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Contribution by UNESCO

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

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

United Nations Commission on Science and Technology for Development (CSTD)

To whom it may concern

The 28th CSTD annual session selected "Science, Technology and Innovation in the age of AI" as one of the priority themes for its 29th session (2025-2026). This theme directly addresses SDG 9 "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" at the 2030 Agenda.

The rapid rise of frontier technologies and the surge in data generation are transforming research and development. Artificial intelligence, as a general-purpose technology, will further accelerate this transformation. These changes in research and development practices offer significant opportunities for inclusive industrialisation and innovation, which are the core objectives of SDG 9.

Under this theme, the Commission could discuss how the use of AI and data analytics would impact research and development processes in science and industry and identify the institutional and policy conditions required to harness these technologies for inclusive and sustainable industrialization and innovation. In this context, the Commission can examine the challenges and opportunities specific to countries at different levels of development; identify good practices and policies to support domestic technological development, research and innovation; and explore ways to leverage international cooperation to bridge the uneven technological capabilities and steer technological progress toward sustainable development.

The CSTD secretariat is in the process of drafting an issue paper on the theme to be presented at the CSTD inter-sessional panel meeting to be held in November 2025. In this context, we would like to solicit inputs from international organizations, UN entities and agencies, and regional commissions on this theme. We would be grateful if you could kindly answer the following questions based on your organization's work at the global, regional, and/or national levels:

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)*
2. What specific challenges, bottlenecks, or failures have you encountered in implementing AI and data for science and innovation? What are the lessons learned?
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)*
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)*
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)?
6. Are you engaged in any bilateral, regional, or international partnership aimed to foster AI for STI? (*Please describe the benefits and challenges of participating in these partnerships)*
7. 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?

Please indicate contact person(s) responsible for projects/policies and international collaboration in this context in case we need clarification on the inputs.

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Please send your responses and any further inputs on the theme to the CSTD secretariat (cstd@un.org) by **31 August 2025**. We look forward to receiving your valuable inputs.

Sincere regards,

CSTD secretariat

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)***

- Education resilience (Dominican Republic, BERLAC project): An AI-driven Agent-Based Model assessed vulnerabilities of 800 schools and 18 bridges to floods and earthquakes, prioritizing interventions that reduced disruption days and costs.
- Risk communication (Eastern Africa, STEPDEA project): An AI-powered mobile chatbot improved two-way communication between citizens and governments before, during, and after natural hazards, providing timely evacuation and recovery information.
- Water management (IHP / forthcoming UNESCO report): “Applications of AI for Water Management,” developed with Deltares and Flanders, highlights AI for hydrological modeling, flood/drought forecasting, water quality monitoring, and climate adaptation.
- Social media analysis (East Africa): AI processed social media data in Kenya, Rwanda, South Sudan, Tanzania, and Uganda to track community needs during disasters (e.g. emergency calls, agricultural vulnerabilities, health crises).
- Biodiversity monitoring (Biosphere Reserves): AI-equipped drones construct 3D models and monitor land use in Wudalianchi (China) and Mount Nimba (Guinea), improving ecosystem management and chimpanzee conservation.
- AI education (Coglabs app): A free, open-source mobile app enables students to build machine learning models, making AI accessible and fostering STEM learning (e.g. plant/tree identification).
  IHP WINS (Water Information Network System): Platform designed to o support seamless data integration, enhance accessibility, and facilitate evidence-based decision-making through thematic data viewers and advanced visualization tools for hydrology. By fostering an open, collaborative, and interactive environment, IHP-WINS now serves as a critical infrastructure for hydrological research, policy development, and capacity-building initiatives.

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

   To implement the UNESCO’s Recommendation on the Ethics of Artificial Intelligence, UNESCO has developed a variety of tools and mechanisms, one of which is the AI Readiness Assessment Methodology (RAM). Through the AI RAM, Member States have identified a range of key challenges to utilizing AI for science and innovation. These are not only limited to a single dimension of the RAM, but rather are reflected in the following ways:

   The Legal Dimension

- A consistent trend across RAM’s conducted was that countries with lacking clarity around data sharing and management led to major limitations in AI policy and legislation, where access to various forms of data (e.g. relating to health or the environment) is essential. For example, Chile’s RAM had highlighted major challenges in clear coordination between ministries on data quality and governance to enable agencies to share information in an agile and secure manner. This had resulted in no policies for the intersection of the environment and AI, substantial knowledge gaps in the governance of technology in the public sector, and a lack of information

on the ethical impacts of technologies on vulnerable populations (children, women and sexual minorities).

