



SUPREME AUDIT INSTITUTION OF INDIA
सुप्रीम ऑडिट इंस्टीट्यूट ऑफ इंडिया
Dedicated to Truth in Public Interest



GREEN FILES VOLUME 57



**Climate Change Adaptation and Strategies-
Strengthening Public Accountability for a
Climate Resilient Future**

**International Centre for Environment Audit
and Sustainable Development (iCED)**

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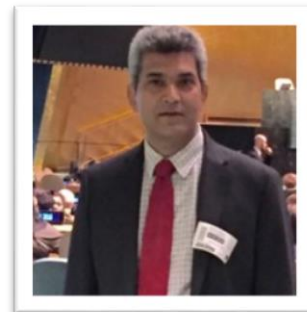
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We thank all the contributors for their immensely valuable contributions and for making this endeavour a success.

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Foreword



Sh. Rajiv Kumar Pandey

In the 57th edition of *The Green Files*, iCED's quarterly journal, we delve into Climate Change Adaptation and Strategies. Climate change is no longer a distant environmental concern; it is a present reality affecting communities, economies, ecosystems, and public health. Rising temperatures, changing rainfall patterns, floods, droughts, heatwaves, and other climate-related hazards are increasing the vulnerability of societies, particularly among poorer and marginalized populations. In this context, climate change adaptation must become a central component of sustainable development and public policy. This volume brings together a series of articles and features that provide a comprehensive perspective on the subject.

An article on Climate Finance in India discusses the local, national, or global funding from public and private sources that pays for projects to address climate change and another article delves into use of Open Datasets and Emerging Technologies for Verification and Preventing Greenwashing.

This edition highlights that Future adaptation strategies should focus on strengthening climate-resilient infrastructure, improving early-warning systems, promoting climate-smart agriculture, protecting water resources, restoring ecosystems, and developing resilient urban planning. Local governments and communities should be empowered to identify their own vulnerabilities and participate in designing solutions suited to their specific needs.

Another article on Performance Audit of Disaster Emergency Response and Adaptation Funding Report discusses Role of Supreme Audit Institutions (like the Comptroller and Auditor General of India) regarding assessment of fund

disbursement speed, compliance with statutory guidelines, institutional coordination, and long-term risk reduction outcomes.

On behalf of the entire team of “Green Files” at iCED, we look forward to your suggestions to make Green Files as informative and user friendly as possible. Your contributions within the broad scope of this quarterly journal will be highly appreciated, including any feedback you may like to share on the featured articles.

(Shri Rajiv Kumar Pandey)

**Additional Dy. Comptroller and Auditor General
and Director General,
iCED, Jaipur**

Editorial



Ms. Bhavika Joshi Lathe

i CED's quarterly journal, "Green Files," offers insights into environmental and sustainable development issues from the perspective of public sector auditing.

This 57th volume of "Green Files" delves into Strengthening Public Accountability for a Climate-Resilient Future because the growing impacts of climate change have made resilience a shared responsibility for governments, institutions, communities, and citizens. A climate-resilient future cannot be achieved through environmental policies alone. It requires effective governance, responsible decision-making, transparent use of resources, and continuous public participation. Public accountability is essential to ensure that climate policies and adaptation programmes are implemented effectively and reach the communities most affected by climate risks.

This edition includes articles related to Legislative Oversight and the Enforcement of National Adaptation Plans (NAPs) in India and monitoring over State Government Compliances. Further, an article on Ensuring Accountability in Resource Allocation for Vulnerable Communities conveys the Principle of "Leaving No One Behind".

I hope this edition will serve as a useful reference for auditors and stakeholders, encourage meaningful discourse, and contribute to strengthening audit practices.

(Ms. Bhavika Joshi Lathe)

Principal Director (Training & Research)

iCED, Jaipur

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iCED in its Role

The International Centre for Environment Audit and Sustainable Development (iCED), Jaipur, sustained its efforts to enhance audit competencies and foster sustainability-oriented knowledge exchange through a diverse range of training programmes and workshops during the first quarter of 2026. These initiatives were designed for officers of the Indian Audit and Accounts Department (IA&AD), officials from other government organisations underscoring iCED’s expanding international engagement and its commitment to high standards of professional capacity building.

Trainings at iCED

1. NTP on Environment Assessment Frameworks, Climate Finance Strategies and ESG Regulations (05.01.2026 to 09.01.2026).



Figure 1: NTP on “Environment Assessment Frameworks, Climate Finance Strategies and ESG Regulations”

A total of 22 participants from 15 field offices including 08 Group officers participated in this five-day training programme. The experts from IA&AD and other reputed organizations and ministries including the Ministry of Environment, Forest and Climate Change (MoEF&CC), New

Delhi, The Energy and Resources Institute (TERI), New Delhi, Birla Institute of Scientific Research, Jaipur, Indian Institute of Technology (IIT), Kanpur, Financial Reporting Review Board (FRRG), The Institute of Chartered Accountants of India (ICAI), New Delhi and Ministry of Finance (MoF), New Delhi delivered the sessions during this training programme.

Further, a study visit was also planned to Jindal Waste-to-Energy Plant, Jaipur to provide participants the practical exposure to waste management practices, energy recovery processes, environmental safeguards, and regulatory compliance mechanisms.

2. International Webinar on “Digital Transformation and Automation in

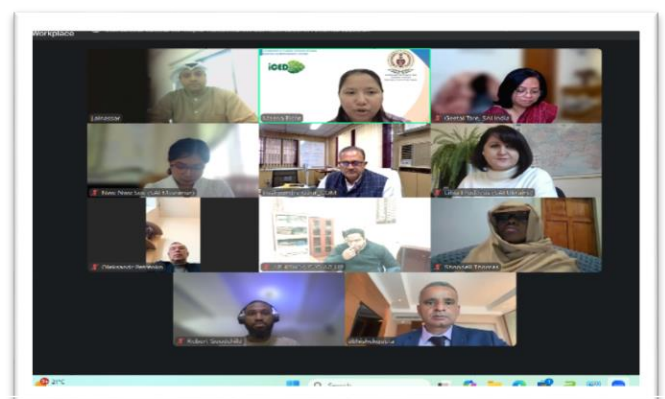


Figure 2: International Webinar on “Digital Transformation and Automation in Extractive Industries” in association with INTOSAI WGEI (13.01.2026)

iCED in its capacity as the Global Training Facility (GTF) of the INTOSAI Working Group on Audit of Extractive Industries (WGEI) organized this Webinar on “Digital Transformation and Automation in Extractive

Industries” On 13th January 2026. The webinar was attended by 87 participants from 26 Supreme Audit Institutions (SAIs) worldwide.

The session was delivered by Mr. Pushpendra Gaur, Controller of Mines, Indian Bureau of Mines, Nagpur. His comprehensive and insightful presentation was highly appreciated by participants.

3. National Workshop on ‘Business Responsibility and Sustainability Reporting’ (28th to 30th January 2026)

A total of 35 participants (29 officers from IAAD including 12 Group Officers, 5 Financial Executives and 1 Statutory Auditor) from 15 field offices and 06 PSUs participated in this



Figure 3: Group photo of National Workshop on “Business Responsibility and Sustainability Reporting”

workshop.

During the workshop, experts from the Indian Audit and Accounts Department (IA&AD), the Ecological Society, Pune, the Institute of Chartered Accountants of India (ICAI), the Securities and Exchange Board of India (SEBI), KPMG India, and EGP delivered sessions on sustainable development, the Sustainable Development Goals (SDGs), the Environmental, Social and Governance (ESG) framework,

Business Responsibility and Sustainability Reporting (BRSR), SEBI disclosure requirements, ESG reporting frameworks and tools, ESG metrics, and the audit perspective on BRSR. The sessions provided participants with a comprehensive understanding of the regulatory, technical, implementation, and audit aspects of sustainability reporting in India.

4. Training Programme on Audit of Forestry and Biodiversity Management for Indian Forest Service Officers (02nd to 04th February 2026)

iCED organised a three-day In-Service Workshop



Figure 4: Group photo of Workshop on “Audit of Forestry and Biodiversity Management” for Indian Forest Service officers”

on “Audit of Forestry and Biodiversity Management” for Indian Forest Service (IFoS) officers.

A total of 19 IFoS officers participated in the workshop. The officers belonged to State Cadres including Uttarakhand, Madhya Pradesh, Karnataka, Telangana, Maharashtra, Uttar Pradesh, Odisha, Nagaland, Meghalaya, Arunachal Pradesh, Haryana, Andhra Pradesh and Jharkhand. The participating officers were from batches ranging from 2000 to 2019.

During the workshop, experts from the Indian Audit and Accounts Department (IA&AD), the National Biodiversity Authority of India, the Forest Department, Government of Rajasthan, the Forest Survey of India, and the National Remote Sensing Centre (NRSC) delivered sessions on the global framework for biodiversity conservation, performance auditing, biodiversity management, environmental auditing, audit perspectives in the forestry sector, climate change mitigation strategies, carbon stock and REDD+, and the use of GIS and remote sensing in forest resource management.

5. National Workshop on "Sustainable Production and Consumption" (09.02.2026 to 10.02.2026)

A total of 28 participants from 15 field offices including 13 Group officers participated in the workshop.



Figure 5: Group photo of National Workshop on "Sustainable Consumption and Production"

During this two-day workshop, experts from various reputed institutes like Eco Paradigm; Indian Institute of Forest Management (IIFM), Bhopal; International Institute of Waste Management (IIWM), Bengaluru; Indian Railways and Zigma Global Environ Solutions

Pvt. Ltd. delivered the sessions during this workshop.

This two days' workshop provided a holistic and in-depth understanding of Sustainable Consumption and Production, including policy and regulatory frameworks; Mission LiFE and SDG-12; national framework indicators and targets of SDG-12; circular economy models for sustainable production and waste reduction; Sustainable Public Procurement; and supporting India on SDG-12 monitoring and reporting.

6. International Workshop on "Renewable Energy sector and its Audit"

iCED in its capacity as the Global Training Facility (GTF) of the INTOSAI Working Group on Environmental Auditing (WGEA), organised this International Workshop from 16 to 20 February 2026 in onsite mode at iCED, Jaipur.

A total of 19 participants from 9 Supreme Audit Institutions (SAIs) participated in this workshop.



Figure 6: Group photo during the International Workshop

During the workshop, experts from the Indian Audit and Accounts Department (IA&AD), the European Court of Auditors (ECA), the Supreme Audit Institution (SAI) Indonesia, NITI Aayog,

the Ministry of New and Renewable Energy (MNRE), The Energy and Resources Institute (TERI) delivered sessions on the renewable energy landscape, climate-resilient energy transition, solar and wind energy, emerging renewable energy technologies, waste-to-energy solutions, electricity grid modernization, and the design and conduct of renewable energy audits.

The workshop also featured case studies from the European Court of Auditors, SAI India, and SAI Indonesia, providing participants with international perspectives and practical insights into auditing the renewable energy sector. In addition to the technical sessions, several cultural and excursion visits were organized for the participants.

7. 13th ITP on "Audit of Extractive Industries" in collaboration with INTOSAI WGEI (part II)

iCED as the Global Training Facility (GTF) of the INTOSAI Working Group on Environmental Auditing (WGEI), organised the part II of the 06th International Training Programme on "Audit of Extractive Industries" in onsite mode at iCED,

Jaipur from 09th to 13th March 2026. A total of 16 participants from 07 Supreme Audit Institutions (SAIs) participated in the training programme.

During the training programme, experts from the Indian Audit and Accounts Department (IA&AD), the Supreme Audit Institution (SAI) Uganda, the Institute of Chartered Accountants of India (ICAI), Central Coalfields Limited (CCL), the Government Accounting Standards Advisory Board (GASAB), and the National Aluminium Company Limited (NALCO) delivered sessions on accounting standards and sustainability reporting in extractive industries, exploration and evaluation costs, environmental accounting, reserves and decommissioning, accounting policy updates, extractive industries audit guidelines, impairment assessment, and financial, compliance, and performance audits.

The programme also featured practical case studies and experience-sharing sessions, providing participants with both national and international perspectives on accounting and auditing in the extractive industries sector.



Figure 7: Group photo during the training programme

8. National Webinar on "Gender equity"

iCED organized a National Webinar on “Gender Equity” on 18th March 2026 through virtual mode. A total of 530 participants, including 09 Group Officers, participated in the webinar.

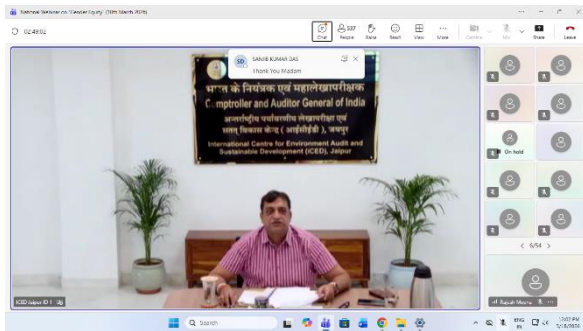


Figure 8: Deputy Director, iCED addressing the participants during the inauguration of the Webinar

During the webinar, experts from ICFAI University, Jaipur, Manipal University Jaipur, and the legal profession delivered sessions on Sustainable Development Goal 5 (SDG 5) on achieving gender equality, prevention of sexual harassment at workplaces, the legal framework under the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 (POSH Act), and workplace safety measure.

*National and International Events in field of
Environment*

IPCC's Sixty-fourth Session (IPCC-64), Bangkok, Thailand

By: Shri Ravi Kumar Sr. Auditor

The Sixty-fourth Session of the Intergovernmental Panel on Climate Change (IPCC-64) was held from 24 to 27 March 2026 in Bangkok, Thailand, bringing together representatives of the IPCC's member governments to guide the work of the Seventh Assessment Cycle (AR7). The session primarily focused on strengthening the institutional and procedural framework of the IPCC to ensure that future assessment reports remain scientifically robust, transparent and inclusive. The Panel adopted the revised provisional agenda by including an additional item on the timeline of the **Seventh Assessment Report (AR7)**. It also granted observer status to 20 new organizations, thereby broadening stakeholder participation in the IPCC process. A major decision was the approval of the structured work plan of the Task Group on Data Support for **Climate Change Assessments (TG-Data)**, which will strengthen data management, archiving, accessibility and coordination among the Working Groups during AR7. The Panel further decided to continue organizing pre-plenary briefing sessions before future IPCC meetings to enhance delegates' preparedness and improve the efficiency of plenary discussions. It also initiated the review of the IPCC Principles and Procedures, with the objective of further enhancing the transparency,

credibility and effectiveness of the Panel's assessment process. In addition, the approval of the draft reports of the 61st, 62nd and 63rd Sessions was deferred to the next plenary session. Overall, IPCC-64 laid the institutional foundation for the successful preparation of the Seventh Assessment Report and reinforced the IPCC's commitment to producing policy-relevant, scientifically credible climate assessments¹.

Major Decisions:

- Adoption of the revised agenda with an AR7 timeline item.
- Admission of 20 new observer organizations.
- Approval of the TG-Data work plan for AR7.
- Continuation of pre-plenary briefing sessions.
- Ongoing review of IPCC Principles and Procedures.
- Deferral of approval of reports from the 61st–63rd sessions to IPCC-65

Significance for India

For India, the outcomes of IPCC-64 are significant as they strengthen the scientific framework that underpins national climate policies, adaptation strategies and

¹ [SIXTY-FOURTH SESSION OF THE IPCC](#)

implementation of the Nationally Determined Contributions (NDCs). The improved data management and transparency mechanisms will support evidence-based decision-making in sectors such as agriculture, water resources,

renewable energy and disaster risk reduction. The decisions will also aid institutions such as the Comptroller and Auditor General of India in conducting robust environmental and climate-related performance audits.

UNFCCC Bonn Climate Conference (SB64), Bonn, Germany

By: Ms. Manju Godara, Auditor

The **64th Sessions of the Subsidiary Bodies (SB64)** under the United Nations Framework Convention on Climate Change (UNFCCC) were held in **Bonn, Germany, from 8 to 18 June 2026**.¹ The conference served as the principal technical negotiating forum in preparation for **COP31**. Delegates from Parties to the UNFCCC met to advance negotiations on the implementation of the **Paris Agreement**, particularly in the areas of adaptation, mitigation, transparency, climate finance and capacity building.² The conference made notable progress in advancing the **Just Transition Work Programme**, including initiating its formal review. Negotiators also continued work on the **Global Goal on Adaptation (GGA)** to develop indicators and strengthen resilience against climate impacts. Discussions progressed on the implementation of the outcomes of the **First Global Stocktake**, aimed at accelerating global climate action. The conference further advanced negotiations on the **Enhanced Transparency Framework**, improving reporting and accountability under the Paris Agreement.

Technical work also continued on **technology development and transfer, capacity building, research, systematic observation and non-market approaches under Article 6**.

Significance for India

For India, the Bonn Climate Conference is significant as it influences the implementation of the **Paris Agreement**, particularly with regard to climate finance, adaptation support, technology transfer and transparency. Progress on the **Global Goal on Adaptation** is especially relevant for strengthening India's climate resilience in sectors such as agriculture, water resources and disaster management. The negotiations also support India's efforts towards achieving its **Nationally Determined Contributions (NDCs)** and long-term net-zero target.³ Furthermore, the outcomes provide an important international framework for evaluating climate-related programmes and environmental governance, thereby supporting evidence-based policymaking and climate-performance auditing in India.

¹ <https://unfccc.int/sb64>

² <https://unfccc.int/news/written-statement-of-unfccc-executive-secretary-on-closing-of-un-june-climate-meetings-sb64>

³ <https://moef.gov.in>

International Day of Zero Waste 30th March

By: Shri Ravi Kumar Sr. Auditor

International Day of Zero Waste is observed every year on 30 March to highlight the importance of waste prevention, sustainable consumption and resource recovery. The United Nations General Assembly, at its seventy-seventh session on 14 December 2022, adopted a resolution proclaiming 30 March as the International Day of Zero Waste. The resolution was put forward by Türkiye along with 105 other countries, reflecting the growing global recognition of the need to reduce waste and promote sustainable resource management.

