

From principles to practice: Standards for interoperable and inclusive AI

AI Standards Report 2026



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1 Foreword



Figure 1: Seizo Onoe, Director of the ITU Telecommunication Standardization Bureau

How can all countries, at all levels of economic development, benefit from trusted artificial intelligence (AI)?

Collaboration will be key.

No country can build the entire AI value chain alone, and very few can put together all the chips, models, data and applications needed to build the entire AI stack at home.

While every country wants a strong AI ecosystem, that should not lead to isolation and fragmentation.

With international collaboration and open standards, we can drive shared progress on AI and help every country and company make the choices right for them.

Creating connections is one of the core aims of ITU's AI for Good programme and our partnerships with fellow UN agencies and standards bodies.

We are advancing technical collaboration and global standards in areas from AI-native networks, embodied AI and multimedia authenticity to AI innovations for better health, agri-food systems, disaster risk reduction, road safety and smart cities.

And with our new AI for Good Lab, we aim to provide public AI infrastructure and expert guidance to help everyone build solutions, standards and skills for long-term success with AI.

Success with AI calls for new innovation ecosystems built on common understandings and trust. That's what consensus-based standards are all about.

This report highlights the many ways we can work together to create the future we want.

2 AI for Good Global Summit 2026

The [AI for Good Global Summit](#) took place from 7 to 10 July 2026 at the Palexpo International Conference and Exhibition Centre in Geneva, Switzerland, welcoming over 12,000 participants from 177 countries. The mission of AI for Good is to unlock the potential of artificial intelligence (AI) to serve humanity through building skills, standards and partnerships. As the leading UN platform for dialogue on AI, the Summit is organized by the International Telecommunication Union (ITU) in partnership with over 50 fellow UN agencies and co-convened with the Government of Switzerland.



Figure 2: Doreen Bogdan-Martin, ITU Secretary-General



Figure 3: Tomas Lamanauskas, ITU Deputy Secretary-General



Figure 4: AI for Good Global Summit 2026 centre stage

3 Executive summary

The AI for Good Global Summit 2026 featured a track dedicated to AI standards.

The International AI Standards track featured the following segments:

i. High-level AI standards panels on centre stage

- From principles to practice: Role of international AI standards
- Media literacy in the age of AI
- Connecting intelligence: AI-native networks and the power of standards
- AI, media and the information integrity challenge
- Bridging the AI infrastructure divide

ii. Thematic AI standards workshops

24 thematic AI standards workshops explored standards work related to AI in different sectors and industry verticals such as:

- AI in disaster resilience: Bridging science, standards and innovation
- The future of AI-native communication networks
- AI and audiovisual accessibility for digital inclusion
- AI foundation: Digital trust and AI infrastructure for all
- AI and multimedia authenticity standards
- Embodied AI for multimedia technologies: From perception to human collaboration
- From standards to science to action: Implementing and scaling sustainable AI across its lifecycle
- AI for health: Scaling impact through standards, investment and intellectual property
- From data centres to climate goals: International standards for a more energy-efficient AI
- Operationalizing AI impact assessment: The interplay between law-based frameworks and international standards
- Foundation model evaluation and standards
- AI for manufacturing: Pharmaceutical industry session on innovation, application and standard development
- Cities that think and act: Agentic AI, physical AI and the citiverse
- Designing trust management for agentic AI
- Agentic AI: Architecture and standards for next-generation AI agents
- Future Networked Car Symposium
- Mobile AI for Good: Ubiquitous, open, accountable, inclusive
- Advancing women's leadership in AI and standards
- From human rights principles to standards: Perspectives from IEC, ISO and ITU
- GeoGPT & OneEarth: Empowering global geoscientists
- Advancing AI in networks
- AI on the menu: Transforming digital food systems

- AI benchmarking and AI-powered testing
- 021 Scientific Foundation Model: Empowering the transformation of scientific research paradigms

iii. Future standards for frontier technologies

Workshops dedicated to emerging technologies and areas for future AI standards work explored:

- Testing and verification of frontier AI systems
- Quantum technologies
 - Building the UN playbook for quantum readiness
 - Quantum and AI: Unlocking new frontiers through convergence
- BCI technology for good and standards cooperation

Key announcements

Key announcements during the AI for Good Global Summit 2026 for the International AI Standards are shown below:

1. Three new [ITU focus groups](#) welcome participation from all interested experts:
 - [ITU Focus Group on Trust and Identity for Humans and Agentic AI](#)
 - [ITU Focus Group on AI for Smart Sustainable Cities and Communities](#)
 - [ITU Focus Group on Embodied AI for Multimedia Technologies](#)
2. ITU's new [AI for Good Lab](#) focuses on building skills, infrastructure, and policy foundations required for long-term AI success. The AI for Good Lab is built around three interconnected priorities to support countries at every stage of their AI journey:
 - AI readiness and policy
 - AI skills development
 - Public AI infrastructure
3. New report [AI-enabled health innovation and intellectual property: From idea to impact](#) from the [ITU-WHO-WIPO Global Initiative on AI for Health](#).
4. New reports from the [AI and multimedia authenticity standards collaboration](#)
 - [Technical paper on AI and multimedia authenticity standards \(second edition\)](#)
 - [Policy paper on the legal landscape for generative AI across different regions](#)
5. New reports from the [United for Smart Sustainable Cities](#) initiative coordinated by ITU, UNECE and UN-Habitat, with the support of another 19 United Nations partners:
 - [Autonomous cities and AI: The next frontier of urban transformation](#)
 - [Case study: AI-driven autonomous urban systems in Valencia, Spain](#)
 - [Case study: Autonomous urban systems in Songdo, Republic of Korea](#)
 - [Case study: Shenzhen's autonomous public transportation](#)
 - [Case study: Dubai's self-driving transport strategy](#)

- [Case study: Guna's journey towards an autonomous city, Madhya Pradesh, India](#)
 - [Case study: Autonomous urban mobility and smart city innovation in Calgary, Canada](#)
 - [Case study: AI-driven urban transformation and autonomous systems in Budapest, Hungary](#)
 - [Case study: Beijing's autonomous intelligent signal light, China](#)
 - [Case study: Zaozhuang High-tech Industrial Development Zone, Shandong, China](#)
6. New reports from the [Global Initiative on AI, Digital Twins and Virtual Worlds: Discovering the Citiverse](#) coordinated by ITU, UNICC and Digital Dubai, with the support of over 70 partners:
- [AI-Enabled Citiverse: Foundational Capabilities for Cities in the Age of AI](#)
 - [AI-Enabled Citiverse: Use Cases for Cities in the Age of AI](#)
 - [City Administration, Services and Public Participation](#)
 - [Urban Planning, Placemaking and Infrastructure](#)
 - [Economic Development, Education and Tourism](#)
 - [Public Safety, Health and Disaster Resilience](#)
 - [Transport and Mobility](#)

Part 1: AI for Good Lab and high-level panels on AI standards

4 AI for Good Lab

4.1 Introduction

Supporting AI solutions, standards and skills, the mission of the [AI for Good Lab](#) is to enable developing and middle- and low-income countries to develop local AI ecosystems to harness the potential of frontier technologies such as AI and machine learning (ML) and address the challenges related to AI skills development for the workforce, professionals, government, startups and youth.

The AI for Good Lab is designed to help countries assess their AI readiness, strengthen national innovation ecosystems, address AI skills gaps and accelerate the development of locally relevant AI solutions based on international standards.

By combining policy support, the adoption of international standards, workforce development and access to infrastructure, the initiative seeks to ensure that AI becomes a driver of inclusive growth and sustainable development rather than a source of inequality.

4.2 Three pillars

The Lab will bring together ITU's AI for Good related projects (for example, AI for Good Readiness Framework, AI Sandboxes, AI Skills Coalition, Machine Learning Challenges, Innovation Factory and Robotics for Good Youth Challenges) targeting different user groups (i.e. youth, government, regulators, policymakers, workforce, AI start-ups and professionals) under three main pillars for national AI development:

- Pillar 1: AI readiness and policy
- Pillar 2: AI skills development
- Pillar 3: Public AI infrastructure

The main objectives of the Lab are to enable emerging economies to:

- Assess their AI readiness and gaps in terms of policies and strategies that need to be implemented to harness AI's potential for economic development
- Leverage AI for development challenges for different sectors, such as health, agriculture and education
- Build comprehensive local AI ecosystems, encourage experimentation and innovation
- Address the AI skills divide

The Lab will provide an AI knowledge transfer programme to support countries in implementing AI solutions based on ITU standards and provide an environment for experimenting and testing AI solutions under real local conditions before deployment. This will provide an institutional pathway for developing countries to establish *Public AI Infrastructure* through the AI for Good Sandbox, using public datasets based on local contexts for training AI models for priority sectors such as health, agriculture, education and mobility. The initiative aims to support cost-effective access to compute infrastructure and

shared open-weight AI models adapted to local contexts for governments, companies and academia.

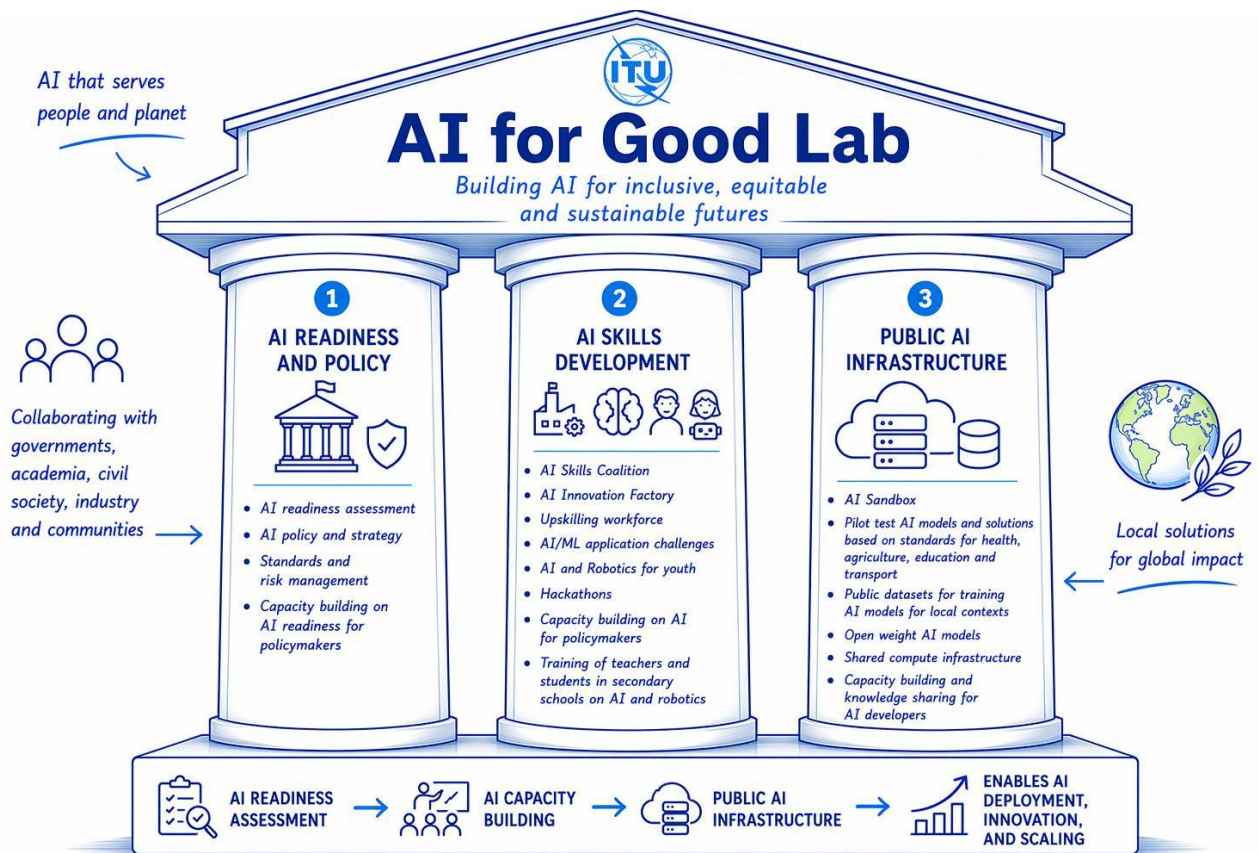


Figure 5: AI for Good Lab pillars

4.3 AI for Good Sandbox

The ITU AI for Good Sandbox is a distributed, standards-based AI innovation environment established under the AI for Good Lab. It is designed to support the development, testing, validation and sharing of AI solutions, policies and strategies using open datasets, models, compute resources, simulators and toolsets within an environment aligned with ITU standards.

The ITU AI for Good Sandbox offers:

- Open datasets for AI experimentation
- Open-source AI models
- Compute resources
- Opensource AI toolsets, simulators and agents
- Technical mentoring and training

- Mechanisms to showcase solutions through AI for Good events and standardization activities.

4.4 ITU standards and functions provided in AI for Good Sandbox

The table below shows the mapping of ITU standards to the functions and capabilities of the sandbox.

Table 1: AI for Good Sandbox functions mapped to ITU standards

ITU standard	Primary Function	Sandbox Capability
ITU-T Y.3174	Data handling	Data pipelines, governance, metadata
ITU-T Y.3172	AI/ML pipeline	Standardised representation of AI/ML pipelines, End-to-end AI/ML orchestration
ITU-T Y.3176	Marketplace interoperability	Dataset/model sharing
ITU-T Y.3181	Sandbox architecture	Experimentation, Testing, simulation, validation
ITU-T Y.3179	Model serving and deployment	Deployment, inference and optimization
ITU-T Y.3187	ML function orchestration	AI/ML lifecycle management

For the AI for Good Sandbox, these ITU standards collectively provide six infrastructure layers:

- Data handling layer (Y.3174)
- AI/ML pipeline layer (Y.3172)
- AI/ML marketplace layer (Y.3176)
- AI/ML sandbox architecture layer (Y.3181)
- Model serving and deployment layer (Y.3179)
- ML function orchestration layer (Y.3187)

Together, they transform the AI for Good Sandbox from a simple experimentation platform into a standards-based public AI infrastructure stack to develop, test, deploy and scale interoperable AI systems aligned with ITU standards.

The standardized aspects provided by the above ITU standards would be used cross-layer, including the applications and services domain, in the sandbox. This includes:

- 1. Architecture concepts such as cross-layer data pipelines
- 2. AI/ML pipeline representations spanning across domains
- 3. Data/model repositories serving vertical applications and services
- 4. Toolsets and generative models which are application-specific
- Cross-layer orchestration of model pipelines.

Thus, in the AI for Good Sandbox, the Recommendations would be applied to vertical applications and services, and not only IMT-2020 (5G) network layers.

4.4.1 Architecture framework for machine learning

Purpose

Y.3172 defines the AI/ML pipeline, including the components required to collect data, train models, deploy models and monitor operational performance. It establishes the reference architecture for AI/ML.

Sandbox function

In the AI for Good Sandbox, Y.3172 provides:

- Standard AI/ML pipeline representation
- Model training
- Model deployment
- Model monitoring
- Lifecycle management

Key components

- Data source
- Data collector
- Pre-processor
- Model pipeline
- Model repository
- Policy engine
- Distribution function
- Inference target systems
- Orchestration function

Outputs

- Trained models
- AI pipelines
- Monitoring dashboards

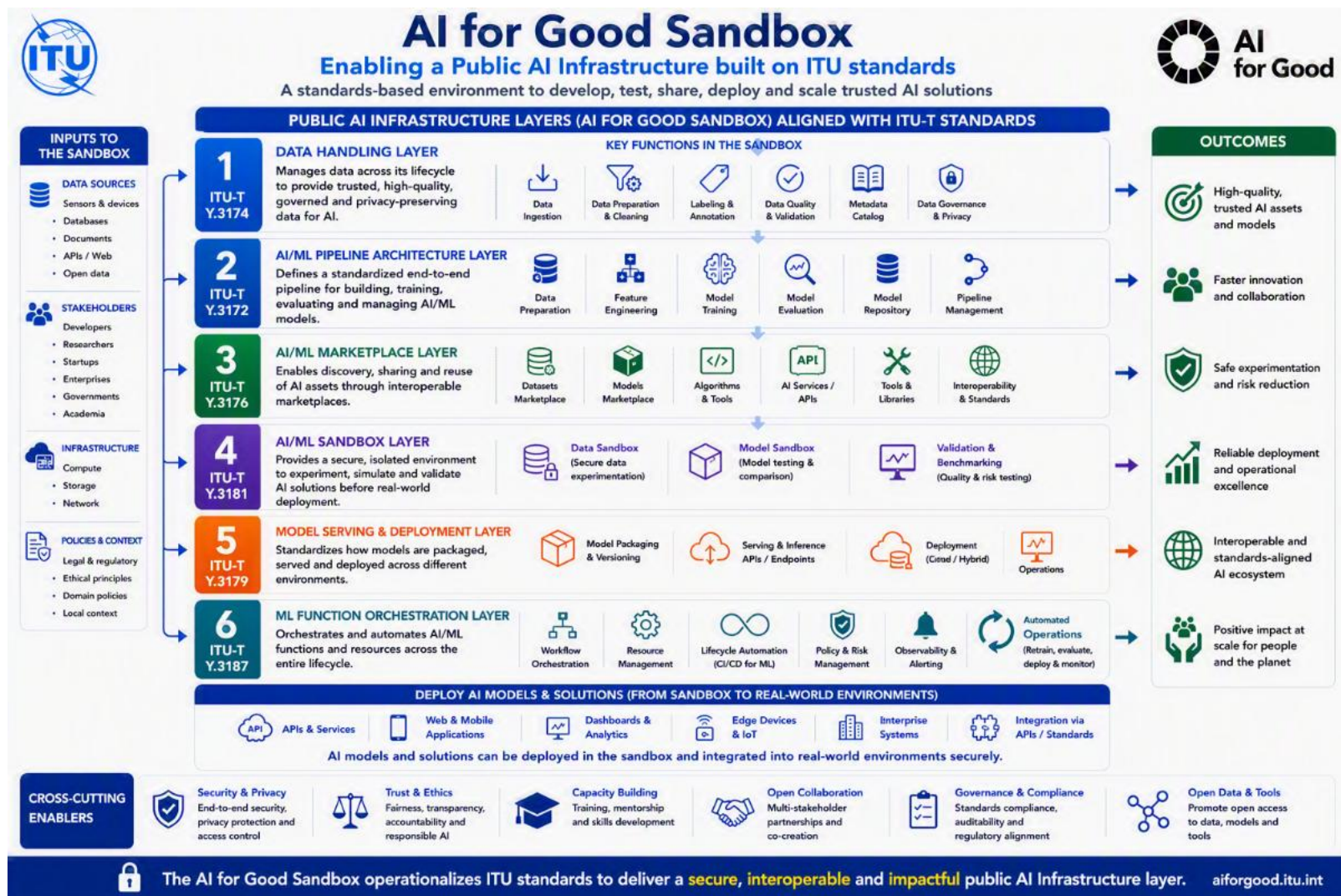


Figure 6: AI for Good Sandbox layers and functions enabled by ITU standards

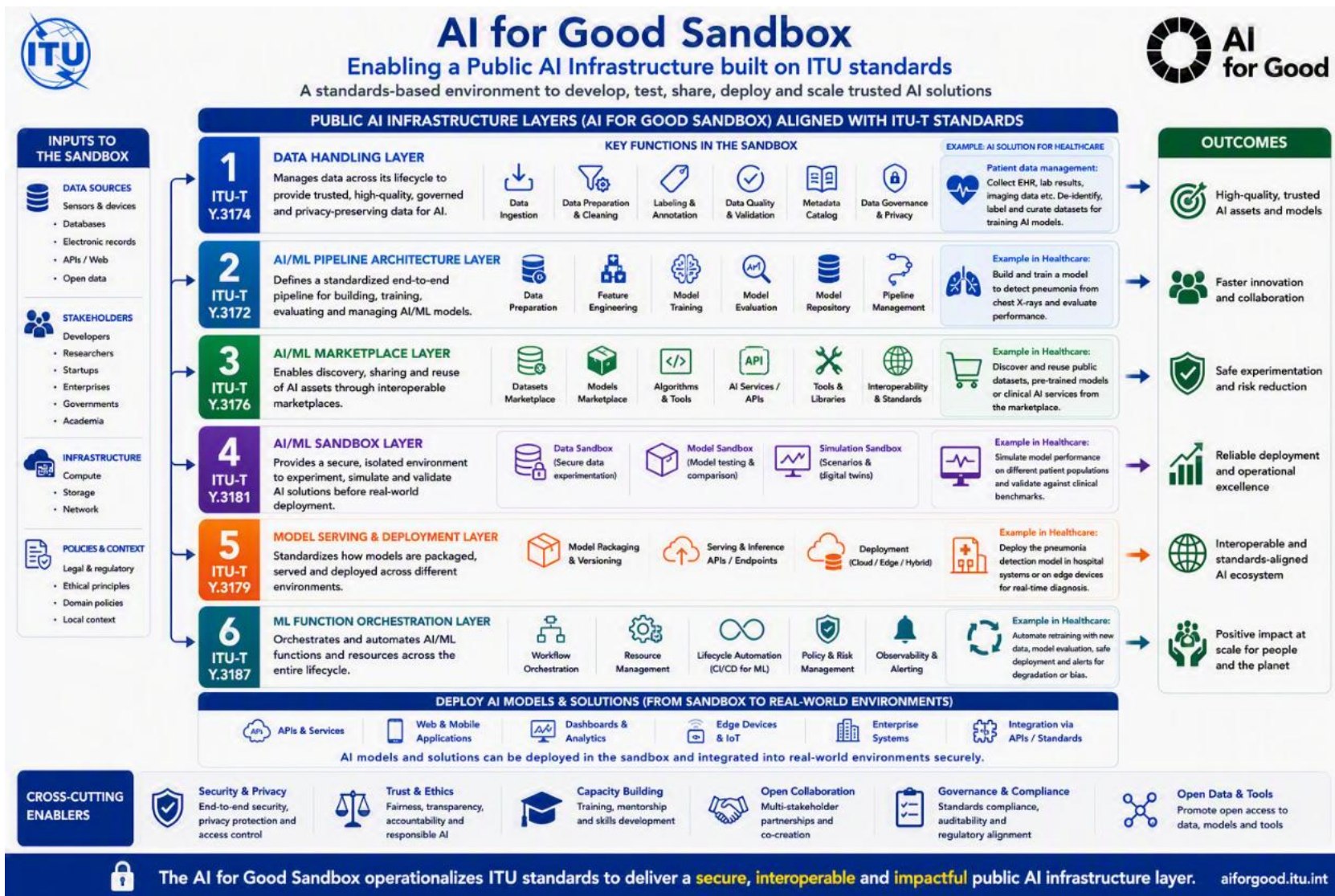


Figure 7: Example for AI in healthcare

4.4.2 Framework for data handling layer

Purpose

Y.3174 focuses on the management of data throughout the AI lifecycle. It provides the data infrastructure layer of the Sandbox.

Since AI quality depends heavily on data quality, this Recommendation provides guidance on:

- Data collection
- Data preparation
- Data quality
- Data labelling
- Data storage
- Data sharing
- Data formats

It supports the data management layer needed for trustworthy ML systems.

Sandbox functions

Y.3174 enables:

a) Data pipelines

- Dataset ingestion
- Metadata management
- Data transformations
- Data versioning

b) Data formats

- Data interfaces
- Privacy protection

c) Data sharing

- Dataset format interoperability
- Data pipeline management

Outputs

- Data pipelines
- Training datasets
- Validation datasets
- Metadata and API catalogues

4.4.3 AI/ML marketplace integration framework in future networks

Purpose

Y.3176 establishes how AI assets (models, datasets and agents) can be discovered, exchanged and reused across organizations, platforms and countries. It enables interoperability between ML marketplaces as the AI ecosystem and collaboration layer of the Sandbox.

Sandbox functions

a) Dataset marketplace

It enables publishing and reuse of:

- Public datasets
- Synthetic datasets
- Benchmark datasets

b) Model marketplace

It enables sharing of:

- Foundation models
- Domain-specific models
- Fine-tuned models

c) Service marketplace

It enables sharing of:

- APIs
- AI services
- Evaluation tools

Outputs

- Shared assets
- Reusable and discoverable models
- Open services and APIs
- Metadata catalogues

4.4.4 Model serving framework

Purpose

Y.3179 addresses how ML models are operationalized and delivered as services after training. It represents the deployment and model serving layer of the Sandbox.

It focuses on:

- Model serving
- Runtime environments
- Inference management
- Deployment architectures
- Resource optimization

Sandbox function

Y.3179 supports:

a) Model deployment

Models become accessible as deployable services.

b) Inference services

- Real-time inference
- Batch inference
- API-based inference

c) Multi-environment deployment

Deployment across:

- Cloud
- Edge

- Hybrid infrastructures

d) Model operations

- Scaling
- Version control
- Rollback
- Service monitoring

Outputs

- Production-ready AI services
- Model endpoints
- Deployment packages

4.4.5 AI/ML sandbox architecture

Purpose

Y.3181 provides the architecture for the Sandbox itself, including components, interfaces, APIs and simulation environments required for experimentation and validation. Y.3181 is essentially the core Recommendation behind the AI for Good Sandbox. It is the secure experimentation layer of the Sandbox.

Sandbox functions

a) Data sandbox

- Secure datasets
- Data experimentation
- Synthetic data generation

b) Model sandbox

- Model testing
- Model comparison
- Risk evaluation

c) Simulation sandbox

- Virtual testbeds
- Scenario simulations
- Digital twins

d) Validation environment

- Benchmarking
- Controlled testing
- Repeatable experimentation

e) Common services

- APIs
- Access control
- Audit trails
- User management

Outputs

- Experimental results
- Model validation reports
- Sandbox audit records

4.4.6 Machine learning function orchestrator

Purpose

Y.3187 focuses on orchestration and automation across the AI lifecycle. It is the ML function orchestration and automation layer of the Sandbox. As AI systems become more complex, multiple functions must be coordinated automatically, including:

- Data pipelines
- Training workflows
- Model deployment
- Monitoring
- Resource allocation

Sandbox functions

a) Workflow automation

Coordinates:

- Dataset preparation
- Training jobs
- Evaluation tasks
- Deployment processes

b) Resource management

Allocates:

- Compute resources
- GPU resources
- Storage resources
- Network resources

c) Lifecycle orchestration

Automates:

- Model retraining
- Continuous integration
- Continuous deployment
- Continuous monitoring

d) Multi-component coordination

Connects:

- Datasets
- Models
- APIs
- Sandbox services
- External infrastructures

Outputs

- Automated workflows
- Resource scheduling
- Lifecycle management
- Scalable AI operations

5 From principles to practice: Role of international standards in AI

Opportunities linked to AI are raising new questions requiring new strategies, principles, regulation and standards for fragmentation to be avoided while fostering innovation. The role of international standards in AI was in focus at a panel discussion welcoming the leaders of the World Standards Cooperation (International Electrotechnical Commission (IEC), International Organization for Standardization (ISO) and the ITU Telecommunication Standardization Bureau).

The first question centred on the gap between policy ambition and practical implementation and the role played by standards in bridging this gap.

Philippe Metzger, CEO and Secretary General of IEC, emphasized that standardization is a complex, horizontal and well-established process that can be leveraged by governments as a building block for AI regulation, implementation and impact assessment.

Sergio Mujica, ISO Secretary General, highlighted that standards can enable the implementation of AI policies and regulations by providing common language and agreed definitions as well as consistent, verifiable AI impact assessment, thereby supporting the interoperability of different policy and regulatory frameworks..

Seizo Onoe, Director of the ITU Telecommunication Standardization Bureau, presented the dilemma of duplication in regulating AI and how ITU and its partners are championing multimedia authenticity and providing relevant tools to stakeholders.

The discussion also focused on inclusivity and the capacity of developing countries to help shape AI standards. Each organization highlighted its programmes supporting developing countries, such as ITU's [Bridging the Standardization Gap programme](#), [AI Skills Coalition](#) and [AI for Good Sandbox](#).

IEC advocated for a three-pronged approach encompassing the role of developing countries as standards makers, the role of organizations as agents of capacity building, and sustainable AI through IEC's diversified work on standards addressing energy and AI.

ISO has adopted a similar three-pronged approach which includes the active enabling of multistakeholder participation in standards development, notably through national positions taken at ISO and support to the implementation of standards in developing countries.



Figure 8: High-level AI standards panel

6 AI standards lunch roundtable: Media literacy in the age of AI

6.1 Introduction

The AI standards lunch roundtable on [*Media literacy in the age of AI*](#) was organized with the support of TikTok to examine how AI literacy, content provenance and shared standards can support trust in digital information environments. The roundtable built on ongoing discussions within the [AI and Multimedia Authenticity Standards Collaboration](#) on multimedia authenticity, content provenance, transparency and the responsible use of AI-generated content.

As AI-generated content becomes increasingly prevalent online, improving AI literacy on a global scale has become an imperative for building trustworthy digital ecosystems. Discussions explored practical approaches to advancing AI literacy, identifying gaps and opportunities and strengthening collaboration across standards bodies, industry, governments and creators to support transparent, trustworthy and responsible digital ecosystems.

6.2 Setting the scene

Opening remarks suggested that media literacy should be recognized as a formal pillar of AI policy, complementing technical standards for content labelling, watermarking, provenance and authenticity by enabling users to interpret and act on these trust signals effectively.

Seizo Onoe, Director of the ITU Telecommunication Standardization Bureau, underlined the importance of media literacy and content integrity as key elements of AI safety and highlighted the need for cross-sector cooperation involving industry, governments and standards bodies.

Bilel Jamoussi, Deputy Director of the ITU Telecommunication Standardization Bureau, noted that effective responses to AI-generated misinformation and disinformation require a dual approach that combines technical standards with societal resilience.

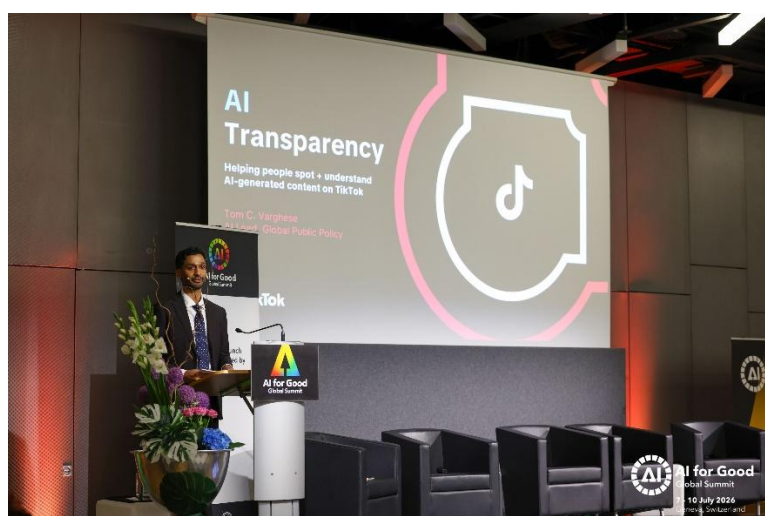


Figure 9: Tom Varghese, AI Lead, Global Product Public Policy, TikTok

Tom Varghese, AI and Enterprise Leader, Global Public Policy at TikTok, emphasized that AI is already part of everyday digital experiences and that users need confidence, context and control to understand when AI is used in content.

6.3 Fireside Chat

As AI-generated content becomes increasingly sophisticated, participants discussed the growing importance of media literacy alongside technical standards for content provenance, authenticity and transparency. While technical safeguards remain essential, the discussion emphasized that lasting trust in digital ecosystems will also depend on improving public understanding of AI-generated content, empowering creators and translating complex standards into practical tools that users can understand and apply.

Building trust in the age of AI-generated content

- Panelists emphasized that creators have an important role in strengthening AI literacy because they are among the most influential voices shaping how audiences engage with digital content.
- Literacy efforts should be developed with the audiences most exposed to AI content, including young people, rather than only designed for them.
- Participants highlighted the value of peer-to-peer engagement, particularly when communicating with younger audiences who may respond more effectively to creators and communities than to institutional messaging.
- The discussion also noted that AI literacy should address all age groups, including older adults vulnerable to AI-enabled scams and impersonation.

Provenance, labelling and cultural context

- Labels, watermarking and provenance mechanisms were identified as important tools for transparency, but panelists also noted that they have limits.
- Some labels may not change perceptions when content confirms existing beliefs, and warning signals can be interpreted differently across cultural contexts.
- Participants stressed the importance of translating technical standards into concepts that users, creators, policymakers and consumers can understand and apply.
- Social science research was highlighted as important to understanding manipulation techniques and designing effective awareness-raising approaches.

Simple and implementable standards

- Panelists emphasized that standards need to be simple enough to be adopted by creators, platforms and other stakeholders.
- Reducing the complexity of technical standards can support low-cost implementation and broader uptake across the digital content ecosystem.
- The discussion highlighted the importance of shared standards, practical safeguards and multi-stakeholder cooperation to support trustworthy digital environments.