- It's essential to establish coherent, cross-sectoral data governance frameworks that enable secure sharing, ensure data quality, and integrate ethical safeguards—so that science and innovation can advance inclusively and responsibly.

Social/Cultural Dimension

- Many RAMs showed limited inclusion of rural populations, local language groups, and women in AI and data systems, undermining research quality. For example, in Senegal, agronomic AI tools or environmental models trained only on data sourced from urban, French-speaking regions failed to generalize to rural contexts or local languages—reducing scientific reliability, utility and public trust. Further, Senegal's gender imbalance in STEM, with fewer than 30% of STEM students being women, narrowed the range of perspectives feeding into research agendas.
- Exclusion of women, rural populations, and minority language groups from research and datasets leads to major blind spots in science, potentially leading to biased datasets and ineffective AI tools, dampening public trust in AI and reducing participation in citizen science or data-sharing initiatives.
- To improve the scientific validity and applicability of AI-led research, it is essential to build datasets and research processes that span diverse demographics, geographies and language groups. Otherwise, the models reinforce inequalities and limit applicability of scientific results.

Scientific/Educational Dimension

- Many countries participating in the RAM process found that a lack of domestic technical skills significantly worsened equitable access to the full benefits of international technological advancement. In South Africa, RAM data showed that only 15% of the population had basic ICT skills and 5% had advanced ICT skills (against a global average of roughly 44% and 7.5% respectively), and that economic inequality, job displacement due to automation, and limited AI-focused entrepreneurship were pressing concerns.
- To close the skills gap, Member States need to be investing in AI-ready talent, scaling national education and upskilling programmes. Prioritising inclusive access to advanced ICT and AI training would strengthen local scientific capacity and ensure that AI and data can be harnessed to advance innovation.

Economic Dimension

- Without strong research funding, many RAMs showed that startups/labs cannot access the talent required to use AI for impactful innovation. For example, Indonesia invests 0.2% of GDP in R&D, constraining capacity for ethical AI research, with a need for 9 million additional tech workers by 2030.
- Science systems need targeted investment in AI-literate researchers, data scientists, and interdisciplinary teams. Without this, AI cannot meaningfully transform national research ecosystems.

Technical/Infrastructural Dimension

- Kenya's RAM showed a gap between internet connectivity in rural areas (17%) compared to urban areas (44%) of the population, and that their 9 data centres are primarily located in the capital city, Nairobi.
- For AI innovations to lead to equitable benefits, rural researchers need secure, affordable, and locally accessible infrastructure. Otherwise, scientific innovation remains dominated by urban demographics, potentially excluding the majority of Kenya's population from frontier work.

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)***

UNESCO has developed the following international standard-setting instruments to support the use of AI and data in science and innovation:

- UNESCO Recommendation on the Ethics of AI (2021): Global framework guiding human-rights–based AI governance.
- UNESCO Recommendation on Open Science (2021): Promotes open data and open innovation, enabling inclusive AI applications.

UNESCO's Recommendation on the Ethics of Artificial Intelligence states: *'Recognizing that AI technologies present great opportunities to help advance scientific knowledge and practice, especially in traditionally model-driven disciplines, Member States should encourage scientific communities to be aware of the benefits, limits and risks of their use; this includes attempting to ensure that conclusions drawn from data-driven approaches, models and treatments are robust and sound. Furthermore, Member States should welcome and support the role of the scientific community in contributing to policy and in cultivating awareness of the strengths and weaknesses of AI technologies.' (p111.)*

To implement the Recommendation, UNESCO has developed a variety of tools and mechanisms, one of which is the AI Readiness Assessment Methodology (RAM). The RAM is a diagnostic tool that provides detailed and comprehensive insights into different dimensions of AI readiness, and is currently being implemented in over 70 countries. By highlighting institutional and regulatory gaps, it enables UNESCO to tailor support for governments to fill those gaps, ensuring an ethical AI ecosystem in line with the Recommendation. One of 5 key policy areas the RAM focuses on is the Scientific/Educational Dimension, evaluating indicators like R&D expenditure, research and innovation output and AI talent. The RAM process also involves a national multistakeholder consultation exercise that includes AI experts and data scientists, to understand their priorities and concerns about the development and deployment of AI. By asking these questions and holding these consultations, UNESCO works with governments to provide detailed policy recommendations to ensure that AI and data advances science and innovation in accordance with the Recommendation.