The observance provides an opportunity to reflect on how societies produce, consume and dispose of resources. Among the different forms of waste, food waste is particularly significant, as it represents not only the loss of food but also the wastage of the water, energy, land, labour and other resources used throughout the food supply chain.

Approximately one billion tonnes of edible food is wasted every year, representing nearly one-fifth of the food available to consumers. Around 60 per cent of food waste occurs at the household level, while the remaining waste largely originates from food service and retail sectors. Tackling this challenge requires improvements across the entire

food system, from production and distribution to consumption and disposal.

Governments, businesses and consumers all have an important role to play. Governments can strengthen policies for food waste prevention, measurement and monitoring, while businesses can improve efficiency and introduce circular practices throughout their supply chains. Consumers can contribute by planning purchases, storing food properly, avoiding unnecessary preparation and supporting food recovery, redistribution and composting initiatives.¹

One of the important principles of zero waste is to treat unavoidable organic waste as a resource rather than a material for disposal. Technologies such as biomethanation can convert biodegradable waste into biogas, which can subsequently be purified into Bio-CNG. The process can also produce organic compost as a useful by-product.

Two examples from Madhya Pradesh demonstrate the potential of this approach.

1. Biomethanation Plant at Maksi Road, Ujjain:

At Maksi Road, Sabzi Mandi, Ujjain, Ujjain Smart City Limited, in association with Aryan

¹ [United Nations](#)

Associates, has established a 5 tonnes per day (TPD) biomethanation plant for managing wet waste generated from vegetable markets.

The plant produces approximately 600 kg of compost every day, which is used in city gardens. It also generates around 225 units of electricity per day, which is utilised for street electrification.

The project demonstrates how decentralised treatment of organic waste can reduce the burden on conventional waste disposal systems while producing useful energy and compost.

2. Choithram Mandi, Indore: From Waste to Bio-CNG

At Choithram Mandi, Indore, approximately 20–25 tonnes of fruit and vegetable waste is generated every day. Earlier, the waste was collected and transported to the centralised waste processing and disposal site of the Indore Municipal Corporation (IMC), resulting in considerable transportation and manpower costs.

To promote decentralised treatment of organic waste, IMC established a biomethanation-based Bio-CNG plant at Choithram Mandi.

The plant processes the fruit and vegetable waste generated at the market and produces approximately 800 kg of purified and compressed Bio-CNG every day, with methane purity of around 95 per cent.

The Bio-CNG is used as fuel for approximately 15 city buses, resulting in savings of around ₹4,500 per day in fuel expenditure, or approximately ₹1.35 lakh per month.

The process also generates organic compost. The digested slurry undergoes solid–liquid separation; the filtered liquid is used in slurry preparation, while the remaining solid fraction is dried and converted into organic compost.²

² [National Institute of Urban Welfare](#)



Articles by iCED

Climate Change Mitigation and Adaptation Strategies in India- Perspectives and Auditing Strategies

By: Shri Rohit Kirodiwal, AAO

Climate change is no longer treated as a peripheral environmental concern in Indian policymaking; rather it is addressed by the Government of India as a determinant of long-term economic stability, livelihood security and fiscal exposure. The Economic Survey for the year 2025-26 situates¹ India's climate strategy within the country's wider goal of becoming a developed nation by 2047, noting that although India's per-capita greenhouse-gas emissions remain well below the global average, climate change nonetheless poses risks to livelihoods, infrastructure and economic stability that call for sustained public investment and institutional response.

Adaptation and Mitigation: Two Different Jobs

The two words get used almost interchangeably in casual conversation, but they describe genuinely different kinds of work, and that difference matters for how each is designed, financed and audited.

Mitigation is about the cause: steps taken for reducing or avoiding the impact of a problem before or after it happens. These steps help in reducing the impact of the problem. For ex. building solar and wind energy plants, improving industrial energy efficiency, electrifying transport, and creating carbon sinks through afforestation are

all mitigation measures, their success is measured in tonnes of CO₂ avoided or megawatts of clean capacity installed.

Adaptation, by contrast, is about the consequence: steps taken to adjust to actual or expected impact from a problem. Its main goal is to lower the risk and prevent damages. Reducing a community's or a sector's vulnerability to climate impacts that are already happening or are now unavoidable, regardless of how successful global mitigation efforts turn out to be. Heat action plans, climate-resilient crop varieties, coastal ecosystem protection, and water-harvesting infrastructure are adaptation measures, their success is measured in reduced losses, protected livelihoods and lives saved, not in emissions curves.

The Economic Survey 2025-26 organises India's climate strategy around three pillars – adaptation, mitigation and finance and puts adaptation first ahead of mitigation and finance precisely because of the country's acknowledged physical vulnerability to extreme weather, water and food insecurity, and slow-onset hazards like sea-level rise. The Survey further acknowledges that unlike mitigation, whose benefits are diffuse and global (a tonne of carbon avoided in Gujarat benefits the

¹ [Ministry of Finance, Government of India, *Economic Survey 2025-26*, Chapter 10, "Environment and Climate](#)

[Change: Building a Resilient, Competitive and Development-Driven India"](#)

whole planet equally), adaptation pays off immediately and locally — it stabilises incomes, protects specific infrastructure investments, and reduces losses for the community that undertakes it. While under the mitigation action promotes energy security, affordability, and industrial competitiveness, it faces challenges such as limited access to advanced technologies, vulnerabilities in supply chain, and affordable financial capital. To address the finance issues, financial market of the country has been streamlined and introduced innovative instruments for sustainable finance such as *Green Bonds, Blue Bonds, Yellow Bonds etc.*

India's International Commitments

India's climate diplomacy has moved through a fairly clear sequence over the past decade.

It began with the Paris Agreement of 2015 and India's first Nationally Determined Contribution, which committed the country to reduce the emissions intensity of its GDP and expanding non-fossil power capacity. Six years later in 2021, at COP26 in Glasgow², Prime Minister announced what came to be called the Panchamrit, five distinct climate pledges, the most consequential of which was the commitment to reach net-zero carbon emissions by 2070. The Panchamrit was not merely a speech; it was translated into a formally revised NDC. The elements which became part of the Panchamrit are as follows:

- (A) Reach 500GW Non-fossil energy capacity by 2030.
- (B) 50 per cent of its energy requirements from renewable energy by 2030.
- (C) Reduction of total projected carbon emissions by one billion tonnes from now to 2030.
- (D) Reduction of the carbon intensity of the economy by 45 per cent by 2030, over 2005 levels.
- (E) Achieving the target of net zero emissions by 2070.

In August 2022, the Union Cabinet approved an updated NDC³, communicated to the UNFCCC, which set out sharper, quantified targets:

- A. Propagate a healthy and sustainable way of living
- B. Adopt a climate friendly and a cleaner path
- C. 45 per cent reduction in emissions intensity of GDP by 2030
- D. Around 50 per cent of installed electric power capacity from non-fossil sources by the same year.
- E. Create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂

² [MoEFCC: India's Stand at COP-26](#)

³ [India's Updated First Nationally Determined Contribution, submitted August 2022](#)

- F. Better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change
- G. Mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions
- H. Build capacities, create domestic framework and international architecture for quick diffusion of cutting edge climate technology in India

The following year, at COP27 in Sharm el-Sheikh, India submitted its Long Term Low Emission Development Strategy (LT-LEDS) to the UNFCCC⁴, the document that lays out the pathway, sector by sector, toward the 2070 net-zero target.

In November 2023, India formally submitted its third National Communication and Initial Adaptation Communication⁵ to the UNFCCC, which sets out the country's adaptation priorities and vulnerabilities in a document distinct from, but complementary to, its mitigation-focused NDC.

India's Domestic Policy

The National Action Plan on Climate Change⁶ (NAPCC), launched in 2008, remains the overarching framework, with the Ministry of Environment, Forest and Climate Change (MoEFCC) as its nodal ministry. The Plan was

originally built around eight national missions. The Economic Survey¹ 2025-26 records that it has since grown to nine, with the addition of a mission on climate change and human health, sitting alongside the original missions on solar energy, energy efficiency, sustainable habitats, water, the Himalayan ecosystem, a green India, and sustainable agriculture, each implemented through its own nodal ministry or department.

Below the national missions sit the **State Action Plans on Climate Change (SAPCC)**, which translate NAPCC's broad objectives into state-specific action tailored to local conditions, a coastal state's priorities look quite different from a Himalayan state's.

Climate Finance

Every mission, scheme and State Action Plan discussed above needs money, and where that money comes from turns out to be one of the more striking features of India's climate story.

India's adaptation-related domestic spending rose from 3.7 *per cent* of GDP in FY16 to 5.6 *per cent* of GDP in FY22 a near 50 *per cent* increase in relative terms over six years. What makes this figure more striking still is where that money is coming from. According to the Economic Survey, roughly 83 *per cent* of India's mitigation finance

⁴ [MoEFCC: India Submits its Long-Term Low Emission Development Strategy to UNFCCC](#)

⁵ [Third National Communication and Initial Adaptation Communication](#)

⁶ [National Action Plan on Climate Change](#)

and a striking 98 *per cent* of its adaptation finance is presently sourced domestically.

Audit Perspective: Two Flagship Programmes Under the Lens

1. Solar Parks and Ultra Mega Solar Power Projects⁷: CAG Report No. 13 of 2025

Solar power sits at the centre of India's mitigation strategy, and the Solar Parks and Ultra Mega Solar Power Projects Scheme was designed to be one of its main delivery vehicles. Launched by the Ministry of New and Renewable Energy in two phases, 2014 and 2017, the Scheme aimed to establish 40,000 MW of capacity across 61 solar parks in 16 States and Union Territories, at an estimated cost of ₹8,100 crore. With Phase I was to be completed by 2018 and Phase II by 2020.

The audit, covered the period from 2017-18 to 2021-22 and updated with data up to March 2024, some of the audit findings are as follows:

- A. The Scheme fell well short of its own targets with achieving only 28.6 *per cent* of the targeted 40,000 MW being installed as of March 2024.
- B. The Solar Potential Map has not been updated since 2014.
- C. In States like Himachal Pradesh, Meghalaya and Maharashtra, five projects were cancelled/stalled due to lack of thorough

feasibility studies, geological studies and non-availability or slow acquisition of land.

- D. Audit identified significant delays at various



stages, including preparation of detailed project reports (DPRs), land acquisition, financial closure and pooling station construction.

- E. Delays in constituting SLCs and the absence of a prescribed meeting frequency

2. Conservation of Coastal Ecosystems⁸: CAG Report No. 4 of 2022

If the Solar Parks audit is a mitigation story, the Coastal Ecosystems audit sits much closer to the adaptation side of the ledger: healthy mangroves, coral reefs and coastal wetlands are not just biodiversity assets, they are the natural infrastructure that buffers coastal communities against storm surges, erosion and sea-level rise — precisely the kind of slow-onset hazard the

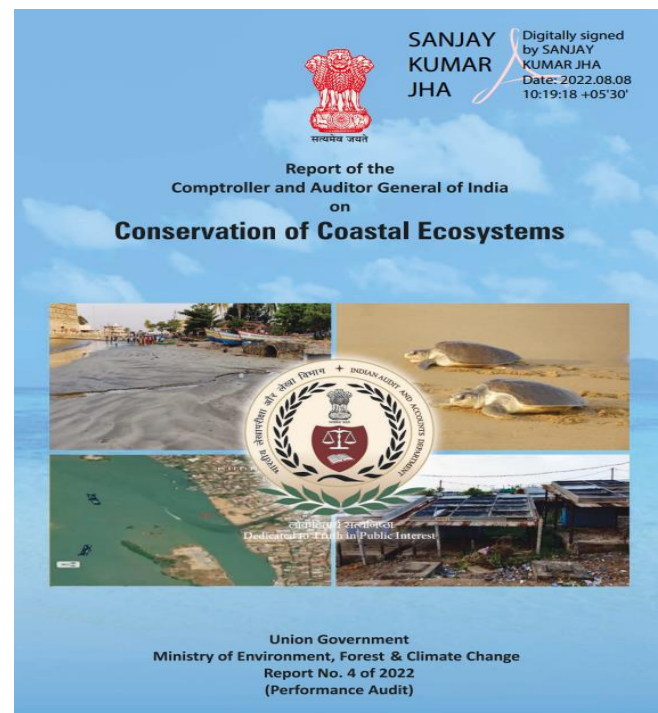
⁷ [CAG Report No. 13 of 2025](#)

⁸ [CAG Report No. 4 of 2022](#)

Economic Survey flags as central to India's vulnerability.

The audit covered the activities of institutions under MoEF&CC and the MoES with regard to implementation of CRZ notifications for the period from 2015 to 2020. Some of the audit findings are as follows:

- A. MoEF&CC has not notified NCZMA as a permanent body with recommended members.
- B. Expert Appraisal Committees (EAC) granted clearances, though domain experts were not present during the project deliberations
- C. SCZMA was not reconstituted in the state of Karnataka and there was delayed reconstitution in the states of Goa, Odisha and West Bengal.
- D. Absence of any active and functional website to disseminate the information related to NCZMA.
- E. Projects were approved despite inadequacies in the EIA Reports which included non-accreditation of the consultant involved with the preparation of the EIA Report.



Conclusion

India's climate effort rests on three pillars: international commitments made over the past decade, a domestic policy architecture built to deliver them, and a financing system that funds nearly all of it from domestic resources. The Solar Parks and Coastal Ecosystems audits add a fourth, often missing, piece: evidence of how that architecture performs on the ground.

Legislative Oversight and the Enforcement of National Adaptation Plans (NAPs) in India and Monitoring Over State Government Compliances

By: Shri Rahul Yadav, AAO

In December 2010 at Cancun, Mexico UNFCCC in its 16th Conference of Parties (COP16) adopted a landmark agreement named **Cancun Adaptation Framework**. Its main goal is to elevate adaptation to the same level of priority as mitigation, helping vulnerable developing countries build resilience and address climate change impacts.¹

The Cancun Adaptation Framework calls upon all Parties to strengthen adaptation action in

accordance with the principle of common but differentiated responsibilities and respective capabilities, while considering national and regional development priorities and circumstances. It encourages Parties to plan, prioritize and implement adaptation measures through projects, programmes and strategies identified in National Adaptation Plans (NAPs).²

The objectives of the NAP process are:

- To reduce vulnerability to the impacts of climate change, by building adaptive capacity and resilience;
- To facilitate the integration of climate change adaptation, in a coherent manner, into relevant new and existing policies, programmes and activities, in particular development planning processes and strategies, within all relevant sectors and at different levels, as appropriate.

India does not yet have a finalized, standalone National Adaptation Plan (NAP), but it is actively

of Environment, Forest and Climate Change.¹ However, India has a historically addressed climate

The Union Ministry of Environment, Forest and Climate Change under the Green Climate Fund Readiness Programme organized a workshop focused on engaging with stakeholders in identifying sectoral adaptation priorities and understanding regional vulnerabilities across **nine key sectors** namely water, agriculture, disaster management & infrastructure resilience, health, forests, ecosystems & biodiversity, poverty alleviation & livelihoods, traditional knowledge & heritage and adaptation resourcing covered under India's upcoming first National Adaptation Plan (NAP). The consultation also explored cross-cutting themes, including gender, traditional knowledge and technology in adaptation strategies

Figure 1: National level workshop on National Adaptation Plan on Climate Change

developing its first official NAP led by the Ministry

adaptation through the broader National Action

¹ [UNFCCC: COP16](#)

² [Cancun Adaptation Framework](#)

¹ [PIB: Workshop on National Adaptation Plan](#)

Plan on Climate Change (NAPCC) introduced in 2008 and operationalized via State Action Plans.²



Figure 2: Nine key sectors for climate adaptation

India's legal fight against climate change is unique, while the term '**climate change**' does not explicitly appear in the text of the Constitution of India drafted in 1950, judicial interpretation and constitutional amendments have erected a powerful constitutional guarantee for environmental protection and climate resilience.

- **Article 48A (Directive Principles of State Policy):** Directs that, *“The State shall upon every citizen of India “to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures.”*

The operational execution of climate adaptation is governed by the distribution of legislative subjects under Schedule VII of the Constitution. Crucially, while the Union Government holds Article 253 powers to enact national legislation fulfilling international treaties (such as the UNFCCC), practical adaptation execution depends entirely on State administrative machinery. Thus, monitoring

endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.” This establishes an affirmative obligation on both Union and State executives to proactively address environmental threats like climate change.

- **Article 51A(g) (Fundamental Duties):** Casts a fundamental duty

State compliance is both a federal challenge and a constitutional necessity.

National Action Plan on Climate Change (NAPCC)

India addressed adaptation through a decentralized-mission approach via the NAPCC launched on June 30, 2008, under the Prime Minister's Council on Climate Change. The NAPCC established an umbrella framework consisting of specific National Missions designed to address adaptation and mitigation across key economic sectors.

² [National Action Plan on Climate Change](#)

Structure of the Core National Missions: The NAPCC initially comprised eight National

Missions, which were subsequently expanded and refined to strengthen adaptation resilience:



Figure 3: Eight-missions under NAPCC 2008

Operationalization through State Action Plans on Climate Change (SAPCCs): Recognizing that adaptation measures should be tailored to local agro-climatic zones, coastal vulnerabilities, and topographic realities, the Union Government directed all States and Union Territories in 2009 to formulate State Action Plans on Climate Change (SAPCCs).¹ SAPCCs serve as the operational

bridge translating overarching national missions into ground-level state implementation.

SAPCC governance operates at both national and state levels with clear institutional arrangements for coordination, approval and validation per MoEFCC's Common Framework.