Key takeaways

The discussion concluded that strengthening trust in the AI era requires complementary investments in technical standards, multimedia authenticity, media literacy, creator

engagement and public education. Participants agreed that trustworthy digital ecosystems will depend not only on advances in provenance, watermarking and content authenticity technologies, but also on ensuring that people have the knowledge and confidence to interpret AI-generated content responsibly. Ongoing collaboration through initiatives such as the AI and Multimedia Authenticity Standards Collaboration was highlighted as an important mechanism for advancing both technical solutions and public understanding.



Figure 10: Panelists for the fireside chat

6.4 Draft content creator responsible AI pledge

Alessandra Sala, Director of AI and Data Science at Shutterstock and Chair of the AI and Multimedia Authenticity Standards Collaboration, introduced the draft content creator responsible AI pledge proposed by TikTok to encourage creators to take a proactive role in promoting trust in digital ecosystems. The pledge aims to encourage creators to adopt responsible AI practices and contribute to efforts to combat misinformation, disinformation and deepfakes (see Box 1).



Figure 11: Alessandra Sala, Director of AI and Data Science at Shutterstock and Chair of the AI and Multimedia Authenticity Standards Collaboration

The draft pledge proposed six guiding principles for content creators:

- Transparency
- Accuracy
- Dignity and non-harm
- Inclusion
- Digital literacy
- Continuous learning

Box 1: Content creator responsible AI pledge

Building a trustworthy online content ecosystem is a key societal challenge, particularly in the age of AI. While AI tools help people enhance their creativity, AI-generated content can undermine people's trust that what they are seeing online is real.

Misleading information has the potential to travel further, faster and sometimes deeper than the truth, with falsehoods 70% more likely to get shared online than accurate news. While misinformation and disinformation are neither new nor unique to online platforms, users' ability to share information online and virality can quickly amplify and spread harmful content.

Online content creators are among the most influential voices shaping how billions of people understand and engage with emerging technology. As AI tools become embedded in everyday content creation, creators have a unique responsibility and opportunity to model responsible and transparent AI practices.

Co-designed by creators, technical experts and industry, this initiative brings together a global community of online creators who can lead the way by making that responsibility visible and concrete, and inviting others to join the movement.

Pledge principles

By signing this commitment, I, as a creator, voluntarily pledge to the following principles to drive a strong online content ecosystem, and combat misinformation, disinformation and deepfakes:

1. **Transparency:** When we use AI generated content or significantly AI-edited media that shows realistic-appearing scenes or people, we will ensure that such media incorporates AI labelling via appropriate means.
2. **Accuracy:** We take responsibility for checking AI-generated or AI-assisted content before publishing, and correct issues promptly and publicly where they occur.
3. **Dignity and non-harm:** We do not use AI tools to generate content that demeans, deceives or targets individuals or communities, including through synthetic media such as deepfakes.
4. **Inclusion:** We actively seek to create content that reflects diverse perspectives and does not marginalize underrepresented groups.
5. **Digital literacy:** We use our platforms to help our audiences engage with AI thoughtfully and critically.
6. **Continuous learning:** We commit to staying informed about the evolving capabilities and risks of AI tools, and to updating our practice as technology, and our understanding of it, develops.

These principles are intended to provide a practical foundation for responsible creator engagement while supporting broader efforts to strengthen trust, authenticity and accountability across digital ecosystems.

7 Connecting intelligence: AI-native networks and the power of standards

A panel discussion on [*Connecting intelligence: AI-native networks and the power of standards*](#) examined how AI is transforming communications networks from systems that simply transport data into intelligent, autonomous platforms capable of learning, optimizing and supporting new AI-enabled services. Panelists explored the technological, operational and policy implications of AI-native networks, highlighting both the opportunities and challenges associated with integrating AI throughout network infrastructure. Particular attention was given to the importance of international standards in enabling interoperability, trust, scalability and global collaboration.

The panel was moderated by **Ebtesam Al Mazrouei**, Chair of ITU's AI for Good Impact Initiative, and welcomed **Ali Taha Koç**, CEO of Turkcell; **Erik Ekudden**, Chief Technology Officer of Ericsson; **Pallavi Mahajan**, Chief Technology and AI Officer, Nokia; and **Serame Taukobong**, Group CEO of Telkom.



Figure 12: Panelists on AI-native networks and the power of standards

Panelists agreed that AI-native networks represent a fundamental evolution in telecommunications, with AI becoming embedded throughout network infrastructure rather than simply operating as an external application. AI-powered automation is already delivering measurable improvements in operational efficiency, energy management, service creation and network resilience, while enabling operators to support increasingly demanding AI-driven applications.

However, speakers emphasized that technology alone will not deliver this transformation. Scaling AI-native networks requires common standards that enable interoperability across cloud infrastructure, data centres, edge computing and telecommunications networks while helping to ensure transparency, human oversight, security and trust. Panelists also stressed that inclusion must remain a central objective, ensuring that AI-native networks help reduce rather than widen digital divides, particularly in emerging markets. The key discussion themes are summarized in the sections below.

7.1 AI-native networks as a new paradigm

The discussion highlighted that communications networks are evolving from connectivity platforms into intelligent systems capable of continuously learning, reasoning and optimizing network performance in real time. This evolution creates opportunities to improve operational efficiency, increase resilience and support entirely new categories of AI-enabled services.

7.2 Balancing AI capability with energy efficiency

Ali Taha Koç argued that the industry should move beyond viewing AI as a simple trade-off between performance and energy consumption. Instead, AI deployments should be appropriately sized for each use case, selecting models according to operational requirements rather than defaulting to the largest available systems.

Drawing an analogy with modern vehicle engines that dynamically adjust performance according to demand, he suggested that AI systems should similarly scale their computational

requirements. He proposed that industry adopt metrics focused on maximizing useful AI output while minimizing energy consumption, emphasizing that not every task requires large language models (LLMs) or complex AI processing.

7.3 AI is already improving network operations

Erik Ekudden noted that AI-powered IMT-2020 (5G) networks are already producing measurable operational benefits. AI is being deployed within radio infrastructure to improve spectral and energy efficiency while AI agents increasingly automate network planning, configuration and fault management across operations support systems.

He highlighted examples of autonomous Level 4 networks already in commercial deployment, including predictive network management capable of anticipating weather-related impacts, automatically resolving faults and implementing closed-loop remediation. These capabilities are significantly reducing operational workloads while accelerating service delivery.

7.4 From automation to autonomy

Pallavi Mahajan distinguished between automation and true network autonomy. While automation executes predefined tasks, autonomous networks operate according to high-level intent, determining independently how objectives should be achieved.

She emphasized that increasing autonomy requires complete transparency and explainability. Nokia's "glass box" approach was presented as a framework in which every AI-driven network decision remains explainable, traceable, reversible and subject to human oversight. The panel agreed that maintaining human control will remain essential as networks become increasingly autonomous.

7.5 AI-native networks and digital inclusion

Serame Taukobong emphasized that AI-native networks should ultimately be evaluated by their contribution to digital inclusion. While operators must continue optimizing services for existing customers, AI also creates opportunities to extend affordable connectivity to previously underserved populations.

He highlighted Africa's linguistic diversity, with thousands of spoken languages across the continent, noting that AI systems, standards and governance frameworks must support this diversity rather than reinforce existing inequalities. Standards therefore have an important role in ensuring that AI-native networks expand access and build trust across emerging markets.

7.6 International standards as the foundation for scale

The discussion underscored that international standards will be fundamental to scaling AI-native networks beyond isolated pilot projects.

Panelists identified several priorities for standards development, including:

- Common data models and languages enabling interoperability across networks, cloud infrastructure and edge computing
- Benchmarking frameworks to evaluate AI deployments consistently

- Governance mechanisms supporting human oversight and trustworthy autonomy
- Energy efficiency metrics that enable operators to deploy AI sustainably at scale

Speakers also noted the complementary work underway across standards organizations and industry alliances to address these challenges.

7.7 Supporting the next generation of AI applications

Looking ahead, the panel described communications networks evolving into an intelligent computing fabric capable of supporting physical AI applications including autonomous manufacturing, connected vehicles, drones, emergency response and healthcare.

This evolution will require distributed computing across edge and cloud environments, ultra-low latency communications, advanced uplink performance and trusted infrastructure built with security and transparency from the outset. Panelists agreed that compute and connectivity will increasingly function as a unified platform supporting AI applications wherever they operate.

7.8 AI investment and inclusion go hand in hand

Discussing investment priorities, **Serame Taukobong** argued that operators should no longer view AI investment and network expansion as competing objectives. AI-driven efficiency enables operators to extend network reach, while expanded connectivity increases access to AI-enabled services.

For emerging markets, this creates a reinforcing cycle in which intelligent networks improve operational efficiency while simultaneously advancing digital inclusion, provided that standards continue to support interoperability and trust.

7.9 Key takeaways

- AI-native networks represent a fundamental shift from programmable telecommunications infrastructure to intelligent, adaptive network platforms
- AI is already delivering measurable gains in network efficiency, automation, resilience and service innovation
- Transparency, explainability and human oversight will be essential as networks become increasingly autonomous
- Energy efficiency should remain a core design principle, with AI models appropriately matched to operational requirements
- International standards will be critical for interoperability across networks, cloud infrastructure, edge computing and AI systems
- Trust and security must be embedded throughout AI-native network architecture rather than added retrospectively
- AI-native networks have significant potential to accelerate digital inclusion, particularly across emerging markets
- Collaboration among operators, vendors, governments and standards bodies will be essential to achieving globally interoperable AI-native networks

7.10 Conclusion

The discussion concluded that AI-native networks are not simply the next stage in telecommunications evolution but represent a new model in which intelligence becomes an integral capability of network infrastructure itself. While technological progress is advancing rapidly, realizing the full potential of AI-native networks will depend on sustained international collaboration to develop trusted, interoperable standards that enable innovation at global scale.

Panelists agreed that the success of AI-native networks should ultimately be measured not only by improvements in network performance and operational efficiency, but also by their ability to expand digital inclusion, strengthen trust and ensure that the benefits of AI-powered connectivity are accessible to all.

8 Bridging the AI infrastructure divide

AI is rapidly becoming a foundation for economic growth, scientific discovery, public service delivery and industrial competitiveness. Yet the infrastructure that enables AI including compute capacity, data centres, high-speed connectivity, reliable energy, high-quality datasets and skilled talent remains concentrated in relatively few regions. A panel discussion on [*Bridging the AI infrastructure divide*](#) explored how governments, industry, academia and international organizations can work together to ensure that every country has the opportunity to participate in and benefit from the AI economy.

Moderated by **Bilel Jamoussi**, Deputy Director of the ITU Telecommunication Standardization Bureau, the panel welcomed **Nkundwe Mwasaga**, Director General of the ICT Commission of Tanzania; **Calista Redmond**, Vice-President of Global AI Initiatives at NVIDIA; and **Katharina Frey**, Executive Director of International Computation and AI Network at ETH Zurich.

The panel examined the investments, partnerships and standards needed to expand AI infrastructure while ensuring that developing countries are not merely consumers of AI technologies but active contributors to their development.

Panelists agreed that closing the AI infrastructure divide requires a holistic approach that extends well beyond expanding computing capacity. Sustainable AI ecosystems depend on investment in digital infrastructure, skills development, cybersecurity, research capacity, trusted governance and international collaboration.



Figure 13: Panelists of the Bridging the AI infrastructure divide session

Speakers emphasized that AI infrastructure should be viewed as foundational national infrastructure, comparable to electricity or transport systems, enabling innovation across every sector of society. Achieving this vision will require open standards, collaborative research, open-source innovation and stronger participation by developing countries in international standards development. Throughout the discussion, collaboration emerged as the central theme, with governments, industry, academia and international organizations each playing a vital role in ensuring AI benefits are shared globally. The sections below summarize some of the key discussion themes.

8.1 Building comprehensive AI ecosystems

Opening the discussion, **Nkundwe Mwasaga** stressed that AI adoption must balance both supply- and demand-side considerations. He outlined five strategic priorities for countries seeking to develop AI ecosystems:

- AI skills at basic, intermediate and advanced levels
- Trusted digital infrastructure capable of supporting AI workloads
- Cybersecurity, privacy and consumer protection
- Telecommunications infrastructure that enables AI deployment
- Research, innovation and entrepreneurship

He emphasized that strengthening these pillars would enable countries to become producers and innovators of AI technologies rather than remaining consumers of solutions developed elsewhere.

8.2 Expanding access to AI infrastructure

Calista Redmond described AI as an increasingly essential technology supporting healthcare, agriculture, government services and economic development. She argued that ensuring equitable access requires maintaining open models, open ecosystems and internationally recognized standards that lower barriers to participation.

She emphasized that standards enable organizations of every size, from startups to governments, to participate in global innovation ecosystems. Drawing on examples from India and France, she demonstrated how shared AI platforms and multilingual models are already improving public services while strengthening local economies.

8.3 Standards as a catalyst for AI infrastructure

A recurring theme throughout the session was the enabling role of international standards.

The discussion highlighted how standards originally developed for telecommunications are now supporting AI infrastructure, including optical networking technologies increasingly deployed within AI data centres to improve bandwidth, energy efficiency and scalability. Panelists agreed that common standards are fundamental to reducing fragmentation, accelerating deployment and enabling innovation across borders.

8.4 Research collaboration and AI capacity building

Katharina Frey emphasized that developing AI capacity requires more than investing in hardware. Countries also need access to expertise, high-quality datasets and international research networks capable of sharing knowledge and computing resources.

She described ICAIN's collaborative model, which connects researchers across Africa, Europe and Asia with high-performance computing infrastructure to address locally relevant challenges. Examples included weather prediction in Kenya and AI-assisted crop disease detection in Uganda, illustrating how international research partnerships can help bridge infrastructure gaps while addressing regional priorities.

8.5 Closing the standardization gap

The panel examined the challenges many developing countries face in participating in international AI standards development.

Nkundwe Mwasaga emphasized that AI standards should address three complementary dimensions: technical interoperability, data interoperability and shared human values that underpin trustworthy AI. He highlighted the importance of multilateral organizations such as ITU in providing neutral platforms where countries can jointly develop standards that serve the global public interest.

The discussion also highlighted ITU's ongoing efforts to bridge the standardization gap through initiatives like its Bridging the Standardization Gap programme, regional groups within international expert groups and new AI for Good Lab, which aim to strengthen AI skills, foster collaboration and increase participation from developing countries.

8.6 Open standards, open source and local innovation

Calista Redmond encouraged countries to view themselves as builders of AI ecosystems rather than simply consumers of AI technologies.

She argued that participation in standards development and open-source communities enables countries to shape AI systems that reflect local languages, cultures and development priorities, while avoiding technological dependency or vendor lock-in. AI infrastructure, she

suggested, should be considered a strategic national asset supporting innovation across both government and industry.

8.7 Connecting research with international standards

Looking ahead, **Katharina Frey** proposed stronger mechanisms to connect research institutions with international standards development. She suggested matchmaking initiatives, collaborative research projects and closer engagement between standards bodies and academic communities to help emerging research more effectively contribute to future international standards.

8.8 Key takeaways

- Closing the AI infrastructure divide requires investment in infrastructure, skills, research, cybersecurity and innovation
- Developing countries should be empowered to become active contributors to AI development rather than simply consumers of AI technologies
- International standards provide the foundation for interoperability, trust and inclusive participation in global AI ecosystems
- Open standards and open-source ecosystems together lower barriers to innovation and accelerate local capacity building
- International research partnerships help countries with limited compute resources to develop locally relevant AI solutions
- AI infrastructure should be viewed as strategic national infrastructure that supports long-term economic growth and digital transformation
- Greater participation by developing countries in standards development can help ensure AI technologies better reflect diverse languages, cultures and societal priorities
- Collaboration between governments, industry, academia and international organizations is essential to building an inclusive global AI ecosystem

8.9 Conclusion

The discussion concluded that bridging the AI infrastructure divide is not simply about deploying more data centres or increasing computing capacity. It is about creating the conditions that enable every country to participate meaningfully in the development, governance and application of AI.

Panelists agreed that sustained investment in digital infrastructure, skills, research and standards combined with strong international cooperation will be essential to ensuring AI becomes a truly global driver of innovation, economic development and social progress. By fostering open collaboration and inclusive standards, the international community can help ensure that the opportunities created by AI are accessible to all countries, regardless of their stage of development.

9 AI, media and the information integrity challenge

Information integrity forms a key part of AI discussions. At a panel discussion on [AI, media and the information integrity challenge](#), the first part of the discussion focused on safeguards linked to synthetic content and content saturation.

One safeguard explored by **Ann E. Greenberg**, President and Founder of Entertainment AI, is the collection of metadata and micro-metadata to help content creators receive recognition for their work and be accurately remunerated.

Jaden Xie, Co-Founder and President of Pixverse, emphasized that the misuse of generative AI is an industry-wide challenge that will require shared standards. He proposed a two-tiered safeguarding mechanism, with the first tier relying on content analysis and understanding to identify harmful content and the second tier relying on an internal safety system able to evolve continuously in the face of new types of harmful content.

The interplay between freedom of expression and content regulation was addressed by **Maria Ressa**, Nobel Peace Prize Laureate 2021 and Co-Chair of the Independent International Scientific Panel on AI. Content duplication and amplification through synthetic AI content, said Ressa, is flooding our information sources and rendering the discernment of truth increasingly difficult.

The second part of the panel was dedicated to the economy of authenticity and the cost of democratizing AI.

Panelists discussed how the cost of producing misleading content is extremely low while the cost of verification remains high, therefore skewing the balance away from integrity. This is where framing by traditional media is central to the construction of meaning and the same framing process should be applied to AI-generated and AI-rendered content, suggested the panelists.

Panelists suggested that information integrity can be upheld by keeping humans at the centre of AI considerations and protecting privacy, identity and freedom of speech, for example, but also by engaging stakeholders across the public and private sectors to develop standards.



Figure 14: Panelists on AI, media and the information integrity

Part 2: Thematic AI standards workshops

10 AI in disaster resilience: Bridging science, standards and innovation

10.1 Introduction

AI is rapidly transforming disaster risk reduction by enhancing hazard monitoring, forecasting and emergency response. Recent advances in AI have demonstrated significant potential to improve preparedness for natural hazards such as floods, landslides, volcanic eruptions and extreme weather events. However, translating scientific innovation into trusted operational tools requires more than accurate AI models. It demands robust governance, interoperable data infrastructures, common standards and close collaboration between researchers, operational agencies, governments, industry, and standards bodies.

A workshop on *AI in Disaster Resilience: Bridging Science, Standards and Innovation* examined how AI can strengthen disaster resilience while remaining trustworthy, transparent and operationally deployable. The workshop was organized by ITU with the support of the International Association of Volcanology and Chemistry of the Earth's Interior.

Discussions focused on bridging the gap between scientific research and operational implementation, highlighting the critical role of standards, interoperability and international cooperation in enabling AI solutions that can be trusted and adopted across regions and institutions.

10.2 Opening of workshop

A ministerial address was delivered by **H.E. Serge Wilmes**, Minister for the Environment, Climate and Biodiversity and Minister for the Civil Service, Government of Luxembourg.



Figure 15: H.E. Serge Wilmes, Minister for the Environment, Climate and Biodiversity and Minister for the Civil Service, Government of Luxembourg

Celeste Saulo, Secretary-General of the World Meteorological Organization (WMO), highlighted the transformative role of AI in weather forecasting and disaster risk reduction, emphasizing its potential to deliver faster, more accurate and more accessible forecasts that support better decisions to protect lives and livelihoods. She stressed that AI should

complement, not replace, the scientific expertise and authoritative role of national meteorological and hydrological services, whose trusted forecasts and warnings remain central to disaster resilience. She further underscored that AI is only as strong as the observations, data, scientific infrastructure and human expertise on which it is built, calling for continued investment in observation systems, data exchange, computing capacity and capacity building.



Figure 16: Celeste Saulo, WMO Secretary-General



Figure 17: Anacláudia Rossbach, Under-Secretary-General of UN-HABITAT

Anacláudia Rossbach, Under-Secretary-General of the United Nations and Executive Director of UN-HABITAT, emphasized the growing vulnerability of cities and communities to climate-related hazards and highlighted the role of AI in strengthening urban resilience through improved risk assessment, planning and disaster preparedness. She stressed that AI solutions must remain human-centred, inclusive and accessible to ensure that the benefits of digital innovation reach all communities, particularly those most at risk.

Florian Pappenberger, Director-General of the European Centre for Medium-Range Weather Forecasts (ECMWF), highlighted the remarkable progress of AI in weather prediction and disaster resilience, noting that recent advances are reshaping forecasting capabilities and supporting more effective disaster risk management. He emphasized that translating scientific innovation into operational services requires close collaboration between researchers, operational agencies, governments, industry and standards bodies, with international standards providing the foundation for trustworthy, interoperable and scalable AI-enabled disaster resilience systems.

The workshop's opening segment was moderated by Bilel Jamoussi, Deputy Director, of the ITU Telecommunication Standardization Bureau, and Monique Kuglitsch, Innovation Manager at Fraunhofer HHI and Chair of the [Global Initiative on Resilience to Natural Hazards through AI Solutions](#).

The opening segment featured the official launch of a new AI for Good Challenge, [One Step Ahead of Drought: Forecasting Global Water Storage](#), organized by ITU, WMO, the UN Convention to Combat Desertification (UNCCD); the European Commission; the Copernicus Programme (the European Union's Earth Observation Programme); the European and Global Drought Observatories (EDO and GDO); the King's Institute for Artificial Intelligence at King's College London; the European Space Agency (ESA); ECMWF; CGIAR Climate Action; the Fraunhofer Heinrich Hertz Institute (Fraunhofer HHI); and the International Water Management Institute (IWMI).

The Challenge invites researchers and AI practitioners to develop robust ML models capable of forecasting global terrestrial water storage one month in advance using satellite observations and climate datasets. In addition to predictive accuracy, submitted solutions will be evaluated on AI trustworthiness, transparency, robustness, sustainability and practical applicability, reinforcing the importance of responsible AI for operational drought monitoring and water resource management.



Figure 18: Launch of the AI challenge on "One Step Ahead of Drought: Forecasting Global Water Storage"

Box 2: Global Initiative on Resilience to Natural Hazards through AI Solutions

The workshop contributed to the objectives of the [Global Initiative on Resilience to Natural Hazards through AI Solutions](#), an international effort launched in 2024 which brings together governments, international organizations, academia, industry, operational agencies, humanitarian organizations and standards bodies to accelerate the responsible use of AI in disaster resilience.

The Global Initiative has three key pillars:

1. Promoting collaboration across the disaster management cycle on scientific research, innovation and standardization
2. Helping identify common challenges and share best practices
3. Support the adoption of trusted and interoperable AI solutions that strengthen resilience to natural hazards worldwide

The initiative is driven by ITU together with the United Nations Environment Programme (UNEP), United Nations Framework Convention on Climate Change (UNFCCC), United Nations Educational, Scientific and Cultural Organization (UNESCO), Universal Postal Union (UPU), United Nations Office for Outer Space Affairs (UNOOSA), and WMO.

It furthers the outputs of the ITU-WMO-UNEP [Focus Group on AI for Natural Disaster Management](#), which conducted its work between December 2020 and March 2024.

10.3 Bridging scientific innovation and operational disaster resilience

The first session explored how recent advances in AI are being translated into operational tools for disaster preparedness, forecasting and emergency response. Presentations showcased applications across volcanology, landslide risk management, humanitarian flood forecasting and emergency operations. Speakers illustrated how AI can enhance scientific understanding and support operational decision-making while highlighting the importance of trusted data, robust governance and institutional readiness.

The session was moderated by **Hwirin Kim**, Chief of the Hydrological and Water Resources Services Division of WMO.

Costanza Bonadonna, President of the International Association of Volcanology and Chemistry of the Earth's Interior, demonstrated how volcanology provides a unique environment for understanding both the opportunities and limitations of AI in disaster resilience. She explained that volcanic systems are inherently complex, combining multiple hazards with highly heterogeneous observations collected across different spatial and temporal scales. AI can help transform these diverse datasets into actionable information for monitoring, forecasting and situational awareness, but meaningful decision-making requires integrating AI with physical understanding and expert scientific interpretation. She emphasized that the objective is not simply to understand volcanoes, but to protect communities by converting observations into knowledge that supports operational resilience. While AI offers significant capabilities, important challenges remain, including fragmented

data infrastructure, uneven monitoring capacity, data heterogeneity, limited transferability of AI models and the need for transparent, trustworthy systems that complement rather than replace human expertise.

Lorenzo Nava, Senior Lecturer and AI+ Senior Fellow at King's College London, presented recent advances in AI for landslide disaster risk management, demonstrating how ML combined with Earth observation and remote sensing is transforming landslide detection, mapping and runout prediction. AI now enables the rapid identification of thousands of landslides from satellite imagery and can significantly reduce the computational time required for complex hazard simulations. However, he emphasized that scientific progress should now focus on evaluating whether AI-generated information genuinely improves operational decision-making rather than solely increasing predictive accuracy. Future research should therefore prioritize the usefulness, timeliness and reliability of AI outputs for emergency managers and disaster response authorities, ensuring that AI contributes directly to protecting lives and infrastructure.

Jessica Rapson, Director of the Algorithmic Governance Foundation, presented INFLOW-AI, an operational flood forecasting system developed to support anticipatory humanitarian action in South Sudan. Combining satellite observations, hydrological information, climate indicators and deep learning, the system generates flood forecasts up to two months in advance, including unprecedented flood events that conventional models often struggle to predict. A key feature of the project is its close integration with humanitarian operations, where AI forecasts are explicitly linked to predefined early-action triggers that enable earlier mobilization of resources, funding and relief activities. She emphasized that AI systems should be designed around the information needs of decision-makers, providing hyper-local, actionable forecasts that directly support operational humanitarian decisions rather than focusing solely on technical model performance.

Fritz Pickhardt, Project Lead for the AI Innovation Lab at Germany's Federal Agency for Technical Relief (THW), shared practical lessons from THW highlighting that the greatest challenges facing disaster AI are rarely technological but organizational. Drawing on operational examples, including AI-assisted victim detection, automated incident documentation and speech recognition, he demonstrated that many promising AI projects fail because organizations lack the governance structures, infrastructure, ownership and sustainable transfer mechanisms needed to move prototypes into operational use. He stressed that AI deployment should begin with clearly defined operational needs, supported by shared datasets, open-source technologies and standards that enable long-term adoption. His presentation reinforced that success with AI depends as much on governance, collaboration and implementation as it does on advances in AI itself.

10.4 What role do standards play in enabling trust, interoperability and adoption across regions and institutions?

The second session shifted the discussion from AI applications to the enabling environment required for their successful deployment. While advances in AI have demonstrated significant potential to improve forecasting, early warning systems, and disaster response, speakers emphasized that these innovations can only achieve broad operational adoption when supported by internationally recognized standards. The discussion explored how standards

promote trust, interoperability, transparency, and institutional adoption, ensuring that AI systems developed by different organizations and deployed across different regions can operate consistently, reliably, and at scale.

The session was moderated by **Muralee Thummarukudy**, Director of the Coordination Office of the G20 Initiative on Land at UNCCD.

Elena Xoplaki, Senior Scientist at the CMCC Foundation (European Mediterranean Centre on Climate Change), highlighted that standards are the critical operational layer that enables AI innovations to become trusted and deployable disaster-resilience services. Based on the activities of the Mediterranean and pan-European forecast and Early Warning System against natural hazards (MedEWSa) and the AleRT and impact-forecast standards for Emergency Management (ARTEMis) projects, she demonstrated how standards support the entire disaster management workflow from weather forecasts, satellite observations and sensor data to impact assessment, operational decision-making, alerts and risk transfer. She explained that standardized approaches to data governance, metadata, APIs, alert semantics and operational workflows help ensure transparency, traceability, validation and accountability, while allowing AI systems to integrate seamlessly with existing early warning infrastructures. Through practical examples, she illustrated how standards reduce fragmentation, facilitate cross-border interoperability, and enable AI-enabled services to be adopted by institutions without redesigning existing operational procedures.

Jesper Dramsch, Scientist at ECMWF, presented the rapid evolution of AI-driven weather modelling and its growing impact on operational meteorology. Foundation models and ML techniques are increasingly complementing traditional numerical weather prediction by producing highly accurate forecasts with significantly lower computational requirements and faster execution times. AI enables more frequent forecast updates and broader access to advanced forecasting capabilities while reducing computational costs for operational weather services.

Patrick Ebel, Visiting Faculty Researcher at Google, discussed how the private sector can actively contribute to the development and uptake of international standards by sharing operational experience, open-source technologies and practical implementation lessons. Drawing on discussions from the Working Group on Communications within the Global Initiative on Resilience to Natural Hazards through AI Solutions, he noted broad agreement that AI offers significant opportunities for disaster resilience but requires practical guidelines, standards and best practices to support responsible implementation. He emphasized that AI applications should always be driven by stakeholder needs and designed to support, not replace, human judgement and responsibility. Using examples such as the evolution of the Common Alerting Protocol (CAP) and Keyhole Markup Language (KML) standards, he illustrated how community-driven, bottom-up standards can achieve widespread global adoption when supported through collaboration among industry, standards bodies, governments, and researchers. He concluded that strong partnerships between the public and private sectors can make standards implementation more accessible, practical and rewarding for developers and operational agencies alike.

10.5 How can we bridge the gap between researchers, developers, end-users and policymakers?

The third session focused on one of the most critical challenges for AI in disaster resilience: translating research and technological innovation into operational solutions that respond to the needs of governments, emergency managers and communities. Speakers highlighted that while advances in AI, Earth observation, remote sensing and digital twins are creating unprecedented opportunities for disaster risk reduction, meaningful impact depends on continuous collaboration between researchers, developers, operational users, standards bodies and policymakers. Human-centred design, interoperability, capacity-building and trusted governance were identified as essential for ensuring that AI solutions move beyond pilot projects to become sustainable operational tools.

The session was moderated by **Jennifer Selby**, Communications Lead for the AI Department at Fraunhofer HHI.

Pierre-Philippe Mathieu, Implementation Manager for Civil Security from Space at ESA, highlighted the growing contribution of Earth observation and space technologies to AI-enabled disaster management. He emphasized that satellite observations, when combined with AI, provide powerful capabilities for hazard monitoring, situational awareness and decision support throughout the disaster management cycle.

Jumpei Takami, Associate Expert in Remote Sensing for Disaster Management at UNOOSA, presented UNOOSA's work on leveraging GeoAI, Earth observation and digital twin technologies to strengthen disaster preparedness and early warning systems. Through the UN-SPIDER programme, UNOOSA supports Member States by providing technical advisory services, capacity-building and access to space-based information throughout the disaster management cycle. He showcased practical applications, including disaster response following the 2025 Myanmar earthquake and the development of AI-enabled digital twins in Tonga and other countries using satellite imagery, deep learning, Internet of Things (IoT) sensors and flood simulation models. These technologies enable more realistic risk assessments, optimized evacuation planning and improved preparedness while demonstrating the importance of international cooperation, interoperable geospatial data and operational partnerships. He also highlighted UNOOSA's partnership with ITU to support AI standards development and capacity building under the Global Initiative on Resilience to Natural Hazards through AI Solutions.

Arif Albayrak, Senior Research Engineer at the University of Maryland, Baltimore County, emphasized that the challenge in disaster resilience is no longer the availability of Earth observation data or AI technologies, but ensuring that different stakeholders can interpret and use this information effectively. Using examples from wildfire monitoring and the 2024 Gofa landslides in Ethiopia, he demonstrated that researchers, emergency responders, policymakers and local communities often ask different questions about the same disaster. The objective is therefore to create a shared operational understanding by integrating Earth observations, AI and multidisciplinary expertise into decision-ready information tailored to each stakeholder while preserving a common view of reality and shared standards. This human-centred approach bridges the gap between scientific research and operational decision-making.

Rakiya A. B. Babamaaji, Deputy Director of the Strategic Space Applications Department at the National Space Research and Development Agency of Nigeria) emphasized that AI can only achieve sustainable impact when researchers, developers, end users and policymakers work as an interconnected ecosystem. She observed that many AI initiatives continue to face barriers arising from fragmented collaboration, limited user engagement, inadequate policies, skills shortages, infrastructure constraints and trust concerns relating to ethics, privacy and accountability. Bridging these gaps requires co-designing AI solutions with end users from the earliest stages, improving communication between technical and non-technical stakeholders, promoting open data and shared resources, strengthening digital infrastructure and capacity-building, and establishing clear regulatory and ethical frameworks. She concluded that responsible AI depends on continuous collaboration, shared responsibility, transparent governance and active participation throughout the AI lifecycle to ensure that research is translated into practical solutions addressing real societal needs.

10.6 Closing reflections and next steps

In his closing reflections, **Kamal Kishore**, Special Representative of the United Nations Secretary-General for Disaster Risk Reduction and Head of the United Nations Office for Disaster Risk Reduction (UNDRR), emphasized that AI represents a significant opportunity to strengthen global disaster resilience, but its impact will ultimately depend on how effectively scientific innovation is translated into trusted operational solutions.