A series of UNESCO projects funded by the Patrick McGovern Foundation (McGovern I, II and III) exemplifies a comprehensive strategy to leverage AI for science and innovation while embedding ethical safeguards such as fairness, transparency, accountability, and inclusivity. McGovern-I piloted the Readiness Assessment Methodology (RAM) in four countries, translating the Recommendation on the Ethics of AI into institutional and regulatory frameworks through a bottom-up, participatory process that built national capacity and aligned innovation with local priorities and values. McGovern-II expanded RAM deployment to five additional countries, enabling broader multistakeholder engagement and generating context-sensitive diagnostics, while also commissioning several knowledge products to guide evidence-based policymaking. Building on this, McGovern-III is extending RAM implementation to six further countries and undertaking a cross-cutting synthesis of completed assessments, supporting follow-ups, refining the methodology, and developing new policy tools such as a Nature Positive AI Toolkit and an Outlook Study on AI and Gender. Ethical considerations are systematically incorporated through 1) the explicit treatment of fairness in addressing inequalities and gender issues, 2) transparency and accountability via open publication of reports and global peer review at the 2025 UNESCO Global Forum on the Ethics of AI, and 3) inclusivity through stakeholder consultations that integrate a range of global perspectives. Supported by the McGovern Foundation, the projects are structured around concrete deliverables and iterative evaluation of the RAM process, ensuring that innovation is fostered in ways that are both effective and ethically grounded.

Similarly, a series of projects funded by the Government of Japan (JFIT I and II) focus on enhancing capacities in Africa and Small Island Developing States (SIDS) to benefit from AI technologies while addressing ethical risks, particularly gender inequality and discrimination. JFIT I piloted the RAM in six countries and then rolled out across a further 12 countries, and JFIT II facilitated the deployment of the RAM in six additional Member States, incorporating comprehensive risk management and mitigation strategies to ensure smooth implementation. The project emphasizes participatory engagement with national authorities and regional knowledge-sharing forums, fostering collaborative learning and peer-to-peer exchange. The project was designed to ensure that AI

supports innovation while upholding fairness, transparency, privacy, and accountability in every stage of the process, ensuring that AI-driven scientific and social innovation advances sustainably and inclusively.

A project supported by the European Commission Directorate-General for International Partnerships is working with Member States to pilot the RAM and the Ethical Impact Assessment in 18 countries around the world, as well as establishing the AI Ethics Experts without Borders Network (AIEB).

The 2021 UNESCO Recommendation on Open Science underscores the transformative potential of the artificial intelligence–open science intersection, calling for the development of AI-driven tools to automate the discovery, linking, and analysis of scientific data and publications. In order to take advantage of opportunities offered by open science research projects, research institutions and civil society initiatives need to call on advanced data science skills including artificial intelligence. While recognizing AI's potential to accelerate knowledge creation and innovation, it stresses that these tools must be deployed within an open, ethical framework that ensures transparency, fairness, accountability, and safeguards against risks. To support this, the Recommendation calls for sustained investment in community-governed, non-commercial infrastructures built on open-source software and guided by the FAIR (Findable, Accessible, Interoperable, Reusable) and CARE (Collective Benefit, Authority to Control, Responsibility, Ethics) principles.

UNESCO publication 'Open Hydrology': As a contribution to the UNESCO Recommendation on Open Science, the publication 'Open Hydrology' has laid out a strategic framework to integrate Open Science into hydrology. This publication follows a thorough mapping exercise of existing actors, activities, initiatives, tools and methodologies that contribute to each of the identified components of Open Hydrology. The Open Hydrology framework advocates for the accessibility of hydrological research to a broad spectrum of researchers, practitioners, and policymakers. Free and equal access to hydrological knowledge, technology, and tools is indispensable for FAIR advancement and innovation in addressing the current intricate water challenges. The six pillars constitute the structure of the Open Hydrology framework: 1. Open Data 2. Open Source 3. Open Education 4. Open Infrastructure 5. Open Publishing 6. Open Participation.

UNESCO publication 'Applications of AI for Water Management': The rapid advances in artificial intelligence (AI) are bringing new possibilities to many scientific and industrial fields, including water management. AI technologies offer opportunities to enhance water management through a number of enabler applications. To identify the current state of AI applications for water management, a mapping exercise was initiated in collaboration with Deltares. This mapping exercise includes a review on the potential of AI for application into water management, and the development of an online database where mid-high technology readiness level (TRL) implementations of AI technology in water management are highlighted. This aims at identifying applications which are available and have made their way from scientific literature to real-world (operational) implementations. An overview of the current state-of-the-art AI techniques, relevant to water management, and the mapping of applications is summarized in a publication.