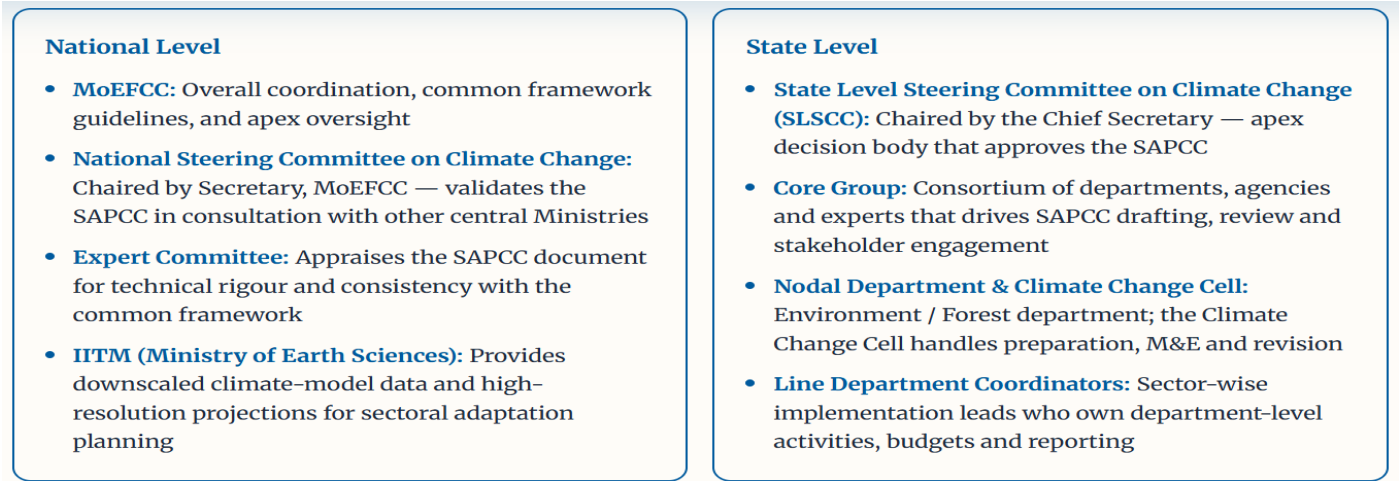


Figure 4: SAPCC Governance Model Source: [MoEFCC Dashboard](#)

¹ [MoEFCC: Guidelines for funding State Action Plan on Climate Change \(SAPCC\) under Climate Change](#)

The institutional machinery for SAPCC operationalization at the state level comprises a three-tiered administrative hierarchy:

- **State Level Steering Committee (SLSC):** Chaired by the State Chief Secretary, comprising Secretaries of Environment, Finance, Water Resources, Agriculture, Urban Development, and Power.
- **State Climate Change Nodal Agency / Cell (SNA):** Housed within the State Department of Environment & Forests or dedicated Climate Change Directorates (e.g., Gujarat's Climate Change Department). SNAs manage inter-departmental coordination, proposal formulation, and monitoring.
- **Sectoral Line Departments & Local Bodies:** Departments of Irrigation, Agriculture, Public Works, along with District Disaster Management Authorities (DDMAs), Gram Panchayats, and Urban Local Bodies (ULBs) executing concrete projects.

Under the ongoing SAPCC 2.0 phase and the emerging NAP framework, concrete sectoral interventions are being actively executed across Indian States. 16 States and UTs have revised their SAPCC so far.¹

- **District-Level High-Resolution Risk & Vulnerability Mapping:** Utilizing

Department of Science and Technology (DST) vulnerability frameworks to map climate risks down to the block and Panchayat level.

- **Climate Resilient Agriculture (NICRA & PKVY):** Expanding the National Innovations in Climate Resilient Agriculture (NICRA) network, deploying drought-tolerant seed varieties, and promoting micro-irrigation.
- **Heat Action Plans (HAPs):** Implementing city- and district-wide Heat Action Plans in over 23 heat-vulnerable States, incorporating cool roofs, early warnings, and modified work hours.
- **Coastal Ecosystem-Based Adaptation:** Restoring bio-shields (mangroves and coral reefs) across coastal districts in Odisha, Tamil Nadu, Andhra Pradesh, Kerala, and Gujarat.
- **Climate Budgeting / Green Budgeting:** States such as Odisha, Bihar, and Assam have pioneered Climate Budget Tagging within state financial budgets to track departmental climate expenditures.

Because State Action Plans on Climate Change (SAPCCs) are executive policy documents rather than statutory mandates, the Union Government enforces compliance primarily through fiscal

¹ [SAPCC: India's Climate Action Dashboard](#)

levers, project appraisal frameworks, and standardized reporting mechanisms

- Established in August 2015, the ***National Adaptation Fund for Climate Change (NAFCC)*** serves as the primary central financial mechanism to assist States and UTs in implementing concrete adaptation projects under SAPCCs. The National Bank for Agriculture and Rural Development (NABARD) functions as the National Implementing Entity (NIE).²
- In November 2020, the “Apex Committee for Implementation of Paris Agreement (AIPA)” was constituted.³
- Funding guidelines mandate that state agencies submit Utilization Certificates (UCs), quarterly progress reports, and mandatory geo-tagged field evidence. Non-compliance or project delays result in freezing subsequent fund tranches. However, recent policy analysis indicates that since NAFCC's reclassification as a 'non-scheme' window in late 2022, central emphasis has shifted toward completing ongoing projects and scaling successful models through Centrally Sponsored Schemes (CSS) such as MGNREGA, PMKSY, and CAMPA.

- To complement financial monitoring, NITI Aayog tracks state-level performance through the SDG India Index, specifically monitoring Goal 13 (Climate Action). States are ranked based on indicators such as renewable capacity installation, disaster readiness, forest cover, and SAPCC implementation, fostering competitive federalism.⁴
- Legislative oversight represents the essential democratic mechanism to convert National Adaptation Plans and SAPCCs from administrative intent into enforceable public policy. In India's parliamentary democracy, legislative scrutiny operates across Union and State tiers.

At the Union level, two primary parliamentary/constitutional institutions exercise scrutiny over climate adaptation compliance:

- **Departmentally Related Standing Committees (DRSCs):** The Parliamentary Committee on Science and Technology, Environment, Forests and Climate Change, alongside committees on Water Resources and Agriculture, have the authority to review ministry demand for grants, to interrogate Union officials, and to table inquiries on delays in SAPCC revisions and NAFCC expenditure.⁵

² [PIB: National Adaptation Fund for Climate Change](#)

³ [Apex Committee for Implementation of Paris Agreement \(AIPA\)](#)

⁴ [SDG India Index](#)

⁵ [Parliamentary Standing Committee on Science and Technology, Environment, Forests and Climate Change](#)

- **Comptroller and Auditor General (CAG) & Public Accounts Committee (PAC):** The CAG conducts performance and financial audits of adaptation schemes (e.g., CAG performance audits on Coastal Zone Management, CAMPA funds, and flood protection works). CAG reports tabled in Parliament reveal the issues like underutilization of funds, diversion, and physical target shortfalls, which are subsequently examined by the PAC.

To finalize India's National Adaptation Plan successfully and ensure binding sub-national compliance, it is essential to institute a structural governance overhaul across legislative, financial, and administrative domains.

Enacting a Framework Climate Governance Act:

At national level there could be an overarching Climate Governance and Accountability Act.

- Mandate the statutory tabling of the finalized NAP before Parliament every five years.
- Obligate State Governments to table annual SAPCC implementation reports before Vidhan Sabhas.
- National Council on Climate Change for the purpose of advising the Central Government on all matters related to climate change.⁶

- Establish a statutory National Climate Change Authority with administrative power over inter-ministerial funds.⁷

The Federal Adaptation Imperative: Without statutory climate legislation in India, National and State Climate Action Plans remain executive policy frameworks. Ensuring sub-national compliance requires a dual mechanism: stringent Union financial monitoring through performance-linked disbursements, paired with proactive legislative scrutiny via Parliamentary Standing Committees, CAG audits, and State Assembly oversight.

Conclusion: In a federal constitutional democracy as ecologically diverse as India, climate adaptation cannot be achieved through top-down executive pronouncements alone. The Cancun Adaptation Framework and UNFCCC mandates provide the global structure; the 2024 Supreme Court ruling in *M.K. Ranjitsinh* provides the constitutional impetus, and the upcoming National Adaptation Plan (NAP) provides the strategic policy blueprint.⁸ However, turning this blueprint into ground reality requires bridging the gap between national formulation and sub-national execution. By binding State Action Plans (SAPCCs) to statutory reporting obligations, leveraging green fiscal federalism through the Finance Commission, and energizing legislative oversight across Parliament and Vidhan Sabhas.

⁶ [Council on Climate Change Bill, 2021](#)

⁷ [Climate Change \(Mitigation and Adaptation\) Act, 2025](#)

⁸ [M.K. Ranjitsinh vs Union of India](#)

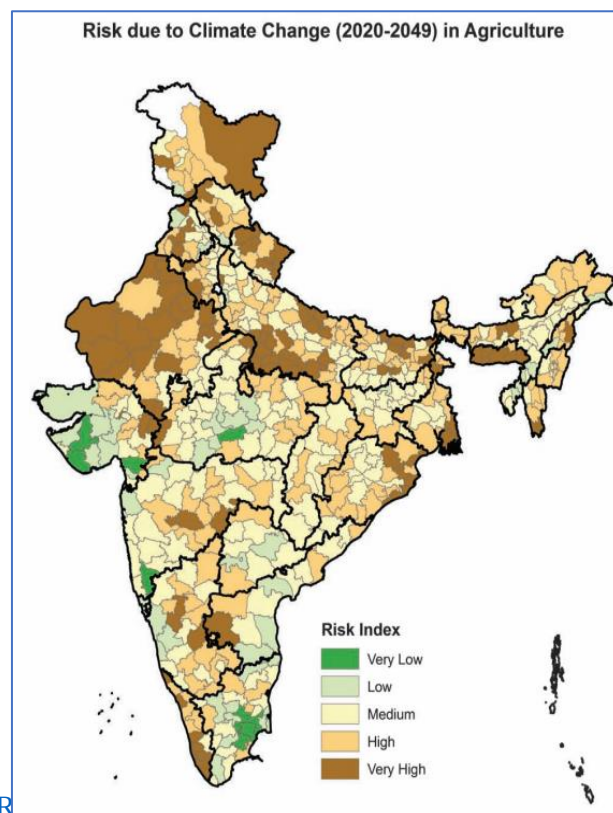
Key Performance Indicators for Climate Resilience and Sustainable Agriculture Strategies in India

By: Dr. Mahesh Kumar Saini (Research Associate)

Introduction

Agriculture is the backbone of the Indian economy, contributing to food security and livelihoods while employing nearly two-thirds of the country's workforce. India achieved self-sufficiency in food-grain production during the Green Revolution, but this brought environmental challenges such as loss of soil fertility, waterlogging, ground and surface water pollution, and intensified pests and diseases.¹ In addition, climate change is also posing significant threats to agriculture². Around 60 per cent of India's net cultivated area is rainfed, making crop production highly vulnerable to changing rainfall patterns, droughts, floods, and rising temperatures³. The DST, 2019-20 report indicates that **all Indian states and districts are vulnerable to climate change**, with state-level vulnerability indices ranging from **0.42 to 0.67** and district-level indices from **0.34 to 0.75**. States such as **Jharkhand, Mizoram, Odisha, Chhattisgarh, Assam, Bihar, Arunachal Pradesh, and West Bengal** exhibit relatively higher vulnerability and should be prioritized for climate adaptation measures. At the district level, **Assam, Bihar, and**

Jharkhand have more than **60% of their districts classified as highly vulnerable**⁴. Additionally,



[Agriculture to Climate Change ICAR](#)

over 80 per cent of Indian farmers are small and marginal landholders with limited adaptive capacity, increasing their vulnerability to climate-related risks⁵. Climate projections indicate that wheat yields in the Indo-Gangetic Plains may

¹ <https://www.frontiersin.org/journals/sustainable-food-systems/articles/10.3389/fsufs.2021.644559/full>

² [Climate change and Indian Agriculture](#)

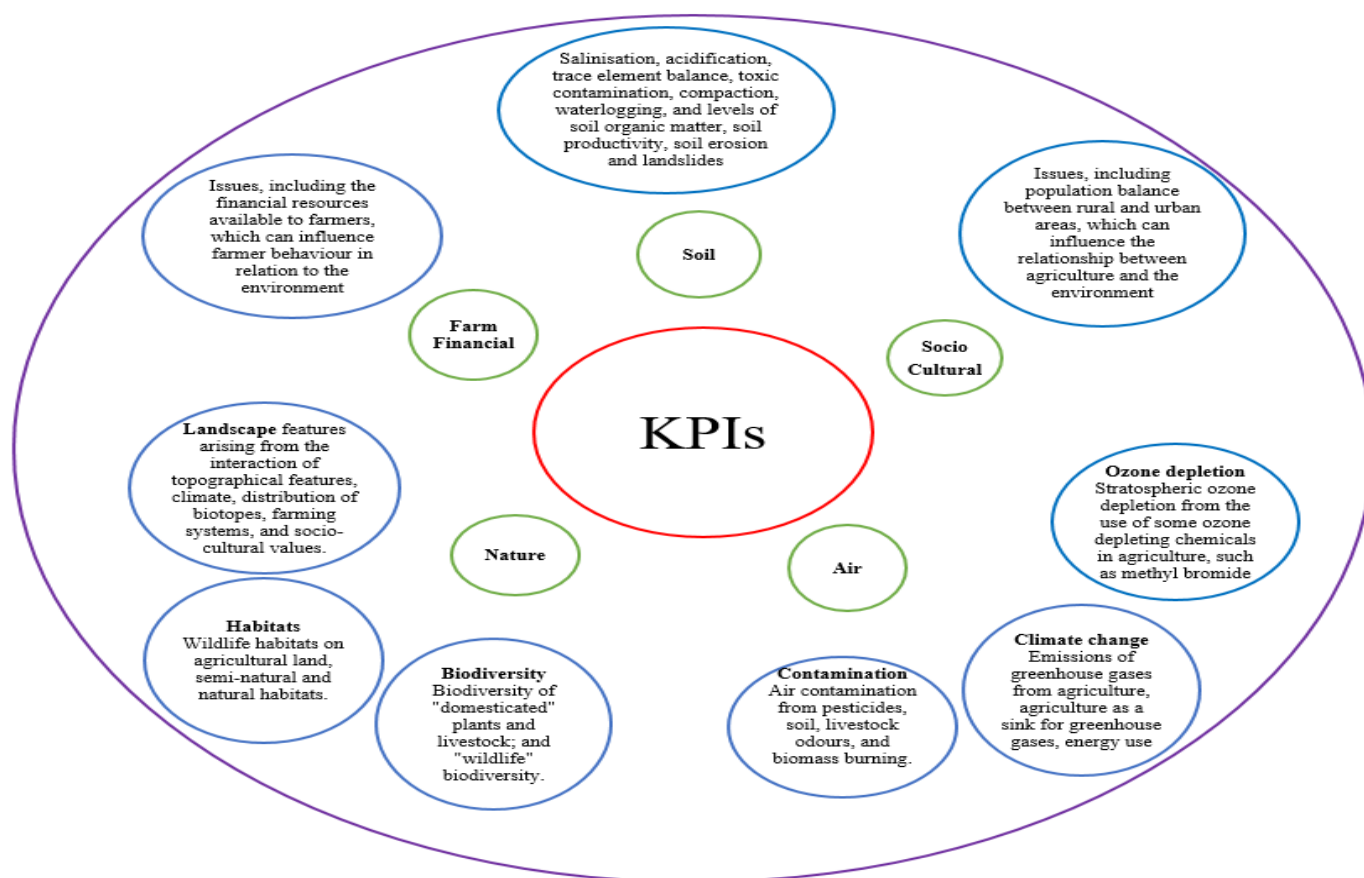
³ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2259279&reg=3&lang=1>

⁴ <https://dst.gov.in/sites/default/files/Full%20Report%20%281%29.pdf>

⁵ <http://www.igidr.ac.in/pdf/publication/WP-2012-014.pdf>

decline by 8–24 *per cent* by 2050, while potato yields could decrease by approximately 6 *per cent*

climate resilience, resource-use efficiency, environmental sustainability, and agricultural



by the 2050. Rising temperatures are also expected to reduce irrigated rice productivity in north-western India⁶. Due to vulnerability of monsoons, droughts, floods, heat stress, decline soil fertility, water quality and dependence rainfed and increasing demand of food security, India's need for climate resilient farming. Monitoring and evaluation through KPIs track climate-resilient farming progress, improve decision-making, optimize resources, enhance accountability, and ensure sustainable agricultural outcomes. This study aims to identify and evaluate existing Key Performance Indicators (KPIs) used to measure

productivity in the agricultural sector.

Key Performance Indicators (KPIs): Key performance indicators (KPIs) are quantifiable measures used to evaluate progress toward specific objectives.

The OECD has identified 13 **priority agri-environmental issues** that serve as **Key Performance Indicators (KPIs)** for monitoring the environmental sustainability of agriculture. These KPIs reflect evolving policy priorities, advances in environmental assessment frameworks such as the **Driving Force–State–Response (DSR)** framework, and improvements in measurement

⁶https://dst.gov.in/sites/default/files/Report_DST_CC_Agric_culture.pdf

methodologies. The indicators cover **nutrient use, pesticide use, water use, land use and conservation, soil quality, water quality, greenhouse gas emissions, biodiversity, wildlife habitats, landscape, farm management practices, farm financial resources, and socio-cultural issues**. Collectively, these KPIs provide a comprehensive framework for evaluating the environmental, economic, and social performance of agricultural systems, supporting evidence-based policymaking and promoting sustainable agricultural development⁷.

Climate Change Impacts on Indian Agriculture

Climate change poses a significant challenge to Indian agriculture. Rising temperatures, changing rainfall patterns, increasing frequency of extreme weather events, and land degradation are affecting crop production, soil fertility, water availability, livestock health, and agricultural biodiversity.

India's average temperature has increased by approximately **0.7°C during 1901–2018**, with projections indicating further warming of **2–4°C by the end of the century** under high-emission scenarios. Rainfall has become increasingly **erratic**, characterized by delayed monsoons, intense rainfall events, prolonged dry spells, and more frequent droughts and floods. Extreme weather events have increased, affecting the timing and duration of crop growing seasons. India's 2007

⁷https://www.oecd.org/content/dam/oecd/en/publications/reports/1999/09/environmental-indicators-for-agriculture_g1gh1797/9789264173873-en.pdf

greenhouse gas inventory reported that **43.86 million hectares** of rice fields emitted **3.37 million tonnes of methane (CH₄)**. Agricultural soils released **0.22 million tonnes of nitrous oxide (N₂O)**, while crop residue burning emitted **0.25 million tonnes of CH₄** and **0.01 million tonnes of N₂O**, highlighting agriculture's significant contribution to GHG emissions⁸. In India, sustainable agriculture has become a national priority because nearly **60% of the net sown area is rainfed**, contributing about **40% of the country's total food production**, making the sector highly vulnerable to climate variability.