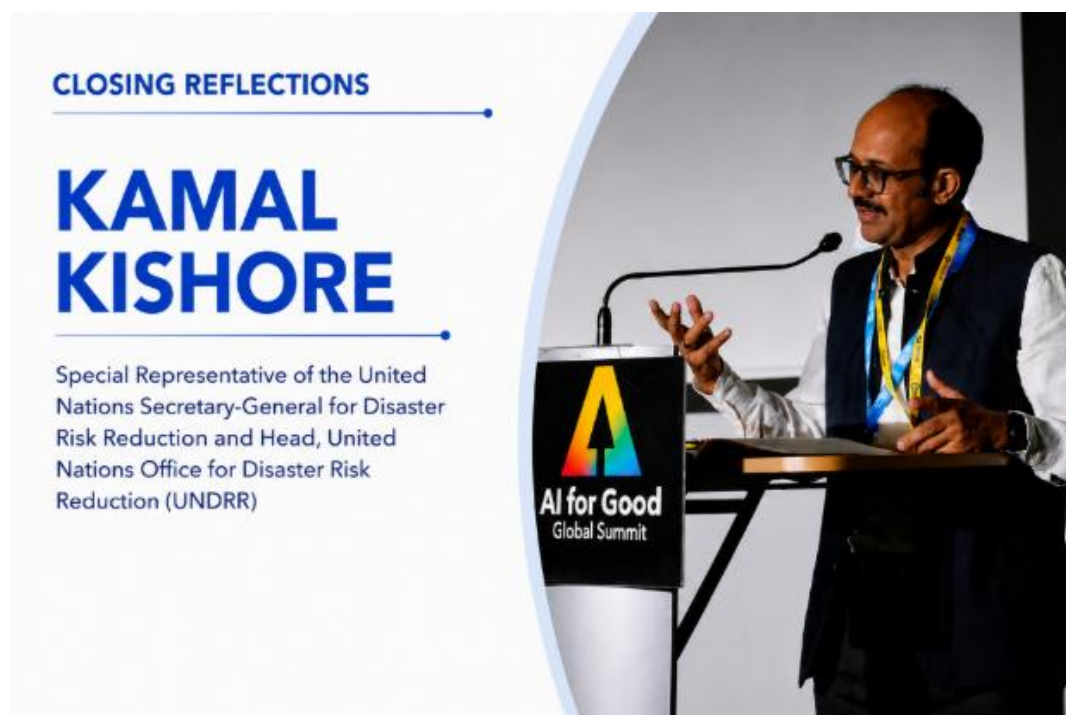


Figure 19: Kamal Kishore, Special Representative of the United Nations Secretary-General for Disaster Risk Reduction and Head of UNDRR

10.7 Conclusion and key takeaways

The workshop demonstrated the transformative potential of AI to strengthen disaster management through improved hazard forecasting, Earth observation, forecasting, disaster

relief, preparedness, digital twins for hazard prediction and decision support for disaster risk reduction. Across the three sessions, speakers consistently emphasized that while AI technologies are advancing rapidly, their successful deployment depends on trust, interoperability, scientific validation and close collaboration between researchers, technology developers, operational agencies, policymakers and standards bodies. AI should complement human expertise and strengthen existing disaster risk management systems by delivering reliable, transparent and decision-ready information.

The discussions identified several priority areas closely aligned with ongoing ITU work where international standards can accelerate the responsible adoption of AI for disaster resilience, including:

- Trustworthy AI principles (e.g. transparency, explainability, accountability, robustness and human oversight)
- Interoperable frameworks for AI-enabled forecasting and Earth observation systems
- Standardized approaches for geospatial data governance and information exchange
- Interoperability between AI, digital twins, IoT, remote sensing and operational forecasting systems

Looking ahead, participants recognized the role that the outcomes of the [Global Initiative on Resilience to Natural Hazards through AI Solutions](#) could play in shaping further standardization. The Global Initiative's outcomes could be envisioned to inform future international standardization activities within [ITU-T Study Group 2 \(Operational aspects\)](#), which holds lead responsibility for ITU standards on disaster relief, early warning, network resilience and recovery. Building on the technical work and operational experience shared through the Global Initiative, ITU-T Study Group 2 could develop standards that support interoperable AI for disaster management. Through this continued collaboration, the Global Initiative could help identify emerging technical requirements, share implementation experience and contribute practical inputs to future international standards for the responsible deployment of AI across the disaster management cycle.



Figure 20: Bilel Jamoussi, Deputy Director of the ITU Telecommunication Standardization Bureau



Figure 21: Workshop moderators Hwirin Kim, Chief of Hydrological and Water Resources Services Section at WMO, and Muralee Thummarukudy, Director of the Coordination Office of the G20 Initiative on Land at UNCCD



Figure 22: Speakers at the workshop on AI in disaster resilience

11 The future of AI-native communication networks

11.1 Introduction

A workshop on AI/ML for networks was held for the fourth time during the AI for Good Global Summit 2026, continuing a series that examines how AI and ML are reshaping communication networks. This edition, titled [***The future of AI-native communication networks***](#), centred on AI-native networks where AI does not merely enhance the network but powers it, marking a shift away from earlier approaches in which ML was applied as an external optimization layer. The workshop explored topics under study in the [ITU Focus Group on Artificial Intelligence Native for Telecommunication Networks](#).

Box 3: Focus Group on Artificial Intelligence Native for Telecommunication Networks

The Focus Group was established in July 2024 and serves as an open pre-standardization platform designed to explore and define the architectural shifts required to transition telecommunication networks from simply using "AI-assisted" add-ons to being inherently "AI-native" by embedding trustworthy, adaptive AI and dedicated data infrastructures directly into the core design, deployment and operation of non-radio network functions. Reporting to [ITU-T Study Group 13 \(Future networks\)](#), the Focus Group is developing unified terminology, gap analyses, architectural frameworks and proof-of-concept guidelines for self-managing, intent-driven and autonomous network ecosystems for next-generation communications.

As networks evolve towards IMT-2030 (6G), intelligence is increasingly embedded in the core of the network rather than added on top, with network functions supported, and in some cases governed, by autonomous agents. Reflecting this shift, the workshop examined how recent advances are redefining the way network services and AI pipelines operate end-to-end, spanning agentic AI, large wireless models, code generation and digital twins. It also considered the potential to establish an AI-Native Network Sandbox as an environment for evaluating new mechanisms, automating code generation, and bridging the digital and physical layers of the network.

A central role of the workshop was to connect academic and industrial research with the technical requirements of standardization. It brought together contributions across AI/ML, telecom architectures, open-source ecosystems and standardization. Together, these contributions connected current research with the practical needs of networks and pointed towards the standardization work needed to support autonomous, self-evolving communication systems.

11.2 Workshop structure

The workshop was structured into four sessions:

- The advancements in AI and AI-native
- Agentic AI for network operations and autonomy
- Infrastructure, platforms and trustworthy operation
- The future of networks

The discussions achieved the following objectives:

- Explore AI-native architectural integration: How to embed AI directly into the core design of non-radio network functions, moving away from legacy "AI-assisted" add-ons to create self-managing, self-optimizing and self-repairing network ecosystems)

- Bridge advanced research with standardization: Aligning cutting-edge innovations such as Large Perceptive Models (LPMs), digital twins, code generation and agentic AI with formal international standardization roadmaps within ITU-T Study Group 13
- Address the dual "AI for Network" and "Network for AI" paradigms: Identifying technical and standardization gaps by reviewing existing technologies, vocabularies and standards to map out missing requirements for dynamic resource allocation, interoperability and AI governance

11.3 Perceptive models and physical-world grounding

LLMs have transformed how machines understand and generate language, while multimodal models have expanded AI capabilities to images, audio and video. However, the next frontier of AI lies beyond content understanding and toward environmental understanding. This session introduced the concept of LPMs, a new class of AI systems designed to perceive, interpret, predict and act on complex real-world environments through heterogeneous sensing modalities, including radio frequency (RF) signals, vision, audio, telemetry and IoT data.

High-fidelity, multimodal measurement datasets – combining synchronized RF, light detection and ranging (LiDAR) and camera data with physically annotated ground truth – constitute the missing infrastructure for closing gap between benchmark performance and reliable deployment. Building datasets that are not merely AI-ready in format but productive in practice can feed directly into open-source evaluation pipelines as calibrated, measurement-derived replacements for simulation assumptions.

Two complementary lines of work were highlighted: one on interpreting RF signals with AI, and one on building the measurement-based data needed to ground such models in physical reality. A shared premise was that language models learned from internet text, whereas the next frontier lies in capturing the "invisible world" of signals that surrounds the network.

The main points discussed are summarized below:

Merouane Debbah, Director of the 6G Center at Khalifa University of Science and Technology, presented a shift from language intelligence to environmental intelligence. Just as LLMs emerged from an explosion of internet text, the telecom domain is now seeing a comparable explosion of signal data from sensors and IoT devices. The work has progressed from TelecomGPT, one of the first LLMs tailored to the telecom domain, to TelecomGPT-R1, which now leads a benchmark ranking of telecom LLMs.

At the centre of this work is RF-GPT, a foundation model that understands, classifies and interprets radio signals across technologies and spectrum bands, allowing an engineer to query a signal in natural language. Because real measurements cannot cover every environment, the model relies heavily on synthetic data from ray tracing and digital twins.

LPMs extend this approach to more sensing modalities such as temperature, pressure and sound, moving towards a form of physical AI closely tied to AI-native networks, whose infrastructure is itself full of sensors. This remains scientifically hard for several reasons: sensor data is inherently diverse and noisy; time-series signals carry complex temporal context that is difficult to model; signal fidelity must be preserved across modalities; and such systems raise

privacy and governance concerns, as they draw on large numbers of distributed and potentially sensitive sensors.

Nada Golmie, Fellow at the US National Institute of Standards and Technology (NIST), addressed the importance of ground-truth data for AI in wireless through high-fidelity multimodal measurements. AI learns by finding correlations in data, so wireless signals must be tied to the physical environment that shapes them. This gap has so far been filled mainly by synthetic data from ray-tracing tools. Such tools are abstracted from a limited number of measurement points, so they cannot pinpoint what is happening in a specific environment.

The approach developed at NIST creates multimodal, measurement-based ground truth that synchronises RF, LiDAR and camera data in time and space. Six environment datasets were released recently, with target datasets for integrated sensing and communication (ISAC) to follow. The longer-term goal is semantic channel modelling, in which a channel can be predicted from a scene and the objects within it.

Several open challenges remain for the wireless community: datasets and models are often incompatible with one another; metrics are misaligned across layers, making results hard to compare; and there are no shared, standardized benchmarks for evaluating models.



Figure 23: Merouane Debbah, Director of the 6G Center and Professor at Khalifa University

11.4 Update on the focus group's journey

Riccardo Trivisonno, Head of Network Architecture at Huawei Technologies and Chair of the ITU Focus Group on Artificial Intelligence Native for Telecommunication Networks, presented an update on the the Focus Group's progress. A key early achievement was grounding the concept of "AI-native" in three defining characteristics, providing a shared reference that had previously been missing across the community:

- AI is integrated into the system rather than added as an external feature
- AI is engaged across every phase of the network lifecycle
- AI itself is treated as a native component of the network

Building on this, the working groups formalized functional and performance requirements not supported by current systems, which in turn informed the design of an AI-native network architecture and its three-layer structure for embedding AI. A related line of work examined how identity management and agentic concepts could be embedded in future networks, motivated by operational challenges raised by mobile operators. Dissemination advanced through the workshop and an associated call for demonstrations, which drew a number of Proofs of Concept whose lessons fed back into the Focus Group's architectural work and output document.

Some of the key outcomes and announcements from the update are highlighted below:

- Additional reports on use cases and requirements were completed and work advanced towards transfer to ITU-T Study Group 13
- The Focus Group remains open to contributions, and academics in particular are encouraged to submit use cases, Proofs of Concept and experimental results

11.5 Agentic AI for network operations and autonomy

This workshop session explored agentic AI, in which AI moves from assisting network operations to driving them autonomously. Speakers from cloud providers, vendors and academia examined how agents are built and deployed in practice, how their cost and reliability can be managed, and how autonomous, multi-agent operation could be realized in future networks. A common theme was that value comes not from individual models but from orchestrating multiple specialized agents, and that reliability, cost and governance must be addressed for agentic AI to be deployed at scale.

The main points discussed are summarized below:

An end-to-end approach to taking AI from models to deployed agents was outlined, drawing on work carried out at Amazon Web Services (AWS). This included an Arabic-language model built for the Middle East market to meet local data and regulatory requirements. The full lifecycle of selecting, fine-tuning, deploying and cost-optimizing models was covered. Value was seen to come not from chatbots but from a "master" model orchestrating specialized agents from multiple providers, connected through an integration layer and protocols such as the Model Context Protocol (MCP).

AI is also reshaping the software development lifecycle. Genuine productivity gains depend less on code generation than on embedding AI across the whole process, including quality, accuracy and governance checks. This is supported by context engineering, which feeds agents the right semantic information rather than raw source code.

AI-native networks were examined from a token economy perspective. As workloads shift from simple tasks to complex agentic use cases, more reasoning loops mean more tokens, and therefore higher cost and energy consumption. Selecting the right model for a telecom task is not trivial, since the accuracy-energy trade-off depends on reasoning capability and architecture, not only model size. Approaches to manage this cost developed at Huawei include

reinforcement-learning-based fine-tuning, speculative decoding with a smaller draft model alongside a larger target model, and an agentic "bash" method in which an agent writes and runs code rather than reasoning through every step.

The role of open-source agentic AI in reshaping industries, including networking, was discussed. Open source was framed as a development model for innovation and knowledge sharing. A shift was described from a "standard first, open source second" sequence to an "open source first" model in the agentic era. Two phases were proposed for networks and agents. In "network for agent," the network supports agents through protocols such as the Agent-to-Agent Protocol (A2A) and MCP. In "agent for network," a layered framework treats agent governance and assessment as key enabling technologies. Discussions suggested that this work, associated with ZTE and the Open AGI Foundation, could factor into further research by ITU on networking for agents and the interfaces between agents, tools and data.

Agentic AI for 6G networks and open radio access networks (Open RANs) was presented in the context of the IMT-2030 (6G) vision, in which full autonomy requires AI to be embedded in the system rather than added externally. Agentic AI was positioned as the means to coordinate the many vendors and functions of Open RAN, managing the complexity of multi-vendor environments and supporting autonomous decision-making across the network. This is done through governance, policy and control agents operating in a closed observe-decide-act loop, with coordination needed to resolve conflicts between objectives such as energy efficiency and quality of service. A multi-dimensional set of key performance indicators (KPIs) was called for, extending beyond traditional network metrics to evaluate intelligence, safety and sustainability.

Recent work at Carnegie Mellon University on quantifying cooperation in multi-agent LLM networks was presented, showing that agents are powerful but can be unreliable, and that the difficulty grows when multiple agents must collaborate without predefined roles or control flow. Common failures include excessive rerouting, repeated problem-solving and deadlocks. To address these, a dynamic interactive graph (DIG) records agent interactions and detects such failures, then "heals" them through targeted interventions. Results showed substantial reductions in error compared with unstructured collaboration, with ongoing work extending to network-aware cooperation and more realistic environments.

11.6 Infrastructure, platforms and trustworthy operation

Beneath the model-level research lies a layer of infrastructure and engineering complexity that remains a primary constraint on scaling AI in networks. This session examined the computing foundation behind large-scale AI, platforms for digital-twin and city services, decentralized network design, and the validation needed to operate autonomous systems safely. A recurring conclusion was that AI-native networks require a strong foundation, and that much of the difficulty lies not in the models themselves but in the systems, data and governance around them.

The main points discussed are summarized below:

Based on the experience of Lablup, the workshop examined the infrastructure and technical challenges of large-scale AI training and serving. AI workloads differ from traditional web workloads: individual requests take longer and are harder to schedule and, at the scale of thousands of accelerators, hardware failures become a routine occurrence that infrastructure

must be designed to absorb rather than treat as an exception. The main challenges include scaling, continuously moving performance bottlenecks and software supply-chain security. Practical approaches include topology-aware resource management, disaggregated serving that separates the two stages of inference, and model routers that send simple requests to smaller models and complex ones to frontier models to optimize cost. As physical AI and robotics emerge, telecommunication networks will become the interconnect between AI agents.

An edge sandbox platform for citiverse services developed by St. Petersburg State University of Telecommunications illustrated how digital twins, virtual worlds and AI can be combined for city applications. This work is related to ITU standards development in [ITU-T Study Group 20 \(IoT, digital twins and smart cities\)](#) on topics including digital-twin cities and their requirements, federation, and reference architecture.

A "new Internet design" for an agentic AI ecosystem developed at Liverpool John Moores University centres on decentralization and human rights by design. The approach shifts power towards users and network nodes and reframes data spaces as agent spaces, in which data, AI and reasoning are packaged together and linked to the physical world through digital twins. In this view, the role of the network extends beyond connecting devices to enabling ecosystems in which independent entities collaborate at scale.

A framework for the systematic safety validation of AI-native networks developed by GSMA with the University of Leeds and AWS addresses a growing concern: as open, disaggregated RAN increasingly runs the LLMs and multi-agent systems on which critical services depend, autonomy makes networks more powerful but harder to validate. The framework tested agents before deployment across many scenarios, using "behavioural personalities" to specify how each agent pursues its objective. It assessed each agent's outcomes, its process and the stability of the system as a whole. The findings showed that safety is highly task-dependent. They also showed that a single agent's configuration can cascade across the whole system, and that snapshot benchmarking cannot capture this instability.

Zindi's multi-year partnership with ITU on AI for Good Challenges includes recent telecom challenges on network fault detection and agent-based network optimization, the latter developed with technical input from Huawei. Solutions are typically open-sourced and published, and some reach production. These challenges point to a wider imbalance: some regions hold the data needed to solve local problems but lack the compute to train models on it, so the inability to process data can be as exclusionary as the inability to access it.

11.7 Panel discussion: The future of networks

This panel discussion explored what future networks will look like and the technologies that will shape them, including generative AI, multi-agent systems, wireless models and simulation. The discussion brought together perspectives from academia, industry and standardization.

On enabling agentic AI for IMT-2030 (6G), panelists noted that supporting agent-based operation requires more than a single dataset or model. It calls for high-quality datasets covering subscriber, mobility and KPI information; a mix of supervised and lightweight models suited to both real-time and non-real-time applications; powerful toolsets to execute decisions; and knowledge bases to provide the policies on which decisions are based.

On architecture options for AI-native wireless networks, the panel observed that industry has not yet reached full consensus on what "AI-native" means, and that the answer differs across companies and perspectives. Two broad streams were identified as potential areas for future standardization. The more disruptive stream treats agents as a necessary and essential component of the network, a radical change from earlier generations. The more conservative stream defines an AI layer, potentially including agent components, that runs in parallel to the existing network but is not strictly required to operate it. Both were seen as likely candidates for discussion over the coming two years.

On code-generation and coordination agents in enterprise settings, panelists noted that coding and general-purpose AI agents are already widely used, with a large share of developers integrating AI-generated code into production. Open platforms such as the Open Platform for Enterprise AI (OPEA) were highlighted as composable architectures that let enterprises combine different models, back ends and databases into unified solutions, although the most important step remains identifying the business scenario and the domain know-how for each industry.

A substantial part of the discussion addressed the role of the sandbox in validating agents, referencing ITU work on sandboxes for autonomous networks. Panelists distinguished the traditional sandbox, used before deployment to test models on simulated or trusted data, from a new need for sandbox mechanisms that constrain agents after deployment, given that agents now execute real tasks and can behave non-deterministically. Digital twins were presented as one way to isolate agents from live networks until fully validated. A recurring conclusion was that a platform-first approach, with policies and guardrails applied at the organizational level, is essential. Guardrails matter as much as accuracy, because agents can do far more than intended.

On whether the two architecture options might be combined, panelists suggested there is no single answer. A progressive, use-case-driven adoption was favoured, starting with lower-risk tasks such as network optimization rather than delegating control of the entire network to a master orchestrator, and increasing autonomy as confidence grows through continuous feedback from production. It was also noted that agents from different vendors are unlikely to interact within the same domain, but may cooperate across domains.



Figure 24: Panel discussion on the future of networks

11.8 ITU standards and ongoing standards work of interest

Some of the related standards and standardization activities discussed are shown below, including the pre-standardization work of the ITU Focus Group on Artificial Intelligence Native for Telecommunication Networks (FG-AINN):

- [ITU-T Y.3172](#): Architectural framework for machine learning in future networks including IMT-2020 (5G)
- [ITU-T Y.3173](#): Framework for evaluating intelligence levels of future networks
- [ITU-T Y.3180](#): Mechanism of traffic awareness for application-descriptor-agnostic traffic based on machine learning
- [FG-AINN Technical Specification](#): Vocabulary for artificial intelligence native for telecommunication networks
- [FG-AINN Technical Specification](#): Architecture framework for artificial intelligence native telecommunication networks
- FG-AINN Technical Specification (under development): AI agent-enabled management and orchestration for AI-native networks
- [ITU-T F.748.46](#): Requirements and evaluation methods of artificial intelligence agents based on large models
- [Technical Report TR.GenAI-Telecom](#): Potential requirements and methodology for deploying and assessing generative AI models in telecom networks
- ITU-T Y.4200 series: Requirements and capabilities of digital twin cities

11.9 Key takeaways

- **Shift to AI-native IMT-2030 (6G) architecture:** Telecommunications networks are moving away from external "AI-assisted" add-ons to inherently "AI-native" infrastructures where embedded autonomous agents govern core operational lifecycles.
- **Environmental intelligence via perceptive models:** The frontier of network AI is expanding beyond LLMs to LPMs and RF-GPT, which process real-world physical, sensor and radio-frequency signals.
- **Orchestration and token economics:** Managing the high compute, token and energy costs of complex reasoning loops requires lightweight model selection, efficient code execution and multi-agent protocols like MCP and A2A.
- **Post-deployment guardrails and safety:** Because autonomous agents behave non-deterministically, traditional pre-deployment sandboxes are being replaced by dynamic guardrails, digital twin isolation and continuous behavioural testing to prevent cascading network failures.
- **"Open source first" standardization:** Standards bodies, with ITU's work on AI-native networks being one of the latest examples, are adopting an open-source-first approach to align cutting-edge research with formal international standards, while highlighting the need to address global compute disparities.

12 AI and audiovisual accessibility: Achieving digital inclusion

12.1 Introduction

AI opens many opportunities while posing many challenges, especially for persons with disabilities. A panel discussion on [*AI and audiovisual accessibility for digital inclusion*](#) brought together experts with perspectives from academia, broadcasting and standardization to address and explore both the challenges and opportunities associated with the use of AI in audiovisual accessibility. Moderated by **Anna Matamala**, Professor at the Universitat Autònoma de Barcelona and Director of AccessCat, the session emphasized the importance of ensuring that technological innovation serves human needs, trust, promotes inclusion and respects fundamental rights. The panel featured three speakers representing complementary perspectives:

- **Estella Oncins**, Associate Professor at the Universitat Autònoma de Barcelona, representing academia and research.
- **Louis Amara**, Project Coordinator and innovation professional at SwissTXT, representing the broadcasting sector.
- **Simão Campos**, Deputy Chief of the Study Group and Policy Department of the ITU Telecommunication Standardization Bureau, and former Counsellor of ITU-T's lead group on accessibility, [ITU-T Study Group 16 \(Multimedia\)](#) – now [ITU-T Study Group 21 \(Multimedia, content delivery and cable TV\)](#) – representing the standardization community.

The panel was supported with remote International Sign interpretation.

12.2 Challenges in implementing AI for audiovisual accessibility

Academic perspective

Estella Oncins highlighted the significant evolution of accessibility challenges over the past 25 years. Initially, accessibility efforts focused primarily on linguistic barriers, such as enabling audiences to understand content in different languages. This later expanded to address sensory accessibility through services such as audio description, sign language interpretation and captions/subtitles for deaf and hard-of-hearing persons.

More recently, attention has turned to cognitive accessibility, including the simplification of complex language and improving comprehension for broader audiences. AI introduces new dimensions to these challenges by creating increasingly interactive and immersive experiences. As audiovisual content moves from traditional two-dimensional formats towards virtual, augmented and immersive three-dimensional environments, accessibility requirements also become more complex.

According to Oncins, a key challenge lies in ensuring that all users can effectively interact with AI-enabled systems and services, regardless of their abilities or accessibility requirements.

Broadcaster perspective

From a broadcaster's viewpoint, **Louis Amara** emphasized that efficiency and speed are important benefits of AI, but that they cannot come at the expense of journalistic integrity and inclusion.

One of the primary concerns is maintaining the transparency and traceability of information sources. As more people increasingly consume information through AI assistants and automated systems, it can become difficult for users to understand where information originates. This poses risks to trust, accountability and established journalistic principles.

Another challenge relates to the vast archives of high-quality media content produced by broadcasters over many decades. These multilingual and culturally diverse datasets are highly valuable for training AI systems. This raises important questions regarding ownership, fair use, value sharing and what broadcasters receive in return when their content contributes to AI development.

The issue of digital sovereignty and the responsible use of media assets for AI training was also identified as an emerging concern.

Standardization perspective

Simão Campos noted that the rapid advancement of speech recognition, natural language technologies and LLMs has created unprecedented opportunities for accessibility. However, these advances also introduce new challenges related to the assessment and measurement of quality.

From a standardization perspective, one of the most pressing issues is determining how to evaluate and verify the performance of AI systems. Standards development requires stable, validated approaches, whereas many AI technologies continue to evolve rapidly.

Assessing whether AI systems deliver reliable accessibility benefits, including support for persons with disabilities and individuals with neurodiverse or cognitive needs, remains a significant challenge. The scope of accessibility assessment must therefore expand beyond traditional user groups and encompass a broader range of user requirements.

12.3 Opportunities for AI-enabled accessibility

Inclusive and representative AI systems

Turning to opportunities, **Estella Oncins** stressed that AI systems are fundamentally data-driven. Therefore, ensuring representative and diverse datasets is essential.

She presented examples of research projects that seek to establish dialogue among developers, researchers, industry representatives and users. Such initiatives aim to ensure that datasets include diverse populations, including users with disabilities, older persons, speakers of minority languages and those living in remote areas.

Another important opportunity lies in the use of AI to support accessibility within immersive environments. As virtual and augmented reality applications become more widespread, AI can help deliver accessible experiences that accommodate diverse user needs.

She also highlighted the importance of user agency and data governance. Users should have meaningful opportunities to interact with AI systems and participate in decisions regarding quality requirements and data management.

AI as an enabler of accessibility services

Louis Amara emphasized that AI offers substantial opportunities to improve accessibility services and reach wider audiences. While automation can increase efficiency, broadcasters view AI as a tool that should support rather than replace human expertise.

Examples of ongoing developments include:

- Real-time speech recognition and captioning
- Automated translation services
- Sign language translation systems
- Sign language avatars capable of expanding access to content where human interpretation may not be readily available

Importantly, these technologies are being developed in close collaboration with user communities. Amara reiterated the principle of “nothing about us without us,” emphasizing that accessibility solutions must be co-designed with the people who will ultimately use them.

Opportunities through standardization

Simão Campos noted that standards have a crucial role in transforming AI potential into practical and trustworthy solutions.

He referenced ongoing work on media authenticity and the fight against deepfakes, highlighting the importance of mechanisms that can verify content sources and support trust in digital media ecosystems.

AI also creates new possibilities for services such as automatic summarization, simplified language ("easy language") generation and expanded captioning capabilities. Demand for these services has grown significantly, particularly since the COVID-19 pandemic, which accelerated the adoption of remote and online communication.

Standards can help ensure that these services achieve consistent levels of quality, interoperability and accessibility across different platforms and regions.

The importance of user involvement

A recurring theme throughout the discussion was meaningful user participation.

Both the academic and broadcasting representatives emphasized the importance of engaging users from the earliest stages of design and development. Building trust requires more than testing final products; it requires involving users throughout the entire innovation process.

Particular attention was given to the diversity that exists even within accessibility communities. Differences in language, culture, communication preferences and local contexts must all be considered when designing scalable solutions.

From the standardization perspective, it was acknowledged that persons with disabilities are often underrepresented in formal standards development processes. While organizations such

as ITU have mechanisms to facilitate such participation, additional efforts and resources are needed to ensure that affected communities can meaningfully contribute.

12.4 Key takeaways and conclusions

In concluding the session, **Anna Matamala** summarized several key messages.

Accessibility must be understood broadly: It is not limited to services such as captions/subtitles, sign language interpretation or audio description. It also includes accessible language, cognitive accessibility and support for diverse user needs across different contexts.

Users must remain at the centre of AI development: Concepts such as user representation, user agency and co-creation are essential to building effective and inclusive solutions.

While AI can improve efficiency and speed, quality must remain a priority: Consensus-based standards play an important role in defining quality requirements and translating high-level principles into practical implementation.

Trust is fundamental: Users must be able to trust both the technologies and the information they produce.

Technology does not exist in isolation: Users, languages, cultures and communication practices all matter. Technology should be useful in real human contexts.

The panel concluded with three concise messages from the speakers:

- "Nothing about us without us" – emphasizing meaningful user involvement
- "Human factors in AI" – ensuring that AI serves human purposes and needs
- "Standards as the bridge between principles and implementation" – highlighting the role of standardization in achieving trustworthy and accessible AI

Overall, the discussion demonstrated that AI has enormous potential to enhance audiovisual accessibility, but realizing this potential requires human-centred design, active user participation, robust standards and a sustained commitment to inclusion and trust.



Figure 25: Moderator and panelists of the workshop on AI and audiovisual accessibility

13 AI and multimedia authenticity standards

13.1 Introduction

According to the World Economic Forum's [Global Risks Report 2026](#), AI-generated misinformation and disinformation, including deepfakes, came second among the short-term (2 years) global risks most likely to present high threats to society.

A workshop on [AI and multimedia authenticity standards](#) provided an update on the activities of the [AI and Multimedia Authenticity Standards Collaboration \(AMAS\)](#). AMAS is convened by ITU under the auspices of the World Standards Cooperation (ITU, ISO and IEC) and was launched at the AI for Good Global Summit 2024. AMAS is advancing standardization in the rapidly evolving field of AI-generated and altered media.

By mapping the landscape of standards for multimedia authenticity, identifying gaps and areas where new standards are needed, AMAS work aims at informing policy frameworks to promote legal compliance, interoperability and safeguard public trust. The workshop provided an update on the latest developments on AI standards for multimedia authenticity and the challenges facing global companies such as social media platforms to comply with the AI and multimedia authenticity legislations in various jurisdictions.

The main objectives of the workshop were to:

- Provide an overview of the work undertaken by AMAS
- Discuss the findings of the gap analysis for the technical standards mapping landscape on areas where technical standards are needed
- Discuss the challenges facing global platform providers for compliance with legal frameworks across different jurisdictions
- Share the lessons learned from the [AMAS Young Research Associate Programme](#)

The workshop provided an update on the work of AMAS with regard to the standards mapping landscape; regulatory landscape addressing misinformation, disinformation and deepfakes; and the projects from the AMAS Young Research Associate Programme.

The discussions reflected a shared concern that AI-generated misinformation, disinformation and deepfakes are now a high-priority global risk.

13.2 Setting the scene

Bilel Jamoussi, Deputy Director of the ITU Telecommunication Standardization Bureau, explained that the establishment of AMAS in 2024 responded to growing recognition that deepfakes and multimedia authenticity are urgent governance and trust challenges, not merely technical issues. He noted that the collaboration has advanced three key streams of work: mapping technical solutions and standards, developing related policy guidance, and sustaining an open multi-stakeholder platform for international cooperation. He also

highlighted the need to move beyond mapping and guidance to coherent, inclusive and implementable tools that can operate across sectors and jurisdictions.

Alessandra Sala, Director of AI and Data Science at Shutterstock and Chair of AMAS, provided an overview of the work of AMAS and emphasized the importance of trusted technical tools for a trusted information environment in the age of AI. The world needs tools to be able to distinguish true from fake and coherence across companies, industries and countries. She also noted the importance of considering different age groups as well as persons with disabilities in efforts to protect information integrity online.