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)

Through the 2021 UNESCO Recommendation on Open Science, UNESCO is actively engaged in promoting open innovation and open data by advancing open scientific knowledge. This encompasses open access to scientific publications, research data, metadata, open educational resources, open-source software and hardware, as well as open research methodologies and evaluation processes. These efforts ensure that knowledge outputs are freely accessible, reusable, and distributed under open licenses that foster transparency, collaboration, and inclusivity across disciplines and regions. Access restrictions are only applied when justified—for example, to protect

human rights, privacy, intellectual property, sensitive knowledge, or endangered species—with safeguards such as anonymization and mediated access.

Under the umbrella of the UNESCO Open Science Toolkit, the UNESCO–CODATA Working Group on Data Policies for Times of Crisis has developed a comprehensive suite of resources on *developing data policies for times of crisis facilitated by open science*, including a Factsheet, a Guidance Document, and a Checklist, to address the growing need for timely, ethical, and actionable data in response to increasingly frequent and complex global crises. These resources demonstrate how the principles of the 2021 UNESCO Recommendation on Open Science can be applied to build robust, coordinated, and transparent data policies during crises.

UNESCO also promotes open platforms for climate and environmental data, enabling AI-driven monitoring of hazards and carbon footprints. In addition, engagement with Indigenous and Local Knowledge (ILK) demonstrates how AI can respect data sovereignty while making traditional knowledge usable for climate and ecosystem management**.**

UNESCO's Recommendation on the Ethics of Artificial Intelligence states: '*Member States should encourage private sector companies to facilitate the access of the scientific community to their data for research, especially in LMICs, LDCs, LLDCs and SIDS. This access should conform to relevant privacy and data protection standards.' (p.109)* as well as '*Member States should promote open data. In this regard, Member States should consider reviewing their policies and regulatory frameworks, including on access to information and open government to reflect AI-specific requirements and promoting mechanisms, such as open repositories for publicly funded or publicly held data and source code and data trusts, to support the safe, fair, legal and ethical sharing of data, among others (p.75).'*

To implement this recommendation, the Legal Dimension of UNESCO's AI Readiness Assessment Methodology (RAM) asks questions about data sharing and accessibility, including metrics like: scores on the Open Data Inventory, whether the country is a signatory of the Open Data Charter, whether it has a national data sharing framework, and the efficacies of each of these elements (including research accessibility, public/private or international data sharing).

After conducting the RAM, Chile has taken significant steps to promote open innovation and data sharing for scientific research. The country enacted the Framework Law on Cybersecurity, establishing the National Cybersecurity Agency (ANCI) to oversee public and private institutions, thereby strengthening the secure deployment of AI systems and enabling safer cross-agency research collaborations. Concurrently, the Digital Government Secretariat (DGD) has been advancing open data and open science initiatives, including a Technical Standard for Open Data to guide governmental bodies in publishing datasets, a Public Data Management Strategy to promote research use of public data, and the relaunch of the National Open Data Portal to enhance accessibility. These measures align with UNESCO's Recommendation on the Ethics of AI by improving data accessibility, safeguarding privacy and security, and fostering an environment where AI and data can be leveraged ethically and effectively to advance science and innovation.

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)?

UNESCO is actively fostering collaboration around AI and data for science, technology, and innovation by engaging industry stakeholders through its Business Council for Ethics of AI. The Council brings companies together in a trusted peer network to exchange experiences and promote good practices in applying the UNESCO Recommendation on the Ethics of AI. The Council serves as a mechanism for collaboration between business and other stakeholders, including policymakers, academia, civil society, and international institutions, to shape responsible AI governance and innovation.

The Council convenes companies across diverse sectors (healthcare, entertainment, food industry, enterprise software, technology and growing) and geographies, spanning both AI developers and deployers, from model and agent development, product R&D to innovation of business processes. It provides a platform for exchange on topics such as corporate governance and human oversight, ethical impact assessments, data governance, and cultural and linguistic diversity in AI systems. This takes place through roundtables, workshops and publications, in collaboration with regulators and academia. The Council promotes collaboration on data sharing through partnering with initiatives such as the AI Company Data Initiative, which enhance understanding of AI's impact and deployment across sectors and geographies.

Looking ahead, the Council is also exploring ways to deepen collaboration, for instance, building on the UNESCO Coalition for Linguistic Diversity to improve the diversity of data for LLM training, or supporting knowledge transfer on ethical AI implementation from large companies to SMEs and startups.

UNESCO also fosters collaboration among diverse stakeholders in AI governance through its Global Civil Society Organizations (CSO) and Academic Network on AI Ethics and Policy. This platform, launched in 2025, brings together CSOs, academic institutions, and others to promote advocacy, knowledge exchange, and inclusive participation in AI governance. Grounded in the Recommendation on the Ethics of AI, the Network supports civil society's crucial role in advancing ethical AI, safeguarding human rights, and strengthening global cooperation on AI challenges.