Greenhouse gas emission from Indian agriculture			
Source	Methane	Nitrous oxide	CO ₂ eq.
Million ton			
Rice cultivation	3.37	-	84.24
Agricultural soil	-	0.22	64.70
Crop residue burning	0.25	0.01	8.21
Total	3.62	0.23	157.15

Government Initiatives to Promote Climate-Resilient Agriculture:

The Government of India launched a flagship network project 'National Innovations in Climate Resilient Agriculture' (NICRA) in 2011 to build resilience against climate variability. Technologies that help farmers cope with current climate variability are being demonstrated in 151

⁸ <https://www.iari.res.in/files/Publication/important-publications/ClimateChange.pdf>

climatically vulnerable districts through 121 Krishi Vignan Kendras (KVKs), 23 Coordinating Centers of the All India Coordinated Research Project on Dryland Agriculture (AICRPDA) and 7 ICAR Institutes⁹. Under NICRA, location-specific climate-resilient practices such as zero-till wheat, direct-seeded rice, and climate-tolerant varieties have been demonstrated in over 448 climate-resilient villages¹⁰.

Since 2014–15, the Government has released ₹2,119.84 crore under the Rainfed Area Development (RAD) programme. This has covered 8.50 lakh hectares of land and benefited 14.35 lakh farmers through the Integrated Farming System (IFS) approach. Since 2015–16, the Per Drop More Crop (PDMC) scheme has covered about 109 lakh hectares, with ₹26,325 crore provided as central assistance. Under the Soil Health Management (SHM) programme, 97.53 lakh soil samples were collected and 92.87 lakh samples were tested in 2025–26. Since 2015, a total of 25.79 crore Soil Health Cards have been issued to help farmers use fertilizers in a balanced and efficient way. In addition, between 2014 and 2025, the National Agricultural Research System (NARS) released 2,996 climate-resilient crop varieties to improve agricultural productivity and strengthen resilience to climate change¹¹.

Under the National Mission for Sustainable Agriculture (NMSA), operational since 2014–15, the Government of India promotes integrated farming systems, efficient water management, soil health improvement, climate-resilient agriculture, and resource conservation. Key principles include conservation of soil and water resources, efficient nutrient management, crop diversification, integrated pest management, organic and natural farming, agroforestry, climate-smart agriculture, precision farming, and the adoption of renewable energy. India's recent achievements demonstrate significant progress towards sustainable agriculture. Since 2014–15, ₹2,119.84 crores have been released under the Rainfed Area Development programme, covering 8.50 lakh hectares and benefiting 14.35 lakh farmers. Under the Per Drop More Crop (PDMC) component of PMKSY, about 109 lakh hectares have been brought under micro-irrigation with ₹26,325 crore released as central assistance. Furthermore, 25.79 crore Soil Health Cards have been issued since 2015, 97.53 lakh soil samples were collected during 2025–26, and 2,996 climate-resilient crop varieties were released between 2014 and 2025¹². These approaches collectively enhance resource-use efficiency, improve farm productivity and resilience, reduce greenhouse gas emissions, and contribute to

⁹ https://www.nitiforstates.gov.in/public-assets/Policy/policy_files/PNCNAA000616.pdf

¹⁰ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2197710&reg=3&lang=1>

¹¹ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2259279&reg=3&lang=1>

¹² <https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=158495&ModuleId=3&reg=3&lang=1>

achieving SDG 2 (Zero Hunger) and SDG 13 (Climate Action).

Paramparagat Krishi Vikash Yojana (PKVY) and Mission Organic Value Chain Development for North Eastern Region (MOVCDNER): Promote organic farming by supporting the use of biofertilizers,, biopesticides, and microbial soil enhancers, thereby reducing dependence on chemical inputs, improving soil health, and strengthening sustainable agricultural practices.¹³

Conclusion

Climate change has emerged as one of the major concerns to the sustainability of Indian agriculture, endangering food security, natural resources, and the lives of millions of farmers, particularly small and marginal landholders.

Rising temperatures, variable rainfall, rising frequency of droughts and floods, deteriorating soil fertility, water scarcity, and greenhouse gas emissions underscore the urgent need to increase climate resilience throughout agricultural systems.

Therefore, the establishment of a comprehensive KPI framework for climate-resilient agriculture is critical for monitoring progress, enhancing resource allocation, reinforcing adaptation strategies, and achieving sustainable agricultural development, thus contributing to SDG 2 (Zero Hunger), SDG 13 (Climate Action), and SDG 15 (Life on Land).

¹³

<https://www.pib.gov.in/PressReleasePage.aspx?PRID=2037424&reg=48&lang=2>

Performance Auditing of Disaster Emergency Response and Adaptation Funding

By: Shri Rohan Sharma, AAO

"There is no such thing as a natural disaster; there are natural hazards, but disasters occur when hazards meet vulnerability."— **Gilbert F. White**

Disasters and climate-related hazards impose a rapidly growing fiscal and human burden on governments, yet conventional financial and compliance audits cannot answer the central accountability question: whether public money has reduced disaster risk. This article talks about Performance Auditing grounded in ISSAI principles and aligned with the Sendai Framework for Disaster Risk Reduction 2015–2030 which equips Supreme Audit Institutions (SAIs) to examine the economy, efficiency, effectiveness, equity and resilience outcomes of disaster and adaptation spending. It concludes that the future of disaster and climate auditing lies not in verifying how much was spent, but in demonstrating, with credible evidence, how much risk was actually reduced.

Introduction

Rising disaster frequency and climate change have sharply increased public expenditure on relief, reconstruction and adaptation. A financial audit can confirm that disaster fund accounts reconcile; only a performance audit can show whether that

expenditure made communities measurably safer. Global policy itself has shifted from reactive disaster management towards proactive Disaster Risk Reduction (DRR), most visibly through the Sendai Framework (2015–2030), which gives auditors, for the first time, measurable global targets against which government performance can be assessed. Audit practice must keep pace with this shift from verifying relief accounts to verifying risk reduction outcomes¹.

Core DRR Concepts for Auditors

Hazard, exposure and vulnerability together determine risk: identical cyclones cause vastly different losses depending on building quality, warning systems and social protection. Capacity and preparedness determine how well institutions cope; resilience determines how quickly systems recover. Mitigation reduces future impact through structural and non-structural measures; recovery restores livelihoods and assets, ideally through "**Build Back Better**"²; and adaptation adjusts systems to actual or projected climate change. These are related but distinct: Disaster

¹[https://www.preventionweb.net/files/46694_readingsendaifr
ameworkfordisasterri.pdf?startDownload=true](https://www.preventionweb.net/files/46694_readingsendaiframeworkfordisasterri.pdf?startDownload=true)

² <https://www.undrr.org/terminology/build-back-better>

Management covers the full cycle, Emergency Response is the immediate hours-to-weeks reaction, DRR is medium/long-term risk prevention, and Climate Adaptation is a long-horizon adjustment to climate impacts — each requiring different audit evidence³.

Global Evolution and the Sendai Framework

International policy evolved from the response-

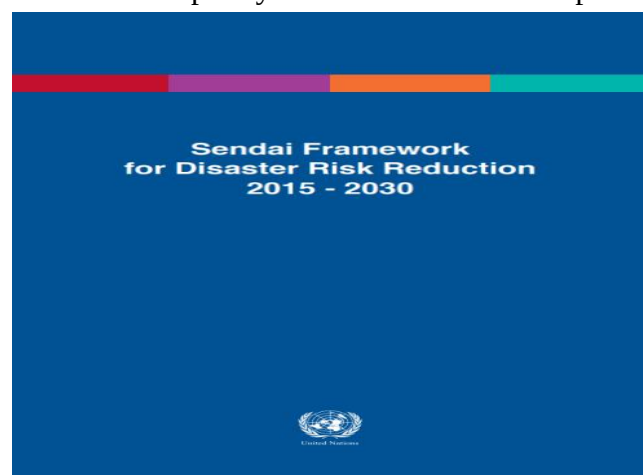


Figure 5 Sendai Framework (Source - <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>)

	Audit Domain
Understanding disaster risk	Use of hazard maps, vulnerability assessments
Strengthening risk governance	Functioning of NDMA ⁵ /SDMA ⁶ /DDMA ⁷ , coordination
Investing in risk reduction	Economy/efficiency/effectiveness of mitigation & adaptation finance
Preparedness & Build Back Better	Early warning reach, response time, resilience of reconstruction

oriented Yokohama Strategy (1994) through the Hyogo Framework (2005–2015)

Table 1: Sendai Priorities mapped to Audit Domains

³ <https://www.undrr.org/drr-glossary/terminology>

⁴ <https://www.undrr.org/media/16176/download?startDownload=20260814>

⁵ NDMA – National Disaster Management Authority

to the Sendai Framework for Disaster Risk Reduction 2015–2030⁴, adopted at Sendai, Japan in March 2015.

Sendai's decisive contribution is measurability seven global targets and thirty-eight indicators, organised under four priorities viz., understanding risk, strengthening risk governance, investing in risk reduction, and enhancing preparedness/Build Back Better. Each priority translates directly into an audit domain: an evidence base (hazard/vulnerability data), institutional performance (NDMA/SDMA/DDMA functioning), adaptation and mitigation finance, and emergency response/reconstruction quality.

India's Disaster Governance Architecture

The Disaster Management Act, 2005⁸ created a three-tier structure: NDMA (chaired by the Prime

Minister) sets national policy; SDMAs

(chaired by Chief Ministers) adapt guidance to states; DDMA (chaired by District Collectors)

⁶ SDMA – State Disaster Management Authority

⁷ DDMA – District Disaster Management Authority

⁸ https://ndma.gov.in/sites/default/files/PDF/DM_act2005.pdf

Case Study: Understanding Vulnerability in Sri Lanka through Integrated Disaster Da



Figure 6 Helena Mettavainio/ WMO/Flickr (source - <https://www.preventionweb.net/resource/case-study/understanding-vulnerability-sri-lanka-combining-disaster-losses-and-damages-0>)

Sri Lanka has demonstrated how integrating **disaster losses and damages data** with **national socioeconomic survey data** can strengthen disaster risk analysis and planning. The Government combined information from its **DesInventar-based national disaster database** with the **Multidimensional Vulnerability Index (MDVI)** developed from national household surveys. This approach enabled the identification of districts where social vulnerabilities—such as limited adaptive capacity, inadequate access to water, and high household indebtedness—coincided with high disaster losses. The analysis showed that nearly **50 per cent** of the population faced constraints in adapting to disasters, while **35.6 per cent** experienced water-related deprivation and **33.4 per cent** suffered from household debt, highlighting the underlying drivers of disaster risk. By integrating historical disaster impact data with multidimensional vulnerability indicators, Sri Lanka was able to prioritise high-risk areas, support evidence-based disaster risk reduction, and guide risk-informed development planning. The case underscores the importance of combining disaster loss databases with socioeconomic data to move beyond hazard mapping towards a comprehensive understanding of vulnerability and resilience.

Source - <https://www.undrr.org/building-risk-knowledge/disaster-data>

handle ground-level implementation, supported by NIDM (training/research) and the NDRF (specialised response force). The State Disaster Response Fund (SDRF, 75:25 or 90:10 Centre-state funded) meets immediate relief; the National Disaster Response Fund (NDRF) supplements it for severe disasters. The Fifteenth Finance Commission (2021–26) additionally created dedicated National/State Disaster Mitigation Funds, formally separating mitigation finance from

relief. It is essential for auditors to maintain a clear distinction between relief expenditure and resilience investment, since treating them as equivalent may result in inaccurate assessments of disaster risk reduction outcomes⁹.

Understanding Disaster and Climate Adaptation Funding

A recurring source of confusion - both in public discourse and in audit planning - is the conflation of emergency funding, recovery funding,

⁹ <https://ndmindia.mha.gov.in/ndmi/responsefund>

adaptation funding, climate finance and risk financing into a single undifferentiated category of "disaster money." These are, in fact, distinct financial instruments with different objectives, timeframes and accountability requirements, and an auditor who does not separate them risks applying the wrong criteria to the wrong fund.

Emergency funding, represented in India chiefly by the SDRF and NDRF, finances immediate life-saving relief in the days and weeks after a disaster strikes. Recovery funding finances the medium-term restoration of damaged infrastructure and livelihoods, often through supplementary Central assistance, externally aided projects, or dedicated reconstruction packages such as those seen after the 2013 Uttarakhand disaster or the 2014 Jammu

and Kashmir floods. Adaptation funding finances forward-looking investments intended to reduce vulnerability to future climate change impacts - such as climate-resilient agriculture, coastal protection or urban drainage redesign - and is judged less by how quickly it was spent than by how much future risk it actually averts. Climate finance is the broader international and domestic resource envelope that supports both mitigation (reducing greenhouse gas emissions) and adaptation. Risk financing, a comparatively newer instrument, includes catastrophe insurance, contingent credit lines and risk pooling arrangements that pre-position financial resources to be released quickly and predictably when a disaster occurs, rather than relying solely on post-disaster budgetary reallocation.

Dimension	Emergency / Relief Funding	Adaptation Funding
Primary Objective	Save lives, provide immediate relief	Reduce future vulnerability to climate-related hazards
Time Horizon	Days to weeks	Years to decades
Typical Source (India)	SDRF, NDRF, CMRF, PMNRF ¹	NAFCC ² , GCF ³ , Adaptation Fund, state climate action budgets
Audit Focus	Timeliness, adequacy, targeting of relief to affected persons	Whether investment demonstrably reduces exposure/vulnerability over time
Key Audit Risk	Diversion to ineligible works, delayed disbursement, weak beneficiary verification	Project delays, weak monitoring of resilience outcomes, difficulty attributing risk reduction to the investment

Table 2: Emergency/Relief Funding vs Adaptation Funding

Audit Principles, Objectives and Criteria

Performance auditing derives its authority from ISSAI 100¹, Fundamental Principles of Public-

Sector Auditing, and is elaborated for performance engagements specifically through ISSAI 300², Performance Audit Principles, ISSAI 3000, the

¹ PMNRF - Prime Minister's National Relief Fund

² NAFCC - National Adaptation Fund for Climate Change

³ GCF – Green Climate Fund

¹<https://www.issai.org/wp-content/uploads/2019/08/ISSAI-100.pdf>

²<https://www.issai.org/pronouncements/issai-300-performance-audit-principles/>

Performance Audit Standard, and GUID 3910, Central Concepts for Performance Auditing (INTOSAI, 2019). ISSAI 300 defines performance auditing as an independent examination of the economy, efficiency and effectiveness of government undertakings, programmes or organisations, with due regard to economy, efficiency and effectiveness, and constitutes the basis on which SAIs develop or adopt their own national performance audit standards (INTOSAI, 2019)³.

Performance auditing is better suited than financial auditing for assessing disaster risk reduction and climate adaptation programmes because the key question for legislatures and citizens is not merely whether funds were spent correctly, but whether they achieved the intended outcomes. While financial audits verify the accuracy of accounts and compliance with rules, performance audits assess whether public expenditure has effectively reduced disaster risks and strengthened resilience. For example, a financial audit may confirm that SDRF accounts are accurate, whereas a performance audit can determine whether the expenditure actually reduced future flood losses. This does not diminish the importance of financial and compliance audits; rather, they complement performance audits. In many instances, financial irregularities identified through financial audits have served as the starting point for broader performance audits, which place

such findings within the wider context of governance and programme effectiveness. Thus, financial assurance alone cannot answer the fundamental question of whether investments have enhanced disaster resilience.

Key audit objectives may include assessing whether disaster relief and adaptation funds were utilised economically, efficiently and in accordance with prescribed norms, whether emergency response and preparedness measures effectively reduced disaster impacts, whether adaptation and mitigation investments have strengthened resilience and reduced vulnerability, whether governance and institutional coordination mechanisms functioned effectively under the Disaster Management Act, 2005, whether recovery and reconstruction initiatives adhered to the "**Build Back Better**" principle, whether vulnerable communities received equitable access to relief and recovery benefits and whether monitoring, reporting and data systems provide reliable evidence for assessing disaster risk reduction outcomes.

Audit criteria can be layered from ISSAI/INTOSAI guidance, the Sendai Framework, the Disaster Management Act and National Disaster Management Plan, SDGs, the Paris Agreement, NDMA guidelines and the National Building Code.

³ <https://www.issai.org/professional-pronouncements/>

Emerging Challenges

Several trends will shape the next generation of disaster and climate audits. Climate uncertainty makes historical hazard data a less reliable guide to future risk, so auditors must increasingly check whether planning uses forward-looking climate projections rather than past return periods alone. Urban flooding and heat waves are emerging as major loss drivers in fast-growing cities, often outside the traditional rural/coastal focus of legacy plans. Compound and cascading disasters — a cyclone followed by inland flooding, or a heatwave coinciding with grid failure — stress-test coordination mechanisms designed for single hazards. Nature-based solutions (mangroves, wetlands, urban green cover) are gaining policy traction but are harder to measure than a completed embankment. Loss-and-damage financing, growing private-sector resilience finance, and the governance of AI used in disaster prediction are all emerging areas for which audit criteria are still evolving.

Conclusion

Disaster and climate adaptation expenditure will continue to grow as hazards intensify and as the

policy shift towards proactive risk reduction, set in motion by the Sendai Framework, deepens across national and sub-national governments. This growth in expenditure carries with it a corresponding growth in the public's legitimate expectation of accountability - not simply an account of what was spent, but a credible demonstration of what was achieved. Traditional financial and compliance audits, valuable as they remain for detecting misappropriation and procedural non-compliance, cannot by themselves answer whether public money has made communities safer or more resilient.

Performance auditing, anchored in ISSAI principles and aligned with the Sendai Framework's targets and priorities, offers Supreme Audit Institutions a methodologically sound and practically actionable pathway to answer that question. Ultimately, the future of disaster and climate auditing lies not in verifying how disaster funds were spent, but in demonstrating, with rigorous and credible evidence, how much risk was actually reduced - and in holding institutions accountable, year after year, for closing the gap between the two.