Alessandra Sala announced two new AMAS [reports](#):

- Technical paper on AI and multimedia authenticity standards (second edition)
- Policy paper on the legal landscape for generative AI across different regions

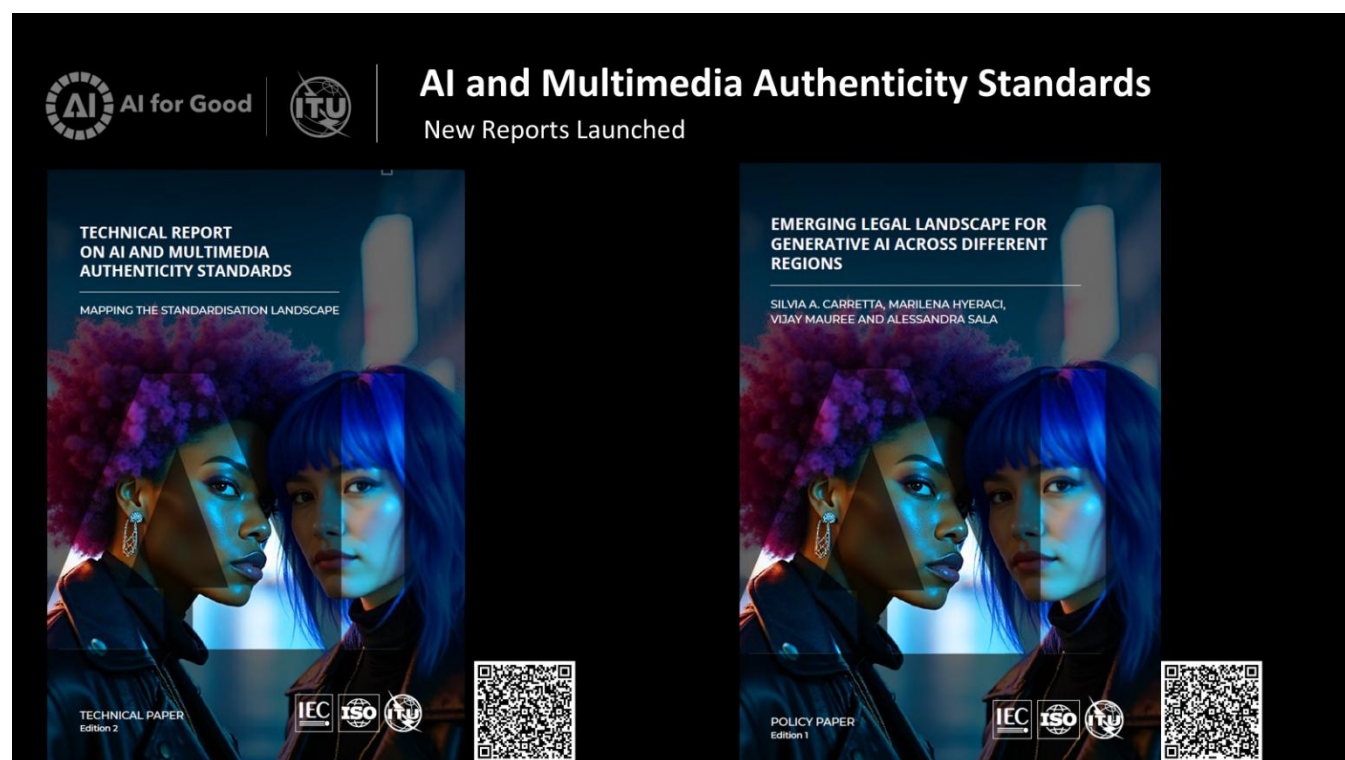


Figure 26: AMAS reports launched at the workshop

13.3 AMAS Young Research Associate Programme

The first session of the workshop shared the outcomes of the AMAS Young Research Associate Programme and showcased some of the lessons learned from the research projects.

The AMAS Young Research Associate Programme launched in January 2026 and brought together a diverse group of young researchers enrolled in Masters or PhD programmes to address a common problem: how to help people understand what is real, what is synthetic, and what can be trusted in increasingly complex digital environments.

The table below summarizes the projects from the three teams that were presented during the session.

Team and project name	Project focus with regard to multimedia authenticity	Main outcome(s)
Social science team: Stop and scan	Recognizing that users need practical cognitive habits, not only technical or policy solutions, the team focused on critical thinking, misinformation resilience, source evaluation, content analysis, contextual alignment and reflection.	A human-centred framework that teaches users to pause, question, verify and decide. It includes the Amito mascot, educational comics, videos, learning resources and a website.
Technical team: Amito agentic toolkit	Recognizing that verification requires layered checks because single detection methods are fragile, the team combined provenance, metadata, pixel-level forensic checks, geolocation/context checks and model-based reasoning.	An agentic chatbot deployed through messaging platforms to guide users through multimedia verification and explain why content may or may not be authentic.
Policy and business team: Policy as code	Legal obligations differ across jurisdictions and platforms, leading the team to explore machine-readable pathways to apply rules at scale.	A policy-as-code compliance concept using digital content passports, jurisdictional rule mapping, and tiered trust/passport levels for different assurance needs.

Table 2: Projects from AMAS Young Research Associate Programme

13.3.1 Stop and scan: Strengthening human resilience

The "stop and scan" framework placed human cognition at the centre of multimedia authenticity. The team argued that users are exposed to massive volumes of digital content without a consistent method for processing or verifying it. The proposed response is to build a durable habit based on five steps: stop, source, content, alignment and reflection. The different actions at each step are shown below:

- Stop: Pause before reacting to content designed to trigger fast emotional responses
- Source: Check who created or shared the content, whether the account is credible, and whether basic account signals support trust
- Content: Examine whether the media, claim, audio, visual features or emotional framing suggest manipulation
- Alignment: Compare the claim or event with trusted sources and external evidence
- Reflection: Make a judgment, including the valid conclusion that the content remains uncertain and should not be shared

The team observed that there is strong user demand for autonomy and structured support and reported high reliance on social media for information, limited prior exposure to verification frameworks, and a preference for making their own judgment before receiving a verdict from an AI system.

13.3.2Amito: Agentic verification support

The technical team extended the stop and scan approach into an agentic verification assistant. Amito was presented as a chatbot that can interact with users, ask clarifying questions and orchestrate multiple forensic and AI-based checks. Rather than issuing a simple binary verdict, the system aims to explain its reasoning and help users learn how to evaluate authenticity. It operates at four levels:

- Level 1: Source checks through metadata, signatures and provenance signals such as the C2PA standard from the Coalition for Content Provenance and Authenticity (C2PA)
- Level 2: Content checks through pixel consistency, forensic analysis and model-based detection
- Level 3: Contextual alignment checks such as geolocation, landmarks and weather/context verification
- Level 4: World-model reasoning to assess whether the content is plausible and consistent with external knowledge

13.3.3Policy as code and digital passports

The policy and business team addressed the complexity of cross-border compliance. They mapped regulatory instruments across multiple jurisdictions and proposed translating legal obligations into machine-readable rules. The core idea was that content should move across platforms and jurisdictions with a form of digital passport that captures relevant provenance, disclosure and compliance information. The work considered four tiers of content:

- Tier 1: Content with no metadata or self-declared AI usage
- Tier 2: Process-logged content where platforms can demonstrate checks were performed
- Tier 3: Chain-of-custody information for evidentiary or high-assurance contexts
- Tier 4: Hardware-backed attestation for sovereign or highly sensitive use cases

13.4 Technical standards for AI and multimedia authenticity

The second session of the workshop examined the standards landscape and the technical infrastructure needed to support multimedia authenticity. The discussion combined economic, technical, user-experience and professional-media perspectives.

13.4.1Economics of trust and market incentives

A keynote from **Amir Banifatemi**, Chief Responsible AI Officer at Cognizant, framed deepfakes as a problem of asymmetric economics. Synthetic content can be inexpensive but costly for victims, organizations and society. By contrast, producing and maintaining trustworthy content requires investment in provenance, authenticity systems, infrastructure and standards. The keynote therefore highlighted the need for market incentives, regulatory recognition and liability differentiation that reward trustworthy content practices.

13.4.2Technical gaps in standards for multimedia authenticity

A panel discussion moderated by **Leonard Rosenthol**, Senior Principal Architect for PDF & the Document Cloud at Adobe and Co-Lead of the Technical Pillar of AMAS, welcomed

Thomas Wiegand, Professor at the Technical University of Berlin and Executive Director of Fraunhofer HHI; **Thomas Bause Mason**, Director of Standards Development at the Society of Motion Picture and Television Engineers (SMPTE); and **Abigail Sellen**, Vice-President and Distinguished Scientist at Microsoft Research UK

Leonard Rosenthol presented the second edition of the AMAS technical paper on AI and multimedia authenticity standards. The report provides an evaluation of the multimedia authenticity standards landscape and how it is evolving, with some standards are coalescing and new standards work underway.

Shift from detection to authentication

Thomas Wiegand highlighted a fundamental shift in the fight against deepfakes and synthetic media. He argued that the traditional approach of detecting manipulated videos and audio through forensic analysis is becoming unsustainable because AI-generated content is rapidly reaching a level where it is indistinguishable from authentic recordings. Advances in generative AI are creating a "virus-antivirus" race between content generation and content detection. He cited examples showing that modern AI-generated videos can now reproduce highly subtle physiological signals, such as a person's pulse detectable from facial video, which were previously used as indicators for identifying manipulated content. As AI systems continue to improve, forensic detection methods will become increasingly unreliable.

Box 4: Standardization work in ITU-T Study Group 21: Authenticating multimedia content and embedding authenticity information within media streams

[ITU-T Study Group 21](#) is working on coded multimedia authenticity, developing standards for authenticating multimedia content and embedding authenticity information within media streams.

The standardization work aims to:

- Embed authenticity metadata directly into video and audio streams
- Transport provenance and authentication information across multimedia delivery networks
- Maintain synchronization between video, audio and associated authenticity information
- Enable verification even when media undergoes transcoding or format conversion
- Support interoperability with provenance frameworks such as C2PA

Rather than defining provenance itself, the work focuses on how provenance and authenticity information can be reliably carried through existing multimedia coding and transmission systems.

He explored the merits of authenticating genuine content at the point of capture to establish trust in media originating from cameras and microphones by creating a verifiable chain of authenticity from capture to consumption.

This approach focuses on:

- a) Authenticating the original content when captured by a camera or microphone
- b) Preserving provenance information throughout the media lifecycle
- c) Enabling end-to-end verification for users receiving the content
- d) Establishing a traceable chain of custody for multimedia content

The proposed framework works as follows:

- a) At the point of capture, the camera or microphone computes a cryptographic hash of the original media
- b) Provenance information is attached to that hash
- c) The hash and metadata are digitally signed using cryptographic keys associated with the device manufacturer
- d) Authentication information is embedded and transported alongside the multimedia stream
- e) When content is modified, transcoded or redistributed, intermediary entities would verify the incoming authenticity information, perform the transformation, and generate and sign a new authenticity record
- f) Each processing stage creates a new verified link in the chain of custody

This enables users to determine:

- Whether content originated from an authentic device
- Who processed the content along the distribution chain
- Whether any stage in the chain failed verification

Wiegand illustrated how authenticity indicators could appear on social media platforms and broadcast systems, for example:

- Green indicator: Verified authentic camera and microphone content with an intact chain of custody
- Red indicator: Content authenticity cannot be verified, has been manipulated or lacks provenance information

This provides a simple trust signal for end users while preserving user choice regarding whether they wish to view authenticity information.

The work is already progressing beyond standardization into practical deployment:

- Video authenticity transport standards are being finalized within ITU-T Study Group 21
- Pilot implementations are being conducted with broadcasters
- Collaboration is underway with the European Broadcasting Union (EBU)

- Digital certificates are being provided by the German Federal Printing Office (Bundesdruckerei)
- Real-world testing is being conducted in regulated broadcast environments as a precursor to wider deployment

According to Wiegand, the future of multimedia trust lies not in detecting deepfakes, but in authenticating genuine content at its source and maintaining a verifiable chain of custody throughout the media lifecycle. ITU-T Study Group 21's work on multimedia authenticity seeks to provide the standardized transport mechanisms necessary to carry provenance and verification information across video and audio ecosystems, enabling trustworthy digital media in an era where AI-generated content may become indistinguishable from reality.

Labels, accessibility and contextual design

Panelists warned against simplistic or universal labels. A label that works in one context may not be appropriate in another. The session therefore treated labelling as a design and research challenge, not only a compliance requirement. Some of the issues related to labelling highlighted during the session were:

- Labels must avoid misleading users into equating “AI-generated” with “false” or “authentic” with “trustworthy in every context”
- Trust indicators must be usable by persons with disabilities, including users who cannot rely on red/green coding or visual-only indicators
- Labels and provenance details may need adjustable levels of prominence depending on risk context, such as news, elections, consumer protection, entertainment, evidence or art
- Cross-cultural research is needed to understand who users trust for provenance information and how terms, icons and labels translate across contexts

Thomas Bause Mason emphasized that the rise of AI-generated media creates an urgent need for mechanisms that allow audiences, broadcasters, platforms and regulators to verify the authenticity and provenance of content. According to Mason, ensuring that audiences can trust the content they consume is becoming increasingly important as AI tools are embedded throughout media creation and editing processes. While C2PA provides the core content credential framework, SMPTE is addressing how those credentials are preserved through professional broadcast, production, interchange, archival and distribution systems. Together, they form the basis of a trusted digital media ecosystem capable of supporting authenticity, provenance, accountability and transparency for AI-generated and human-created media.

The main points raised during the discussion of the session are summarized below:

Authenticity cannot rely solely on detection technologies. Instead, professional media systems should preserve trustworthy metadata documenting:

- Who created the content
- When it was created
- How it has been modified
- Which AI tools were involved

- Whether authenticity claims can be independently verified

The relationship between different standards initiatives were discussed. C2PA was presented as an important provenance specification with broad international participation, while JPEG Trust was discussed as an international standards route that can support trust frameworks, provenance records and interoperability.

A flexible trust architecture may be more realistic than a single universal label or disclosure method.

Future work should address agentic AI authenticity, local-language verification, metadata durability, and evidence reporting from real-world label deployments.

Regarding C2PA, audience members asked whether provenance infrastructure is overly dominated by US technology companies and responses emphasized broad international membership and alignment with international standards routes.

Panelists cautioned that mandatory or prominent AI labels may suppress artistic work or misrepresent legitimate AI-assisted creativity.

Regarding innovation and barriers to entry, speakers argued that provenance standards can add value and protect creators without preventing innovation if designed as open and interoperable infrastructure.

Gap	Why it matters	Key needs
Authentication of authentic content	Synthetic content will become increasingly difficult to detect. Authentication of original camera and microphone content may be more sustainable than attempting to detect every fake.	End-to-end provenance, chain-of-custody information and transport of authenticity messages in media streams.
User experience and intelligibility	Standards are ineffective if users cannot understand labels, provenance indicators or trust signals.	User-experience guidance, cross-cultural research, accessibility, mobile-first design and careful use of icons, colours and terminology.
Professional media workflows	Broadcast, cinema, professional editing and distribution chains need standards that work across production, transcoding and distribution environments.	Alignment between C2PA, JPEG Trust, SMPTE workflows, professional media formats and broadcast infrastructure.
Live media	Live video and audio create new authentication challenges for calls, news, streaming and other real-time communications.	Embedding authenticity signals into live media streams and exploring deployment in broadcast and conferencing systems.

Detection results and metrics	Detection models are fast-changing, proprietary and unreliable in some contexts.	Avoid standardizing specific detection algorithms; instead standardize result presentation, metrics, interfaces and transparency.
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Table 3: Main gaps in technical landscape for multimedia authenticity

13.5 Challenges for cross-border compliance for global platforms

The third session of the workshop examined the emerging legal landscape for generative AI, deepfakes and multimedia authenticity across regions. It focused on the practical challenge for global platforms: how to comply with laws that are converging in policy objectives but diverging in definitions, triggers, procedures and remedies.

The session was moderated by **Marilena Hyeraci**, Of Counsel at Chiomenti Law Firm, and the welcomed **Tang Juyuan**, Research Scientist at the China Academy of Information and Communications Technology (CAICT); **Philippe Rixhon**, Chair of the Management Board at Valunode OÜ, Tallinn, Estonia; **Bala Ravindran**, Head Wadhvani School of Data Science at the Indian Institute of Technology Madras; and **Claire Liebowicz**, Director of AI, Trust and Society at the Partnership on AI.

Findings from the AMAS policy paper

Marilena Hyeraci provided a summary of the AMAS policy paper on the legal landscape for generative AI across different regions, explaining the different legal approaches to deepfakes, disinformation and multimedia authenticity across Africa, the Americas, Asia, Europe and the Middle East (see table below). Despite fragmentation, several common policy directions are emerging.

Policy topic	Observed convergence	Compliance implication
Transparency	Jurisdictions increasingly require disclosure or transparency for AI-generated or manipulated content.	Platforms must distinguish obligations for developers, deployers, intermediaries and content distribution services.
Provenance	There is growing interest in provenance, content credentials and traceability.	Technical standards need to support legally meaningful provenance without creating unacceptable privacy or surveillance risks.
Copyright and AI training	Copyright compliance is becoming a core concern, but legal bases differ significantly.	Providers need jurisdiction-specific compliance policies and evidence of data governance.
Creator compensation	Some regimes consider mechanisms for creator compensation, while others rely primarily on existing copyright remedies.	Platforms and AI providers may need flexible approaches to rights management and remuneration.

Enforcement provisions	Enforcement varies by harm category, authority and remedy.	A single global takedown or labelling workflow may not satisfy all jurisdictions.
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Table 4: Legal landscape of multimedia authenticity, misinformation, disinformation and deepfakes

The policy paper identifies recurring high-risk contexts: elections, likeness and identity harms, privacy and consent, and severe harms involving non-consensual intimate or sexually explicit deepfakes. It emphasizes that platforms need separate legal assessments for each jurisdiction rather than assuming one disclosure method or harm category will suffice globally.

Panel discussion

The key points that emerged from the panel discussion are summarized in the table below.

Perspective	Main points raised
Tang Juyuan	China has adopted a regulatory approach to deep synthesis and AI-generated content labelling, including obligations on service providers, application distribution platforms, content distribution platforms and users. The approach combines regulation, standards and platform user agreements, with both visible and invisible labelling requirements.
Bala Ravindran	India has focused on platform obligations to address challenges including digital literacy, local-language deepfake detection, traceability in encrypted channels, and limited enforcement leverage over global technology providers.
Claire Liebowicz	Labelling is not automatically helpful. Users can misunderstand labels, and “AI-generated” does not necessarily mean false. Effective transparency requires evidence collection, interpretability, care for salience, and feedback loops from real-world deployment.
Philippe Rixhon	A flexible trust framework such as JPEG Trust can support different stakeholders, contexts and jurisdictions. Trust profiles, distributed metadata storage and collaboration with policymakers can help bridge differences among legal regimes.
Cross-border interoperability	Differences in label placement, size, format, obligations and definitions make compliance difficult. International standards can help, but need to cater for national priorities and privacy, safety and freedom-of-expression trade-offs.

Table 5: Summary of panelists' interventions

The key issues discussed are summarized below:

- Cross-platform content distribution can strip or corrupt metadata during compression, transcoding or re-uploading. Open-source models can be downloaded, modified and deployed outside traditional platform accountability mechanisms.
- A grey market for removing labels, metadata and watermarks can weaken disclosure regimes.
- Legal requirements for label size, placement, modality and responsible entity differ across countries.
- Traceability requirements may conflict with privacy, encryption and technical feasibility concerns.
- Cross-border interoperability: Differences in label placement, size, format, obligations and definitions make compliance difficult. International standards can help, but need to cater for national priorities and privacy, safety and freedom-of-expression trade-offs
- Cross-border compliance is not only a legal mapping problem; it is also a standards, user experience, platform governance, evidence and implementation problem.
- Local-language and low-resource contexts create major capacity gaps for detection, verification and media literacy.
- Agentic AI will extend the authenticity problem beyond media into actions, transactions and delegated decision-making.

13.6 Key takeaways

The main takeaways of the workshop are summarized below:

- Multimedia authenticity is becoming a baseline layer of digital trust. It underpins public information integrity, legal evidence, democratic processes, media production, consumer protection and digital safety.
- There is no single solution. Provenance, watermarking, detection, media literacy, user experience, policy-as-code, platform governance and regulatory frameworks must operate as mutually reinforcing layers.
- Detection remains useful but cannot be the only strategy. As synthetic media quality improves, authentication of trusted capture and chain of custody will become increasingly important.
- Labels need evidence and design discipline. Poorly designed labels can confuse users, stigmatize legitimate creative work, or be ignored. Effective labels require research, accessibility, salience calibration and data about use.
- Developing countries require dedicated attention. Local languages, mobile-first access, platform dependence, digital literacy gaps and limited regulatory leverage change the implementation landscape.

- Standards must be technically robust and policy aware. They should support cross-border compliance while leaving room for different national trust profiles, legal safeguards and sector-specific contexts.

14 Embodied AI for multimedia technologies: From perception to human collaboration

14.1 Introduction

Embodied AI (EAI) marks a shift in how intelligent systems are designed and experienced. Rather than operating purely in digital environments, EAI integrates AI into physical or virtual bodies, enabling systems to perceive, learn and act within real-world contexts. This opens new possibilities for multimedia technologies that are not only interactive, but deeply responsive to human behaviour and environments.

A workshop on [*Embodied AI for multimedia technologies: From perception to human collaboration*](#) explored how EAI can support human-centred multimedia applications by combining multimodal perception, adaptive learning and collaborative capabilities. Participants engaged with emerging concepts such as world models, closed-loop control and real and virtual training datasets, while examining how embodied systems can operate in dynamic, unstructured environments. The session also addressed practical implications across sectors including healthcare, smart manufacturing, logistics and home automation. Bringing together researchers, industry experts and policymakers, the workshop offered a space to reflect on the technical foundations, standardization needs and future directions of EAI in multimedia systems.

14.2 Background

The [ITU Focus Group on Embodied AI for Multimedia Technologies](#), reporting to ITU-T Study Group 21, was established in February 2026 to lead pre-standardization work on EAI. Its mandate covers terminology, reference architecture, multimodal data, models, interfaces, interoperability, vertical applications, human alignment, evaluation benchmarks and open-source ecosystem development.

14.3 Workshop sessions

14.3.1 Opening of workshop

H.E. Lecheng Li, Minister of Industry and Information Technology of China, highlighted that EAI, as an integration of AI with physical systems, is emerging as a key industry of the future, with the potential to transform the way people work and live and drive the intelligent transformation of society. He proposed three avenues to support EAI development: first, promote application-driven development and create a global hub for exemplary use cases; second, strengthen systematic planning and forward-looking research on international standards; and third, uphold openness and inclusiveness, establish an open and innovative cooperation mechanism, fully leverage the role of the ITU Focus Group, and integrate the concept of "AI for Good" throughout the entire life cycle of standard development. The three

avenues, said Minister Li, could jointly support the building of a diverse, collaborative, secure and trustworthy global industrial ecosystem.

14.3.2 Introduction to the focus group

Moderated by **Yuntao Wang**, Professor-Level Senior Engineer at the AI Institute of CAICT and Chair of the ITU Focus Group on Embodied AI for Multimedia Technologies, presented a comprehensive overview of the group's mandate, organizational structure and work plan. It operates through nine working groups covering foundational architecture, multimodal data, models, system integration, connectivity, vertical applications, human alignment, evaluation benchmarking and open-source ecosystems.



Figure 27: Opening session of the workshop on embodied AI

14.3.3 Frontiers and global developments in embodied AI

Moderated by **Anna Matamala**, Professor at the Universitat Autònoma de Barcelona and Director of AccessCat, this session of the workshop showcased cutting-edge technical advances in EAI hardware, perception systems and computing infrastructure.

14.3.3.1 Capacitive tactile sensors for robots: Can tactile-integrated embodied AI exceed human perceptual limits?

Wuqiang Yang, Professor at the University of Manchester, presented the state of robotic tactile sensing, noting that while vision and audio sensing have matured rapidly, high-performance tactile sensors remain scarce and prohibitively expensive for mass deployment.

He introduced a 3D capacitive tactile sensor with three operating modes: proximity sensing, material identification via touch, and 3D force sensing through capacitance variation.

14.3.3.2 AI infrastructure: From token to physical AI

Boxun Li, Chief Technology Officer of Infinigence, analysed the widening supply-demand gap in AI computing power driven by the rapid scaling of EAI models and reinforcement learning workloads. He highlighted that EAI is entering the era of scaling laws, with model capabilities growing rapidly alongside parameter scale and training data. To address the unique demands of embodied reinforcement learning, his team develops a flexible large-scale reinforcement learning infrastructure, which delivers improvements across simulators and tasks, and supports end-to-end workflows from simulation training to real-world deployment.

14.3.3.3 Embodied multimodal intelligence

Andrea Cavallaro, Professor at EPFL, presented research advances in embodied multimodal intelligence, focusing on bridging natural language, visual perception and physical human-robot interaction. Trained across diverse task types and robot embodiments, the approach enables systems to perform open-vocabulary object perception and manipulation, significantly improving generalization to unseen objects and task scenarios. On the topic of physical human-robot interaction, he presented vision-based methods for accurate hand-object motion reconstruction, which support smooth and reliable human-to-robot object handovers.



Figure 28: First session of the workshop on embodied AI

14.3.4 Embodied AI: Recent advances in technical paradigms and industrial deployment

Moderated by **Yuntao Wang**, this panel welcomed **Yonghua Lin**, Vice-President and Chief Engineer at the Beijing Academy of Artificial Intelligence; **Lyn Wang**, Regional Manager for

the EU and Middle East at Unitree; and **Anna Matamala** to discuss the transition from laboratory prototypes to scalable real-world EAI applications.

The discussion centred on the core gap between current perception-capable systems and genuinely human-collaborative systems:

- **Open-source foundation layers:** Panelists discussed the feasibility of shared open-source foundations for EAI, noting that while tight coupling between perception, world models and hardware creates challenges, standardized abstraction interfaces and hardware-agnostic model layers can enable a shared ecosystem.
- **Global deployment barriers:** Industry representatives noted that cross-market regulatory divergence – in safety certification, data governance and compliance requirements – is a significant barrier to technical maturity for international scaling of humanoid robots.
- **Inclusive design:** The panel emphasized that EAI systems must be designed with diverse end users – including older adults and persons with disabilities – from the earliest stages, to avoid building systems that work in abstract test settings but fail in real human contexts.



Figure 29: Panel discussion at the workshop on embodied AI

14.3.5 Evaluation, standardization and safety for embodied AI

Moderated by Focus Group Vice-Chair **Shin-Gak Kang**, Special Research Fellow at ETRI, this session examined governance, security and evaluation frameworks for responsible EAI development.

14.3.5.1 Open-source embodied robotics and conversational AI

Andres Marafioti, Head of the Multimodal Research Team at Hugging Face, presented Reachy Mini, an open-source expressive robot designed for human-robot interaction research and development. He noted that while voice AI technology has matured significantly, most

robotic platforms remain socially awkward, prohibitively expensive and difficult to customize.

Reachy Mini is positioned as an accessible, repairable and hackable platform targeted at researchers, students and developers. The presentation covered the robot’s conversational application architecture, cloud-based serving infrastructure optimized for low-latency voice interaction, and a natural-language “vibe coding” workflow that allows users to rapidly develop robot applications through plain-language instructions.

14.3.5.2 Ensuring security and privacy for physical AI systems

Heung Youl Youm, Professor at Soonchunhyang University and Chair of the Open Digital Identity Foundation, presented a systematic analysis of security risks for physical AI systems. He traced the evolution of AI from traditional predictive systems to generative AI, agentic AI and physical AI, noting that each stage expands the threat surface – with physical AI attacks able to cause tangible real-world harm including human injury, property damage and mission disruption.

He mapped distinct threats across the EAI pipeline, such as sensor spoofing at the perception layer, adversarial attacks at the perception layer, prompt injection at the reasoning layer, goal hijacking at the planning layer, and unsafe execution at the action layer. He further outlined a multi-layered security framework spanning device, cyber-physical system, application and AI model layers, and presented corresponding privacy controls including data minimization, privacy-preserving processing and secure data governance.

14.3.5.3 The first large-scale, real-robot-cased benchmarking of embodied intelligence

Emily Chen, General Manager for Open Source Strategy and Ecosystem at Dexmal, outlined the core gap in current EAI evaluation: while the vast majority of model testing takes place in simulated environments, standardized real-world physical validation remains very scarce, creating a persistent barrier for reliable real-world deployment.

She presented RoboChallenge, a centrally hosted benchmark platform that allows researchers worldwide to test embodied AI models on physical robotic hardware through a unified interface. The platform runs a closed-loop evaluation workflow between on-site robotic systems and remotely submitted models, lowering the barrier for teams without dedicated laboratory setups to carry out real-robot testing.



Figure 30: Second session of the workshop one embodied AI

14.3.6 Roundtable discussion on embodied AI benchmark testing

Moderated by **Weimin Zhang**, Deputy Director of the Embodied Intelligence and Robotics Department at the AI Institute of CAICT and Chair of Working Group 8 (Evaluation and benchmarking) in the ITU Focus Group on Embodied AI for Multimedia Technologies, this roundtable brought together **Sebastian Hallensleben** from CEN-CENELEC Joint Technical Committee 21 (Artificial Intelligence); **Marija Jankovic** from the ETSI Technical Committee on Methods for Testing and Specification; **Rongwei Ren** from China's National Embodied AI Robotics Innovation Center; and **Bret Jordan** from Afero to explore the design of comprehensive, comparable and reproducible benchmark frameworks for EAI.

Key discussion points included:

- **What makes EAI benchmarking different:** Unlike traditional AI benchmarks measured purely on model outputs, EAI evaluation must account for hardware variability, physical environment uncertainty, human-robot interaction dynamics, safety reliability and generalization capability.
- **Building trusted international standards:**
 - Lifecycle-based testing methodologies can improve interoperability and comparability across heterogeneous EAI systems.
 - Benchmark standards should align with regulatory frameworks such as the EU AI Act, supporting compliance while accelerating industrial innovation.
 - Current benchmarks overemphasize technical performance. Governance, risk and conformity assessment dimensions should also support responsible deployment.

- Core principles for trustworthy benchmarking include scientific validity, reproducibility and cross-scenario generalizability.



Figure 31: Roundtable session at the workshop on embodied AI



Figure 32: Participants in the workshop on embodied AI

14.4 Conclusion and key takeaways

This workshop convened the global EAI community to support alignment on technical trends, standardization priorities and governance principles.

The workshop explored the evolution of embodied and physical AI, highlighting how perception, learning and action can be integrated in real-world environments, while discussing challenges in multimodal sensing, human-robot collaboration, security, benchmarking and deployment.

Participants agreed that standardization is essential to advance EAI, enabling interoperability, safety, trust and scalable deployment across industries.

15 From standards to science to action: Implementing and scaling sustainable AI across its lifecycle

15.1 Introduction

As AI continues to scale globally, its environmental footprint across energy, water, materials and infrastructure has become a critical area of focus. While recent years have seen significant progress in developing methodologies and frameworks for measuring environmental impacts, the priority has now shifted toward scientifically grounded, measurable and scalable implementation. A workshop on [*From standards to science to action: Implementing and scaling sustainable AI across its lifecycle*](#) explored how scientific evidence, international standards and practical implementation can be combined to measure and reduce the environmental impact of AI systems.

Building on previous discussions around sustainable AI, participants examined current approaches to environmental impact assessment, implementation experiences, emerging research and strategies for improving sustainability across the AI lifecycle. Discussions highlighted the importance of moving beyond frameworks towards practical action while ensuring that methodologies remain scientifically robust and internationally comparable.

The workshop's discussions also supported ITU's [Green Digital Action initiative](#) and ongoing standardization work within [ITU-T Study Group 5 \(Environment and circular economy\)](#).

15.2 ITU standardization activities related to sustainable AI

15.2.1 Guidelines for assessing the environmental impact of artificial intelligence systems

A central focus of the workshop was [ITU-T L.1801](#), an ITU standard released in February 2026, which provides guidance on assessing the environmental impact of AI systems. The standard covers both lifecycle-based assessments of AI systems and evaluation of the environmental consequences resulting from AI deployment and use. Participants repeatedly emphasized the importance of harmonized methodologies to support comparable and credible environmental assessments across the AI ecosystem.

15.3 Opening remarks

Seizo Onoe, Director of the ITU Telecommunication Standardization Bureau, and **Gitta Kutyniok**, Bavarian AI Chair for Mathematical Foundations of Artificial Intelligence at Ludwig Maximilian University of Munich, emphasized that AI is increasingly becoming critical infrastructure with implications extending far beyond computing performance alone. They stressed that sustainable AI should not only consider resource consumption but also the societal value generated by AI systems and the equitable distribution of their benefits.

Gitta Kutyniok highlighted that progress requires close collaboration between mathematicians, computer scientists, engineers, industry stakeholders and standards bodies. She noted that sustainability depends on both reliability and scientific understanding, emphasizing that mathematical foundations can reveal hidden opportunities for efficiency throughout the AI stack.



Figure 33: Seizo Onoe, Director of the ITU Telecommunication Standardization Bureau



Figure 34: Opening remarks by Gitta Kutyniok, LMU Munich

15.4 Grounding in science: Measuring AI's environmental impact

Moderated by **Vijay Karia**, CEO of OptiCloud, the opening session explored the scientific foundations required to understand and assess the environmental impacts of AI.

Vijay Karia highlighted AI's unprecedented rate of adoption and the rapidly increasing demand for electricity, water and computing resources associated with AI systems. Referring to recent estimates from the International Energy Agency (IEA), he noted that data centres currently consume around 1.5 per cent of global electricity, with AI-related workloads expected to contribute significantly to future growth in demand. He emphasized that considerable uncertainty remains regarding future consumption trajectories, underlining the need for improved measurement, transparency and forecasting to support evidence-based decision-making.

Gitta Kutyniok emphasized that sustainable AI requires more than efficient software. Long-term progress will require innovation across the entire computing stack, including algorithms, hardware and emerging paradigms such as neuromorphic and photonic computing. She also noted that defining meaningful environmental metrics remains an important scientific challenge.

