactive sediment management, and adopting global best practices to ensure their long-term safety.

The Core Issue - Reservoir Sedimentation and Dam Safety Crisis

The Finding - A recent study by IISER Bhopal has revealed an alarming 50% loss in the storage capacity of reservoirs across India, primarily due to sedimentation.

The Threat - This rapid loss of storage capacity poses a direct threat to India's water security, hydropower generation, and flood control capabilities.

Vulnerable Regions - The problem is particularly acute in dams located in the Himalayas, the Narmada-Tapi basin, and the Western Ghats, where erosion rates are high.

Dams in India - A Statistical Overview

Global Standing - India has more than 5,200 large dams, making it the third-largest dam-owning nation in the world, after China and the USA.

Aging Infrastructure - A significant concern is the age of these structures. Nearly 80% of India's large dams will be over 50 years old by 2030, and over 200 are already more than 100 years old, raising serious questions about their structural integrity.

UN Warning on Storage Loss - A United Nations assessment has warned that due to sediment accumulation, Indian dams could lose approximately 26% of their original storage capacity by 2050, which would severely impact food and water security.

Key Concerns for Dam Safety in India

Seismic Vulnerability - Many major dams are located in earthquake-prone zones. The 2001 Bhuj earthquake, which damaged the Chang Dam in Gujarat, serves as a stark reminder of this risk.

Climate Change and Extreme Weather - The increasing frequency of glacial lake outbursts (GLOFs), cloudbursts, and extreme rainfall events poses a severe threat. The catastrophic failure of the Chungthang Dam in Sikkim in 2023 due to a glacial flood highlighted the vulnerability of Himalayan dams.

Sedimentation Risks - Beyond reducing storage, sedimentation puts additional structural pressure on dams, damages turbines, clogs gates, and increases the risk of overtopping during floods.

Financial and Administrative Lapses - Many states face budgetary constraints, leading to poor maintenance and delayed repairs. A CAG audit of the Gandhi Sagar Dam in Madhya Pradesh, for instance, revealed a failure to implement safety measures recommended by the Central Water Commission.

High Human Vulnerability - Millions of people live downstream of major dams, making any failure a potential humanitarian catastrophe with massive loss of life and property.

Key Initiatives for Dam Safety in India

The Dam Safety Act, 2021

Purpose - This landmark Act provides a comprehensive legal framework for the surveillance, inspection, operation, and maintenance of specified dams to prevent failures.

Institutional Framework - It establishes a four-tier structure to ensure accountability -

1. **National Committee on Dam Safety (NCDS) -** Formulates policies and guidelines.
2. **National Dam Safety Authority (NDSA) -** Acts as the central regulator.
3. **State Committees on Dam Safety (SCDS) -** Oversee state-level implementation.
4. **State Dam Safety Organisations (SDSOs) -** Responsible for inspections and enforcement.

Key Mandates - The Act requires dam owners to prepare Emergency Action Plans (EAPs) and conduct regular Comprehensive Safety Evaluations (CSEs).

Other Major Initiatives

Dam Rehabilitation and Improvement Project (DRIP) - A massive project, supported by the World Bank and AIIB, aimed at modernizing and rehabilitating over 700 aging dams across 19 states.

Digital Tools for Monitoring - The government has deployed several advanced digital platforms -

1. **DHARMA (Dam Health and Rehabilitation Monitoring Application) -** A web tool to track dam health.
2. **SHAISYS (Seismic Hazard Analysis Information System) -** A tool to assess seismic risks.
3. **India-WRIS -** A GIS-based platform for real-time water resource data.

Global Best Practices and Innovations

United States - Maintains a comprehensive National Inventory of Dams (NID) and mandates strict, periodic inspections.

Japan - A leader in earthquake-resistant dam designs and has pioneered innovative sub-surface dams that store groundwater underground, preventing evaporation and sedimentation.

China - Employs advanced sediment flushing technologies and large-scale catchment afforestation to manage siltation in rivers like the Yellow River.

European Union - Integrates dam safety standards with environmental directives to ensure ecological balance.

The Way Forward - A Multi-Pronged Strategy

1. **Proactive Sediment Management** - Implement large-scale afforestation and soil conservation in catchment areas. Where feasible, use technical solutions like sediment flushing, sluicing, or dredging.
2. **Modernize Monitoring and Assessment -** Regularly use hydrographic surveys, remote sensing, and GIS to track siltation and identify erosion hotspots.
3. **Technology Integration -** Broaden the use of AI, IoT, and remote sensing to enable real-time monitoring and predictive early warning systems for potential failures.
4. **Decommission Unsafe Dams -** Create a systematic national policy for the decommissioning of dams that are too old or unsafe to be retrofitted.
5. **Strengthen Community Preparedness -** Actively involve downstream communities through emergency drills, clear flood warning systems, and robust evacuation plans.
6. **Learn from Global Practices -** India should adapt international innovations like Japan's sub-surface dams and China's sediment management strategies to enhance the resilience of its water infrastructure.

Conclusion - Modernizing India's "Temples"

Dams, once hailed by Nehru as the "temples of modern India," are critical national assets. To ensure they remain safe and functional for future generations, India must shift its focus from just building new dams to the comprehensive management of existing ones. By modernizing them with a focus on safety, resilience, and sustainability, India can protect livelihoods, reduce disaster vulnerability, and advance its commitments to SDG 6 (Clean Water and Sanitation) and SDG 13 (Climate Action)

Source - https - //timesofindia.indiatimes.com/city/bhopal/dams-in-india-at-half-level-due-to-sedimentation-study/articleshow/123815993.cms