Ensuring Accountability in Resource Allocation for Vulnerable Communities — Principle of Leaving No One Behind

By: Shri Ajay Babu Meena, AAO

Introduction

The escalating frequency and intensity of climate-related extreme weather events underscore a harsh reality that climate change is not merely an environmental crisis, but a profound socio-economic challenge. Vulnerable groups—including the rural poor, indigenous and tribal populations, coastal communities, women, persons with disabilities, and informal sector workers—bear the brunt of climate impacts due to high exposure and systemic deficits in adaptive capacity.¹ SDG 13 explicitly calls for urgent action to combat climate change, emphasizing the necessity of strengthening resilience and adaptive capacity in all countries.² However, the efficacy of these actions relies entirely on the equitable distribution of public resources. Ensuring accountability in the allocation of adaptation funds and welfare schemes is paramount to securing a climate-resilient future.

The "Leave No One Behind" (LNOB) Principle in Climate Governance

The "Leave No One Behind" (LNOB) principle is the central, transformative promise of the United Nations 2030 Agenda for Sustainable

Development. It represents an unequivocal commitment by UN Member States to eradicate poverty in all its forms, end discrimination, and reduce the systemic vulnerabilities that undermine human potential. LNOB not only entails reaching the poorest of the poor but requires combating discrimination and rising inequalities within and amongst countries, and their root causes.

Operationalizing the commitment to LNOB at the country level requires a comprehensive approach with a series of steps, including identifying who is being left behind and why; identifying effective measures to address root causes; monitoring and measuring progress; and ensuring accountability for LNOB. Ensuring free, active and meaningful participation of all stakeholders, particularly those left behind is a key component of all steps and phases of policy, planning and programming for LNOB.

In the context of climate resource governance, operationalizing LNOB demands a paradigm shift. It requires moving beyond aggregate national mitigation targets to focus on decentralized, inclusive, and highly targeted adaptation financing.

¹ [Climate Change 2022: Impacts, Adaptation and Vulnerability](#)

² <https://globalgoals.org/goals/13-climate-action/>

The LNOB approach dictates that public accountability mechanisms must proactively identify those most vulnerable to climate impacts and dismantle barriers that exclude them from climate finance, disaster risk reduction (DRR) funds, and post-disaster relief.³

Resource Allocation Frameworks: International and Domestic Perspectives

The allocation of public resources for climate adaptation is governed by a complex architecture of international financing mechanisms and domestic welfare schemes.

International Frameworks

At the global level, the architecture of climate finance is designed to channel resources toward the most exposed regions.

Green Climate Fund (GCF): The Green Climate Fund (GCF) is the world's largest dedicated climate fund, created to address the climate crisis. Its mandate is to foster low-emission, climate-resilient development pathways in developing countries. As an operating entity of the financial mechanism of the United Nations Framework Convention on Climate Change (UNFCCC), the GCF maintains an explicit commitment to equitable allocation. The fund targets a 50:50 balance between mitigation and adaptation investments over time. Crucially, it stipulates that at least 50% of its adaptation financing must be directed to the most vulnerable

nations, specifically Least Developed Countries (LDCs), Small Island Developing States (SIDS), and African states.⁴

Sendai Framework for Disaster Risk Reduction (2015–2030):

The Framework was adopted at the Third UN World Conference on Disaster Risk Reduction in Sendai, Japan, on March 18, 2015. It aims to achieve the substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries. It outlines seven clear targets and four priorities for action to prevent new and reduce existing disaster risks: (i) Understanding disaster risk; (ii) Strengthening disaster risk governance to manage disaster risk; (iii) Investing in disaster reduction for resilience and; (iv) Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.⁵

Indian Government Initiatives

India has developed dedicated domestic frameworks to channel adaptation funds to its vulnerable demographic and geographic zones:

National Adaptation Fund for Climate Change (NAFCC):

It was established to support adaptation activities in States and Union Territories (UTs) that are vulnerable to the adverse effects of climate change. The National Bank for Agriculture and

³ [Universal-values Leave-no-one-behind](#)

⁴ [GCF Investment Framework](#)

⁵ [Sendai Framework for Disaster Risk Reduction 2015-2030](#)

Rural Development (NABARD) is the National Implementing Entity (NIE) for NAFCC and project funds are released to NABARD in instalments based on the performance of the

projects and NAFCC guidelines. The fund supported 30 critical projects across 27 States/UTs, addressing vulnerabilities in agriculture, coastal zones, and dairy sectors, before transitioning to a non-scheme status in 2022.¹

Mission LiFE (Lifestyle for Environment): It was announced at the 2021 UN Climate Change Conference (COP26), to bring individual behaviours at the forefront of the global climate action narrative. The mission envisions replacing the prevalent 'use-and-dispose' economy—governed by mindless and destructive consumption—with a circular economy, which would be defined by mindful and deliberate utilization. The Mission intends to nudge individuals to undertake simple acts in their daily lives that can contribute significantly to climate change when embraced across the world. It focuses on creating a decentralized network of "Pro-Planet People" (P3) to drive behavioural change, ensuring that climate action is democratized and community led.²

State Action Plans on Climate Change (SAPCC)

These decentralized plans localize national adaptation strategies, ensuring that financial

DID YOU KNOW?

Climate Budget Tagging (CBT) is an innovative public financial management tool used to identify, classify, and track climate-related expenditures in national and sub-national budgets. By tagging these funds, governments can transparently demonstrate how much public money is being explicitly directed toward climate adaptation for vulnerable communities.

interventions are tailored to the specific ecological and socio-economic vulnerabilities of local populations.

Mechanisms for Ensuring Accountability

Institutional transparency and rigorous public accountability are essential to prevent the misdirection of resources. Effective governance requires mechanisms that monitor the flow of funds from central repositories to grassroots beneficiaries.

Climate Budget Tagging (CBT)³: CBT is an emerging public financial management tool used by governments to identify, monitor, and track climate-relevant expenditures in national and sub-national budget systems. By tagging these specific funds, ministries can align budgets with climate policy priorities, identify crucial financing gaps, and transparently communicate their financial

¹PIB Press Release 05th August 2024

² <https://www.niti.gov.in/key-initiatives/life>

³ <https://www.undp.org/publications/knowning-what-you-spend-guidance-note-governments-track-climate-change-finance-their-budgets>

commitment to climate action, thereby enabling strict accountability to investors and citizens alike.

Social Audits and Participatory Planning⁴: The LNOB principle necessitates a whole-of-society approach. Engaging Gram Sabhas and local communities ensures that marginalized groups dictate their adaptation needs. Participatory mapping and social audits empower vulnerable groups to physically verify that adaptation infrastructure (e.g., coastal embankments, water harvesting structures) meets quality standards and reaches intended beneficiaries.

Supreme Audit Institutions (SAIs)⁵: Environmental auditing by SAIs plays a pivotal role in enforcing accountability. By conducting performance and compliance audits on climate funds, SAIs evaluate the socio-economic outcomes of environmental policies, identifying systemic leakages, inefficiencies, and exclusion errors in welfare delivery.

Gaps and Challenges in Equitable Allocation⁶

Despite strong global commitments, ensuring that resources reach the most vulnerable communities remains a complex challenge. Several deep-rooted systemic gaps create barriers to equitable resource allocation.

The Invisible Identity Challenge: The lack of legal identity poses a profound barrier to equitable resource allocation, as civil registration is a hard

prerequisite for accessing rights and services. Without official recognition, marginalized groups—including minorities, refugees, displaced or stateless persons, and persons with disabilities—are severely excluded from education, healthcare, employment, and financial services. This invisibility compounds their vulnerability and creates a data void, preventing governments from developing targeted measures or allocating funds to populations they cannot count.

Data Fragmentation and "Blind Spots": Official data frequently fails to reflect the realities of marginalized populations, creating massive blind spots in fund allocation. Household surveys, the primary tools for measuring poverty, are often irregular, yield insufficient local data, and miss intra-household discrimination faced by women, children, or persons with disabilities. Furthermore, national statistics consistently omit hard-to-reach groups, particularly those who are socially unrecognized or criminalized, leaving them invisible to policymakers.

Intersecting Forms of Discrimination: Inequality is driven by intersecting barriers that severely compound exclusion from public resources. Planners must evaluate five converging factors: identity-based discrimination, geographic isolation, vulnerability to shocks (such as climate or conflict), governance failures, and socio-economic status. An indigenous woman in a remote, impoverished

⁴ [Operationalizing Leaving No One Behind](#)

⁵ [SAI India Environmental Audit Guidelines](#)

⁶ [Operationalizing Leaving No One Behind UNSDG](#)

community, for instance, experiences multiple reinforcing deprivations, making her exponentially more likely to be left behind than an individual facing a single challenge.

Capacity Gaps: Equitable allocation is hindered by severe capacity gaps between governments (duty-bearers) and communities (rights-holders). Duty-bearers frequently lack the financial, human, and technical resources, motivation, or legal frameworks required to fulfill their obligations and include marginalized groups in institutional structures. Conversely, rights-holders in marginalized communities often lack the necessary knowledge, information, skills, or security to actively claim their rights and access resources.

Barriers to Meaningful Participation: Consultation processes designed to guide resource allocation often unintentionally exclude the very populations they aim to assist. Common hurdles include a lack of translation services for ethnic minorities, inaccessible venues for persons with disabilities, and failing to cover transport costs for impoverished participants. Additionally, these consultations frequently ignore power dynamics between different age and social groups, causing the most vulnerable voices to be drowned out by privileged members of the same community.

Way Forward and Recommendations⁷

To truly operationalize the pledge to leave no one behind, governments and organizations must shift

from broad, universal approaches to highly targeted, empowering, and data-driven interventions. Here are the recommended pathways forward based on the UN Country Teams' good practice note.

Adopt a Human Rights-Based Approach to Data: To eliminate data blind spots, data collection must be inclusive, ethical, and disaggregated based on core principles like the active participation of marginalized groups, self-identification, transparency, and strict privacy protections that prevent harm. Governments should invest in merging diverse data sources, such as microdata, administrative records, and citizen science initiatives, to capture accurate local realities. Additionally, advanced methodologies like the Classification and Regression Tree (CART) analysis must be utilized to remove human bias and precisely identify the intersecting circumstances—such as wealth, education, or location—creating the deepest inequalities.

Create Enabling Legal and Policy Environments: Accountability requires a legal framework that actively protects the marginalized, necessitating the repeal of discriminatory laws and policies, including those that appear neutral but carry a disproportionately negative impact on specific groups. These policies must be underpinned by human rights-based budgeting and expenditure tracking to ensure funds equitably reach marginalized communities. Furthermore,

⁷ [Operationalizing Leaving No One Behind UNSDG](#)

taxation policies should be reformed to tackle income inequalities through progressive and property taxes, while subsidies that promote the unsustainable use of natural resources must be discontinued.

Enhance Quality and Accessibility of Services:

Because universal policies often fail to overcome structural barriers, governments must explicitly remove cost barriers and improve access to basic infrastructure, especially for disadvantaged populations in remote areas. Targeted social protection systems—including unconditional cash transfers, social pensions for the poor, and social housing—must be expanded to shield people from poverty and vulnerability across their lifecycle. Simultaneously, digital inclusion must be prioritized by building necessary infrastructure and promoting digital literacy to bridge the growing digital divide.

Foster Community Empowerment and Meaningful Participation: Guided by the principle of inclusive participation, marginalized groups must be empowered to assume leadership roles in decision-making processes, including local governance, participatory budgeting, and policy planning. Accountability should be reinforced through community-led mechanisms like public audits, citizen juries, and user-friendly scorecards, which establish direct feedback loops between citizens and policymakers. Crucially, safe premises and protective measures must be established to shield communities from intimidation and reprisals when they engage in civil society or speak out against injustices.

Climate Finance in India- Perspectives & Auditing Strategies

By: Shri Manoj Kumar, Sr.AO

India's per capita emissions remain well below the global average, even though, climate change poses risks to livelihoods, infrastructure, and economic stability. Adaptation is, therefore, central to India's climate strategy, driven primarily by public investment and community-based action. However, inadequate global capital flows to developing countries remain a significant constraint, underscoring the need to reform multilateral financial institutions and to strengthen domestic financial systems.

By 2030, developing economies are estimated to need USD 5–6 trillion¹ for climate action. The Fourth International Conference on Financing for Development, titled *Compromiso de Sevilla*² recognised that, despite sustained global efforts, the gap between sustainable development ambitions and available financing has continued to widen—particularly for developing countries—reaching an estimated USD 4 trillion annually. This gap does not arise from a lack of global capital, but rather from the disparity between where capital is concentrated and where investment needs for sustainable development are most pressing.

¹ [Second report on the determination of the needs of developing country Parties related to implementing the Convention and the Paris Agreement](#)

Global Financial Crisis & bias towards developing countries

In 2023, global climate finance totalled USD 1.9 trillion, of which private capital accounted for nearly USD 1.3 trillion. More than half of this private finance flowed to advanced economies, with China attracting another 30 per cent, while developing countries, excluding China, received only about 15 per cent.³ International public finance to developing economies remains limited, and domestic actors continue to dominate global climate finance, accounting for nearly 80 per cent of total flows. Despite the abundant global capital, investors often hesitate to finance climate resilience projects in developing countries, even when these nations are more vulnerable to climate change impacts and such investments could yield significant benefits. Investors, do not internalise the social benefit of their investments in developing countries.

Climate Finance- Indian Perspective

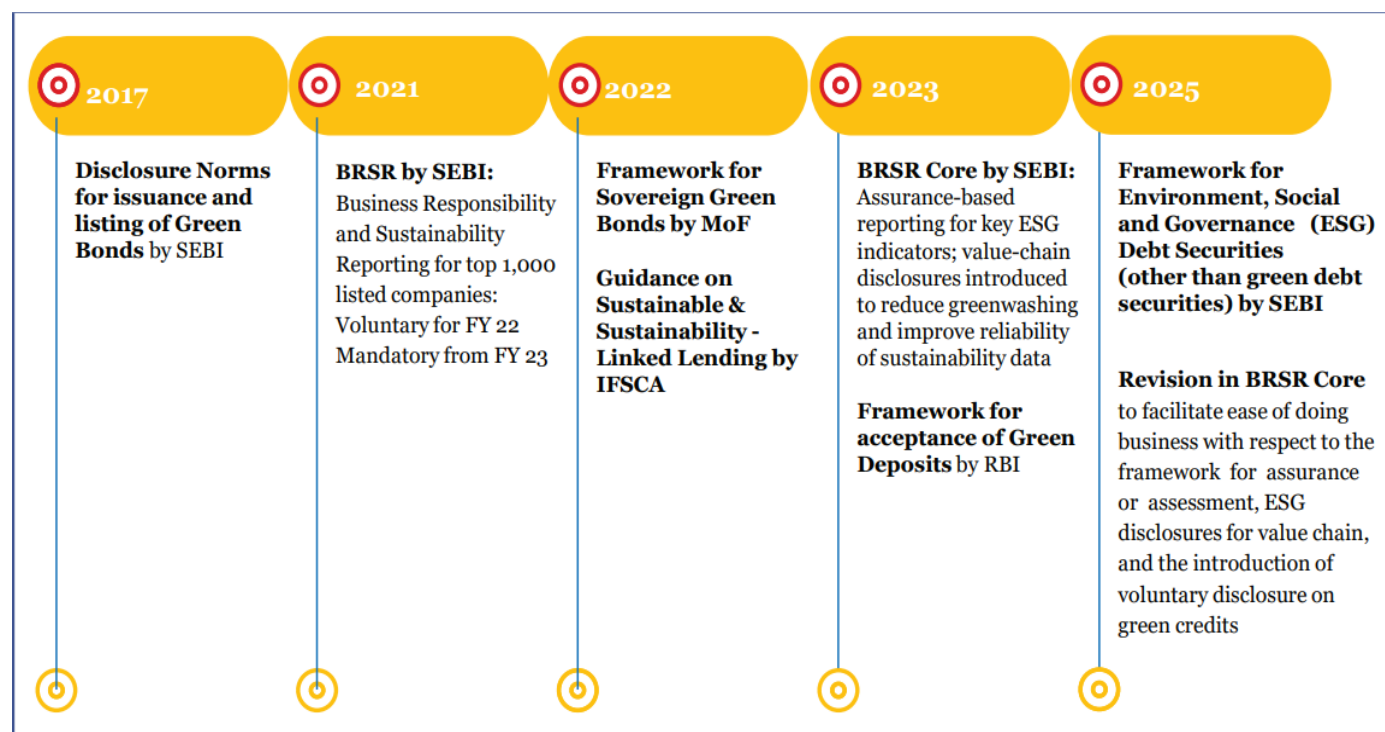
Climate finance remains skewed towards mature sectors such as solar, wind energy and energy efficiency. Critical areas, including adaptation, financing for micro, small, and medium enterprises

² [UNDESA. Sevilla Commitment Fourth International Conference on Financing for Development](#)

³ [Climate Policy Initiative. 2025. Global Landscape of Climate Finance 2025](#)

(MSMEs), urban infrastructure, and hard-to-abate industries, remain underfunded. Currently, around 83 per cent of India's finance for mitigation and 98 per cent of finance for adaptation is sourced domestically.⁴

FDI has been permitted under the automatic route for renewable energy projects.⁸⁹ Development finance institutions, such as Indian Renewable Energy Development Agency Ltd (IREDA),⁶ National Bank for Agriculture and Rural



However, the gaps in available finance and the needs persist,⁵ relying solely on domestic resources will not be sufficient.