Boris Gamazaychikov, Co-Founder and CEO of Sustainable AI Group, drew attention to the growing disconnect between AI research and business decision-making. While frontier research increasingly focuses on efficiency and sustainability, decisions regarding infrastructure investments often occur separately from scientific discussions. He argued that

closing this gap will require a combination of standards, disclosure mechanisms, practical tools and procurement frameworks.

A recurring theme throughout the discussion was the importance of incentives. Speakers suggested that sustainability labels for AI systems could help create market incentives for developing more environmentally responsible technologies. Discussions also highlighted the need to question whether increasingly large models or resource-intensive approaches are always necessary.



Figure 35: Workshop session on measuring AI's environmental impact

15.5 From theory to practice: Implementation experiences and lessons learned

Moderated by **Luis Adrián Salazar**, Professor at the Latin University of Costa Rica, this session focused on practical experiences implementing environmental impact assessments for AI systems and lessons learned from industry pilots.

Luis Adrián Salazar emphasized that standards serve as enablers of scale, trust and interoperability. He stressed that sustainability should be integrated into the entire technology development lifecycle rather than treated as a secondary consideration. Standards play a critical role in enabling stakeholders to speak a common language while reducing uncertainty and fostering responsible innovation.

Susanna Kallio, Head of Sustainability Standardization at Nokia, presented insights from Nokia's pilot efforts to assess the environmental impact of AI systems. She emphasized the importance of collecting accurate measurement data across the supply chain and stressed that standards create value only when they are put into practice.

Lisa Rivalin, Senior Staff Systems Engineer at Meta AI, highlighted the need for environmental information throughout the full AI value chain, from mining and hardware manufacturing to model training and deployment. She emphasized three priorities: open measurement tools, standardized frameworks, and secure data-sharing mechanisms.

Jon Turnbull, Program Manager for gTech Sustainability at Google, emphasized the importance of avoiding "analysis paralysis." Rather than waiting for perfect data, organizations should establish baseline measurements with the information currently available and continuously improve their methodologies. He stressed methodological transparency and clear disclosure of assumptions and system boundaries.

Gabriela Haenel, Co-founder and Chief Product Officer at Resilio Solutions, described challenges organizations encounter when attempting to incorporate AI into corporate sustainability and net-zero strategies. Key obstacles include fragmented data, lack of transparency and limited access to production-level information from AI providers.

15.5.1 Key challenges identified

- Lack of access to environmental performance data
- Fragmented reporting methodologies
- Unclear lifecycle boundaries
- Difficulty obtaining information from across the AI value chain
- Need for implementation guidance and open-source tools

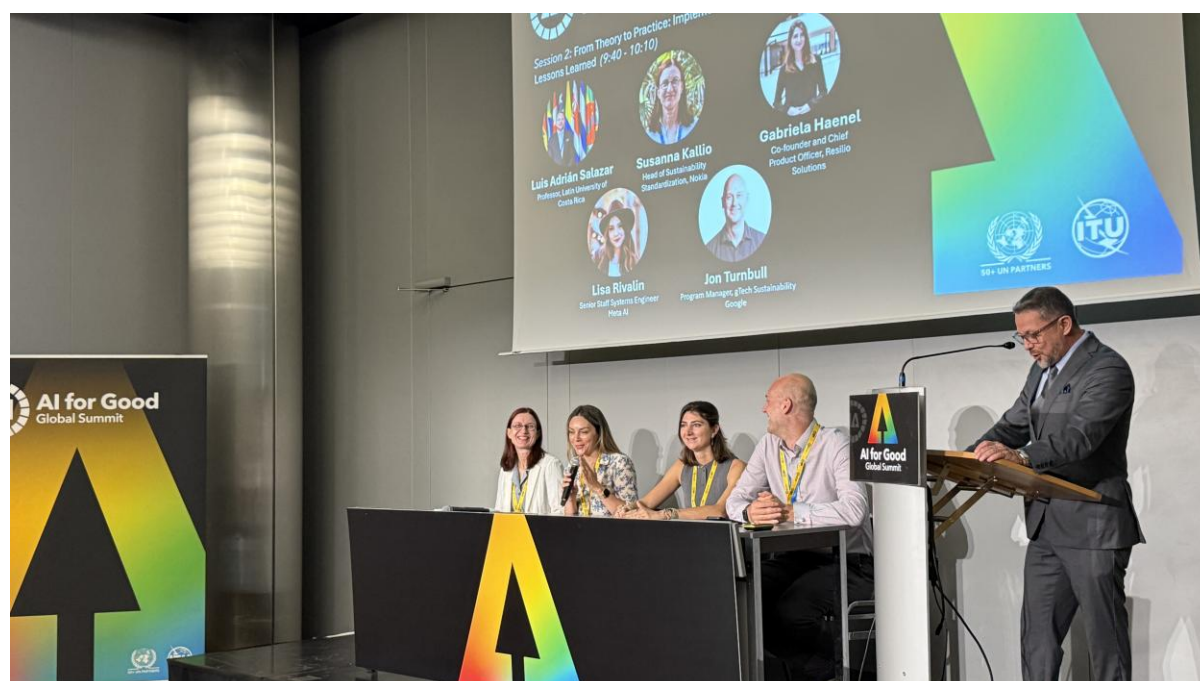


Figure 36: Panel discussion on implementation experiences and lessons learned

15.6 Setting the scene: The global landscape of sustainable AI

Moderated by **Gitta Kutyniok**, this session provided a global overview of sustainable AI and the rapidly growing attention to AI's environmental impacts.

Participants discussed the growing demand for transparency regarding AI energy consumption, water use and resource requirements. While some AI providers have begun publishing energy-related information, speakers noted that the absence of standardized reporting methodologies limits meaningful comparison between systems.

The discussion highlighted concerns about future energy demand, particularly as AI systems become increasingly multimodal and agent-based. Participants emphasized the need for robust scientific methodologies and internationally comparable metrics to support the implementation of policy and governance interventions.



Figure 37: Sasha Luccioni, Co-Founder and Chief Scientific Officer at Sustainable AI Group

15.7 Designing sustainable AI: Models, infrastructure and lifecycle

Moderated by **Leona Verdadero**, Programme Specialist at UNESCO, this session examined practical approaches to building and operating more sustainable AI systems across their lifecycle.

Ivana Drobnjak, Director of the Undergraduate Programme in Computer Science at University College London (UCL), demonstrated how sustainability can be improved through quantization, prompt optimization, model compression, distillation and routing techniques. These approaches can significantly reduce computational requirements while maintaining useful levels of performance. She argued that efficiency should be considered a design objective from the outset.

Hiroshi Yamamoto, Director of the Standardization Office at NTT, discussed the relationship between AI infrastructure and energy systems. He highlighted the need for stronger collaboration between ICT providers, power utilities and policymakers. He introduced the concept of moving data closer to renewable energy sources rather than expanding energy transmission infrastructure to support concentrated computing hubs.

Thomas Spencer, Senior Energy Analyst at IEA, examined current trends in AI-related electricity demand and the rapid expansion of hyperscale data centre infrastructure.

Discussions underscored concerns regarding the scale, speed and geographical concentration of AI infrastructure and its implications for future energy systems.

15.7.1 Key Messages

- Resource-efficient AI is already achievable
- Smaller, task-specific models often provide significant efficiency gains
- Infrastructure planning must be aligned with energy system realities
- Collaboration between digital and energy sectors is critical
- Efficiency should become an element of AI governance and procurement

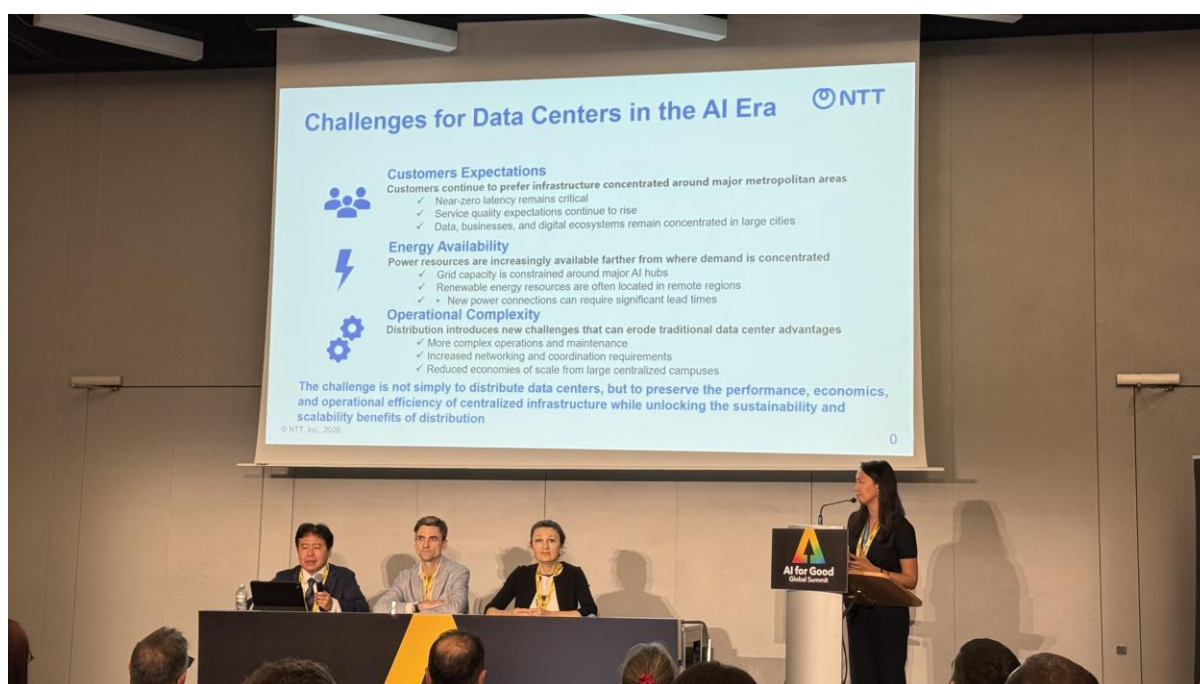


Figure 38: Session on designing sustainable AI

15.8 Bridging efforts: Aligning science, industry and technical communities

Moderated by **Qi Shuguang** from CAICT, Vice-Chair of ITU-T Study Group 5, this session focused on strengthening cooperation among scientific, industrial, policy and standardization communities.

Qi Shuguang emphasized that sustainable AI requires cross-sector collaboration and stronger coordination between AI development and electricity systems. Such cooperation will become increasingly important as AI energy demand grows.

Sally Radwan, Chief Digital Officer at UNEP, highlighted UNEP's role in bringing environmental evidence into AI policy and governance discussions. She emphasized that sustainable AI must address the entire lifecycle, including energy, water, minerals, hardware, deployment and electronic waste. She noted that the next priority is to translate principles into practice through stronger science, better environmental data systems, enhanced country capacity, scalable use cases and shared metrics.

Tim Smolcic, Director and Global Head of Strategic Partnerships at HSBC Securities Services, highlighted the growing environmental implications of accelerating investments in

AI infrastructure and data centres. Drawing on HSBC's experience as a major user of digital technologies, he emphasized the importance of understanding and managing the sustainability impacts associated with AI deployment. As organizations increasingly integrate AI into their operations, access to reliable data, transparent reporting and comparable metrics becomes essential for informed decision-making.

He noted that standards and policy frameworks play a critical role in enabling responsible AI adoption by providing consistency, reducing uncertainty and supporting accountability across the value chain. From a financial sector perspective, trusted methodologies are needed to assess environmental impacts, guide investment decisions and ensure that innovation is accompanied by effective environmental stewardship. He stressed that addressing AI's sustainability challenges will require collaboration across industry, governments, standards bodies, infrastructure providers, and technology developers.

Jean-Manuel Canet from Orange, Rapporteur for Question 9/5 (Assessing the impact of telecommunications/ICTs on climate change, biodiversity and the environment - including the influence on other sectors) within ITU-T Study Group 5, presented recent progress on ITU standards for the environmental sustainability of AI systems. In particular, he highlighted how ITU-T L.1801, provides a globally applicable methodology for assessing the environmental impact of AI systems throughout their lifecycle. The standard supports the evaluation of both the direct environmental impacts associated with the development, deployment, operation and end-of-life management of AI systems, and the indirect impacts and consequences resulting from their use. By establishing a common assessment framework, ITU-T L.1801 enables organizations to conduct more consistent, transparent and comparable environmental evaluations of AI technologies.

He encouraged stakeholders from industry, academia, governments and international organizations to implement ITU-T L.1801 and share practical experiences and assessment results, and contribute feedback to support the continued evolution of the standard. He emphasized that widespread adoption of common methodologies is essential to improve transparency, facilitate benchmarking and support evidence-based decision-making across the AI ecosystem.

He also highlighted several ongoing and future standardization activities building on the foundation established by ITU-T L.1801. These include work on practical implementation examples and case studies, guidance for scoring AI systems from an environmental impact perspective, and methodologies for assessing the environmental impacts of AI at global, national and city levels. Together, these initiatives seek to provide organizations with practical tools and guidance to move environmental measurement towards actionable sustainability improvements.



Figure 39: Panel discussion on bridging science, industry and technical communities

15.9 From pilots to scale: Building the next phase of sustainable AI

Moderated by **Yolanda Martínez**, Senior Programme Coordinator for the GovStack initiative at ITU, the final panel focused on scaling implementation, policy development and collaboration.

Bridgette McAdoo, Chief Sustainability Officer at Genesys Cloud Services, discussed the importance of building organizational awareness and sustainability literacy as foundational elements of responsible AI adoption. Drawing on Genesys' experience, she explained how sustainability considerations are being integrated across business operations, technology strategies, resilience planning and customer engagement efforts. She emphasized that education plays a critical role in ensuring that employees, decision-makers and customers understand both the opportunities and environmental implications associated with AI technologies.

She highlighted the value of sharing best practices internally and extending those learnings to customers and partners to help accelerate adoption of more sustainable approaches across the digital ecosystem. She noted that sustainability should not be viewed as an additional compliance burden or a constraint on innovation. Rather, organizations that embed sustainability principles into the design and deployment of AI systems can improve efficiency, strengthen resilience, support long-term business value, and build greater trust with stakeholders.

Bjorn-Soren Gigler, Senior Digital and Green Transformation Specialist at the European Commission, highlighted the growing importance of policy and regulatory frameworks in supporting the sustainable deployment of digital technologies. He emphasized that sustainability objectives cannot rely solely on voluntary actions and technological innovation, but must also be supported by enabling policies, appropriate incentives and regulatory

measures that encourage organizations to measure, report and reduce the environmental impacts of AI systems.

He also stressed the value of public sector leadership in driving implementation at scale through practical use cases, open exchanges of experience and collaborative initiatives. Drawing on European efforts in digital and green transformation, he noted that sharing methodologies, real-world implementation experiences and lessons learned can help accelerate adoption and support more informed decision-making. He further emphasized that policy frameworks should not only address environmental impacts directly but also create conditions that encourage innovation, interoperability, transparency and responsible AI deployment across sectors.

Xavier Merlin, Board Member for France's regulator ARCEP, presented ARCEP's approach to digital sustainability, emphasizing the role of telecommunications regulators in ensuring that connectivity remains accessible, resilient and sustainable over the long term. He highlighted ARCEP's work on measuring the environmental impact of digital technologies, including AI, and presented recent findings on the eco-design of AI models, coordinated planning for data-centre deployment, and increased transparency around AI services. He concluded by stressing the importance of European and international cooperation, including within the ITU, to address sustainability challenges.

Joaquim Barris, Mitigation Data Service Unit Lead at UNFCCC, emphasized that the rapid expansion of AI must be accompanied by robust measurement frameworks and internationally recognized standards capable of supporting implementation at scale. He noted that the environmental impacts of AI cannot be effectively addressed through fragmented approaches and stressed the need for common methodologies, transparent reporting practices, and trusted data to enable consistent assessment and comparison across the AI ecosystem.

He further highlighted the importance of collaboration among governments, industry, researchers, standards bodies and international organizations to build consensus around shared approaches for measuring and managing AI's environmental footprint. As AI adoption continues to accelerate, he stressed that efforts to understand, monitor and reduce its impacts must advance at the same pace, helping ensure that technological innovation remains aligned with broader climate and sustainability objectives.



Figure 40: Panelists on moving from pilots to scale

15.10 Key messages for standardization

Workshop participants identified four priority areas to accelerate the transition from measuring AI impacts to implementing sustainable AI practices:

- **Measuring impacts:** Strengthen data sharing, transparency and the development of common metrics to enable consistent and credible environmental assessments of AI systems.
- **Sustainable AI infrastructure:** Promote sustainable AI deployment through efficient data centres, resource-efficient models and environmentally conscious hardware and infrastructure design
- **Empowering users:** Increase awareness of the environmental impacts of AI and support informed and efficient choices by organizations, developers and end users
- **Scaling implementation:** Expand pilot projects, practical implementation experiences and best-practice sharing to accelerate the adoption of sustainability methodologies and standards across the AI ecosystem

15.11 Call to action

Participants highlighted the importance of practical implementation, data sharing and collaboration to advance the environmental sustainability of AI. Key areas identified during the discussion include:

- Sharing implementation experiences, assessment results and lessons learned
- Strengthening environmental data systems and improving the availability of reliable environmental data
- Supporting collaboration among standards bodies, industry, academia, governments and international organizations
- Developing common approaches, metrics and methodologies to improve transparency and comparability

- Building country capacity and promoting scalable use cases

Organizations were further encouraged to explore the implementation of ITU-T L.1801 and share practical experiences, assessment results and lessons learned.

15.12 Conclusion

The workshop demonstrated a strong consensus that sustainable AI requires a transition from conceptual frameworks toward measurable implementation. Participants repeatedly emphasized that measurement is the foundation for action, but measurement alone is insufficient. Sustainable AI requires incentives, scientific rigor, transparency, practical tools, standards and collaboration across the entire AI ecosystem.

Several themes emerged consistently throughout the discussions. First, stakeholders need access to reliable, comparable and transparent environmental performance data. Second, standards such as ITU-T L.1801 provide an essential foundation for harmonized environmental assessment. Third, sustainability must be considered throughout the full lifecycle of AI systems, from raw materials and hardware manufacturing to model training, deployment, operation and end-of-life management. Finally, effective sustainable AI strategies require collaboration among researchers, industry leaders, policymakers, regulators, standards bodies and international organizations.

The workshop concluded with a call to move beyond measurement towards action, encouraging organizations to implement existing methodologies, share lessons learned, contribute to emerging standards and work collectively toward an AI ecosystem that is both innovative and environmentally sustainable.

16 AI for health: Scaling impact through standards, investment and intellectual property

16.1 Introduction

A workshop on *AI for health: Scaling impact through standards, investment and intellectual property* – hosted by ITU, WHO and WIPO in support of their [Global Initiative on AI for Health](#) – examined how AI-enabled health solutions can move from promising pilots to trusted, scalable and sustainable health-system implementation through standards, governance, investment and intellectual property.

The workshop was organized around three connected themes: responsible AI governance and trust; trustworthy health data and evaluation of medical LLMs; and the role of intellectual property in scaling AI-enabled health innovation. Across the programme, speakers emphasized that the challenge is no longer only technical: AI for health requires interoperable data foundations, practical governance, evaluation frameworks, sustainable investment and commercialization pathways aligned with public-health impact.

16.2 ITU standards work and linked UN initiatives

Box 5: ITU standardization on AI for Health

ITU-T Study Group 21 is carrying forward AI-related standardization work across multimedia and related application domains. Its AI portfolio is organized primarily under Question 5/21 (Artificial intelligence-enabled multimedia applications), which addresses evaluation methodologies for AI models, datasets and services, including testing frameworks and trustworthiness indicators. Related work is underway on AI-enabled accessibility under Question 1/21, AI-enabled digital health under Question 2/21, AI-enabled digital culture under Question 3/21, and AI-enabled visual systems under Question 7/21. These areas are directly relevant to the workshop's focus on trusted evaluation, accessibility, health data and deployment readiness.

Previous work includes the [ITU-WHO Focus Group on AI for Health](#) active from 2018 to 2023, which developed a standardized assessment framework for evaluating AI-based methods used in diagnosis, triage and treatment. The Focus Group brought together health experts, regulators, researchers and standards specialists to bridge the gap between AI innovation and clinical deployment. The group's work laid the foundation for the current Global Initiative on AI for Health led by ITU, WHO and WIPO.

The Focus Group concluded its work with [36 publications](#) organized under four pillars: ethics, regulatory, clinical assessments and use cases, and technical. Together, these publications established an important body of technical guidance supporting the deployment of AI in healthcare and continue to inform ongoing standardization efforts under ITU-T Study Group 21 and the work of the Global Initiative on AI for Health.

Box 6: ITU-WHO-WIPO Global Initiative on AI for Health

The Global Initiative on AI for Health was launched in 2023 by ITU, WHO and WIPO, building on the ITU-WHO Focus Group on AI for Health. Its mission is to enable, facilitate and implement responsible AI in healthcare through governance structures, policies, normative technical guidance, standards, expert communities and sustainable implementation models at country level.

The initiative's three-part structure – enable, facilitate and implement – was reflected throughout the workshop: standards and governance for trust; knowledge exchange and data frameworks; and practical pathways for deployment, investment and scale.

Box 7: Joint publication: AI-enabled health innovation and intellectual property

The workshop was closely linked to the joint ITU-WHO-WIPO publication on [AI-enabled health innovation and intellectual property: From idea to impact](#) launched during the AI for Good Global Summit. The publication provides practical guidance on intellectual property considerations across the innovation lifecycle, commercialization pathways, and health data governance and standards. It also includes an Innovation Lifecycle Intellectual Property Matrix to support innovators from ideation to global scale-up.

16.3 Opening and keynotes

Bilel Jamoussi, Deputy Director of the ITU Telecommunication Standardization Bureau, stressed that AI's potential in health will only be realized if solutions are trusted, accessible, scalable and equitable. He framed trust as an ecosystem outcome requiring technical standards, governance, reliable data and implementation capacity, and positioned the workshop as a bridge between standards, health policy and intellectual property.



Figure 41:

Habiba Mizouni (Tunisia) , Jamal Alshanfari (Oman) and Bilel Jamoussi (ITU)

Habiba Mizouni, Professor of Radiology at the Faculty of Medicine of Tunis and Head of the Radiology Department at La Rabta University Hospital in Tunis – speaking on behalf of Tunisia's Ministry of Health – presented Tunisia's vision for AI for health, arguing that AI must be built on secure digital systems, trustworthy data governance and strong human capacity. She highlighted Tunisia's digital health experience, including national teleradiology and plans for a National AI Centre for Health, and emphasized that Africa should not only adopt AI but also create, govern and own AI adapted to regional needs.

Jamal Alshanfari, Head of Health Office to the World Health Organization, Sultanate of Oman Permanent Mission, emphasized that AI can support stronger health systems and better access, but only where transparency, accountability, regulatory frameworks and quality data are in place. His remarks placed trust at the centre of health AI adoption and underlined the importance of international cooperation between countries with different levels of digital maturity.

16.4 Making responsible AI operational: Governance, standards and trust

A panel discussion moderated by **Sameer Pujari**, Lead on AI for Health at WHO, focused on the shift from high-level principles to practical implementation.

Jamal Alshanfari called for governance discussions to translate into practical mechanisms for public benefit, patient safety and trust.

Aline Conchon, Director of EU and International Affairs and France's Ministry of Health, presented France's work on health data and AI, emphasizing data quality, interoperability and responsible reuse.

Habiba Mizouni returned to the need for locally validated AI and evaluation capacity.

Guy Parsons, Technology Lead at Wellcome Trust, highlighted the need for stronger and more harmonized evaluation frameworks, including approaches that work in lower-resource settings.

Rose Nakasi, Researcher at Makerere University, emphasized co-design with clinicians and communities, drawing on AI-supported malaria diagnosis.

Paul Byrne, Executive Director of Education, Innovation and Artificial Intelligence at the Medical Council of Ireland, focused on AI literacy for health professionals and regulators.

The session's analysis was clear: responsible AI cannot remain a policy slogan. Standards, evaluation protocols, health-worker literacy, regulatory capacity and investment in shared digital foundations are needed before AI systems can be embedded into care pathways at scale.



Figure 42: Panel discussion on making responsible AI operational

16.5 Data for trustworthy AI: From discovery to LLM evaluation

Moderated by **Marc Lecoultré**, Associate Partner, Chief Technology Officer and Chief Information Security Officer at OWT, this session addressed the data foundations required for trustworthy AI.

Marc Lecoultré introduced the work of the Global Initiative on AI for Health's Working Group on Data and Open Code Infrastructure, noting that trustworthy AI depends on trustworthy data across the lifecycle, from discovery and documentation to evaluation and regulatory evidence generation.

Arijit Patra, Senior Principal Scientist at University College Birmingham and an Honorary Senior Lecturer at the University of Glasgow, focused on dataset discoverability, explaining that health data may exist but remain difficult to locate, understand and reuse because of fragmented infrastructure, inconsistent metadata and insufficient documentation.

Xiao Liu, Physician Scientist at Microsoft AI, discussed medical LLM evaluation, noting that benchmarks based only on exam-style or synthetic data do not replace real-world evaluation, continuous monitoring and post-deployment assessment.

Joyce Nabende, Senior Lecturer at Makerere University, challenged assumptions that Africa lacks data, arguing that the harder challenge is often finding, connecting and governing existing datasets while ensuring local ownership, language inclusion and benefit sharing.

The session pointed to standards needs around dataset metadata, provenance, discovery mechanisms, evaluation datasets, performance monitoring and representative real-world evidence. It also reinforced the role of the Global Initiative on AI for Health as a coordination space where technical infrastructure, standards and data governance can be developed together.



Figure 43: Panel discussion on data for trustworthy AI

16.6 From pilots to systems: Scaling AI through intellectual property

Moderated by **Nancy Pignataro**, Associate External Relations Officer at WIPO, this session connected AI-health innovation to IP strategy, commercialization and access. The session introduced the new joint ITU-WHO-WIPO publication on [AI-enabled health innovation and](#)

[intellectual property: From idea to impact](#) and showed how decisions on intellectual property affect investment, partnerships, technology transfer and the ability to scale in the health sector.

Natalie Raffoul, Managing Partner at Brion Raffoul LLP, presented the Innovation Lifecycle Intellectual Property Matrix included in the new ITU-WHO-WIPO publication, emphasizing that intellectual property includes patents, copyright, trade secrets, data rights, contracts, licensing and commercialization choices, not patents alone.

Sarah Aboerjaib, Founder of ScansX, presented ScansX's portable AI-enabled stroke triage solution, illustrating how patent strategy, freedom-to-operate analysis and regulatory pathways shape the transition from invention to implementation.

Aishwarya Karnataki, Founder of Glovatrix, described Glovatrix's accessibility-focused AI tools, showing how intellectual property protection can help attract partners and investors while supporting social impact.

This session's core message was that intellectual property should be treated as a strategic enabler of responsible scale, not a late-stage legal formality. For AI-enabled health innovators, intellectual property strategy must evolve across ideation, validation, approval, deployment and global scale-up, while remaining aligned with access and public-health objectives.

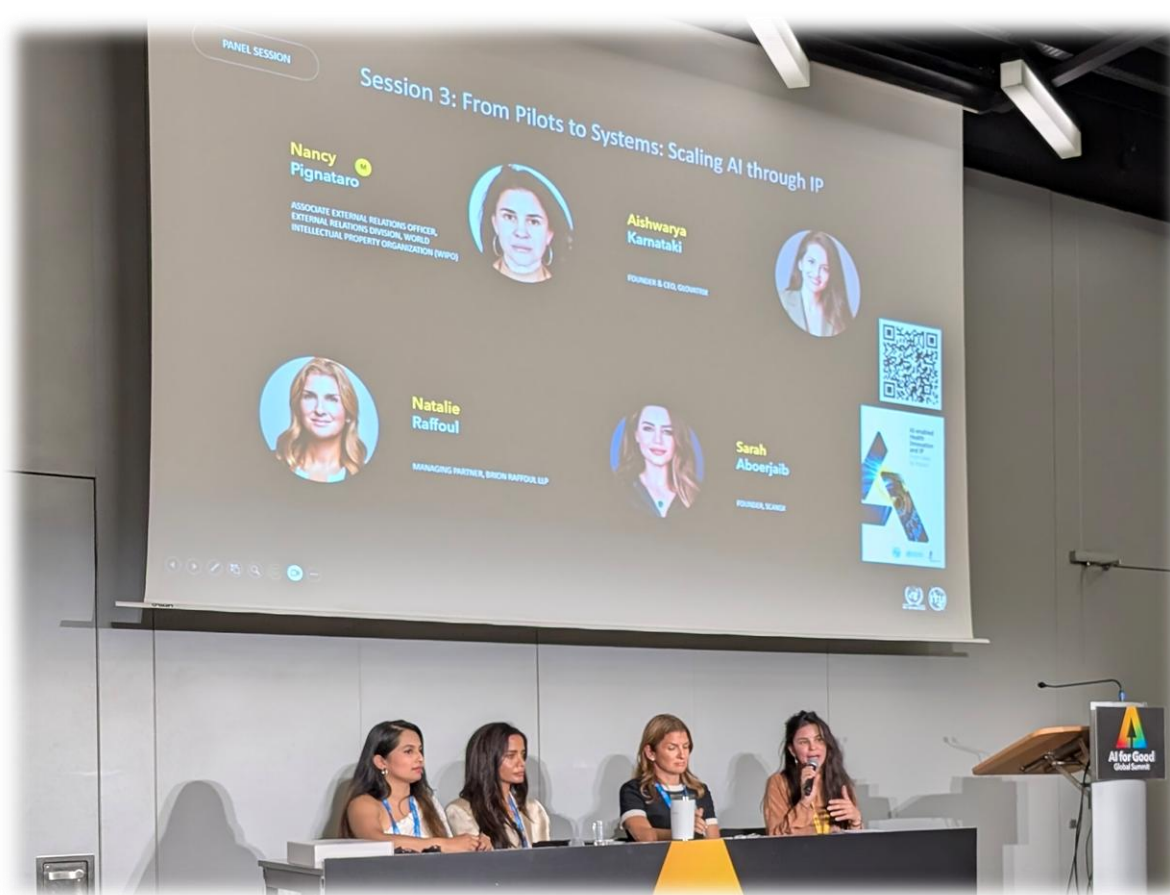


Figure 44: Panelists on scaling AI through intellectual property

16.7 Closing reflections and key takeaways

Alain Labrique, Director of Data, Digital Health, Analytics and AI at WHO, linked governance, standards, evaluation, data, investment and IP into one ecosystem for trustworthy AI adoption. His key reminder was that AI itself is not the endpoint: the objective is better health outcomes.

Dalila Hamou, Director of External Relations at WIPO, reinforced the value of ITU-WHO-WIPO collaboration and the role of intellectual property in supporting confidence, investment and sustainability for health innovation.



Figure 45: Dalila Hamou from WIPO and Alain Labrique from WHO

Several key messages emerged from the discussions:

- AI for health requires practical governance and evaluation frameworks that can be applied across diverse health systems
- Standards are needed for interoperability, metadata, data provenance, evaluation and lifecycle monitoring
- Scaling requires investment in infrastructure, people, regulatory capacity and validation mechanisms, not only algorithms
- Intellectual Property can help innovators protect ideas, attract investment, form partnerships and move solutions from pilots into health systems

16.8 Key messages and next steps

Global Initiative on AI for Health positioned as the implementation platform for responsible AI in health: The Global Initiative on AI for Health was highlighted as a joint ITU-WHO-WIPO mechanism to enable, facilitate and implement responsible AI in healthcare through governance, standards, expert communities and country-level implementation models (see section 16.2).

ITU-T Study Group 21 AI-for-health standards work highlighted: ITU-T Study Group 21's AI portfolio was presented as directly relevant to trusted evaluation, accessibility, health data and deployment readiness, including work under Question 5/21 and related Questions on accessibility, digital health, digital culture and visual systems (see section 16.2).

Focus Group legacy reaffirmed: The ITU-WHO Focus Group on AI for Health concluded with 36 publications across ethics, regulation, clinical assessment, use cases and technical pillars, providing a framing for current health AI work in ITU-T Study Group 21 and a reference for further work in the Global Initiative on AI for Health (see section 16.2).

Tunisia announced its AI-for-health vision and National AI Centre plans: Tunisia's approach to AI for health includes national teleradiology experience and plans for a National AI Centre for Health, emphasizing African capacity to create, govern and own locally adapted AI (see section 16.3).

Trust positioned as the foundation of AI-for-health adoption: AI can strengthen health systems only where transparency, accountability, regulatory frameworks and quality data are in place (see section 16.3).

Responsible AI requires operational mechanisms, not only principles: Standards, evaluation protocols, health-worker literacy, regulatory capacity and shared digital foundations are needed before AI can be embedded into care pathways at scale (see section 16.4).

Work on data and OCI highlighted: The workshop presented the work of the Global Initiative on AI for Health's Working Group on Data and Open Code Infrastructure (OCI), emphasizing dataset discovery, documentation, provenance, real-world evaluation and post-deployment monitoring as standardization needs (see section 16.5). The point was made that trustworthy AI in health depends on trustworthy data infrastructure, and that infrastructure is built through common metadata standards, machine-readable permission terms, quality evidence that travels with the data, and evaluation methods that respect the constraints under which health data must remain. It was also noted that in many settings the harder challenge is not the absence of data but the ability to find, connect and govern datasets that already exist, while ensuring local ownership, language inclusion and benefit sharing.

