INTERSESSIONAL PANEL OF THE UNITED NATIONS COMMISSION ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT (CSTD)

Geneva, Switzerland
17 November 2025

Contribution by UNEP

to the CSTD 2025-2026 priority theme on "Science, Technology and Innovation in the age of AI"

UNEP Input to CSTD :
PRIORITY THEME 2: Science, Technology and Innovation in the age of AI

Global Freshwater Ecosystem Explorer / SDG 6.6.1

1. **Can you provide some successful examples of how AI and data are being used to advance science and innovation in your country? (Please describe how these applications transformed research and development practices and their impacts)**

UNEP's work on SDG 6.6.1 is a leading example within the Global SDG Framework, of how AI and Earth observation data have been leveraged to transform the monitoring of freshwater ecosystems. Through the Freshwater Ecosystem Explorer (www.sdg661.app), UNEP uses machine learning and geospatial analytics to assess changes in rivers, lakes, wetlands, and mangroves globally. Satellite-based Earth observations (EO) are analyzed using AI algorithms that provide regular updates on surface water extent, flow variability, and lake water quality thereby transforming static reports into dynamic decision-support systems for countries and generating impactful trend analysis. The Freshwater Explorer has enabled countries to:

- Identify hotspots of freshwater degradation
- Link ecosystem trends to climate and biodiversity targets.
- Integrate SDG 6.6.1 data into national biodiversity strategies and water management frameworks.

Link to SDG661 stories: https://stories.sdg661.app/#/story

2. Challenges, bottlenecks, or failures in implementing AI and data

Data Ownership and Integration: A key challenge has been combining satellite (top-down) observations with ground-based (bottom-up) datasets, particularly in low-data contexts. This 'global to local' challenge makes it difficult for countries to verify and calibrate EO data outputs across ecosystems within in-situ data generated by a different methodology. However, increasingly many more countries are now able to replicate the EO methodology applied for SDG661 sub-indicators which results in increased ownership of the data.

Capacity Gaps: Often, in many resource constrained countries, national institutions lack the infrastructure, training, or bandwidth to process and act on remote sensing data. This limits the local uptake of AI-based insights unless capacity-building is prioritized.

3. Strategies or policy instruments to support AI and data (including ethics)

UNEP's data policy within the Freshwater Explorer follows an open, transparent, and accountable data governance approach. The Freshwater Ecosystem Explorer, developed with UNEP-DHI, the European Commissions Joint Research Center (JRC) and Google, applies open-sourced data from providers when accessing time-series datasets.

All data is produced under the Copernicus Programme and is provided free of charge, without restriction of use. For the full license information see the Copernicus Regulation.

4. Promoting open innovation or open data

Yes. The Freshwater Ecosystem Explorer is an open-access platform where all processed data on SDG 6.6.1 are made available at global, regional, national, and basin levels. Tools like national dashboards, mangrove maps, and lake water quality metrics are downloadable in open formats, supporting data use and reapplication for example among universities, NGOs, and citizen scientists. In addition, UNEP SDG661 sub-indicator published methodologies are used to promote integration into other SDG tools and reporting systems, including the Convention on Wetlands and National Biodiversity Strategies and Action Plans (NBSAPs)

5. Are you engaged in putting in place mechanisms to foster collaboration around AI and data for science and innovation among different stakeholders (e.g., university-industry, or private-public)?

UNEP collaborates with DHI (a private water consulting firm) and universities (e.g., University of Copenhagen) and with Google (algorithm development). UNEP works closely with all UN member states (national government bodies and river basin authorities) to validate national datasets on a regualr basis. UNEP also collaborates with NGOs and citizen science platforms, including Global Mangrove Watch, to align data sources. These partnerships are facilitated through UNEPs collaboration with the UN-Water Integrated Monitoring Initiative (IMI-SDG6), which offers training, workshops, and co-development of open tools.

6. How can international cooperation enhance the use of AI and data for science and innovation to support technological capacity building in your country? In what ways can the UN CSTD contribute to this effort?

The UN's strength lies in its scientific legitimacy and convening power. However, advancing AI at scale requires closer collaboration with the global technology ecosystem. To foster transformative innovation, we recommend:

- Promoting public–private partnerships between UN bodies and leading AI/tech companies
- Supporting national-level technology transfer, training, and infrastructure for AI tools
- Ensuring AI integration aligns with environmental ethics, open science, and capacity building

The UN CSTD can play a pivotal role by brokering partnerships, scaling open-source digital public goods, and mainstreaming ethical AI in global SDG implementation efforts.