Sovereign green bonds have been issued to fund low-carbon public infrastructure, providing policy signalling and market benchmarks. The broader ecosystem has also been strengthened. 100 per cent

Development (NABARD)⁷, Small Industries Development Bank of India (SIDBI)⁸, Power Finance Corporation Ltd.⁹ (PFC), and Rural

Electrification Corporation Ltd. (REC)¹⁰, offer credit lines and financing schemes for climate-related investments. SEBI's Business Responsibility and Sustainability Reporting (BRSR) framework, green bond guidelines and IFSCA's guidance on sustainability-linked lending

⁴ [Climate Policy Initiative. 2024. Landscape of Green Finance in India 2024](#)

⁵ [Climate Policy Initiative. 2024. Landscape of Green Finance in India 2024](#)

⁶ <https://www.ireda.in>

⁷ <https://www.nabard.org/about-departments.aspx?id=5&cid=2788>

⁸ <https://www.sidbi.in/uploads/financialreport/Annual-Report-for-FY-2024-25-Part-1.pdf>

⁹ https://www.pfcindia.co.in/ensite/DocumentRepository/ckfinder/files/Investors/ESG_Report/ESG%20Standalone%20report%20FY%202024-25.pdf

¹⁰ <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2002548@=3&lang=2>

have improved disclosure quality and investor confidence in climate-related investments. RBI has also introduced the green deposit framework that optimises the flow of credit to green activities/projects by channelising institutional and household savings, with guardrails in place to overcome greenwashing challenges.

Key Milestones in India's Climate and Sustainable Finance Framework

Bridging the Finance Gap in the Indian Context¹¹

India has adopted a two-pronged strategy for scaling up finance for climate action from both domestic and international sources.

Strengthening the Domestic Financial System

Specialised Institutions such as IREDA, NABARD, SIDBI, Power Finance Corporation Ltd., and Rural Electrification Corporation Ltd. are already working in the low-carbon/renewable energy space, promoting the adoption of sustainability practices and encouraging green investments through key initiatives and schemes. SEBI's Business Responsibility and Sustainability Reporting (BRSR) framework, green bond guidelines and IFSCA's guidance on sustainability-linked lending have improved disclosure quality and investor confidence in climate-related investments.

Deep and Liquid Bond Markets

Bond markets are crucial for financing climate infrastructure, which requires substantial upfront capital and extended repayment horizons. Deeper, more liquid bond markets can provide long-term, stable, and scalable financing at predictable costs.

Sovereign green bonds (SGBs) have been issued to fund low-carbon public infrastructure, providing policy signalling and market benchmarks. Urban local bodies in Indore, Ghaziabad, Ahmedabad, and Vadodara have issued green bonds in line with SEBI's green bond framework. Municipal green bonds can unlock USD 2.5–6.9 billion for local bodies driven climate action over the next 5–10 years. Besides, Government of India has now issued sovereign green bonds worth ₹15,000 crore in FY26, with the cumulative issuance reaching ₹72,697 crore since FY23.

International Climate Finance and the Role of Multilateral Development Banks

Multilateral Development Banks (MDBs) prioritise low-risk, sovereign-backed lending and the preservation of AAA ratings, limiting balance-sheet recycling and private capital mobilisation. A shift toward balance-sheet optimisation—from “originate-to-hold” to “originate-to-share”—is essential to reposition MDBs as global risk managers, utilising guarantees, insurance, and blended finance to attract private investment.

¹¹ [PIB- Ministry of Finance](#)

Availability of insurance cover against climate risks

Expanding insurance coverage is essential to safeguard people against economic losses associated with the physical risks of climate change, but it also improves the creditworthiness of climate-exposed borrowers such as farmers and MSMEs. In India, the role of insurance is particularly significant for the agriculture sector.

Auditing Climate Finance - Perspectives and Strategies

1. Financial Audit Perspective — “Is the money correctly accounted for?”

Focus on the **financial integrity and reliability** of climate-related expenditure.

Key audit areas:

- Completeness and accuracy of identification/reporting of climate-related expenditure.
- Proper accounting and classification of climate expenditure.
- Reconciliation of budget allocation, releases and actual expenditure.
- Utilisation of funds under climate-related schemes/programmes.
- Accounting and utilisation of proceeds from **Sovereign/municipal green bonds**, where within the audit mandate.
- Grants, subsidies and financial assistance provided for climate-related activities.
- Avoidance of double counting of climate expenditure.

- Verification of assets created and expenditure incurred.
- Detection of irregular, wasteful or avoidable expenditure.

2. Compliance Audit Perspective — “Was the money used according to the rules?”

Examine compliance with:

- Appropriation Acts and applicable financial rules.
- Sanctions and scheme guidelines.
- Government policies and climate-related commitments applicable to the audited entity.
- Conditions attached to grants and externally aided projects.
- Rules governing green bonds and other relevant financial instruments.
- Procurement and contracting requirements.
- Environmental and statutory clearances applicable to projects.
- Monitoring, reporting and disclosure requirements.
- Conditions attached to climate-related loans, grants and financing arrangements.

Specific climate-finance risks:

- Funds diverted from approved climate purposes.
- Expenditure outside approved eligible activities.
- Non-compliance with conditions attached to green financing.
- Weak monitoring and reporting.
- Incorrect classification of expenditure as climate-related.
- Non-compliance with prescribed disclosure/verification requirements.

3. Performance Audit Perspective — “*Did the money achieve climate results?*”

This should be the **principal value-adding dimension** for climate finance.

Examine whether climate finance has been used with due regard to:

Economy

- Was climate finance obtained/used at reasonable cost?
- Were financing mechanisms economical?
- Were avoidable costs, delays and idle funds minimised?

Efficiency

- Were available funds converted into outputs efficiently?
- Were projects completed within cost and time?
- Did financing reach intended sectors/beneficiaries?
- Were administrative and transaction costs reasonable?

Effectiveness

- Did expenditure achieve intended climate objectives?
- Did mitigation measures actually reduce emissions?
- Did adaptation measures improve climate resilience?
- Did climate finance reach vulnerable regions and communities?
- Did green financing result in measurable environmental benefits?

Use of Open Datasets and Emerging Technologies for Verification and Preventing Greenwashing

By: Shri T V S Kalyan Chakravarthi
(Research Associate)

Abstract: Environmental and climate-related claims made by governments, corporations, and financial institutions are increasingly difficult to verify at the pace and scale demanded by public and investor scrutiny. This paper proposes a three-layer verification architecture, natural language processing (NLP)-based claim extraction, open-data and satellite corroboration, and blockchain-secured monitoring, reporting and verification (MRV) for detecting and preempting greenwashing, with particular reference to Blue Economy and ocean-climate reporting. The framework draws on open datasets maintained by the UN Environment Programme (UNEP) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO and is designed for use in the environmental audit practice of Supreme Audit Institutions (SAIs) within INTOSAI's Working Group on Environmental Auditing (WGEA). The paper outlines the architecture, maps it to institutional audit workflows, and discusses its application to Blue Carbon, marine pollution, and blue bond disclosures.

Introduction

As Nationally Determined Contributions, corporate net-zero pledges, and Blue Economy

investment claims proliferate, the gap between what is disclosed and what is independently verifiable has widened. The European Commission's 2021 sweep of environmental claims found that a large share of the claims examined were exaggerated, false, or deceptive¹, and the International Consumer Protection Enforcement Network reported a comparable proportion of misleading claims across sampled websites globally¹. Manual verification of such claims by regulators and auditors cannot scale to the volume of disclosures now produced under ESG, TCFD, and SDG-14 reporting regimes.

Closing this verification gap requires treating three classes of emerging technology as complementary layers rather than standalone tools. Natural language processing enables the systematic extraction and classification of environmental claims from disclosures at a scale no manual review can match. Open geospatial and ocean datasets provide the independent observational evidence against which those claims can be corroborated. Blockchain-based monitoring, reporting, and verification then preserves the chain of custody linking a claim to the evidence that substantiates or refutes it. Applied individually, each of these technologies

¹<https://onlinelibrary.wiley.com/doi/full/10.1111/eufm.12509>

addresses only part of the problem. Text analysis alone can flag rhetorical inconsistencies, but cannot verify physical reality, while raw satellite or sensor data cannot, by itself, identify which corporate or national claims warrant scrutiny in the first place. It is only when the three are layered together that a credible, scalable verification pathway emerges. This logic carries particular weight for the Blue Economy and ocean-climate reporting, where claims about blue carbon sequestration, marine protected area effectiveness, and sustainable fisheries are difficult to corroborate given the historically limited public availability of ocean data. Open data infrastructure maintained by UNESCO's Intergovernmental Oceanographic Commission and by the UN Environment Programme is beginning to close that gap, offering the observational backbone on which independent verification can draw. Positioned within the environmental audit practice of Supreme Audit Institutions under INTOSAI's Working Group on Environmental Auditing, this layered architecture offers a scalable, evidence-based front end that narrows auditor effort toward the claims most likely to constitute greenwashing—while leaving open questions of language robustness, uneven data coverage across small island and low-income coastal states, and the still-limited institutional adoption of blockchain-secured MRV, all of which merit further empirical testing before wider deployment.

The Verification Gap

UNEP's Regulatory Frameworks to Combat Greenwashing report, developed under the One Planet Network with the International Climate Initiative, analyses advertising and marketing legislation across eleven jurisdictions spanning multiple continents and legal systems, and identifies recurring gaps in enforcement capacity.² At the same time, UNEP's Enhanced Transparency Framework has supported over a hundred countries in submitting biannual transparency reports on climate data, an effort intended to standardize national-level climate disclosure but which still depends on self-reported figures.³

Independent of regulation, a growing body of computational work has treated greenwashing detection as a text-based fact-verification problem. Surveys of this literature group tasks into identifying climate-related statements, mapping them to disclosure frameworks such as TCFD or ESG taxonomies, and assessing the sentiment, certainty, and evidentiary support behind each claim⁴. Related work has achieved high classification accuracy in flagging greenwashing risk patterns using dual NLP and financial-ESG divergence pipelines⁵, while knowledge-graph-augmented retrieval pipelines have been proposed to cross-check ESG key performance indicators against independent

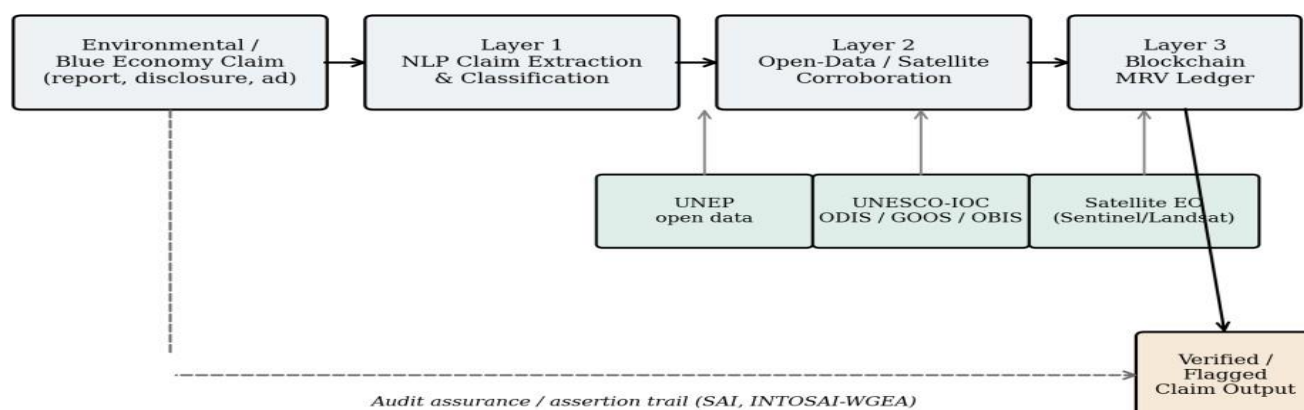
² [Webinar - Fighting greenwashing: the role of regulations to empower consumers](#)

³ <https://www.unep.org/topics/climate-action/climate-transparency>

⁴ [Corporate Greenwashing Detection in Text- a Survey](#)

⁵ [Artificial Intelligence Models for Detecting Greenwashing in UK ESG and Green](#)

news and advertising sources⁶. These text-only approaches are necessary but not sufficient: they can flag rhetorical inconsistency but cannot, on their own, corroborate a claim against physical or institutional reality.



Proposed Three-Layer Verification Architecture

Layer 1 — NLP-Based Claim Extraction

The first layer parses corporate, government, or project-level disclosures (sustainability reports, prospectuses, advertising copy) to extract discrete, checkable environmental claims. Established pipelines segment text, classify sentences against ESG/TCFD taxonomies, and score certainty and specificity, treating vague or unfalsifiable language as a greenwashing risk marker in itself⁷. A parallel line of work constructs ESG-specific lexicons and topic models to compute a quantitative Greenwashing Severity Index by comparing self-reported disclosure against external media coverage⁸.

Layer 2 — Open-Data and Satellite Corroboration

Extracted claims are cross-checked against independent, openly licensed observational data. For climate and pollution claims, this includes UNEP's Emissions Gap and

Adaptation Gap assessments and its Greening the Blue reporting on UN system environmental performance. For ocean and coastal claims, the relevant open infrastructure is UNESCO-IOC's Global Ocean Observing System (GOOS), the International Oceanographic Data and Information Exchange (IODE), and the Ocean Biodiversity Information System (OBIS), which together deliver over a hundred thousand near-real-time ocean observations daily and aggregate more than 168 million marine species records⁹. Satellite earth observation imagery (e.g., Sentinel, Landsat series) is used for independent land-use, Coastal change, and biomass verification, an approach already standard in INTOSAI-WGEA's own guidance for environmental auditors¹⁰.

⁶ [EmeraldMind: A Knowledge Graph–Augmented Framework for Greenwashing detection](#)

⁷ <https://arxiv.org/pdf/2311.01469>

⁸ <https://www.mdpi.com/2071-1050/18/3/1486>

⁹ <https://www.ioc.unesco.org/en/articles/ioc-turning-ocean-science-action>

¹⁰

<https://www.intosai.org/fileadmin/downloads/news>

Layer 3 — Blockchain-Secured MRV Trail

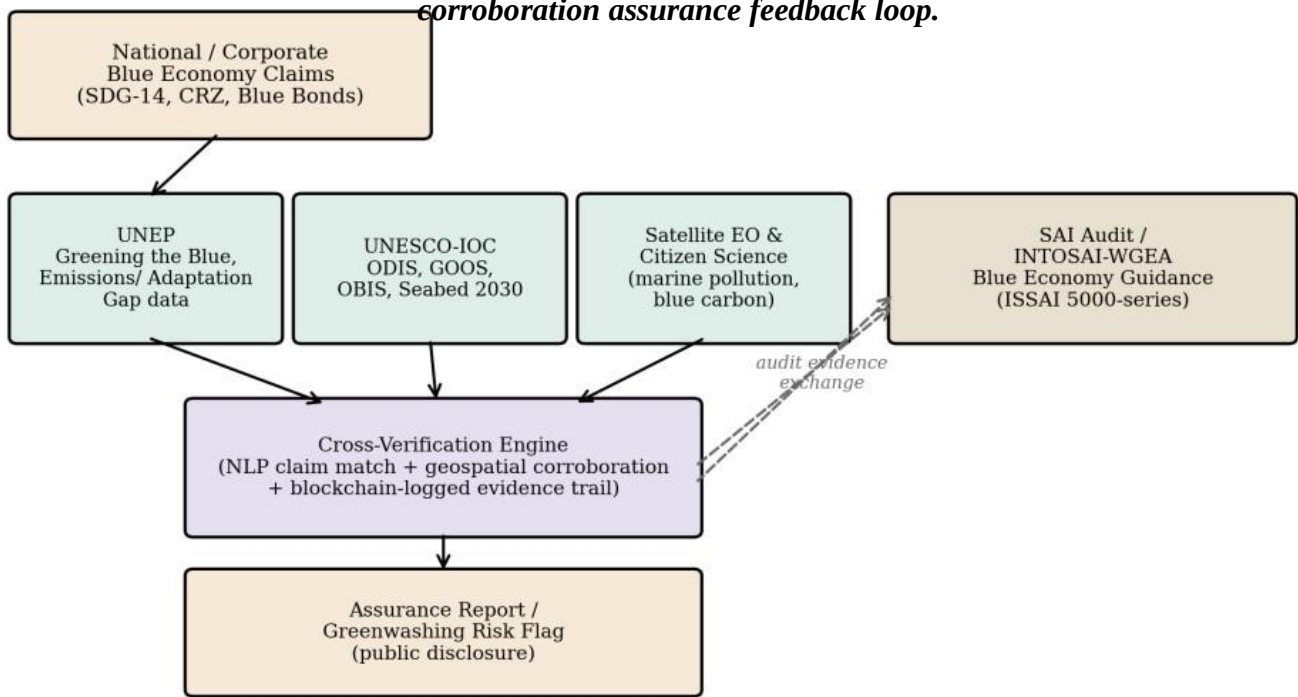
The third layer records the chain of custody of evidence—from raw sensor or satellite feed, through processing, to the verified claim—on a tamper-evident ledger. Digital MRV (dMRV) platforms combining satellite and IoT feeds with blockchain-secured audit trails have been reported to reduce carbon credit verification timelines from many months to as few as forty-five days for some project types, and dMRV

accuracy in continuous environmental monitoring for MRV purposes¹², and blockchain MRV, with an audit.

Application To Blue Economy and Ocean-Climate Reporting

Blue Economy reporting carries distinctive verification challenges: claims about blue carbon sequestration, marine protected area effectiveness, and sustainable fisheries are harder to corroborate than terrestrial claims because much of the underlying data has

Fig. 1. Three-layer verification architecture: NLP claim extraction, open-data/satellite corroboration assurance feedback loop.



systems more broadly have demonstrated substantial gains in measurement accuracy and cost reduction relative to manual audit cycles¹¹. A UNFCCC-presented case study similarly found that combining satellite data with ground sensors and machine-learning analytics achieved high

historically been held privately by industry. The Ocean Decade Corporate Data Group, co-chaired by UNESCO-IOC and private-sector partners, was established specifically to unlock privately held ocean data, for example, bathymetry surveys, for public verification

[/2025/2025_09_09_WGEA_Guidance_Environmental_Auditing.pdf](#)

11

<https://carbonmarketnetwork.com/blog/emerging-carbon-credit-technologies/>

¹²https://unfccc.int/sites/default/files/resource/ME_P004_Cfi_Addressing_Leakage_Mungroo_o.pdf

use, an initiative directly relevant to closing this layer-2 data gap¹³. Complementary citizen-generated marine pollution data is now being integrated into UNESCO-IOC's Ocean Data and Information System (ODIS), expanding the independent evidence base available to auditors and regulators¹⁴.