- Call for contributions to the OCI: Contributions and volunteers were invited to develop the OCI – the operational arm of the Working Group on Data and OCI – as a digital public good and sandbox environment. The OCI is open-source and free at the point of use.
- Next steps foreseen include: furthering discussion on definitions and standards for quality assurance of health datasets; embedding provenance governance in the OCI through the Data Use Ontology (DUO) from the Global Alliance for Genomics &

Health, the Open Digital Rights Language (ODRL) from the World Wide Web Consortium, and the Croissant metadata standard; working towards a release of OCI version 2, bringing dataset discovery, access governance and annotation onto a single standards-aligned, open-source base; and community engagement through open benchmarking challenges.

The new ITU-WHO-WIPO publication on AI, health and intellectual property highlights how intellectual property strategy shapes investment, partnerships, technology transfer, commercialization, access and the scaling of AI-enabled health innovation. The workshop emphasized that intellectual property strategy is not only about patents but also copyright, data rights, trade secrets, contracts, licensing and commercialization choices (see section 16.6).

- **Innovation Lifecycle Intellectual Property Matrix introduced:** The joint publication's Innovation Lifecycle Intellectual Property Matrix was presented as a tool to help innovators address intellectual property across ideation, validation, approval, deployment and global scale-up (see section 16.6).

17 From data centres to climate goals: International standards for more energy-efficient AI

17.1 Introduction

A panel discussion on [*From data centres to climate goals: International standards for more energy-efficient AI*](#) explored the intersection between AI, energy systems and climate objectives. Bringing together experts from various fields, the discussion focused on the increasing electricity demand associated with AI, the implications for data centres and grid infrastructure, and the role of international standards in supporting sustainable, resilient and energy-efficient AI deployment.

Moderated by **Priyanka Dasgupta**, Associate Project Manager for Communications at IEC, the panel discussion welcomed **Thomas Spencer**, Senior Energy Analyst at IEA; **Laura Schade**, Senior Energy Engineer at the UK Department for Energy Security and Net Zero; **Molly Webb**, Founder and CEO of Energy Unlocked; and **Cyrille Brisson**, Global Data Center Segment Leader at Eaton

17.2 Main discussions

Strategic discussion: AI, energy and climate goals

Panelists highlighted that the rapid growth of AI is increasing electricity demand worldwide, making energy efficiency, grid resilience, and sustainable infrastructure critical policy concerns. The discussion emphasized that AI's future depends not only on advances in computing but also on the ability of energy systems to support growing digital infrastructure sustainably.

Data centres and the AI energy challenge

Panelists explored how AI workloads are driving significant growth in data centre energy consumption and infrastructure requirements. They stressed the importance of improving efficiency, cooling technologies and energy management practices to balance AI innovation with climate and sustainability goals.

The role of international standards

International standards were presented as practical tools for translating energy and climate ambitions into operational action. Participants discussed how standards can support energy efficiency, sustainability reporting, grid integration and the development of resilient digital infrastructure across different regions and markets.

AI, energy systems and decarbonization

Panelists highlighted opportunities for AI to contribute positively to energy system transformation, including by helping to optimize electricity networks, supporting renewable energy integration and improving overall system efficiency. At the same time, they noted that unmanaged growth in AI infrastructure could place significant pressure on energy systems and climate objectives.

Practical perspectives from the field

AI is driving significant changes in infrastructure requirements, particularly around cooling systems, energy management, and operational efficiency. The discussion also explored emerging debates around AI sovereignty, national infrastructure planning, and the relationship between digital transformation and the energy transition. Panelists agreed that addressing these issues requires collaboration among governments, industry, utilities and standards bodies.

Stakeholder priorities

Panelists examined the biggest challenges created by AI's growing energy demand, including rising electricity consumption, access to clean energy, grid capacity constraints, measurement and reporting of energy use, and balancing AI growth with climate commitments. International standards were identified as a key mechanism for providing common guidance and supporting coordinated action across stakeholders.

17.3 Key standards and related upcoming outputs

In the ISO/IEC portfolio, data centre efficiency metrics such as Power Usage Effectiveness (PUE) and Cooling Efficiency Ratio (CER) provide common methods for measuring and improving operational performance. These metrics are becoming increasingly important as AI-driven computing places unprecedented demands on electricity systems worldwide.

Standards presented included:

- The ISO/IEC 30134 series provides data centre KPIs for energy and operational performance
- The PUE metric provided by ISO/IEC 30134-2 looks at overall data centre energy efficiency, helping to identify inefficiencies in cooling, power distribution and facility operations
- The CER metric provided by ISO/IEC 30134-7 looks at the efficiency of cooling systems, one of the most significant energy consumers in data centres

Recognizing the current challenges in this landscape, the IEC Market Strategy Board is currently developing a white paper on data centre efficiency to support policymakers, industry leaders and standards developers in understanding emerging requirements for AI-era digital infrastructure. The paper is expected to examine several key themes (also highlighted in the panel discussion):

- Data centres should be viewed as active participants in energy systems, not just electricity consumers, with opportunities to support grid flexibility, demand response and resilience
- Cleaner and more efficient data centres, including advanced cooling technologies, liquid cooling, immersion cooling and improved thermal management for AI workloads
- Broader sustainability impacts, including energy use, water consumption, e-waste, land use, lifecycle emissions and environmental reporting

- New data centre architectures and technologies
- Closer integration between digital infrastructure and the energy transition, including renewable energy sourcing, energy provenance and 24/7 carbon-free energy approaches
- Identification of future standardization priorities for IEC, including AI-ready power quality, data centre grid interaction, lifecycle assessment and interoperable sustainability reporting

17.4 Conclusion and key takeaways

The panel discussion highlighted that the future of AI is closely connected to the future of energy systems. Sustainable AI growth will depend on efficient digital infrastructure, resilient electricity networks, and greater integration between AI development and climate objectives.

Several key themes emerged:

- AI is becoming a significant factor in energy planning and infrastructure development
- Data centres play a critical role in both AI innovation and energy consumption
- International standards can support sustainable, efficient and resilient AI infrastructure
- AI has the potential to accelerate energy system transformation and decarbonization
- Greater synergy is needed between the energy, technology, policy and standards
- Energy efficiency and sustainability should be integrated into AI deployment strategies from the outset

Panelists highlighted that international standards can provide the common framework needed to align AI innovation with energy and climate goals. Standards enable consistent measurement, benchmarking, interoperability and implementation of best practices across data centres, energy systems and digital infrastructure. Standards also help governments and industry translate sustainability ambitions into practical actions and support the responsible scaling of AI globally.

Discussions concluded that international standards are not merely technical tools but essential enablers of sustainable digital transformation, helping ensure that AI remains energy-efficient, resilient, affordable and aligned with global climate objectives.



Figure 46: Panel discussion on standards for more energy-efficient AI



Figure 47: Panelists on standards for more energy-efficient AI

18 Operationalizing AI impact assessment: The interplay between law-based frameworks and international standards

18.1 Introduction

A workshop on [Operationalising AI impact assessment: The interplay between law-based frameworks and international standards](#) explored how international standards can support the implementation of emerging legal and policy requirements for trustworthy AI. Bringing together policymakers, standards experts, international organizations, human rights specialists and government representatives, the workshop examined how standards-based approaches can complement law-based AI impact assessment methodologies and help organizations operationalize AI governance in practice.

A central theme throughout the workshop was the growing need for practical mechanisms that bridge high-level legal principles and real-world AI deployment. Discussions focused

particularly on the role of ISO/IEC standards, including [ISO/IEC 42001](#) (Artificial Intelligence Management System) and [ISO/IEC 42005](#) (AI System Impact Assessment), and their potential alignment with frameworks such as the Council of Europe’s Human Rights, Democracy and Rule of Law Impact Assessment ([HUDERIA](#)).

The workshop was structured around two main sessions: a high-level policy panel on institutional collaboration in AI impact assessment, and a technical discussion on implementation challenges and practical pathways for conducting AI impact assessments in real-world settings.

18.2 Main discussions

18.2.1 High-level policy panel on institutional collaboration on AI impact assessment

Moderated by **Gilles Thonet**, Deputy Secretary-General of IEC, the panel welcomed **Wafa Ben-Hassine**, Chief of Digital Technology and Human Rights at OHCHR; **Matthias Kloth**, Head of Digital Governance and Sport at the Council of Europe; **Erich Kieck**, Director of Capacity Building at ISO; **Jeremy Ng**, Counsel for AI and Digital Economy at World Bank Group; and **Harry Verweij**, Ambassador-at-Large and Special Envoy on AI for the Government of the Netherlands.

Global developments in AI governance

Panelists emphasized that effective AI governance requires alignment between international law, regulation, human rights frameworks and technical standards.

Panelists noted that standards are increasingly viewed not merely as technical documents but as important governance tools capable of translating normative objectives into operational requirements that organizations can implement and verify.



Figure 48: High-level policy panel on institutional collaboration on AI impact assessment

The Council of Europe Framework Convention and HUDERIA

The Council of Europe explained its Framework Convention on AI and presented [HUDERIA](#) as a practical methodology for assessing AI impacts on human rights, democracy and the rule of law. Participants noted that standards can support implementation by offering structured assessment processes and common terminology.

The role of standards in implementation

- Standards presented included:
 - [ISO/IEC 42001](#) (Artificial Intelligence Management System) provides requirements for establishing and maintaining an AI management system to support governance, accountability and risk management
 - [ISO/IEC 42005](#) (AI System Impact Assessment) provides guidance for assessing AI system impacts in specific deployment contexts and addressing potential societal and organizational consequences
- ISO highlighted how its Capacity Building Journey on AI Policy and Standards brings regulators and national standards bodies together
- Speakers agreed that while laws establish governance objectives, standards provide practical methods for implementing them consistently across jurisdictions



Figure 49: View of the packed session

National and global perspectives on AI governance

The World Bank and the Government of the Netherlands emphasized the importance of governance approaches that can operate across diverse legal and regulatory environments. Standards were identified as a common language that can help align governance practices internationally and support long-term implementation.

Pilot project on AI impact assessment

The session concluded with inputs and ideation for a proposed ISO/IEC pilot project.

The project would apply international standards relating to AI management systems, risk management and impact assessment to a real-life AI deployment. The resulting assessment would then be mapped to legal and policy frameworks, including HUDERIA, to evaluate interoperability across governance approaches.

Potential benefits identified by participants included:

- Demonstrating practical implementation pathways for AI governance
- Generating evidence on synergy between standards and legal frameworks
- Supporting public-sector procurement and outsourcing decisions
- Improving comparability of AI impact assessments across jurisdictions
- Building institutional capacity through practical learning
- Developing common terminology and governance approaches

18.2.2 Technical discussion on AI impact assessment in the real world

Moderated by **Cindy Parokkil**, AI Policy Lead and Capacity Building Programme Manager at ISO, and **Boris Inderbitzin**, External Relations Officer at IEC, the panel welcomed; **Daniel Pap**, Legal Advisor at the Council of Europe; **Nevine Tewfik**, Senior International Relations and Policy Expert at Egypt's Ministry of Communications and Information Technology; **Mauricio Gibson**, Head of International AI Governance at the UK Department for Science, Innovation and Technology (DSIT); **Jeremy Ng**, Counsel for AI and Digital Economy at World Bank Group; **Michel Roberto Oliveira**, Human Rights Officer at OHCHR; and **Susanne Kuch**, German Accreditation Body (DAkkS) and Germany's delegated expert to ISO/IEC JTC 1/SC 42/WG 1 (Foundational Standards).

Cross-community collaboration and lessons learned

Panelists reflected on lessons from collaboration across governments, international organizations, human rights organizations and standards bodies. A key message was that effective AI governance depends on sustained dialogue between technical experts, policymakers, legal professionals, procurement authorities and human rights stakeholders.

The implementation challenge in AI governance

Panelists noted that many governments are moving from developing AI policies to implementing them in practice. Standards were highlighted as an important tool for translating governance principles into structured processes, while long-term capacity building was identified as critical for sustainable AI governance.



Figure 50: Technical discussion on AI impact assessment in the real world

Public procurement as a governance tool

Representatives of Egypt and the UK emphasized the role of public procurement in promoting responsible AI adoption. Procurement guidelines can help embed governance requirements into purchasing decisions and encourage suppliers to strengthen risk management, transparency and accountability practices.

Contextual impact assessment and conformity assessment

The discussion distinguished between conformity assessment and impact assessment in real-world deployment contexts. While certification against standards such as ISO/IEC 42001 demonstrates that an organization has established AI governance processes, assessing impacts in specific environments requires additional context-sensitive evaluation, supported by standards such as ISO/IEC 42005.

18.3 Conclusion and key takeaways

The workshop demonstrated strong consensus that standards are critical for operationalizing trustworthy AI governance.

Several key messages emerged:

- International standards and law-based frameworks should be viewed as complementary rather than competing instruments
- AI governance requires collaboration across legal, policy, technical, human rights, procurement, accreditation and standards communities
- Context matters: AI impact assessments must consider real-world deployment conditions and societal impacts
- Standards such as [ISO/IEC 42001](#) and [ISO/IEC 42005](#) provide practical mechanisms for translating governance principles into operational processes
- Public procurement represents an important policy lever for promoting responsible AI deployment
- Capacity building remains essential to support effective implementation, particularly in developing and emerging economies
- Greater synergy between standards, legal frameworks and human-rights-based methodologies is increasingly needed

A significant workshop outcome was broad support for the proposed ISO/IEC pilot project, which would assess a real-world AI system and map standards-based impact assessment results to frameworks such as HUDERIA. Participants viewed this potential project as an opportunity to generate practical evidence, strengthen international cooperation and advance implementation-oriented AI governance.



Figure 51: All speakers at the workshop on operationalizing AI impact assessment

19 AI foundation model evaluation and standards

19.1 Introduction

A workshop on [*AI foundation model evaluation and standards*](#) organized by CAICT brought together representatives of standards bodies, research institutions and companies to examine the current state and future trajectory of foundation model evaluation, and how international standardization can support trustworthy, interoperable evaluation at global scale.

Foundation models have emerged as core enablers of general-purpose AI. Their capability boundaries and trustworthiness carry direct implications for the digital economy, industrial applications and the evolution of global governance frameworks.

The workshop discussed how standards and evaluation can help guide technological innovation, clarify the conditions for industrial application, and provide a shared basis for international dialogue on AI governance.

19.2 Opening session

Considering the rapid development of foundation models, **Bilel Jamoussi**, Deputy Director of the ITU Telecommunication Standardization Bureau, noted the importance of international standards in providing a common language and shared benchmarks for assessing, comparing and trusting AI systems.



Figure 52: Bilel Jamoussi, Deputy Director of the ITU Telecommunication Standardization Bureau

Yu Xiaohui, President of CAICT, noted that a foundation model evaluation system embodies humanity's value choices regarding the direction of AI development: the way evaluation dimensions and methods are defined will profoundly shape the trajectory of technological evolution and real-world application, making evaluation an important foundation for advancing trustworthy AI while taking into account social equity and sustainable development. He stated that the key to advancing international cooperation on evaluation lies in building global consensus to strengthen coordination on technical approaches to evaluation, while jointly establishing a value orientation of safe, trustworthy, controllable and beneficial AI. Yu Xiaohui also announced the launch of a new CAICT International Initiative on Co-building Foundation Model Evaluation Ecosystems for AI for Good.



Figure 53: Yu Xiaohui, President of CAICT

Wang Jian, Founder of Alibaba Cloud and Director of Zhejiang Lab, noted that foundation models are highly complex systems with capability boundaries that are difficult to delineate accurately even for their own developers, which poses a significant challenge for evaluation. He observed that much of today's evaluation is, in effect, functionality testing of a system. Looking ahead, the community could draw on the approach of human intelligence testing to explore a consistent methodology for measuring machine intelligence. He stated that the significance of evaluation lies not only in scoring and ranking, but more importantly in helping to understand and advance the technology itself.



Figure 54: Wang Jian, Founder of Alibaba Cloud and Director of Zhejiang Lab

The two thematic sessions of the workshop were moderated by **Yuntao Wang**, Professor-Level Senior Engineer at the AI Institute of CAICT and Chair of the ITU Focus Group on Embodied AI for Multimedia Technologies.

19.3 Frontiers of foundation model evaluation and industry practice

Lin Yonghua, Vice-President and Chief Engineer of the Beijing Academy of Artificial Intelligence (BAAI), traced the shift of evaluation focus across four stages – foundation models, reasoning models, agentic systems and embodied AI – and shared BAAI's practices on the faithfulness and token efficiency of reasoning models; domain-specific benchmarks for agentic systems; and embodied AI evaluation covering the model "brain," task execution and physical safety in both simulation and real-hardware settings.

Stéphanie Herlin, Co-Founder of Korabench.ai, presented KORA, an open-source benchmark for child safety built on a taxonomy of 26 risks across three age groups and applied to 39 models, observing that risks specific to generative AI remain the least well managed and inviting the community to contribute to its improvement.

Shivagami Gagan, Chief Technologist for Middle East and Africa at AWS, addressed the safe and scalable deployment of models at enterprise grade, discussing guardrails and policy frameworks, LLM-as-a-judge approaches, reusable policy assets and the management of token economics through intelligent orchestration.

The session concluded with a panel discussion on ***Balancing evaluation capability and responsible development of foundation models*** moderated by **Latif Ladid**, Founder and President of IPv6 Forum, Chair of the AI & Blockchain Global Forum, and Founder of the

EU Public Safety Forum. The panel welcomed **Lin Yonghua**, Vice-President and Chief Engineer of BAAI; **Max Stauffer**, Founder and CEO of the Simon Institute for Longterm Governance; **Arnaud Taddei**, Chair of [ITU-T Study Group 17 \(Security\)](#); and **Chang Xin**, Vice-President of Standardization and Industry Development at Huawei.

The discussion converged on several shared observations.

A gap exists between today's largely static benchmarks and the dynamic, agentic settings in which models are increasingly deployed. Evaluation is expected to evolve towards dynamic, continuous approaches operating under reasonable cost constraints.

As the unit of deployment shifts from single models to systems of interacting agents, evaluation needs to take a systemic perspective, including cascading and coupling risks along multi-step, multi-tool task chains and the collective behaviour of multiple agents.

Certain risks may only become observable after deployment, for example when general reasoning capabilities allow models to re-derive sensitive knowledge or when risks emerge from interactions among agents. Evaluation should therefore extend into the post-deployment phase and inform corresponding governance decisions.

Evaluation capabilities are unevenly distributed globally, highlighting the value of supporting more countries and regions in building local evaluation capacity as well as strengthening the role of third-party evaluators.



Figure 55: Panel discussion on balancing evaluation capability and responsible development of foundation models

19.4 Standardization pathways and international synergies for foundation models

Adrianna Tan, Founder of Future Ethics Lab, discussed red teaming, benchmarks and other tools for downstream AI assurance, highlighting multilingual and cross-cultural gaps in current testing, the value of broader public participation, and the importance of communicating evaluation in plain language.

Nicolas Mialhe, Co-Founder of AI Safety Connect, addressed what he termed the "missing metrology": as AI shifts towards large-scale stochastic systems, a solid science of measurement is needed, particularly for assessing the robustness of model refusal mechanisms under adversarial conditions. He suggested that the community converge on verifiable, dynamic and interoperable evaluation methods as a form of global public infrastructure.

Wei Kai, Director of the AI Institute at CAICT, presented CAICT's evaluation practice based on the ITU standard [ITU-T F.748.44](#) and its relationship with international standardization, which is described in the following section.

The session concluded with a panel discussion on *Standardization pathways and international synergies for foundation models* moderated by **Wei Kai**. The panel welcomed **Gilles Thonet**, Deputy Secretary-General of IEC; **Nicolas Mialhe**; **Tian Li**, Head of Standards Strategy at ZTE Corporation; and **Kangchan Lee**, Director of Strategic Standards Research at ETRI, Vice-Chair of ITU-T Study Group 13 and Chair of its Working Party 2, and Chair of ITU's Joint Coordination Activity on AI.

The discussion converged on several shared observations:

Given that model iteration is far faster than traditional standardization cycles, standards may usefully focus on the relatively stable layers of methodology, frameworks and classification, while specific tools, metrics and datasets evolve dynamically through open-source collaboration under the same framework – a combination that can help narrow the gap between standardization cycles and the pace of technology.

Establishing common definitions and shared understanding of core concepts such as a "foundation model" or "AI agent" is a basic precondition for evaluation standardization and coordination among organizations. Currently, there are differing interpretations across standards bodies and jurisdictions.

Collaboration among standards bodies could move beyond information exchange towards earlier identification of overlaps and, where appropriate, joint standards development. The discussions also noted that industrial adoption remains the ultimate test of a standard's value.

Fourth, evaluation oriented towards real industrial scenarios helps bridge the gap between laboratory scores and real-world performance, and evaluation results can in turn feed back into the refinement of standards.



Figure 56: Panel discussion on standardization pathways and international synergies for foundation models

In his closing remarks, **Noah Luo**, Senior Consultant at Huawei and Chair of ITU-T Study Group 21, reviewed the Study Group's portfolio of AI-related standards and noted that foundation model evaluation constitutes a critical part of this work. He invited experts and organizations worldwide to bring their evaluation methods, testing data and industry practices into ITU, including the ITU Focus Group on Embodied AI for Multimedia Technologies.



Figure 57: Noah Luo, Chair of ITU-T Study Group 21

19.5 Assessment criteria for foundation models

As foundation model capabilities advance, evaluation faces a set of common challenges: benchmark saturation as top-model scores approach their ceilings; possible leakage of public test data into training corpora; divergence between laboratory scores and real-world industrial performance; the limitations of static, single-turn testing for complex tasks; and fragmented metrics and datasets that hinder fair comparison.

The ITU standard ITU-T F.748.44 establishes a common language for measurement, aiming to help model capability comparison move towards harmonized benchmarks. It aims to support public, reusable and continuously improvable infrastructure for collaboration.

Box 8: ITU-T F.748.44 (Assessment criteria for foundation models: Benchmark)

Developed by ITU-T Study Group 21, ITU-T F.748.44 defines four core elements of a benchmark system:

- Testing capabilities (what to evaluate)
- Testing methods (how to evaluate)
- Testing datasets (what to use for evaluation)
- Testing tools (how to execute the evaluation).

New ITU standards under development will extend this framework to multimodal and other foundation models, security benchmarks, AI agents and vertical applications.



Figure 58: Wei Kai presenting ITU-T F.748.44

The FactTesting evaluation system presented by **Wei Kai** showed how this international standard is implemented at scale in China. CAICT developed FactTesting by building on ITU-T F.748.44 and working with partners from industry and academia. The system adopts a five-in-one testing paradigm spanning basic, general, application, industry and advanced-intelligence-oriented tests. It covers language, multimodal, code and agent capabilities and extends into sectors such as manufacturing, energy, finance and transportation. Since its first release in 2023, it has completed more than 1,500 model assessments, built a pool of 8.5 million test items, and adopted adaptive dynamic sampling to reduce the impact of benchmark gaming. It has four main characteristics: standard-driven, application-oriented, dynamic testing and well-established practice. Considering the potential for results and experience with this large-scale evaluation activity to inform further standardization, CAICT expressed its readiness to share methods, data and lessons learned with the global community.

19.6 International initiative on co-building foundation model evaluation ecosystems

The new CAICT International Initiative on Co-building Foundation Model Evaluation Ecosystems for AI for Good presented by **Yu Xiaohui**, President of CAICT. The initiative calls on companies, research institutions and all other relevant stakeholders to work together to build an open, trusted ecosystem for foundation model evaluation.

The initiative sets out ten areas of action, summarized as follows:

Box 9: Areas of action

1. **Recognizing the value of evaluation:** The value of foundation model evaluation lies in guiding technological progress, advancing real-world deployment, and fostering industrial development. We call on the industry to fully recognize the core value of evaluation in driving technological advancement and responsible application.
2. **Driving evaluation innovation:** Innovation in testing technologies is a vital driver for advancing foundation model capabilities. We call on the industry to closely follow frontier developments in international AI testing, collaboratively advance innovation in foundation model evaluation technologies, and ensure that evaluation methodologies effectively address emerging capabilities.
3. **Strengthening evaluation frameworks:** Scientific standards and specifications are essential to ensuring evaluation validity. We call on the industry to jointly establish and continuously update foundation model evaluation standards and specifications, to build a scientific, comprehensive, and open evaluation framework, to promote the open-source sharing of testing datasets, testing tools, and testing frameworks, and to promote open, voluntary, and mutually beneficial mechanisms for the recognition of evaluation results.
4. **Enhancing data foundations:** High-quality testing datasets are essential for fully exploring the capability boundaries of foundation models. We call on the industry to accelerate the construction of more comprehensive, diverse, and multilingual high-quality testing datasets that adequately reflect application scenarios across different cultural and linguistic contexts, providing robust support for optimizing and improving foundation models.
5. **Enabling industrial applications:** Current foundation model evaluation, which focuses on general capabilities, remains insufficiently aligned with real-world applications. We call on the industry to accelerate the development of testing methodologies oriented toward practical industrial scenarios, to design professional testing scenarios targeting key sectors such as manufacturing, energy, transportation, healthcare, and education, and to address the technical challenges encountered in industrial deployment.
6. **Fostering open collaboration:** An open and shared evaluation ecosystem is the cornerstone for the continuous advancement of foundation model evaluation. We call

on enterprises, universities, research institutions, open-source communities, international organizations, and other diverse stakeholders to deepen cooperation, share evaluation resources, establish regular international dialogue and collaboration mechanisms, to advance capacity-building, knowledge-sharing and technical cooperation in AI evaluation.

7. **Ensuring evaluation transparency:** Public disclosure of testing information is key to the authority and credibility of evaluation. We call on evaluation leaderboard publishers to disclose essential information, including testing frameworks and methodologies, thereby enhancing the transparency of the evaluation process.
8. **Ensuring integrity of evaluation:** Establishing comprehensive oversight mechanisms is essential for ensuring the accuracy and reliability of evaluation results. We call on evaluation leaderboard publishers to implement such mechanisms to safeguard the fairness and consistency of the evaluation process.
9. **Promoting interoperability of evaluation standards:** The coordination and interoperability of evaluation standards are key to preventing the fragmentation of global governance. We call on the industry to strengthen coordination and cooperation with international standardization organizations and relevant international institutions, to advance the international alignment and mutual recognition of foundation model evaluation standards, and to foster an open, fair, and inclusive international environment for cooperation in foundation model evaluation.
10. **Promoting AI for Good:** The goal of AI technology is to serve the common well-being of humanity and sustainable development. We call on the industry to embed the principles of trustworthy, and beneficial AI throughout the evaluation and development lifecycle of foundation models, to use evaluation frameworks to guide foundation model technologies in contributing positively to healthcare, educational equity, scientific research, and sustainable development, and to ensure that the Global South and developing economies benefit equitably.

20 AI for manufacturing: Pharmaceutical industry innovation, applications and standards development

20.1 Introduction

A workshop on [*AI for manufacturing: Pharmaceutical industry innovation, applications and standards*](#) addressed the growing role of AI across the pharmaceutical industry value chain, from drug discovery and development to manufacturing, quality management, supply-chain coordination and post-market activities. It focused on how AI-enabled innovation can be translated into practical industrial applications, while considering the requirements of a highly regulated sector where trust, evidence, data integrity, safety and accountability are essential. It provided a platform to exchange experience on AI applications in pharmaceutical

and health-product contexts and to discuss technical and standardization conditions that can support responsible implementation.

Discussions on *Global strategic perspectives* focused on the strategic conditions for responsible AI adoption in the pharmaceutical sector, covering governance, innovation, local production, equitable access and standardization. Discussions on *Case studies on AI applications in the pharmaceutical industry* presented practical applications in pharmaceutical manufacturing, drug discovery, programmable biology, outbreak response and precision medicine.

20.2 Objectives and structure

The workshop explored how technical standardization may support common terminology, interoperability, documentation, performance evaluation, risk management and lifecycle governance in areas where AI is increasingly being deployed.

It aimed to:

- Exchange practical experience with the use of AI across the pharmaceutical industry value chain
- Identify common implementation challenges related to data, model evaluation, regulatory alignment, quality management, engineering deployment and organizational capability
- Examine how technical standards and shared methods can support trustworthy and scalable AI applications in pharmaceutical contexts
- Promote international dialogue among industry, research institutions, standards bodies, international organizations and other relevant stakeholders

20.3 Standardization relevance

Several speakers noted that AI applications in pharmaceutical contexts draw on multiple existing bodies of standards and guidance, including those related to AI, software lifecycle management, data governance, health data, cybersecurity, quality systems, data integrity and pharmaceutical manufacturing. In addition to discussing potential for new standards, participants emphasized the need to coordinate and apply existing standards.

The session highlighted a possible role for technical standardization in the following areas:

- Common terminology for AI-enabled pharmaceutical applications
- AI-ready data, metadata, provenance and data-quality requirements
- Interoperability across data systems, laboratory systems, manufacturing systems and digital platforms
- Context-of-use-based model evaluation and validation
- Documentation and traceability for AI models, datasets and system changes
- Deployment architectures for regulated or quality-critical environments
- Human oversight, accountability and third-party responsibility
- Competency frameworks and shared validation capabilities

Discussions noted that technical standards can help establish common language, baseline technical methods, documentation practices and interoperability conditions, while regulators

remain responsible for legal, evidentiary and approval decisions. In pharmaceutical settings, AI deployment must be aligned with applicable regulatory and quality requirements.

Table 6: Standardization issues identified during the session

Area	Standardization relevance	Possible follow-up direction
Data governance	AI systems require structured, traceable and context-rich data.	AI-ready data and metadata requirements.
Interoperability	Pharmaceutical data are distributed across R&D, clinical, manufacturing, quality and supply-chain systems.	Common interfaces, semantic models and data-exchange methods.
Model evaluation	AI performance must be assessed in relation to a defined context of use.	Context-of-use-based evaluation methods.
Trustworthy deployment	AI systems used in regulated environments require documentation, lifecycle control and oversight.	Deployment, monitoring and change-control guidance.
Capacity-building	AI adoption requires interdisciplinary capability across technical, regulatory, quality and clinical domains.	Competency frameworks and training resources.

20.4 Global strategic perspectives

Moderated by **Simão Campos**, Deputy Chief of the Study Group and Policy Department of the ITU Telecommunication Standardization Bureau, the first session examined the strategic, scientific, public-health and standardization conditions required for the responsible adoption of AI in pharmaceutical and health-product contexts.

Dennis Chornenky, Founder and Chief Executive Officer of Domelabs AI, addressed "AI governance, compliance and pathways for industry adoption." He identified AI strategy, governance policies and adoption roadmaps as core organizational capabilities and discussed risk assessment, decision authority, context-of-use validation, lifecycle monitoring, vendor assessment, cybersecurity and accountability as elements of operational AI governance.

Vaibhava Lakshmi Ravideshik, Research Lead at the MIT Kellis Lab, presented "Multimodal AI, biomedical knowledge graphs and foundation models for pharmaceutical innovation." She described biomedical ontologies and knowledge graphs as structured vocabularies and relationships that can support more traceable model outputs. Her presentation also identified fragmented vocabularies as an interoperability challenge and referred to the value of common, published methods for reproducible model evaluation.

should be to coordinate relevant existing standards for AI-enabled pharmaceutical use cases and develop new specifications only where genuine gaps remain.

The issues identified in his presentation included AI-ready data and metadata, evaluation linked to defined contexts of use, deployment in good practices (GxP)-related environments, human oversight, third-party accountability, consistent terminology, competency frameworks and shared validation capabilities.