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UNEP Input CSTD :

PRIORITY THEME 2: Science, Technology and Innovation in the age of AI

International Methane Emmissions Observatory (IMEO)

1. **Can you provide some successful examples of how AI and data are being used to advance science and innovation in your country? *(Please describe how these applications transformed research and development practices and their impacts)***

   UNEP's International Methane Emissions Observatory (IMEO) operates on a global and regional level. Satellite data, company data and scientic research data is pulled from around the world, aggregating country level dashboards. In additional Methane Alert Response System (MARS) regional case managers work with governments, national companies and private sector to notify on methane emissions so it can be addressed and mitigated.

   A recent success story in Algeria showcases this end-to-end approach, where detected emissions were rapidly addressed through coordinated response facilitated by IMEO : https://www.unep.org/news-and-stories/story/technology-helping-reduce-methane-emissions-more-action-needed

2. **What specific challenges, bottlenecks, or failures have you encountered in implementing AI and data for science and innovation? What are the lessons learned?**

   Data Quality and Readiness : Integrating diverse data streams—top-down satellite measurements, bottom-up inventories, and scientific research—remains a key challenge in building a robust picture of methane emissions. Despite methane being one of the most actionable levers for climate mitigation, communicating the critical distinction between measured emissions and inventory-based estimates continues to pose difficulties, even among informed stakeholders. Ongoing efforts with scientists and data teams aim to unify these streams into coherent, actionable data products.

   Bridging Scientific and Technical Expertise: Collaboration between domain scientists and AI/data teams is often hindered by differing terminologies, workflows, and mindsets. Creating a shared, collaborative space where both groups can align, co-create, and complement each other's expertise is not only essential—but requires intentional facilitation and a culture of mutual learning.

   Infrastructure and Scalability Constraints: Progress on cloud infrastructure, DevOps, and MLOps has been delayed by bureaucratic hurdles, and existing technology standards often lag behind best practices in the broader tech ecosystem. These constraints limit scalability and delay the deployment of more advanced AI solutions.

3. **Can you provide examples of strategies or policy instruments to support AI and data for science and innovation? *(Please describe how ethical considerations—such as fairness, transparency, privacy, and accountability—are being incorporated and provide relevant details such as links, budget, evaluation, or other information to characterize them)***

   IMEO is actively using the Secretary General's Digital Cooperation Roadmap as the guiding force, specifically around transparency and open data/products.

4. **Are you engaged in promoting open innovation or open data? If not, why? If yes, can you share specific projects and outcomes? *(Please provide relevant details such as links, budget, evaluation, or other information to characterize them)***

   Yes, IMEO has a strong AI and data principle which is rooted in open data and transparency. We routinely publish our work and are currently working to offer some of our products as a digital public good.

   Example of latest work:
   https://arxiv.org/html/2408.04745v1

5. **Are you engaged in putting in place mechanisms to foster collaboration around AI and data for science and innovation among different stakeholders (e.g., university-industry, or private-public)?**

   Yes, IMEOs regularly works with educational institutes and organizations to forward science in a collaborative manner. The IMEO team is actively collaborating with the Environmental Defense Fund (EDF) and the MethaneSAT team to further develop and refine the Plumeviewer system, our plume detection platform.

   In parallel, IMEO is engaging with Harvard University to integrate an external plume detection and quantification methodology into PlumeViewer. The Harvard research team will contribute both detection results and a quantification approach that may be incorporated into the system, supporting a more coherent and consistent plume validation process.

   To build broader momentum for change, IMEO is actively working with Google research teams to test and validate the IMEO plume viewer potentially considering Google detections to be pulled in as a data stream.

6. **How can international cooperation enhance the use of AI and data for science and innovation to support technological capacity building in your country? In what ways can the UN CSTD contribute to this effort?**

   The UN's comparative advantage lies in scientific credibility and convening power—but not in technology development or infrastructure. To fully unlock the potential of AI for climate and environmental action, **closer collaboration with global technology leaders** is essential. This includes:

   - Co-developing digital tools and platforms as public goods
   - Strengthening national AI capacity and infrastructure
   - Supporting ethical, open, and interoperable data ecosystems

   The **UN CSTD** can accelerate this process by:

   - Facilitating cross-sector partnerships,
   - Scaling open innovation frameworks, and
   - Embedding environmental AI applications into global development agendas.

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