For blue carbon and dryland/coastal carbon claims specifically, digital MRV protocols combining satellite remote sensing, IoT sensing, and blockchain have been proposed as a foundation for credible carbon-data quality assurance in the Global South, where field verification capacity is limited¹⁵. Figure 2 maps this institutional data flow: national and corporate Blue Economy claims are cross-checked against UNEP, UNESCO-IOC, and satellite/citizen-science data through a verification engine, with the resulting assurance report feeding into SAI audit practice under INTOSAI-WGEA guidance.

Alignment With INTOSAI-WGEA Audit Practice

INTOSAI's Working Group on Environmental Auditing explicitly identifies environmental auditing as a field in which Supreme Audit Institutions can experiment with satellite analysis, GIS, drones, geo-tagging, and citizen participatory auditing to validate the reliability of underlying data and assumptions. The WGEA audit database, which holds more than 1,800 environmental

audit reports from 86-member SAIs, provides a benchmarking resource against which a layered verification architecture, such as the one proposed here, can be piloted and compared. The architecture is therefore proposed not as a replacement for SAI judgment, but as an evidentiary front-end that narrows auditor effort toward claims already flagged as high-risk by Layers 1 and 2, with Layer 3 preserving the chain of custody required for audit opinion.

Limitations And Discussion

Three limitations merit note. First, NLP claim-extraction models remain sensitive to language and jurisdiction; multilingual robustness is uneven across the sustainability-reporting landscape¹⁶. Second, open-data coverage remains geographically uneven, with small island developing states and low-income coastal states particularly underserved by satellite ground-truthing and observation density, a gap UNESCO-IOC has flagged as a priority for its equitable-participation mandate. Third, on-chain MRV adoption remains small relative to total voluntary carbon market volume, constrained by fragmentation and regulatory uncertainty rather than by technical readiness. These constraints argue for phased adoption, beginning with Layers 1–2, where open UN data already exists, with Layer 3 introduced

¹³ <https://oceandecade.org/ocean-decade-corporate-data-group/>

¹⁴ <https://www.ioc.unesco.org/en/universal-plastic-joins-ocean-data-and-information-system-strengthen-global-marine-data-sharing>

¹⁵ <https://www.mdpi.com/2071-1050/17/24/11001>

¹⁶ <https://dev.to/julien786534/using-nlp-to-detect-greenwashing-building-a-claim-verification-engine-a5d>

once registries and SAIs agree on interoperable evidentiary standards.

Conclusion

Preventing greenwashing at the scale now required by Blue Economy and climate disclosure regimes depends on layering complementary technologies rather than relying on any single method. NLP-based claim extraction, corroboration of open UN

and satellite data, and blockchain-secured MRV together offer Supreme Audit Institutions a scalable, evidence-based front end for environmental audit in line with INTOSAI-WGEA guidance. Future work should pilot the architecture against a specific coastal audit, for example, a state-level Blue Carbon or CRZ compliance claim, to quantify its marginal contribution to audit efficiency and assurance quality.

Experiences from other SAIs and Faculties

Case study on Impacts of Irrigation Pond Decommissioning Works on Downstream Areas (Measures Taken) by Ministry of Agriculture, Forestry and Fisheries and relevant agricultural offices.

By: Mr. Navid Ishiguri, Auditor, Board of Audit of Japan

1. Overview of Irrigation Pond Decommissioning Works

The Ministry of Agriculture, Forestry and Fisheries provided subsidies to prefectures and municipalities (implementing entities) to support the decommission of the water storage function of aging irrigation ponds that are no longer expected to be used (irrigation pond decommissioning works), in order to prevent flood damage caused by a breach as part of disaster risk reduction and mitigation projects.

The irrigation pond decommissioning works mainly consist of excavating part or all of the embankment, constructing a new canal at the bottom of the excavated embankment, and connecting it to the existing canal downstream ("existing canal"). The new canal and the existing canal are supposed to function as drainage canals, draining rainwater and other runoff from the abandoned irrigation ponds to the downstream area.

According to design standards, drainage canals must be planned to safely control drainage by determining their cross-sectional shape and gradient aligning with the design flow rate during floods.

2. Results of the Audit

The Board of Audit of Japan audited 198 locations managed by 80 implementing entities that had completed irrigation pond decommissioning works from FYs 2021 to 2024 (total engineering expenses: 1.71564 billion yen, total corresponding subsidy amount: 1.51876 billion yen). The results of the audit are as follows.

- In 94 irrigation pond decommissioning works executed by 47 implementing entities, the entities were unaware of the flow capacity of the existing canals. Among these works, the design flow rate of the new canals exceeded the flow capacity of the existing canals in 14 irrigation pond decommissioning works carried out by 9 implementing entities (1).
- Of the irrigation pond decommissioning works in which the implementing entities recognized the flow capacity of the existing canals during the design phase, the design flow rate of the new canals exceeded the capacity of the existing canals at 9 locations

implemented by 5 entities (2).

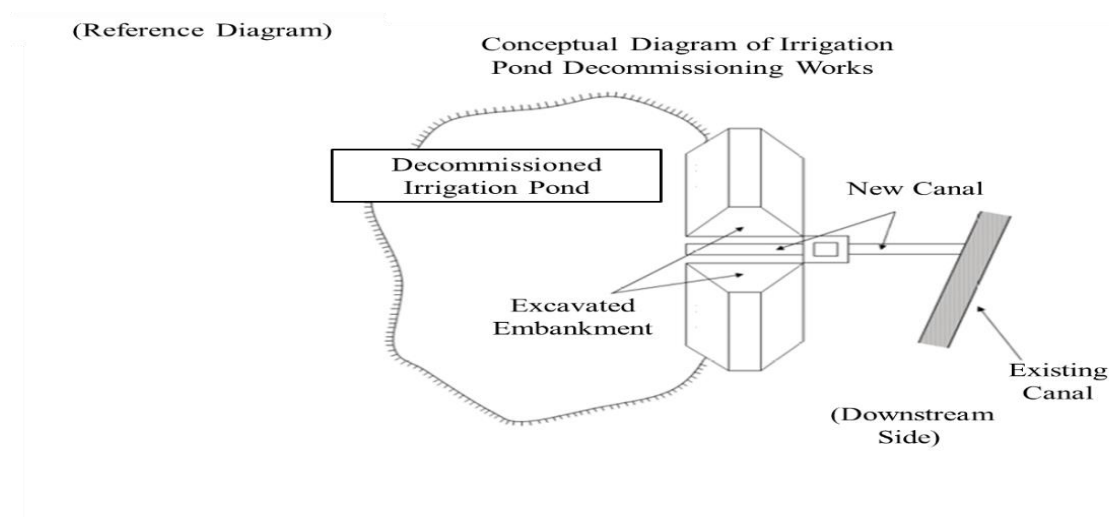
- As to the 23 irrigation pond decommissioning works executed by 14 implementing entities (the total engineering expenses were 0.16811 billion yen, and a total corresponding subsidy amount was 0.15683 billion yen) ((1) + (2)), stormwater was not safely drained to downstream areas, and therefore entailed a risk of overflow at the connection between the new and existing canals, which could cause flooding and damage to downstream areas.

3. Measures Taken

- In March 2025, the "Guidelines for the Design of Agricultural Irrigation Pond Decommissioning Works" (formulated by the Disaster Prevention and Restoration

Division, Rural Development Bureau at the Ministry of Agriculture, Forestry and Fisheries) were issued and thoroughly informed by the Ministry. The guidelines clearly require confirmation, from the planning stage through the design stage, that stormwater can be safely drained downstream via the existing canals.

- In July 2025, the Ministry issued a notice to prefectures and relevant bodies, providing specific methods for assessing the impact on downstream areas, and requiring them to implement systematic countermeasures for irrigation ponds concerned when necessary, including those for which decommissioning work has already been carried out.



Auditors' Responsibility towards environment in Mining Industries

**By: Shri B K Dash, Former Executive Director (Finance),
National Aluminium Company Limited**

The extractive industries, including mining, oil, and gas, play a significant role in global economic development. The mining industries particularly Coal Mining, Iron Ore mining and Bauxite Mining are often associated with complex financial transactions, environmental risks, corruption, and governance challenges. As a result, auditors have a critical responsibility in ensuring the reliability of financial reporting, compliance with regulations, and accountability to stakeholders. This literature explains the responsibilities of auditors in extractive industries, drawing on existing International accounting standards, auditing standards, environmental regulations and industry-specific frameworks.

1. Introduction

Mining process in general passes through following stages/ activities

- i. Sanction/approval/allotment of mining land
- ii. Exploration and evaluation of Mining reserve
- iii. Statutory Clearance for Mining
- iv. Mining Infrastructure
- v. Mining Operation (Own operation/ MDO)
- vi. Statutory Compliance (Environment, Pollution, Regulatory etc)

- vii. Transportation (own transportation/MDO)
- viii. Mines closure activities

Auditing serves as an essential mechanism for enhancing the credibility of financial information and promoting transparency in organizations. According to International Federation of Accountants, auditors are responsible for expressing an independent opinion on whether financial statements are prepared, in all material respects, in accordance with the applicable financial reporting framework. In extractive industries, this responsibility extends beyond traditional financial audits because of the sector's exposure to environmental liabilities, resource valuation, taxation, and revenue transparency.

2. Financial Reporting Responsibilities

Auditors are responsible for evaluating whether financial statements present a true and fair view of an entity's financial position. In extractive industries, this involves examining:

- Exploration and evaluation assets in compliance with IFRS 6 (Exploration for and Evaluation of Mineral Resources)
- Mineral and petroleum reserve valuation in compliance with the provisions of IFRS 6

- Asset impairment In compliance with IAS 36 (Impairment of Assets)
- Decommissioning and restoration obligations in compliance with the provisions of IAS 16 (Property Plant & Equipment) and IAS 37 (Provisions, contingent Liabilities and contingent assets)
- Revenue recognition in compliance with IFRS 15 (Revenue from Contracts with Customers)
- Joint venture accounting in compliance with IFRS 11 (Joint arrangements) and IAS 28 (Investment in Associates and Joint ventures)
- Related Party Disclosure in compliance with IAS 24

The complexity of reserve estimation increases audit risk because management relies heavily on geological and engineering assumptions. Auditors require industry expertise to assess these estimates effectively.

3. Environmental Responsibilities

Extractive Industries face substantial environmental obligations, including land rehabilitation, pollution control, and mine closure costs. Auditors assess whether companies appropriately recognize environmental liabilities in accordance with applicable accounting standards.

Auditors increasingly play an assurance role over sustainability reporting. Independent verification of environmental and social disclosures improves

stakeholder confidence and reduces information asymmetry.

Environmental protection guidelines generally require mining industries to:

- Obtain statutory environmental clearances and permits before commencing operations.
- Implement approved Environmental Management Plans (EMPs).
- Control air, water, and noise pollution.
- Properly manage mine waste, overburden, and tailings.
- Prevent contamination of surface water and groundwater.
- Carry out progressive mine reclamation and ecological restoration.
- Develop and maintain green belts and implement dust suppression measures.
- Conduct regular environmental monitoring and submit accurate compliance reports.
- Ensure safe handling and storage of hazardous materials.
- Close mines in accordance with approved mine closure plans.

Some Common Forms of Non-Compliance by the Mining Companies which the Auditors frequently encounter violations are:

- Mining beyond approved lease boundaries.
- Extraction beyond approved production capacity.

- Failure to implement pollution control measures.
- Improper disposal of overburden and mine waste.
- Discharge of untreated mine water into natural water bodies.
- Poor dust suppression on haul roads and crushing plants.
- Inadequate monitoring of air and water quality.
- Non-restoration of mined-out areas.
- Illegal tree felling and inadequate compensatory plantation.
- Submission of false or incomplete environmental monitoring data.

Few environmental Impacts of Non-Compliance of the above are :

Air Pollution

Failure to control dust emissions from drilling, blasting, crushing, and transportation increases particulate matter in the atmosphere. Excessive dust affects nearby villages, agricultural fields, vegetation, and wildlife while increasing respiratory illnesses among workers and local residents.

Water Pollution

Untreated mine discharge may contain suspended solids, heavy metals, acidic drainage, and chemicals. These pollutants contaminate rivers, lakes, and groundwater, making water unsuitable for drinking, irrigation, and aquatic life.

Soil Degradation

Improper dumping of waste materials destroys fertile topsoil, reduces agricultural productivity, and increases erosion. Soil contamination can persist for decades.

Biodiversity Loss

Unregulated mining destroys forests and wildlife habitats, fragments ecosystems, and threatens endangered species. Recovery of biodiversity is often slow and incomplete.

Noise and Vibration

Poor blasting practices and inadequate noise control disturb nearby communities, livestock, and wildlife while increasing occupational health risks.

Landscape Degradation

Abandoned pits, unstable waste dumps, and un-reclaimed land create long-term environmental hazards and reduce the productive use of land.

Non-compliance of the environmental regulations may also attract legal consequences which includes:

- Show-cause notices.
- Monetary penalties.
- Prosecution under environmental laws.
- Suspension of environmental clearance.
- Revocation of permits and licenses.
- Court-ordered restoration measures.
- Criminal liability in severe cases involving negligence or environmental damage.

Auditors should ensure that enforcement actions are consistent, evidence-based, and legally sound.

Auditors must look into the environmental monitoring through Regular inspections and should verify:

- Ambient air quality monitoring.
- Water quality monitoring.
- Noise level monitoring.
- Groundwater level monitoring.
- Stability of waste dumps.
- Tailings management.
- Green belt development.
- Mine reclamation progress.
- Compliance with environmental clearance conditions.
- Accuracy of environmental records and reports.

Monitoring should include field verification rather than relying solely on submitted documents. Role of Auditors includes:

- Conducting systematic inspections.
- Verifying compliance with statutory conditions.
- Identifying violations objectively.
- Collecting reliable evidence.
- Directing corrective actions.
- Monitoring implementation of remedial measures.
- Recommending enforcement where necessary.
- Promoting awareness of environmental best practices.

- Maintaining transparency, impartiality, and integrity during inspections.

4. Mine Developer and Operator (MDO):

MDO contract is a long-term contractual arrangement in which an external contractor is responsible for developing and operating a mine on behalf of the mine owner. The contractor generally provides equipment, manpower, technical expertise, and operational management, while production targets, quality specifications, and payment mechanisms are governed by contractual agreements.

The MDO model has gained importance because it enables mine owners to improve operational efficiency, reduce capital expenditure, access specialized expertise, and optimize production. However, it also increases the need for independent assurance regarding contract compliance, financial reporting, and operational performance. Mining operations are subject to stringent environmental and occupational safety regulations. MDO contractor being a separate entity other than Mines Owner, Auditors verify following compliance in respect to MDO contract which otherwise shall bring liability to the Mines Owner.

- Environmental clearance conditions.
- Mine closure plans.
- Waste management procedures.
- Air and water quality standards.
- Rehabilitation measures.
- Occupational health requirements.
- Safety management systems.

- Accident reporting procedures.

Environmental and safety audits contribute to sustainable mining practices and reduce legal liabilities.

Environmental protection is not merely a regulatory requirement; it is a fundamental responsibility that ensures sustainable mining, protects public health, conserves natural resources, and preserves ecosystems for future generations.

Government inspectors play a critical role in maintaining environmental standards through vigilant inspections, objective assessment, timely enforcement, and continuous monitoring. Consistent compliance benefits mining companies, surrounding communities, regulatory authorities, and the nation as a whole.

5. Emerging Trends

Several developments affecting auditor responsibilities in extractive industries are as below:

- Increased use of data analytics and artificial intelligence in auditing

- Greater emphasis on environmental, social, and governance (ESG) assurance
- Climate-related financial reporting
- Integrated reporting
- Expanded stakeholder expectations for sustainability assurance

These trends are broadening auditors' responsibilities beyond traditional financial statement audits.

6. Conclusion

Auditors play a critical role in promoting accountability, transparency, and good governance in extractive industries. Their responsibilities encompass financial statement assurance, evaluation of accounting estimates, assessment of environmental liabilities, fraud risk evaluation, and verification of sustainability disclosures. Given the sector's inherent complexity and exposure to governance risks, auditors require specialized technical expertise, strong ethical standards, and adherence to international auditing standards. In addition, auditors should focus on the impact of digital technologies, ESG assurance, and evolving regulatory frameworks on audit quality within extractive industries.

Climate Adaptation and Corporate Accountability: The Role of Credible Assurance

By: Moni Bajaj, Chartered Accountant & Sustainability Professional

A climate-resilient future cannot be built on pledges alone. It requires a disciplined process: identifying the physical climate risks a company faces, assessing how vulnerable its operations are, investing in measures that reduce that vulnerability, and checking whether those measures work. Yet adaptation that cannot be credibly disclosed cannot easily be scrutinised or held to account. As India moves towards mandatory sustainability reporting through the Business Responsibility and Sustainability Report (BRSR), an underlying question deserves attention: how do we know that what companies report about their exposure and response to climate risk is actually true? This is where assurance — an independent evaluation of the underlying information and processes — becomes central to the adaptation story.

Having worked as a sustainability professional on BRSR, and engaged professionally with the wider family of standards such as IFRS S1 and S2 and the GRI framework, I have come to see this process as a clear sequence, with assurance as its final accountability layer. Disclosure makes a company's adaptation progress visible; assurance is what allows stakeholders to rely on it. Assurance does not, by itself, create resilience — it creates the credible conditions under which

adaptation can be assessed, financed, scrutinised and improved.

Adaptation as a process, not a pledge

Meaningful adaptation begins with honest risk identification. A company must first understand which physical climate hazards bear on it — heat, water stress, flooding, cyclonic damage, shifting monsoon patterns — and where in its operations and value chain they strike. A manufacturer may face heat exposure at its plants, water scarcity at a key site, and flood risk in its suppliers' logistics corridors. Naming these risks specifically, rather than gesturing at climate change in the abstract, is the foundation on which everything else rests.

From identification follows assessment: how exposed and how vulnerable is the business? Adaptation then becomes concrete — climate-proofing facilities against heat and flood, securing alternative water sources in drought-prone regions, diversifying and hardening supply chains, and building redundancy into critical infrastructure. Each demands real capital, and each should be matched by indicators that reveal whether vulnerability is genuinely falling. Adaptation that is never measured is indistinguishable from adaptation that never happened.