Figure 61: Dong Min presenting on why trust starts with standards

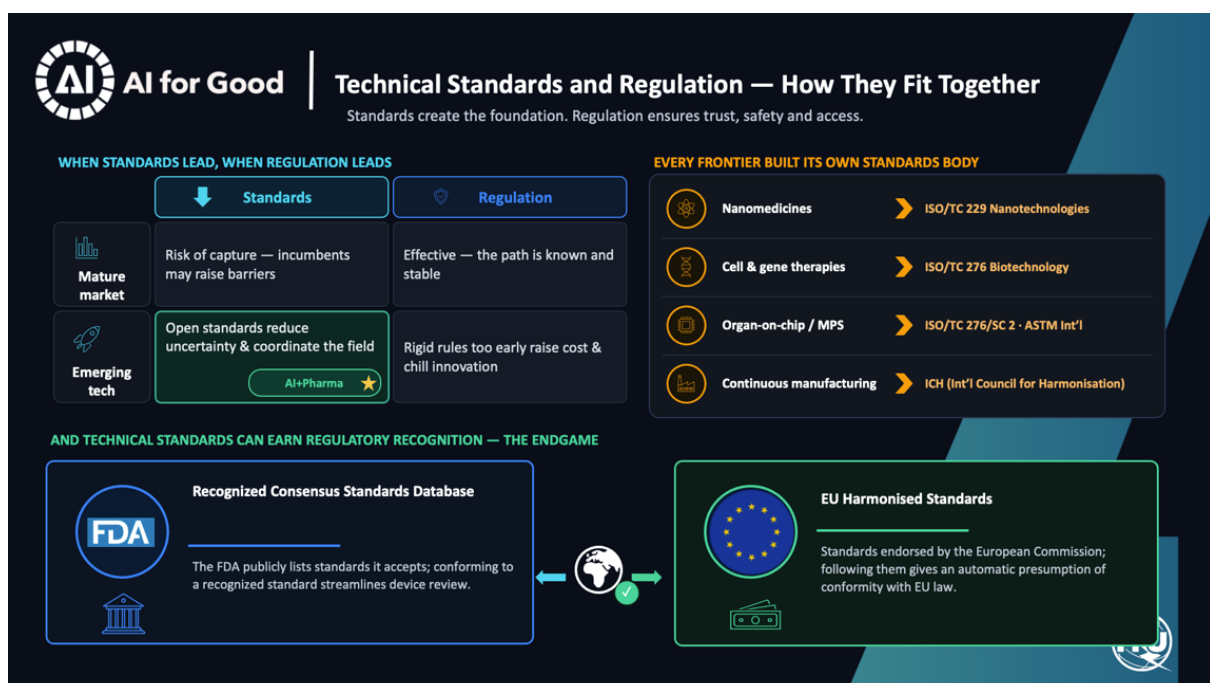


Figure 62: Technical standards and regulation as complementary pathways to trust, safety and access

20.5 Case studies on AI applications in the pharmaceutical industry

Moderated by **Noah Luo**, Senior Consultant at Huawei and Chair of ITU-T Study Group 21, the second session presented practical examples of AI applications in manufacturing, drug discovery, programmable biology, outbreak response and precision medicine. The case studies illustrated both the expanding scope of AI-enabled innovation and the implementation conditions required for wider adoption.

Andrew Whytock, Head of Thought Leadership for the Life Sciences Sector at Siemens, presented "AI-enabled digital transformation in pharmaceutical manufacturing." He described a “molecule-to-market” approach connecting research, development, manufacturing and supply chains through a common digital foundation. His presentation emphasized interoperable systems, standardized interfaces, contextualized data and unified semantic models as conditions for digital continuity across equipment, processes and products.



Figure 63: Andrew Whytock presenting on AI-enabled digital transformation in pharmaceutical manufacturing



Figure 64: Siemens’ connected transformation from laboratories to manufacturing and supply chains

Alex Aliper, President of Insilico Medicine, presented generative AI applications in target discovery, molecular design, structure-informed optimization and candidate selection. He described domain-specific benchmark and training resources and examples that progressed from computational design to synthesis, testing and experimental validation.

Chris Lai, Co-Founder and CEO of METiS TechBio, presented AI-driven nanodelivery platforms and programmable biology. He described the use of computational modelling, generative design, experimental screening and feedback from wet-lab and preclinical studies in the design of lipid nanoparticles and targeted delivery systems.

Pascal Mayer, CEO of Alphanosos, addressed AI-driven therapeutic discovery for emerging outbreaks. He presented an AI-guided iterative screening approach, in-vitro assays performed by an independent research organization, subsequent animal-model validation and a proposed rapid-response workflow linking pathogen sequencing with candidate selection for evaluation.

Yu Zhao, Co-Founder of Phil Rivers Technology and Deputy Director of the Turing-Darwin Laboratory, presented a human-disease-drug digital twin approach in computational medicine. His presentation described the integration of clinical, imaging, pathology and multi-omics data for individualized risk assessment, together with virtual clinical trials and subsequent evaluation using patient data and investigator-initiated studies.

20.6 Closing remarks

In his closing remarks, **Seizo Onoe**, Director of the ITU Telecommunication Standardization Bureau, noted that the pharmaceutical sector is highly regulated and that progress in AI should be grounded in evidence, transparency and human oversight. He highlighted secure

data exchange, interoperability and globally coordinated technical standards as foundations for scaling AI-enabled innovation across organizations, sectors and borders.

Yu Xiaohui, President of CAICT, emphasized that pharmaceutical data remain fragmented across the value chain, that evaluation methods need to be aligned with application scenarios, and that moving from proof of concept to industrial deployment requires strong engineering, validation, risk-management and compliance capabilities. He called for continued cooperation on application promotion, standards development and capacity building, and noted that standards coordination can help establish a common technical language for data governance, model evaluation, risk management and interoperability.

20.7 Conclusion and key takeaways

The session showed that AI is increasingly being applied across the pharmaceutical lifecycle, including drug discovery, development, manufacturing, quality management, supply-chain coordination and post-market activities. The case studies demonstrated innovation potential, while the strategic discussions emphasized that implementation in pharmaceutical contexts requires trust, documentation, validation and governance.

Several common implementation challenges emerged:

- Data remain fragmented across institutions, systems and stages of the value chain
- Terminology and data models are not sufficiently harmonized
- AI evaluation methods are often not tied to clearly defined contexts of use
- Model transparency, explainability, reproducibility and traceability remain critical concerns
- Integration with quality systems, GxP-related processes and regulatory expectations requires further work
- Engineering deployment, lifecycle monitoring, cybersecurity and human oversight need to be strengthened
- Capabilities differ across countries, institutions and enterprises, affecting equitable access to AI-enabled innovation

The session identified several areas where technical standards and shared methods may help support responsible implementation:

- AI-ready data and metadata
- Interoperable data and system architectures
- Context-of-use-based model evaluation
- Risk management and lifecycle governance
- Documentation, traceability and change control
- Deployment in regulated or quality-critical environments
- Competency frameworks and shared validation capability

These issues raised by speakers and participants may inform future dialogue among pharmaceutical companies, technology providers, researchers, standards and testing bodies, regulators, international organizations and other stakeholders.



Figure 65: Group photo of speakers and organizers of the workshop

21Cities that think and act: Agentic AI, physical AI and the citiverse

21.1Introduction

A workshop on [*Cities that think and act: Agentic AI, physical AI and the citiverse*](#) convened ministers, mayors, city officials, UN leaders, standards experts and industry. It examined how AI, digital twins and immersive technologies are moving from pilots to urban systems that can sense, simulate, predict and act. Discussions addressed the interoperability, leadership, institutions, skills, financing, data and partnerships required for responsible city-wide deployment.

The workshop drew on the standardization work of ITU-T Study Group 20 and the implementation work of two other global platforms: the [United for Smart Sustainable Cities Initiative \(U4SSC\)](#) and the [Global Initiative on AI, Digital Twins and Virtual Worlds: *Discovering the Citiverse*](#). 17 new publications were launched, translating emerging concepts into practical frameworks, case studies and tools for city leaders. The workshop also highlighted the newly established [ITU Focus Group on AI for Smart Sustainable Cities and Communities](#).

21.2Standards and global initiatives: Foundations for cities and communities in the age of AI

21.2.1Standards are the infrastructure beneath urban intelligence

Agentic and physical AI can scale only when urban data, platforms, digital twins, devices and services operate under shared requirements. ITU-T Study Group 20 develops international standards for IoT, digital twins and smart sustainable cities, enabling systems to connect across agencies and suppliers while supporting security, accessibility, trust and human-centred deployment.

Box 10: Standards work relevant to AI for cities and citiverse

In the spotlight: ITU-T Y.4505 (Minimal interoperability mechanisms for smart and sustainable cities and communities)

The ITU standard [ITU-T Y.4505](#) defines Minimal Interoperability Mechanisms (MIMs), a minimal yet sufficient foundation for data, platforms and services to work together. For agentic and physical AI, shared interfaces and pivotal points of interoperability enable reliable coordination across mobility, energy, emergency response and public services, while supporting reuse and reducing fragmentation and vendor lock-in.

Ongoing ITU-T Study Group 20 work related to AI and the citiverse includes:

- Requirements of AI-integrated digital twin for cities and communities
- Requirements for AI-enabled interoperability in citiverse
- Requirements and framework for AI agent system in industrial IoT environment
- Guide on the use of embodied AI for smart sustainable cities

Together, these work items address the technical foundations needed to connect AI, digital twins, IoT systems and urban platforms in a trusted, interoperable and scalable manner.

21.2.2 New Focus Group provides open bridge from emerging practice to standards

Reporting to ITU-T Study Group 20, the ITU Focus Group on AI for Smart Sustainable Cities and Communities established in May 2026 will examine the integration requirements, interfaces, coordination mechanisms and frameworks needed for AI technologies to interoperate safely and effectively with IoT, digital twins and smart-city systems.

21.2.3 Global platforms translating standards into city action

The following initiatives translate international standards and emerging technologies into practical tools, shared knowledge and implementation pathways for cities. By connecting policy, technical expertise and city experience, they support scalable, people-centred action.

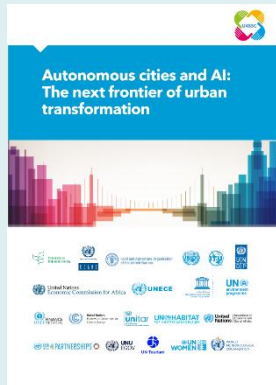
Box 11: United for Smart Sustainable Cities (U4SSC) Initiative

[U4SSC](#) is a global UN platform coordinated by ITU, UNECE and UN-Habitat, with support from 19 UN entities. It provides a neutral platform for cities, governments, experts and partners to advance the Sustainable Development Goals, the Pact for the Future and the New Urban Agenda. U4SSC Key Performance Indicators, based on the ITU standard [ITU-T Y.4903](#), are being implemented in more than 300 cities. Four new working groups were launched during the AI for Good Global Summit and UN Global Dialogue on AI Governance:

- Future of economy
- Future of work
- Future of government

- Guiding principles and frameworks for people-centred smart cities in the AI era (co-led by ITU and UN-Habitat)

New U4SSC reports include:

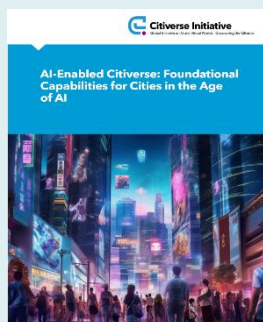


- [Autonomous cities and AI: The next frontier of urban transformation](#)
- [Case study: AI-driven autonomous urban systems in Valencia, Spain](#)
- [Case study: Autonomous urban systems in Songdo, Republic of Korea](#)
- [Case study: Shenzhen's autonomous public transportation](#)
- [Case study: Dubai's self-driving transport strategy](#)
- [Case study: Guna's journey towards an autonomous city, Madhya Pradesh, India](#)
- [Case study: Autonomous urban mobility and smart city innovation in Calgary, Canada](#)
- [Case study: AI-driven urban transformation and autonomous systems in Budapest, Hungary](#)
- [Case study: Beijing's autonomous intelligent signal light, China](#)
- [Case study: Zaozhuang High-tech Industrial Development Zone, Shandong, China](#)

Box 12: Global Initiative on AI, Digital Twins and Virtual Worlds: *Discovering the Citiverse*

Launched by ITU, UNICC and Digital Dubai and supported by more than 70 international partners, the [initiative](#) advances the AI-enabled citiverse where AI, spatial intelligence, digital twins and immersive environments converge. It connects governments, cities, industry, academia and the UN system to promote safe, open, interoperable and human-centred digital ecosystems.

New reports from the initiative include:



- [AI-Enabled Citiverse: Foundational Capabilities for Cities in the Age of AI](#)
- [AI-Enabled Citiverse: Use Cases for Cities in the Age of AI](#)
 - [City Administration, Services and Public Participation](#)
 - [Urban Planning, Placemaking and Infrastructure](#)
 - [Economic Development, Education and Tourism](#)
 - [Public Safety, Health and Disaster Resilience](#)
 - [Transport and Mobility](#)

21.3 Key highlights

The following highlights capture the main messages and perspectives shared by speakers across the workshop's keynote, high-level and technical sessions.

21.3.1 Putting people at the centre

Master of Ceremonies **Gamze Hakli Geray**, Adjunct Faculty Lecturer at Middlesex University Dubai and Co-Leader of the U4SSC Thematic Group on Digital Transformation

Assessment of People-Centred Cities, asked what happens when cities move from sensing to thinking and acting, while stressing that cities remain about people.

H.E. Angellah Jasmine Mbelwa Kairuki, Minister of Communication and Information Technology for Tanzania, called for inclusive-by-design systems shaped by developing countries.

Christina Kitsos, Mayor of Geneva and President of the Global Cities Hub, described AI and humanoid robotics as a technological, social and anthropological revolution, highlighting opportunities and risks related to employment, the environment, democracy and power.

21.3.2 Human accountability must accompany automated decisions

In the keynote "Who still decides? AI, cities and the human who answers," moderator **Anita Perera**, Knowledge Management AI Lead at Accenture, introduced the boundary between automation and human judgement.

Marco Camisani Calzolari, Founder of Cyberhumanism, argued that the most dangerous gap in AI governance is cognitive: the distance between what AI actually does and what decision-makers believe it does. As systems move from recommendations to action, cities must distinguish routine automation from the delegation of consequential judgement.

21.3.3 Leadership turns technology into public value

Moderated by **Aline Matta**, Head of the Geneva Office of UN-Habitat, the first high-level segment examined how leadership, investment, partnerships and standards turn innovation into public value.

H.E. William Kabogo Gitau, Cabinet Secretary of Kenya, said adoption depends on trust, reliability, visible value, political continuity, financing and citizen ownership.

Cristina Bueti, Counsellor of ITU-T Study Group 20, described standards as an "ambassador of trust" across jurisdictions and urged cities to start with public needs, prevent a new digital divide, and take advantage of U4SSC and the Global Initiative on AI, Digital Twins and Virtual Worlds: *Discovering the Citiverse*.

Antonio Jara, Executive Board Member of Libelium, presented physical intelligence as the convergence of IoT, data spaces and AI, requiring governance, interoperability, cybersecurity, skills, financing and public trust.

21.3.4 From prediction to coordinated real-world action

Moderator **Judit Kozenkow**, Economist at Kozenkow Advisory, linked agentic AI and the citiverse with interoperability, trusted governance and human-centred action.

Okan Geray, Steering Committee Chair of the Global Initiative on AI, Digital Twins and Virtual Worlds: *Discovering the Citiverse*, identified five trends – world models, agentic AI, physical or embodied AI, AI-native virtual worlds and digital twins – that can move cities from prediction to coordinated action when matched by strong governance.

21.3.5 Institutional capacity is the real implementation layer

Moderated by **Peter Sailer**, Project Director at GIZ, the second high-level segment focused on institutional readiness, skills, data governance, procurement and measurable results.

H.E. Yasir Al Naqbi, Director General of GovAcademy in Abu Dhabi's Department of Government Enablement, stressed that AI-enabled cities are ultimately about people. Abu Dhabi's AI-native ambition is supported by an AI-fluent workforce and Tomouh, a personalized learning platform designed to enable smarter, more responsive and more human public services.

Tatiana Roque, Secretary of Science and Technology for Rio de Janeiro, linked AI deployment with inclusion and technological sovereignty through community technology hubs and stronger public capacity to govern strategic data.

Dino Cataldo Dell'Accio, Deputy Chief Executive of the UN Joint Staff Pension Fund, emphasized readiness, digital identity and independent evaluation, and highlighted the [City leader's field guide: Preparing for the AI-enabled citiverse](#) as a practical tool to help cities assess their current capabilities, identify gaps and define a pathway from ambition to implementation.

21.3.6 Trust at scale requires accessibility, open standards and a city voice

In the third high-level segment, moderator **Kamelia Kemileva**, Co-Director of the Global Cities Hub, highlighted three principles: AI should improve quality of life and human well-being rather than maximize efficiency alone; governance should strengthen institutional resilience and continuity of essential services; and local and regional governments should be systematically included in global AI governance discussions.

Paola Cecchi Di Meglio, Professor at Harvard University, called for accessibility by design, non-proprietary standards, and multistakeholder participation in the Global Initiative on AI, Digital Twins and Virtual Worlds: *Discovering the Citiverse*.

Karen Lassmann, Head of Smart City and Data Management at the Berlin Senate Chancellery, identified skills, transparency and data availability as essentials for trustworthy public administration.

Martin Brynskov, Founding Board Director at Open & Agile Smart Cities & Communities (OASC), called for a stronger city voice where standards, governance and terms for data use are set.

21.3.7 Building the foundational capabilities of the AI-enabled citiverse

Sameer Chauhan, Director of UNICC, launched [AI-enabled citiverse: Foundational capabilities for cities in the age of AI](#), a new publication that provides a practical framework to help cities translate advances in AI into trusted public value. He emphasized that lasting impact depends not only on technology, but on building interoperable, secure and human-centred capabilities that strengthen governance, resilience and sustainable urban development.

21.4 Closing message: standardization turns intelligence into opportunity

Hyoung Jun Kim, Chair of ITU-T Study Group 20, closed the workshop by emphasizing that trust, cooperation and international standards are essential to transform innovation into scalable solutions. As cities become more intelligent, their success should be measured by how effectively technology improves people's lives.

21.5 Conclusion and key takeaways

The workshop demonstrated that AI-enabled urban transformation is not simply a race to acquire new technologies. It is a policy, standards and capability-building agenda. Lasting public value will depend on whether cities can combine interoperable technical foundations with accountable institutions, skilled people, sustainable financing and meaningful public participation.

Key takeaways included:

- **Start with public value:** AI, digital twins and immersive technologies should be deployed to address clearly defined urban challenges and improve services, resilience and inclusion.
- **Build interoperability before autonomy:** In the age of AI, international standards are essential for cities to enable systems to work across departments, sectors and suppliers while reducing fragmentation and vendor lock-in.
- **Keep people at the centre:** AI-supported decisions that affect rights, access to services or public resources must remain accountable and contestable.
- **Advance international standardization:** Further work is needed on AI-integrated digital twins, citiverse interoperability, and AI for cities and communities.
- **Strengthen global collaboration:** Platforms such as U4SSC and the Global Initiative on AI, Digital Twins and Virtual Worlds: Discovering the Citiverse can help connect standards development with city experience, implementation evidence and practical capacity building.



Figure 66: Pictures from the workshop on AI and cities

22 Designing the trust management for Agentic AI

A workshop on [*Designing the trust management for Agentic AI*](#) examined how trust should be designed, implemented, assessed and standardized as AI systems move beyond advisory output generation towards autonomous digital participation.

Discussions framed the central shift as one from models that recommend to agents that perceive, decide, delegate, use tools and act on behalf of humans or organizations. In this setting, trust cannot remain an implicit assumption anchored in a human decision-maker; it needs to become explicit, measurable, enforceable and auditable throughout the agent lifecycle.

The workshop was the third in a series of 2026 workshops organized by ITU-T Study Group 17 to address security and privacy challenges associated with agentic AI.

A shared message was reiterated: trust cannot be reduced to identity alone. Agentic trust requires an accountable chain linking human or organizational intent, delegated authority, agent identity, permitted capabilities, runtime behaviour, evidence and post-action accountability. The need becomes sharper in multi-agent systems, where authority and intent can pass through orchestrators, sub-agents, tools, platforms and organizational boundaries. As a result, trust management for agentic AI should address not only model safety, but also control-plane architecture, runtime enforcement, auditability, dynamic authorization, behaviour tracing, cross-organization federation, continuous assessment and cross-border interoperability.

The workshop also highlighted the standardization opportunity for ITU-T Study Group 17. Presentations pointed to agent identity, delegation, trust federation, authenticated provenance, dynamic risk and autonomy classification, runtime policy enforcement, cryptographic assurance, compliance attestation, audit trail interoperability, security benchmarks, and evaluation methods for agentic behaviour as priority areas.

The workshop also announced the launch of the new [ITU Focus Group on Trust and Identity for Humans and Agentic AI](#). Reporting to ITU-T Study Group 17, the Focus Group was established in June 2026 as a global pre-standardization initiative aimed at ensuring that autonomous AI agents are explicitly identifiable, verifiable and bound by human oversight.

23 Agentic AI: Architecture and standards for next-generation AI agents

23.1 Introduction

As AI moves from static models towards autonomous agents that can reason and plan, robust technical foundations are needed to support this shift.

A workshop on [Agentic AI: Architecture and standards for next-generation AI agents](#) examined the emerging ecosystem of agentic AI, with a focus on the architecture and orchestration frameworks required for multi-agent systems, as well as interoperability protocols and standards needed to deploy autonomous agents safely, at scale and transparently across different technical environments.

AI is entering a new phase in which systems no longer simply answer questions but act as agents that reason, plan and collaborate. This autonomy brings new opportunities but also raises questions that standardization will need to address. Two challenges are central. First, when many agents are combined into a single system and their behaviour is non-deterministic, measuring whether each agent is doing its job well remains an open problem. Second, in multi-agent environments, agents from different systems and operators must work together, which requires shared protocols for how they discover one another, coordinate and stay accountable. The central question is therefore not only how to make agents smarter, but how to make them trustworthy, measurable and safe enough to deploy in networks that serve the public.

Beyond software frameworks, the workshop considered the convergence of AI and telecommunications, in particular how agentic AI will shape next-generation AI-native networks. These questions are especially relevant to network operations, in areas such as dynamic spectrum management, self-optimizing resource allocation, autonomous fault recovery, and predictive traffic orchestration for massive IoT connectivity.

The workshop's presentations spanned the practical lessons of building and evaluating agents, the protocols and semantic layers needed for agents to communicate, emerging standards for agent and resource discovery, the role of sandboxes and world models in validation, and open challenges that test agentic AI on real telecom-troubleshooting tasks. Together, these contributions pointed towards the technical foundations and shared evaluation frameworks that agentic AI will require as it moves into production and into the network.



Figure 67: Opening of the agentic AI workshop

23.2 Workshop structure

The workshop was structured as two sessions: ***Blueprint of autonomy: Architectures and orchestration*** and ***Applications of AI agents in telco and standards***.

The first session focused on architecture, orchestration and building blocks of agentic AI systems by exploring the foundational components required to run reliable multi-agent systems.

The second session focused on future-proofing, international standards and telco integration of AI agents by addressing how agentic AI interfaces with next-generation network architectures and standard-setting bodies.

23.3 Building, evaluating and connecting AI agents

The first part of the workshop focused on the practical realities of building agents, testing their reliability and connecting them across telecom networks. A common thread was that agents unlock new capabilities but behave non-deterministically, making reliability, evaluation and domain grounding as important as capability itself.

The main points discussed are summarized below:

An agent combines a model with tools and an orchestration layer that lets it reason, plan and act in a loop. Drawing on Google's experience, the principal challenge in building agents is evaluation. A correct final answer does not by itself show that an agent is working, since the same result may occur by chance, so evaluation must assess not only the outcome but the trajectory by which the agent reaches it – its reasoning, tool calls and their order. Numerical metrics tracked over time serve as a useful first filter, but anything passing that filter still needs deeper assessment. For this, using an LLM or a dedicated agent as a judge is more scalable,

and it works best when rubric-based criteria are defined together with domain experts rather than left open-ended. Even then, human evaluation remains necessary in some cases, while guardrails such as callbacks enforce checks at sensitive points in a workflow. Underlying all of this is a shift in mindset: evaluation belongs from the outset rather than as an afterthought, and its aim is to track whether an agent is improving rather than to reach perfection.

Simulation-Based AI (SBAI) offers a way to make agents more reliable on telecom troubleshooting. Many diagnosis tasks are deduction problems, in which a hidden cause must be inferred from incomplete observations by querying the system. LLMs struggle here, because they often exhibit a gap between describing a solution and executing it: a model can explain how to solve such a task yet perform poorly when asked to carry it out. Pairing an LLM with explicit models, solvers and information-theoretic reasoning addresses this gap, with the LLM handling data extraction and orchestration while a solver performs the reasoning. Building on this, a joint-hypothesis agent reasons at once about the nature of a fault and its location, selecting each action to maximize the information gained per unit of cost and reducing uncertainty until it is confident enough to answer. The result is higher accuracy at sharply lower token cost, since a small model can make a single reasoning call and a series of fast tool calls rather than many expensive ones, allowing weaker and cheaper models to perform well.

Specialized agents can use the flexibility of LLMs to execute narrow tasks, but to be useful they must run reliably and predictably at low cost and high volume, and frameworks for assessing this reliability remain a major gap. Using consent verification for intellectual property as a grounding case, a controlled prompt-chaining pipeline of small, single-purpose agents proved more reliable and auditable than a single general-purpose agent, because responsibilities are isolated and each step can be inspected. To make such reliability measurable, the work moved from informal, ad-hoc assessment towards structured benchmarking, with explicit hypotheses and ground-truth test sets, while noting that the best-performing model on a benchmark is not necessarily good enough for deployment.

The path from AI agents to agentic networks begins with grounding models in the physical environment. Khalifa University's RF-GPT, a vision-language model trained on spectrograms, allows an engineer to interpret a radio environment, with the aim of progressing from models that describe a signal to agents that understand, predict and act on it. As networks move towards operation by many interacting agents, however, existing agent protocols fall short for telecom, since they are not grounded in the domain, their scalability is untested, and they are not domain-specialized. Rather than build a new protocol, the proposal is to add a semantic layer on top of existing ones to standardize how intent is decomposed and conveyed between agents, supported by a benchmark that evaluates intent recognition, tool-use sequencing, latency and resolution accuracy.



Figure 68: Presentations on building, evaluating and connecting AI agents

23.4 Standards, sandboxes and benchmarking for agentic networks

The second part of the workshop turned from building individual agents to standards, validation environments, and benchmarks that agentic networks will require. A common thread was that as agents begin to discover one another, act on real networks, and take on the work of engineers, trust depends on shared mechanisms for discovery, evaluation and safe experimentation.

The main points discussed are summarized below:

As agents proliferate, they need a standard way to discover which tools and other agents exist and can be trusted, which is the aim of the Agentic Resource Discovery (ARD) specification, presented by Google. Rather than generating a fixed configuration for every task, an organization publishes a catalogue: a structured file, identified through its domain and a well-known path in the Domain Name System (DNS), that lists available tools and agents with their capabilities and compliance attributes. At run time, an agent interprets a user's intent, queries the catalogue through a natural-language search, and receives a ranked set of tools, which it can filter by attributes such as regulatory compliance. Because such a registry is open, trust is built in through several layers: grounding the catalogue in a verified domain, signing entries so tampering can be detected, and checking compliance in real time. Catalogues can also federate, so an agent may draw on external catalogues or restrict itself to internal tools, which matters most where agents operate across organizational boundaries.

Evaluating whether AI agents can perform the work of network engineers requires benchmarks that reflect the real job rather than knowledge tests. Conventional benchmarks tend to use multiple-choice questions that saturate as models improve, and they draw tasks from a single abstraction layer, so they say little about how an agent performs across the messy, multi-step tasks of a real role. NOC-Bench, a benchmark being developed at GSMA, addresses this by imagining agents working in a network operations centre. For each operator use case, the capabilities an agent must demonstrate are identified first, and an environment is then built to test those capabilities, simulating only the parts of the real infrastructure that the use case actually exercises. Three principles guide the design: focus on capabilities rather than isolated tasks for a model's strengths and weaknesses to be mapped; combine several distinct environments rather than one synthetic setting; and keep the benchmark harness-agnostic for different agent implementations to be compared fairly. Because GSMA operates as a membership body of operators, it can convene the data and collaboration needed to build such a shared benchmark.

Sandboxes give agents a controlled environment in which to act, and pairing the two was described as a natural fit. Language models alone face limits in reasoning, domain knowledge and, above all, planning, whereas an agent that acts on a network can plan step by step and ground its answers in real conditions. Building on this, an experienced agent operates within a running environment rather than on static knowledge, which allows it to be trained, validated and supplied with test data before deployment. Central to this is the idea of a world model, which represents the network so an agent can predict the consequences of its actions, and which an agent can reach either through a structured API or, more flexibly, through mechanisms such as code execution or MCP. In evaluation across several models and agent frameworks, the choice of model dominated performance and, while a stronger agent framework improved results, it did not close the gap between models. This work also connects to ITU's work on standards and sandboxes for autonomous networks and related work on evaluation and benchmarking.

Extending competitive benchmarking to agents, Zindi's first agentic AI challenge tested whether a system could investigate and resolve real telecom faults rather than only make predictions. Run with ITU and supported by GSMA and other partners, the challenge fixed a single open-weight base model so that entrants could compete on agent design rather than model choice, and it was split into wireless and IP-network tracks. Its three phases rewarded first the design of the agent, then its ability to generalize to unseen data, and finally its performance under a scoring scheme that also rewarded speed. Agents were expected to query a live network, retain memory of past cases and retrieve documentation to support a fix. The challenge drew a large number of participants from many countries and the strongest solutions are now being taken into production, illustrating how a well-designed challenge can build practical agentic-AI capability at scale.

One winning entry from that challenge showed what a practical troubleshooting agent looks like. Given noisy measurements from a user moving through an IMT-2020 (5G) network and a list of candidate corrective actions, feeding all the raw data to a language model at once performed very poorly, since the data was unstructured and the decision space too large. A more reliable design decomposed the problem into smaller decisions: raw data was first transformed through feature engineering into telecom-specific indicators, a supervised classifier then predicted the relevant action group, and a further step localized the fault to a specific base station. It used a decision tree whose logic could be inspected rather than a black box. A language model was brought in only for the remaining ambiguous cases, reasoning over a focused context with task-specific prompts. This design reached full accuracy in the first round but fell to below half when the second round required a single answer among several plausible ones with no training data for the distinction, underlining that domain understanding and careful feature design remain essential, with language models most useful on a small set of already narrowed cases.

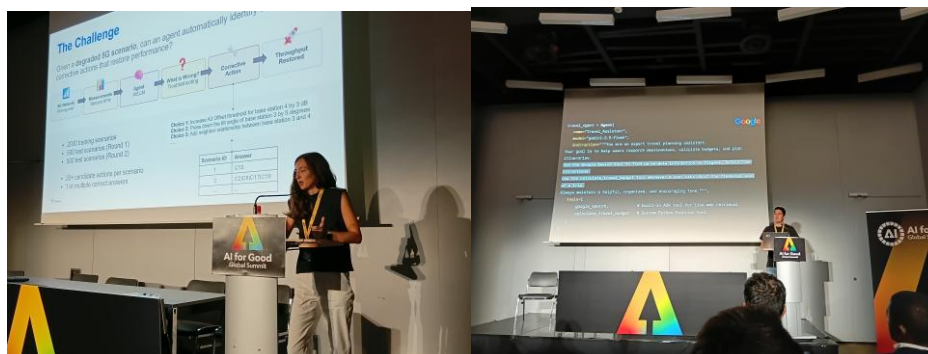


Figure 69: Presentations on standards, sandboxes and benchmarking for agentic networks

23.5 ITU standards and ongoing standards work of interest

Some of the related standards activities include:

- [ITU-T F.748.46](#): Requirements and evaluation methods of artificial intelligence agents based on large models
- [FG-AINN Technical Specification](#): Vocabulary for artificial intelligence native for telecommunication networks
- [FG-AINN Technical Specification](#): Architecture framework for artificial intelligence native telecommunication networks
- FG-AINN Technical Specification (under development): AI agent-enabled management and orchestration for AI-native networks
- [Technical Report TR.GenAI-Telecom](#): Potential requirements and methodology for deploying and assessing generative AI models in telecom networks

23.6 Key takeaways

- Evaluation and benchmarking are a shared priority and most useful when they reflect real, multi-step tasks rather than one-off results or knowledge tests
- Reliability depends as much on architecture as on model size, and pairing language models with solvers, grounding and sandboxes can allow smaller models to perform well
- Scaling agentic systems depends on shared standards for agent discovery, intent exchange and trust

24 Future Networked Car Symposium

The [***Future Networked Car Symposium \(FNC\)***](#) brings the telecommunication and automotive sectors together to examine connectivity, automated mobility and AI in transport, and their implications for the work of ITU and UNECE.

24.1 Introduction

As automated driving systems (ADS) move from testing towards deployment, the convergence of the automotive and telecommunication worlds raises new questions for technology, regulation and standards. FNC-2026 addressed four themes: the regulatory framework for automated driving, the role of connectivity and data, the validation of driving automation systems, and vehicular communication for automated driving. This report summarizes the sessions and highlights related ITU work, in particular the ITU-led [Collaboration on Intelligent Transport System Communication Standards \(CITS\)](#) and its [Expert Group on Communications Technology for Automated Driving \(EG-ComAD\)](#), alongside the ongoing ITU–UNECE cooperation on connected and automated mobility.

24.2 Opening ceremony

Moderated by **Peter Vanham**, Editor in Chief at The Cercle, the opening ceremony welcomed **Seizo Onoe**, Director of the ITU Telecommunication Standardization Bureau; **Tatiana Molcean**, Executive Secretary of UNECE; **Jean Todt**, UN Secretary-General's Special Envoy for Road Safety; and **Oliver Steil**, CEO of TeamViewer.