Biosphere Reserves and Geoparks serve as living laboratories where universities, local governments, and communities co-develop AI-based monitoring tools. In addition, Multi-stakeholder initiatives under IHP (e.g. forthcoming AI for Water publication) bring together governments, researchers, and technical institutes.

6. Are you engaged in any bilateral, regional, or international partnership aimed to foster AI for STI? (Please describe the benefits and challenges of participating in these partnerships)

In partnership with the Government of Uzbekistan, UNESCO established the UNESCO-Uzbekistan Beruniy Prize for Scientific Research on the Ethics of AI. This Prize recognizes contribution to AI ethics research, scientific cooperation and practical application at all levels, encouraging collaboration across countries and disciplines and aligned with 2021 UNESCO Recommendation on the Ethics of AI. The first three laureates will be announced later this year in Samarkand, Uzbekistan at the 43rd UNESCO General Conference. The benefits include strengthening global research capacities, increasing visibility for ethical AI practices, and supporting innovation that serves humanity.

UNESCO's AI Ethics Experts Without Borders (AIEB) network brings together 100+ experts from 30+ countries to support Member States globally in implementing the Recommendation on the Ethics of AI. It provides tailored policy guidance, legislative advice, capacity building, and expert matching through collaborative projects. By fostering international collaboration and knowledge exchange, AIEB helps countries develop responsible AI frameworks that advance STI.

UNESCO collaborates with the European Commission and the Dutch Authority for Digital Infrastructure on the Supervising AI by Competent Authorities project, which strengthens institutional frameworks for ethical AI governance aligned with the EU AI Act and UNESCO's Recommendation on the Ethics of AI. This partnership builds capacity for effective AI supervision, fostering responsible AI development that supports scientific, technological, and innovation ecosystems.

Finally, UNESCO's collaboration with the G20 is continuing with the South African Presidency through the launch of the 'Technology Policy Assistance Facility' and the 'AI in Africa Initiative' at the AI in Africa Conference in September 2025. This is accompanied by financial support and guidance provided for the African Union's Continental AI Strategy and Implementation framework, drawing on insights from 28 RAM assessments in African countries. These partnerships aim to strengthen

capacity building for AI development and use in African countries, thereby supporting scientific and technological innovation.

7. 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?

UNESCO's Recommendation on the Ethics of AI emphasizes the importance of international cooperation to advance AI for science, technology, and innovation, particularly by supporting technological capacity building in low- and middle-income countries (LMICs), including least developed countries (LDCs), landlocked developing countries (LLDCs), and small island developing states (SIDS) (para. 80). It encourages Member States to promote collaborative AI research and innovation that enhances the participation and leadership of researchers from these regions (para. 81). Furthermore, the Recommendation highlights the need to bridge technological divides by fostering cooperation among countries with varying levels of AI development, ensuring inclusive and equitable progress in AI ethics worldwide (para. 83).

UNESCO's Global Forum on the Ethics of AI convened international stakeholders to engage in dialogue and knowledge-sharing on AI, with a strong focus on science and capacity building. The session "From Readiness Assessment to Enhanced Institutional, Technical, and Human Capacities on AI" showcased countries' experiences with UNESCO's RAM and strategies to build national AI capacities. Meanwhile, "AI and Science and Scientific Research" explored how AI is reshaping scientific inquiry, raising new questions around integrity, transparency, and innovation.

The UNESCO Recommendation on Open Science emphasizes international cooperation as essential for enabling knowledge exchange, joint research, and shared infrastructures that strengthen global scientific and technological capacity. UNESCO's collaboration with the Royal Society on the intersection of open science and AI for research and innovation acceleration exemplifies this approach, with a drafting working group established to further investigate how AI and open science can reinforce each other to advance scientific discovery.

AI can significantly enhance the efficiency and precision of policy analysis in the realm of STI. These tools have the capacity to process and analyze vast datasets, identify patterns, and yield insights that might be challenging to obtain through conventional methods. By harnessing the power of AI, UNESCO is striving to work with international partners to make comprehensive information systems, such as STI policy databases and data visualization tools, more accessible and user-friendly in its Global Observatory of Science, Technology and Innovation Policy Instruments (GO-SPIN) platform.

The UN CSTD can contribute by facilitating policy dialogue, supporting capacity-building programmes, and promoting the values and principles of the UNESCO Recommendation on Open Science and UNESCO's Recommendation on the Ethics of AI.