This is where disclosure and, ultimately, assurance enter — not as the point of the exercise, but as the layer that makes it trustworthy. A credible disclosure should let an outsider follow the same chain the company did: risks identified, exposure assessed, measures taken, capital committed, results measured.

Why this matters for public accountability

The accountability that credible disclosure creates reaches well beyond the company and its investors. Whether a firm has genuinely adapted to physical climate risk matters to its employees and surrounding communities, to the financial institutions exposed to it, and to the public resources and infrastructure that absorb the consequences when adaptation fails. Credible climate information therefore serves a public interest, not merely the needs of investors. This is why assurance sits at the heart of public accountability: it determines whether the information so many stakeholders rely on can, in fact, be trusted.

The Securities and Exchange Board of India has recognised this through its assessment or assurance requirements for BRSR Core — the key sustainability parameters that carry the greatest accountability weight. Following SEBI's circular of 28 March 2025, a listed entity may meet this requirement through either a third-party assessment, conducted under standards developed by the Industry Standards Forum in consultation with SEBI, or assurance.

Assurance or assessment, however, is not a guarantee of resilience. It can establish that

information has been prepared against defined criteria; it cannot establish that an adaptation strategy will succeed. Its value lies in making the underlying risks, actions and progress credible enough for stakeholders to question, compare and hold companies to account — turning an adaptation narrative into something that can be scrutinised rather than simply believed.

The challenges assurance providers face on the ground

The promise of assurance meets some hard practical realities. The most persistent, in my experience, is that many companies still lack proper systems to accumulate non-financial data. Financial data flows through mature, auditable accounting systems; sustainability data often does not — which makes verifying reported numbers harder, because the figures cannot always be traced to a reliable, well-controlled source.

Compounding this is the absence of standardised measurement. When different entities record the same parameter in different ways, comparability suffers and the risk of greenwashing rises — through honest error or the temptation to present numbers favourably. On scope, BRSR brings welcome clarity: assurance is presently confined to the core parameters, giving both companies and assurers a defined boundary. But a clear scope does not, by itself, resolve the underlying question of data quality and systems maturity.

There is also a readiness dimension. The early adopters — India's largest listed companies — have had time to build capacity; as the mandate reaches smaller, less-resourced entities, the

accountability net widens faster than the capacity to meet it. The option of an assessment as an alternative to full reasonable assurance, introduced in 2025, is a pragmatic easing, yet it does not remove the underlying need to build real capability. Recognising this gap is not a criticism of these companies; it is a call to support them.

From compliance mindset to adaptation mindset

This brings me to the central obstacle to a climate-resilient corporate sector: mindset. The adaptation measures described above all demand real capital, often before any loss has materialised. Faced with that cost, many companies view sustainability reporting through a narrow compliance lens — a box to be ticked, a burden to be borne — rather than as sound risk management that protects their long-term interest.

Yet the long-term case is compelling. A facility that can withstand a flood, an operation that can function through a drought, and a supply chain that holds under climatic stress all avoid far larger future losses. The difficulty is one of timing: the cost of resilience is felt today, while its benefit — a loss that never occurs — accrues tomorrow. This is also where credible disclosure helps, by making the value of resilience visible to those who increasingly reward it.

Enabling adaptation: capacity and incentives

If companies are to internalise adaptation rather than resent it, mandates alone will not suffice; they must be paired with real enablement. Two levers matter, and work best together. The first is capacity building — training and adequate time,

so that identifying risks, reporting on them, and building the systems behind that reporting become embedded capability rather than an annual scramble. The second is financial incentive — tax benefits, and subsidies on the equipment and measures procured for resilience, which soften the upfront cost that makes adaptation feel like a burden.

Training, sufficient time, tax benefits and subsidised resilience measures each matter, and work best in combination — training without financial support leaves companies willing but unable; subsidies without training leave them equipped but unskilled. Alongside these, companies should build auditable climate-data systems, with clear ownership of data, documented methodologies, internal controls and traceable evidence behind key adaptation disclosures. It is precisely the absence of such systems that makes assurance difficult today, and their presence that would make credible accountability routine. Such support, extended in particular to the smaller companies now entering the reporting net, would do more to advance genuine adaptation than the mandate alone ever could.

Conclusion

Strengthening public accountability for a climate-resilient future rests on a simple chain of logic. Adaptation must be real, not rhetorical; to be trusted, it must be disclosed; for disclosure to be credible, it must be assured; and for assurance to be meaningful, the companies being assured must possess the systems, skills and incentives to report

honestly and to adapt genuinely. Credible assurance turns commitments into accountability, and capacity and incentives turn compliance into conviction. Together, they can move corporate India from ticking a compliance box to building

measurable resilience — turning climate commitments into information that can be trusted, decisions that can be scrutinised, and adaptation that can, in the end, be held to account.

Gender Equality: Beyond a Slogan, A Reality in Progress

**By: Shri Hitesh Manglani, Assistant Professor,
The ICFAI University, Jaipur**

Sustainable Development Goals (SDGs) are made up of 17 interlinked goals set by all United Nations member states in 2015 through the 2030 Agenda for Sustainable Development and aim at ending poverty, protecting the planet and ensuring prosperity for all. Of the goals, goal 5 - Gender Equality - sits in an important place as being universal to both developed and developing countries, integral to the success of the other 16 goals and based on the idea of leaving no one behind.

The Sustainable Development Goal 5 (SDG 5) seeks to ensure gender equality and empowerment of all women and girls by the year 2030. It entails the end of all discrimination, violence, and practices such as child marriage and female genital mutilation, alongside ensuring that women participate actively in leadership roles. SDG 5 also stresses the importance of equal rights to productive resources, as well as access to reproductive health services, and recognition of unpaid care work. Although there have been significant advancements, the world's development efforts are clearly derailed. Only 27.2 percent of parliamentary seats in the world are occupied by women, they do 2.5 times more unpaid care work compared to men, and 56.3 percent do not have complete control over their reproductive health choices. Inadequate

legislation, deep-rooted social norms, and limited access to technology and land are among those factors that make equality impossible underscoring the urgency of concerted action to meet the 2030 targets.

What SDG 5 Strives for

Essentially, the main objective of SDG 5 is to empower women and girls equally in all aspects of life by ensuring equal rights, access, and opportunities. The main objectives include elimination of discrimination and violence against women, recognition of unpaid care and domestic work, empowerment of women through leadership roles, guarantee of access to reproductive health services, equal economic rights, use of technology for empowerment, and policy and legal changes.

The progress towards achieving these goals is measured by the following indicators, which include the presence of legal framework to support and uphold non-discrimination based on sex (Indicator 5.1.1), the ratio of seats held by women in national parliaments and local governments (Indicator 5.5.1), and the percentage of women between 15 and 49 years old that have the ability to make their own decisions regarding sexuality and reproduction (Indicator 5.6.1) among other indicators.

Key Legal and Policy Frameworks in India

Under the Indian Constitution, Article 14 (equality before law), Article 15 (no discrimination by reason of sex) and Article 16 (equality of opportunity in matters of public employment) ensure that equality between genders is ensured. This principle is also reflected in the Preamble of the Constitution, where it talks about ensuring justice - social, economic and political to all its citizens.

Some important legislative enactments in the last two decades are:

- Protection of Women from Domestic Violence Act, 2005 offers legal remedy to women who suffer from domestic violence within the household.
- Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 (popularly known as the POSH Act) requires the setting up of Internal Complaints Committees in places of work for complaints of sexual harassment.
- The Hindu Succession (Amendment) Act, 2005 gives daughters equal rights over ancestral property which will lead to economic empowerment and ownership of land as envisaged in SDG target 5.a.
- The Criminal Law (Amendment) Act, 2013 imposed stringent punishments for sexual offenses including rape and recognized marital rape as an offense under some conditions.

Landmark Judicial Interventions

The Indian judiciary has been instrumental in taking SDG 5 forward through its landmark judicial interpretations of constitutional provisions. In *Vishaka v. State of Rajasthan* (1997), the Supreme Court ruled that sexual harassment at the workplace is in violation of the fundamental rights enshrined in Articles 14, 15, and 21. The Vishaka Guidelines formulated by the Court have now been enshrined in the POSH Act, 2013. In the recent *Shayara Bano v. Union of India* (2017) case, the Supreme Court declared the practice of triple talaq to be illegal and void.

In the case of *Mary Roy v. State of Kerala* (1986), the Court ruled that Syrian Christian women are entitled to equal property rights as provided for under the Travancore Christian Succession Act. This judgment marks an important victory for the women's struggle for their economic rights and land ownership. Most recently, in the *Indian Young Lawyers Association v. State of Kerala* (2019) case, also popularly known as the Sabarimala case, the Court declared that the exclusion of women of menstruating age from the entry of temple as being discriminatory and violating Articles 15 and 25.

Government Initiatives Aligned with SDG 5

Some of the initiatives taken by the Government of India to achieve the goals of SDG 5 are:

- Beti Bachao Beti Padhao (BBBP) is a program run across India for gender parity and girl education.
- Sukanya Samridhi Yojana (SSY) is a saving scheme to ensure financial security of the girl child.

- Janani Suraksha Yojana (JSY) offers financial help to pregnant women for institutional deliveries.
- Mahila E-Haat is a digital platform to empower women entrepreneurs by providing them equal market access.
- Digital Literacy Programs is to enhance the access of rural women to ICTs consistent with SDG target 5.b.

Emerging Frontier: LGBTQI+ Inclusion in SDG 5

While SDG 5 addresses the empowerment of women and girls, its principles of non-discrimination, bodily autonomy and rights have been seen to be fundamental not only for lesbians, bisexual and transgender persons but also for other people of the LGBTQI+ spectrum who experience gendered discrimination. While the Indian decision *NALSA v. Union of India* (2014) regarding recognition of transgender persons as a third gender is in line with SDG 5 and equal legal protection, the implementation of Transgender Persons (Protection of Rights) Act, 2019 is an issue. Meanwhile, the struggle of same-sex couples to marry in the *Supriyo v. Union of India* (2023) case touches upon discriminatory practices and the equality of all people under Articles 14, 15 and 21.

There are still limitations in the economic sphere. Trans and queer persons, in particular those living in the countryside, encounter high unemployment rates and perform mostly informal work. In terms of health care, queer and unmarried women got

equal access to the right to terminate pregnancy after a Supreme Court decision of 2022, thus, moving closer to the achievement of SDG 5.6. With regards to education, it has been estimated that around one-third of LGBTQI+ students leave school because of bullying prompting recommendations such as gender-neutral restrooms and inclusive curricula. Genuine progress will require queer leadership in policy design and systematic data collection on sexual orientation, gender identity, expression, and sex characteristics (SOGIESC).

Persisting Challenges

The existence of a strong legal framework does not resolve problems with structural obstacles to the enforcement of law. Patriarchal culture leads to the continuation of the dowry system, son preference, and marital rape as non-prosecuted offenses. Gender based violence is also prevalent, with domestic violence affecting almost 30% of Indian women as per the NFHS-5 survey, in addition to low conviction rates and low reporting due to stigma.

Women have limited economic empowerment. Their labour force participation rate was only 31.7% in 2023-24, their average income was 70% of men's, and 90% of employed women work in the informal economy lacking social protection schemes. Less than 14% of women own agricultural land despite their significant contribution to farming, while inheritance rights are often breached by the custom. Digital inequality is also evident; only 33.3% of women use the internet compared to 57.1% of men.

Care work is still very skewed with women spending up to 352 minutes per day on care work, almost 2.5 times that of men, leaving less time for educational opportunities and economic activity, as well as for political participation. Political participation is also lacking with women accounting for only 15% of the total members of the Lok Sabha. Although the Women's Reservation Bill was passed, the bill seeks to reserve one-third of the seats in the Lok Sabha and state assemblies for women. Crime data further illustrates the scale of the challenge. The National Crime Records Bureau recorded 4,48,211 cases of crimes against women in 2023 - up from 4,45,256 in 2022 and 4,28,278 in 2021 - translating to a national crime rate of 66.2 incidents per lakh female population, with cruelty by husband or relatives remaining the single largest category. On a more encouraging note, the Sex Ratio at Birth has improved from 899 females per 1,000 males in 2016-18 to 918 in 2022-24,

according to the Sample Registration System Statistical Report 2024, though it still remains below the natural benchmark of 950-970, indicating that gender-biased sex selection has been reduced but not eliminated.

Conclusion

India has developed a well-formulated legal and policy regime for SDG 5, backed up by progressive interpretations and specific government programs. However, various structural obstacles in the form of discriminatory social practices, ineffective law enforcement, and traditional customs pose barriers to the actual realization of the SDG 5. The enforcement of the Women's Reservation Bill would greatly help to achieve women's political empowerment in India, and ongoing reforms in the legal and policy arena together with proper law enforcement will be crucial in realizing the entire idea of gender equality by 2030.

Biodiversity At iCED

By: Shri Rahul Yadav, AAO

Indian Treepie, *Dendrocitta vagabunda parvula*

Treepie, belong to the crow family (Corvidae), and are highly adaptable omnivores. The bird is native to the Indo-himalayan realm, stretching across the Indian Subcontinent and contiguous zones of Southeast Asia. Its range encompasses Pakistan, India, Nepal, Bangladesh, Myanmar, Laos, Thailand, and Vietnam. The species is non-endemic, maintaining a stable, widespread distribution across diverse bioclimatic zones. It occupies lowlands and lower foothills up to roughly 2,100 meters, predominantly utilizing open dry deciduous forests, scrublands, agro-ecosystems, plantations, and urban canopy gaps.

As it feeds up on many pests of agricultural crops like grasshopper, red palm weevil, banana stem weevil, cockroaches, nestlings of house rat and squirrel, Indian Treepie is an important biocontrol agent in the agro-ecosystem of the region.



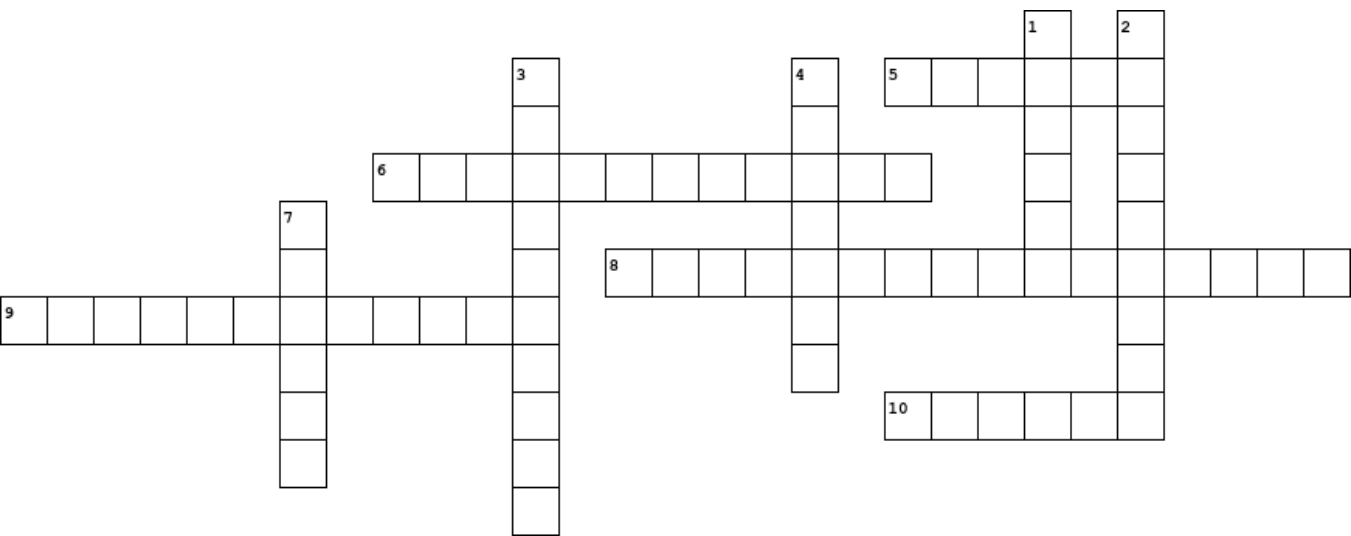
Malabar spinach, *Basella alba*

Malabar spinach, scientifically named *Basella alba*, is a tropical leafy vine native to the Indian subcontinent and Southeast Asia. It is not strictly endemic to one small area but grows natively across tropical Asia. The plant gets its name from the Malabar Coast of southwestern India, where it grows abundantly, combined with its culinary similarity to true spinach. The leaves taste mild, peppery, and slightly citrusy, featuring a succulent, mucilaginous texture when cooked. It is highly versatile and commonly used to thicken soups, stews, curries, and stir-fries, or eaten raw in fresh salads.

Grown commercially as a highly profitable summer leafy green. It thrives in extreme heat and humidity, continuing to yield heavily when traditional spinach or lettuce bolts and becomes bitter. Dark purple berries from the *Basella rubra* variety are processed to extract natural red-violet pigments (betalains and betacyanins). These act as non-toxic food dyes for confectionery, pastries, and beverages.



Crossword Puzzle



Across

- 5. Indian river heavily polluted by industrial discharge.
- 6. It is the practice of controlling the growth, composition/structure, and quality of forests to meet values and needs, specifically timber production.
- 8. Chemical accumulation in organisms at higher trophic levels.
- 9. The process of removing salt and minerals from seawater or brackish water to produce fresh water for human consumption, irrigation, and industrial use.
- 10. African desert expanding due to climate stress.

Down

- 1. The City hosted a major climate event in India to discuss urban heat mitigation.
- 2. National park famous for one-horned rhinoceros.
- 3. ESG pillar concerned with accountability and ethical oversight.
- 4. Natural disaster caused by tectonic disturbances under oceans.
- 7. The extraction of geological materials and minerals from the surface of the Earth.

Answers of the crossword puzzle

Across	Down
5.Yamuna 6. Silviculture 8.Biomagnification 9.Desalination 10.Sahara	1.Mumbai 2.Kaziranga 3. Governance 4.Tsunami 7.Mining