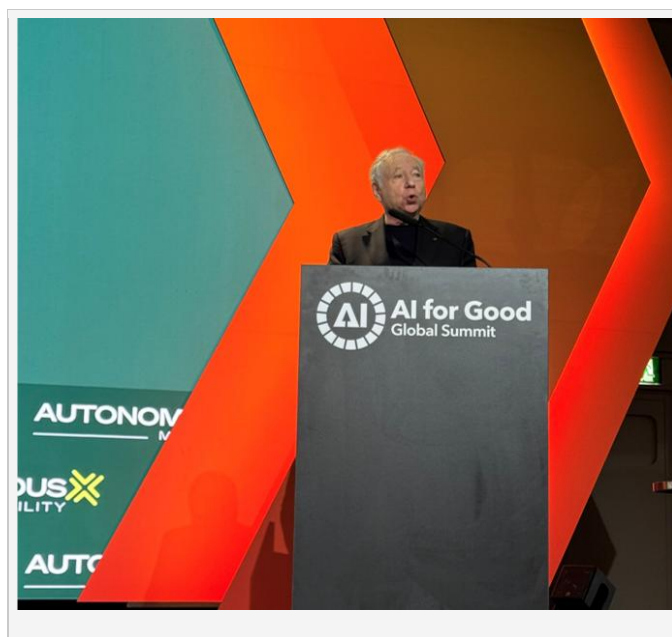


Figure 70: Jean Todt, UN Special Envoy for Road Safety

Seizo Onoe emphasized that the development of autonomous driving, connected vehicles and AI needs to be grounded in international standards, interoperability and trusted governance.

Tatiana Molcean noted that UNECE's adoption of the world's first global regulatory framework for automated driving systems marks a concrete step by the international community in turning AI governance from principles into actionable rules. She also called on all stakeholders to uphold safety, transparency, accountability and a people-centred approach.

Jean Todt stressed that the ultimate value of technological innovation lies not in the technology itself, but in reducing road casualties, improving road safety and ensuring that safer and more sustainable mobility benefits everyone.

24.3 Regulatory framework for automated driving

This first session examined the latest UNECE regulatory developments in automation and safety, and how the newly adopted regulations on automated driving are shaping safer and more responsive vehicles.

Moderated by **Duncan Kay**, Head of Vehicle Engineering at the UK Department for Transport (DfT UK), the session welcomed **Mike Braisher**, Head of Automated Vehicle Engineering at DfT UK; **Daniel Smith**, Deputy General Counsel for Regulatory and Compliance at Waymo; and **Daniel Quirke**, Senior Manager of Global Technical Assurance at Wayve.

Master of Ceremonies **Alexander Epstein**, Chief of Vehicle Regulations at UNECE, framed the challenge: technology is advancing faster than policy and public trust.

Duncan Kay set the scene by introducing UNECE WP.29, the UNECE World Forum for Harmonization of Vehicle Regulations, through which governments agree common technical requirements via two complementary routes – the 1958 Agreement (type approval and mutual recognition) and the 1998 Agreement (UN Global Technical Regulations) – with automated and connected vehicles handled by its Working Party on Automated/Autonomous and Connected Vehicles (GRVA).

Mike Braisher presented the UN's new regulatory approach to ADS – systems that replace, rather than assist, the driver. Because ADS are complex systems often involving ML and operating in complex environments, they cannot be assured through a finite set of prescriptive tests. The regulation structures safety assurance around a safety management system, a safety case and performance-reporting obligations, supported by technical requirements (the dynamic driving task, user interaction, data storage/DSSAD, cybersecurity and software updates) and manufacturer and assessment requirements. The guiding principle is that an ADS should be at least as safe and as careful as a competent human driver, and that safety is not a one-off judgement but must be continually managed.

Industry contributions showed this philosophy meeting deployment. **Daniel Smith**, speaking from a regulatory and compliance standpoint, situated fully autonomous driving within the wider automation spectrum and reported that, across more than 220 million rider-only miles to end-2025, Waymo vehicles were associated with markedly fewer injury-causing and serious crashes than an average human driver over the same distance – an example of the type of real-world safety evidence relevant to the framework. **Daniel Quirke** introduced an embodied-intelligence, foundation-model approach ("AV2.0") built to scale across vehicles, environments and markets; as a learning-based system spanning ADAS to full automation, it illustrates why the new safety-case approach is relevant to such technologies.



Figure 71: Alexander Epstein, Chief of Vehicle Regulations at UNECE

24.4 The rise of automotive AI data infrastructure

The second session examined how AI is changing automotive engineering, data governance, lifecycle management and in-vehicle computing, together with the connectivity and infrastructure needed to collect, process, protect and update vehicle data and AI models.

Moderated by **Roger C. Lanctot**, President of the Mobile Satellite Users Association, the session welcomed **Georg Doll**, CTO for Automotive & Mobility at Microsoft; **Nicola Concer**, Head of Product Marketing at NXP Automotive Processors; **James J. Hunt**, Co-Founder, CEO at CTO of aicas; and **Alicia Montoya**, Head of Industry Development for the Swiss Data Science Center.

Georg Doll focused on the use of AI in embedded and safety-related engineering. He described a progression from manual coding through specification-driven development toward agentic engineering, in which humans define intent, goals and guardrails while AI assists architecture, coding, traceability and validation. He stressed that probabilistic models inevitably make mistakes, so engineering workflows must be designed for imperfection, with independent checks and end-to-end traceability between stakeholder needs, requirements, design specifications, code and testing. He also distinguished between tasks requiring deterministic answers and semantic tasks for which language models may be useful.

James J. Hunt stressed that "garbage in, garbage out" continues to apply. He identified safety and reliability, privacy, security, legal and ethical questions, model updating and long vehicle lifecycles as central challenges. He noted that different vehicle functions may require different models and that language models are not necessarily appropriate for safety-critical control. He also discussed processing and standardizing data inside the vehicle so that only necessary information is transmitted, reducing communication costs. He described lifecycle processes spanning the vehicle and cloud for identifying required data, retraining and validating models, securely deploying updates and monitoring model performance.

Nicola Concer described the consolidation of vehicle functions into centralized vehicle computers, creating access to information across previously separate vehicle domains. Using

a multiple-brain and cerebellum analogy, he distinguished driving and infotainment functions from an always-on vehicle core layer responsible for maintaining vehicle operation. He described this layer as low-power and focused on determinism and safety, while also capable of running AI models when the vehicle is parked. He outlined applications including virtual sensors, predictive maintenance, acoustic detection, imaging radar, and energy and battery management.

Alicia Montoya presented a data-infrastructure perspective, arguing that data is the enabler for moving from connectivity to trust and that more sensors and bandwidth do not by themselves produce trustworthy AI without appropriate governance. She outlined a three-pillar approach covering safe, high-quality, interoperable and privacy-preserving data; sound data science using synthetic scenarios and digital twins to test high-risk situations in simulation; and the application of these capabilities to clean, smart and safe mobility. She noted that connected vehicles can act as beacons within the wider traffic environment, helping to ease congestion, improve incident response, support emissions measurement and inform infrastructure planning. Her recommended practices included well-governed data, well-designed standards, privacy by design, open and reproducible methods, and continuous collaboration among industry, regulators, academia and the public sector. She also observed that the relationship between the driver and the vehicle is changing, and that continuously learning systems require ongoing attention rather than reliance on a one-time approval process.

Across the presentations, the session showed that automotive AI depends on more than individual models. It requires traceable engineering processes, governed and privacy-preserving data, appropriate separation between deterministic and probabilistic methods, secure lifecycle management, in-vehicle processing, and coordinated vehicle-cloud infrastructure. Connectivity enables these processes, but data collection and transmission must remain selective, purposeful and governed.

24.5 Validation of driving automation systems

The third session brought together subject-matter experts from three organizations to present their approaches to the technical, societal and institutional challenges of validating driving automation systems and determining their readiness for on-road testing and series deployment.

Moderated by **William Gouse**, International Technical Affairs for Global Ground Vehicle Standards at SAE International, the session welcomed **James C. Owens**, Chief Legal and Policy Officer at Nuro; **Sooji Yeom**, Global Program Senior Manager at MORAI; **You-Jun Choi**, Principal Researcher at the Korea Automotive Technology Institute; and **Tong Wang**, General Manager at CATARC Europe Testing and Certification.

James C. Owens from Nuro, and former Acting Administrator of the US National Highway Traffic Safety Administration, offered a regulator-turned-developer perspective, welcoming the newly adopted UNECE framework as a basis for scaling deployment and introducing a measure of reciprocity among Member States.

A common theme across the three presentations was that real-world mileage alone cannot demonstrate the safety of automated driving, because the critical cases lie in a long tail of rare scenario combinations. This means that validation must combine road evidence with

simulation, closed-track and in-service evidence, and increasingly use AI to generate and prioritize the scenarios that manual testing cannot enumerate.

Sooji Yeom highlighted that AV validation strategy must evolve with the system – from a rule-based era with clear behavioural boundaries towards end-to-end systems where those boundaries blur – using an AI validation agent to map the failure space and situating the work across the established standards landscape (e.g. ISO 34503/34504 Test Scenarios for Automated Driving Systems; ISO 21448 Safety of the Intended Functionality (SOTIF); ISO 26262 Functional Safety; UL 4600; and the UNECE New Assessment/Test Method for Automated Driving (NATM)).

You-Jun Choi presented AI-driven virtual validation aligned with the UNECE Validation Method for Automated Driving (VMAD) framework, using software- and vehicle-in-the-loop simulation and digital twins for quantitative operational design domain (ODD) coverage, and extending it with vision-language and large-language models for explainable validation and automated edge-case generation, and with private-5G-V2X-in-the-loop testing for cooperative driving.

Tong Wang framed the shift as moving "from innovation speed to regulatory trust," showing how the AI-defined, over-the-air-updated vehicle multiplies the safety evidence required across functional safety, SOTIF, cybersecurity (UNECE R155), software updates (UNECE R156) and data/AI governance, and presenting a multi-pillar validation stack in which AI is used to validate AI across the software lifecycle.

24.6 Vehicular communication for automated driving

Moderated by **T. Russell Shields**, Chair of CITS, the fourth session welcomed **Jan Luehmann**, Strategy & Communications Lead for CARIAD (Volkswagen Group), Vice-Chairman of the Technical Committee at the International Organization of Motor Vehicle Manufacturers (OICA), and Co-Chair of CITS EG-ComAD and its Working Group 3; **Ganesh Jayaram**, Regulatory Affairs & Standardization Lead at CARIAD, Representative of OICA at UNECE and ITU, and Chair of CITS EG-ComAD Working Group 1; **Stephane Buffat**, Director of the LAB (Laboratory of Accidentology, Biomechanics and Driver Behaviour), and Chair of CITS EG-ComAD Working Group 2; and **Rémi Bastien**, Strategic Advisor to the CEO of FISITA, Vice-Chair of CITS EG-ComAD and Co-Chair of its Working Group 3.

The session explored how vehicular communications might be used in vehicles with ADS and what future actions are likely to be needed, with EG-ComAD providing updates on its work.

T. Russell Shields explained that the expert group does not write standards but builds the requirements that communications regulators need from vehicle manufacturers for the 2030-2060 period, and that participation is open to all.

Jan Luehmann described V2X evolving "from connectivity to cooperative mobility," from vehicles merely exchanging information to road users cooperating on safety-relevant decisions through cooperative perception, vulnerable-road-user protection and automated manoeuvres. Building on his image of vehicular communication as a sixth sense for road safety, he observed that this additional sense is becoming collective while remaining complementary to on-board sensing rather than a replacement for it. He cautioned against

premature technology mandates so that regulation follows demonstrated need. He noted that the debate has shifted from "which technology?" to "which safety-relevant requirements?" and that no single communication path suffices, creating need for a technology-neutral hybrid ecosystem enabled by trust, including authentication, integrity and misbehaviour detection. He also flagged a lifecycle and spectrum mismatch: because communication may become safety-relevant after 2030, automotive requirements should shape telecom and spectrum discussions today.

Ganesh Jayaram presented EG-ComAD WG1's completed "systematics" on vehicular communication for automated merging into congested lanes, a concrete scenario that translates abstract V2X discussion into measurable requirements ("in open traffic, a gap is found; in congestion, a gap must be given"). Treating communication as one input to a functionally safe decision chain – including sensing, knowing the rules, coordinating and merging only when safety criteria are met – WG1 assessed the main Intelligent Transport System (ITS) message families (CAM/BSM, CPM, DENM/IVIM and MCM/MSCM) and concluded that useful information is not automatically usable: a message must be correct, authentic, timely and legally meaningful before it can influence a manoeuvre, with each identified inadequacy translated into a verifiable requirement for the 2030-2060 horizon.

The other two EG-ComAD working groups were introduced by their leads. **Stephane Buffat** outlined WG2's work on vehicular communications for the protection of vulnerable road users, using the next generation of V2X to strengthen automatic emergency braking. He noted that vulnerable road users account for around half of road deaths worldwide and that this burden falls very unevenly across regions – often mostly on those least served by advanced automated vehicles – so the group is seeking the common denominators across differing cultures, behaviours and regulations from which shared requirements can be drawn.

Rémi Bastien presented EG-ComAD WG3's focus on the technical and economic sustainability of vehicular communications and developing requirements for sustainable vehicular communications, in particular reconciling the useful life of a vehicle with the much faster evolution of communication technologies so that safety-relevant functions remain supported over a vehicle's lifetime. Drawing a lesson from the European Union's eCall, whose only partial success he attributed to insufficient dialogue with stakeholders before regulation was introduced, he set the numbers side by side: the average life of a car is rising from about 17 to 20 years and a tenth of the fleet is still on the road after 28, while a new generation of mobile technology arrives roughly every decade. WG3 is accordingly pursuing dialogue between the automotive and telecommunication sectors, a problem statement on the updateability and longevity of communication modules, and industry-led adaptation in preference to regulation. It has launched a stakeholder survey on the sustainability of vehicular communications and is supporting closer cooperation between OICA, FISITA and 3GPP.

EG-ComAD develops automotive-industry requirements for vehicular communications for the 2030-2060 period and supports ITU's consideration of future spectrum and communication needs for next-generation V2X. It works through three working groups – WG1 (automated merging into congested lanes), WG2 (advanced emergency braking and protection of vulnerable road

Box 13: CITS Expert Group on Communications Technology for Automated Driving (EG-ComAD) and WG3 (technical and economic sustainability of vehicular communications) and coordinates with UNECE WP.29 and telecom stakeholders. WG1 targets completion of its report by December 2026, while WG2 plans to issue a report with an initial set of recommendations by November 2026.



Figure 72: T. Russell Shields, Chair of CITS

24.7 Conclusion and key takeaways

Automated driving is moving from testing towards deployment and this shift is reshaping regulation (a safety-case approach rather than single tests); data and software infrastructure (the AI-defined vehicle); validation (an evolving, AI-driven search across the scenario space rather than mileage alone); and vehicular communication (from connectivity to trusted cooperative mobility).

Priority areas for requirements development:

- Trusted V2X supported by authentication, integrity and misbehaviour detection
- Communication requirements for cooperative manoeuvres such as automated merging
- The protection of vulnerable road users
- The mismatch between vehicle and telecommunication lifecycles, together with the spectrum decisions it implies

EG-ComAD WG1 has completed its systematics on vehicular communication for automated merging into congested lanes and WG3 has opened a stakeholder survey on the sustainability of vehicular communications and is supporting closer cooperation between OICA, FISITA and 3GPP.



Figure 73: Speakers at the Future Networked Car Symposium 2026

25 Mobile AI for Good: Ubiquitous, open, accountable inclusive

25.1 Introduction

The [**GTI Forum 2026 – Mobile AI for Good: Ubiquitous, open, accountable, inclusive**](#) was jointly hosted by Global Technology Association of Infocomm (GTI), China Mobile, ITU, China Institute of Communications (CIC) and the CAST UN Consultative Committee on Open Source and Innovation (CCOSI).

The forum aims to convene global innovation stakeholders, call for international collaboration to advance the integration of networks and AI, drive open-source innovation, and foster an inclusive framework for technology policy. It brings stakeholders together to explore the future direction of global digital innovation; shape strategic roadmaps for mobile AI development; showcase cutting-edge technologies, open-source practices and AI-enabled products and applications; and support the evolution of AI towards ubiquitous, open, accountable and inclusive development.

As a global cooperation platform in the infocomm industry, GTI focuses on mobile network carrier-side AI practices and the GTI Forum 2026 aimed to bring its latest work to the attention of ITU's AI standards research.

25.2 Opening remarks

Wei Wei, Director General of the Department of Science and Technology at China's Ministry of Industry and Information Technology (MIIT), mentioned that AI technology is evolving at an accelerating pace and has become a powerful driving force for economic and social development.

In terms of networks empowering AI, the total number of IMT-2020 (5G) base stations in China reached 4.958 million by the end of the first quarter of 2026. China has achieved Gigabit broadband coverage in all counties and 5G access in all towns, with 5G coverage extending to 95 percent of administrative villages. The scale of intelligent computing power stands at 1,882 EFLOPS (floating point operations per second). More than 70 cross-regional computing backbone links have been built around national computing hubs, laying a solid information and communications foundation for the development of AI.

In terms of AI empowering networks, basic telecom enterprises represented by China Mobile have integrated the analytical capabilities of large AI models into the full lifecycle of networks, including planning, construction, operation and maintenance, and optimization. They have carried out practical applications such as intelligent agent-based fault diagnosis, automatic recovery and intelligent customer service, advancing the evolution of traditional networks towards a new type of network capable of autonomous perception and intelligent optimization.

Looking ahead to the integrated development of networks and AI, Wei Wei put forward three proposals:

- **Consolidate the development foundation:** Collaborate with innovative players across the global communications and AI industries to pursue technological breakthroughs, actively contribute standardization proposals to organizations like ITU and 3GPP, and support large-scale industrial development.
- **Bolster security safeguards:** Strengthen international exchanges and cooperation in the security field; advance research and development on technologies covering intelligent network risk prevention and control, computing power security protection, and compliance of AI applications; and develop comprehensive security solutions spanning networks, computing power and AI to guide the sound and responsible integrated development of networks and AI.
- **Advance open cooperation collectively:** Leverage the GTI to build an open and collaborative innovation mechanism; share technological achievements, test environments and industry implementation experience; promote low-cost and replicable best practices; and foster an interconnected, inclusive and mutually beneficial global industrial ecosystem.



Figure 74: Wei Wei, Director General of the Department of Science and Technology at MIIT China

Ebtesam Almazrouei, CEO and Founder of AIE3 and Chair of ITU's AI for Good Impact Initiative, emphasized that "AI for Good" is far more than a slogan. It represents a vital mission to advance sustainable development, empower developing countries, preserve cultural and linguistic diversity, and tackle humanity's shared challenges. Achieving responsible AI requires coordinated efforts from all stakeholders.

When it comes to mobile AI for Good, said Almazrouei, we need to consolidate the foundation of digital equity through broadly accessible network infrastructure; lower barriers to innovation via open models, shared data and unified standards; and safeguard the responsible advancement of AI with secure, transparent, trustworthy and explainable governance frameworks. Building global consensus and fostering an open, collaborative global ecosystem for AI governance and inclusive development, said Almazrouei, will be key to ensuring that the benefits of AI reach more regions and communities worldwide.



Figure 75: Ebtesam Almazrouei, CEO and Founder of AIE3 and Chair of ITU's AI for Good Impact Initiative

Zhang Dong, Executive Vice-President of China Mobile, highlighted that, as one of the founding members of GTI, China Mobile has long partnered with global industry players to advance the maturity and large-scale deployment of new mobile technologies.

At present, leveraging GTI's global cooperation network, the company is advancing the integration of networks and AI. For example, by integrating networks and intelligence, China Mobile delivered an immersive, intelligent viewing experience of the FIFA World Cup 2026.

With the aim of supporting inclusive AI development, the company has set up eight open labs worldwide; jointly developed a "6G Open Testbed" with GTI and other partners; and contributed to the GSMA-GTI Mobile AI Whitepaper.

Zhang Dong noted three key priorities for China Mobile:

- **Build premium networks and upgrade communication services:** The company has deployed over 2.9 million IMT-2020 (5G) base stations and is rolling out 5G-Advanced, 10G Passive Optical Networks and space-air-ground integrated networks. It deploys technologies including three-carrier aggregation and 5G RedCap and implements large-scale Level 4 autonomous networks to evolve towards network self-configuration, self-optimization and self-healing capabilities.
- **Develop robust computing power networks and accelerate computing services:** The company advances the development of a nationwide integrated computing power network. It has built two super-scale intelligent computing centres with more than 10,000 accelerator cards and 12 regional intelligent computing nodes, resulting in intelligent computing capacity exceeding 107 EFLOPS with the capability of

hundred-trillion-level Token scheduling. The effort enables unified management, intelligent orchestration and global scheduling of computing resources.

- **Foster innovative intelligent networks and elevate smart services:** China Mobile has upgraded MoMA (Mobile Model Management Platform), its AI model service platform, aggregating more than 300 mainstream models. It has constructed the Tiangong Industrial Internet Platform and upgraded the Lingxi Intelligent Agent. AI services have been introduced in scenarios spanning sports, culture and finance, while new forms of mobile intelligence such as AI-enabled smartphones, AI glasses and humanoid robots are being explored.

Zhang Dong highlighted four ways China Mobile will support ubiquitous, open, accountable and inclusive AI:

- **Advance ubiquitous connectivity to enable AI to reach everywhere:** The company aims to promote the construction and interconnection of global network infrastructure, drive the evolution of network technologies, and leverage AI to shape new capabilities for future mobile networks.
- **Deepen open cooperation to unlock AI innovation vitality:** Drawing on platforms including GTI OpenLabs and the 6G Open Testbed, the company aims to provide global partners with innovation scenarios, environments and facilities.
- **Improve accountable governance to uphold the principles of AI for Good:** The company aims to support trustworthy AI entities, measurable risks, traceable processes and controllable behaviours, and plans to build more partnerships to advance AI security governance.
- **Embrace inclusiveness to bridge the AI development divide.** Via platforms such as ITU and GTI, the company aims to share AI development experience and innovation resources and promote inclusive AI solutions tailored to different development stages.



Figure 76: Zhang Dong, Executive Vice-President of China Mobile

25.3 Network-intelligence convergence for ubiquitous AI

Hatem Dowidar, Non-Executive Director at Vodafone Group, explored how traditional transport networks are evolving into an AI-integrated intelligent foundation, driving the coordinated advancement of networks and AI in both directions. The next-generation network extends beyond human-to-human connectivity to support the deployment of diverse AI agents in practical use cases such as telemedicine. Computing power is gradually expanding from central data centres to network edges and terminal devices, making low latency, high reliability and distributed intelligence key requirements for network development.

He noted that AI infrastructure is becoming a core digital asset for all nations and that trust serves as the bedrock of industrial growth, but that the uneven distribution of computing resources creates stark disparities in regional AI infrastructure.



Figure 77: Hatem Dowidar, Non-Executive Director, Vodafone Group

Ali Taha Koç, CEO of Turkcell, explored how network infrastructure is transforming from a data-transmission system into a platform that supports intelligent operation, machine learning and large-scale AI development.

He encouraged industry to look beyond just large models and computing power and invest systematically in the five-layer AI infrastructure value chain covering energy supply, chips, data centres and cloud infrastructure, AI models and industry applications, so as to embed AI into daily business operations and end-user scenarios.

He noted that Turkcell is accelerating the construction of AI-native infrastructure, advancing local data centres, cloud services, Turkish-language AI models and digital assistant capabilities. These efforts aim to bolster data security, digital sovereignty and the development of regional AI infrastructure for secure, flexible and scalable intelligence capabilities to be deployed in real-world scenarios.



Figure 78: Ali Taha Koç, CEO, Turkcell

25.4 Secure, accountable and inclusive AI

Khaled Soufi, President of ISO, highlighted that international standards serve as a vital bridge for translating AI governance principles into trustworthy practices by providing common language, unified benchmarks and actionable tools. Considering AI's impact on economies and societies, the advancement of responsible AI calls for a socio-technical collaborative approach, said Soufi.

He noted that AI management system standards such as ISO/IEC 42001 lay foundational support for AI deployment across industries and markets, and that support should be provided to developing countries to strengthen their capacity to engage in developing and implementing international standards.



Figure 79: Launch of the GTI Initiative on AI Security Governance



Figure 80: Khaled Soufi, President of ISO

Bilel Jamoussi, Deputy Director of the ITU Telecommunication Standardization Bureau, emphasized that industry needs to accelerate standards coordination in areas including agentic AI security and identity, multimedia authenticity and AI-native networks to boost the

security, transparency and trustworthiness of AI systems. He added that ITU stands ready to deepen cooperation with GTI in areas such as AI-native networks as well as open labs and sandbox environments to support AI capacity building around the world.



Figure 81: Bilel Jamoussi, Deputy Director of the ITU Telecommunication Standardization Bureau

Yvonne Baldwin Mushi, CEO of Ele-vate AI Africa, explored the challenge of ensuring that the benefits of AI reach underserved communities. She made the example of MamaMate, Ele-vate AI Africa's offline intelligent assistant for maternal and infant health, and called on the mobile industry to incorporate offline functionality and localized requirements at the initial stage of architecture design for mobile AI to reach more people around the world.



Figure 82: Yvonne Baldwin Mushi, CEO of Ele-vate AI Africa

25.5 Open source for AI prosperity

Jianmin Wang, Dean and Professor of the School of Software at Tsinghua University and Chair of CCOSI, noted that open-source code and technological transparency carry great significance in the AI era, supporting global AI innovation, the translation of research outcomes into real-world applications, and the lowering of barriers to technological participation.

China hosts a vibrant open-source ecosystem and contributes substantially to open-source development globally. Jianmin Wang made examples of the open-weight model DeepSeek, open-source AI agent Qwen, and open-source data infrastructure OpenDigger. He noted that efforts could be made to enhance the transparency and sustainability of the open-source ecosystem in areas including licensing frameworks, supply chain management, and tiered governance for open-source AI.



Figure 83: Jianmin Wang, Dean and Professor of the School of Software at Tsinghua University and Chair of CCOSI

25.5.1 Open source and openness: Building a sustainable AI ecosystem

A panel discussion on open source moderated by **Mathias Gabrysch**, Professor for Product & Innovation Management at Munich University of Applied Sciences and Senior Advisor for Ecosystem Development at GTI, welcomed **Wei Wang**, Professor at East China Normal University and Secretary-General of CCOSI; **Christofer Dutz**, Director of the Apache Software Foundation; and **Yue Gao**, Chair Professor and Dean of the Institute of Space Internet at Fudan University and Vice-Chair of CCOSI.

Participants noted that open-source AI covers far more than open code. It encompasses a wide range of elements including data, models, documentation and toolchains. Greater consensus still needs to be forged on transparency, definitional boundaries, governance mechanisms and sustainable incentives.

AI-generated code contributions, issue reports and other outputs are boosting community efficiency, but they also place new review burdens on open-source maintainers. Meanwhile, AI translation tools lower barriers for non-English-speaking developers to join open-source projects. Open models, open data and open educational resources are enabling broader participation in AI innovation across more regions and communities.



Figure 84: Panel discussion on open source

25.6 Conclusion and key takeaways

This forum discussed the integrated development of mobile networks and AI around three core dimensions: ubiquitous intelligence, security accountability, and inclusive openness.

Network-intelligence integration supports ubiquitous AI empowerment. Networks and AI continuously promote each other's development. Telecom operators are implementing full-lifecycle intelligent network management and improving network autonomous perception, fault recovery and intelligent service capabilities. AI capabilities are also expanding from central data centres to edge and terminal devices.

Security governance faces new challenges. AI agents and generative AI are introducing new cybersecurity threats and governance difficulties. Announced at the forum, a new GTI Initiative on AI Security Governance aims to promote multi-stakeholder collaboration to build a trustworthy AI system with measurable risks, traceable processes and controllable behaviours.

Open and inclusive cooperation boosts global AI prosperity. The forum also highlighted the need to narrow the global AI development gap. Open-source innovation and international cooperation can help lower technical barriers and accelerate large-scale industrial AI deployment. Open-source models, public infrastructure and unified international standards greatly facilitate global AI innovation.

26 Advancing women's leadership in AI and standards

26.1 Introduction

A panel discussion on [*Advancing women's leadership in AI and standards*](#) organized by the [Network of Women in the ITU Telecommunication Standardization Sector \(NoW in ITU-T\)](#) and [Women in AI \(WAI\)](#) highlighted the progress made and remaining challenges in advancing women's leadership and meaningful participation in AI and standards development. The session explored how fostering inclusivity drives innovation, addresses barriers, and creates support systems to empower women across the entire pipeline, from education and research to decision-making and strategic leadership.

26.2 Main findings of women's strategic and technical leadership in ITU-T

Rim Belhassine-Cherif, Chief Innovation and Strategy Officer at Tunisie Télécom and Chair of NoW in ITU-T, set the scene for the session and described the evolution of women's strategic and technical leadership in ITU-T:

- At present, significantly more men than women participate in ITU-T activities
- However, over the past ten years, there has been consistent growth in women's participation and leadership
- The highest growth rate, and the highest current level (35%), of women's leadership is in the field of AI

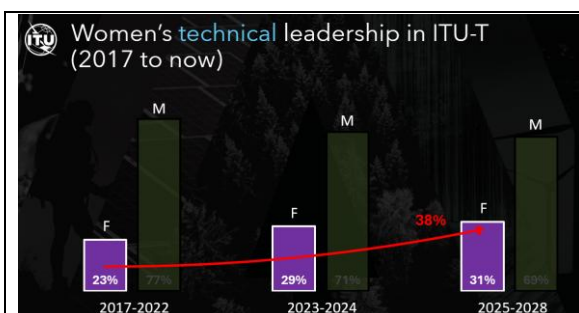


Figure 85

Women's technical leadership in ITU-T
(2017 to now)



Figure 86

Women's strategic leadership in ITU-T
(2017 to now)

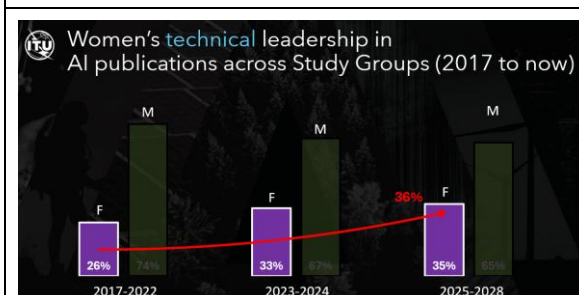


Figure 87

Women's technical leadership in AI (2017
to now)



Figure 88

Women's strategic leadership in AI focus
groups (2017 to now)

26.3 Discussion highlights

Rim Belhassine-Cherif highlighted the importance of women's leadership in AI and standards, emphasizing that inclusion is not only a matter of equity but also essential for achieving better long-term outcomes. She underscored the distinction between participation and influence, calling for more women to engage in ITU's work and take on decision-making and leadership roles.

Alessandra Sala, President of Women in AI, Director of AI and Data Science at Shutterstock, and Chair of the AI and Multimedia Standards Collaboration, shared her professional journey, stressing the importance of education, support networks and resilience in building a successful career in technology. She also highlighted the challenge of retaining women in the tech sector and creating environments where they can thrive over the long term.

Sasha Luccioni, Co-Founder and Chief Scientific Officer at Sustainable AI Group, reflected on her path from advocacy to driving practical impact, emphasizing the importance of using technology to create positive social change. She also discussed the role of regulation and governance frameworks, including AI-related policies, in shaping responsible innovation.

Hala Hibri, Ambassador for the Swiss Chapter of Women in AI, emphasized that technological progress is ultimately driven by people and highlighted the importance of empowering individuals who can lead meaningful change. She connected innovation with leadership, collaboration and human-centred impact.

Karen Mulberry, Senior Manager of Technology Policy at the IEEE Standards Association (IEEE SA), shared her personal career journey, illustrating how curiosity, mentorship and unexpected opportunities can shape a meaningful professional path. She encouraged participants to follow their interests while remaining committed to advancing equity and inclusion.

H.E. Rose Pola Pricemou, Presidential Advisor on New Technologies and Artificial Intelligence to the President of the Republic of Guinea, highlighted the links between gender, education and social development, particularly in developing countries. She discussed the importance of supporting girls in basic education and STEM, increasing women's participation in leadership, and addressing barriers that disproportionately limit women's influence in decision-making roles.

Lisa Bechtold, Head of Group Risk Management at Nestle, spoke about the value of interdisciplinary experience and following one's interests rather than a predefined career plan. She emphasized curiosity, passion and the need to actively shape the future by ensuring technological progress develops in an inclusive and responsible direction.

Johnathan Nagao, Director of Data & AI at World Bank Group, shared the World Bank's perspective on scaling impact through evidence-based approaches and long-term development goals. He illustrated how expanding access to finance and entrepreneurship opportunities for women can drive economic empowerment and reduce poverty at scale.

Liya Yuan, Senior Engineer at ZTE Corporation, emphasized that leadership should be built on the foundations of expertise, credibility and trust. She described leadership as the ability to deal with uncertainty, build consensus, make decisions and take responsibility, while encouraging women to seize opportunities and grow into leadership roles through experience.

26.4 Key takeaways and calls to action

Key messages from the discussion:

- Leadership is based on credibility and begins with the choice to engage
- Standards are written by people, and diverse perspectives lead to more inclusive, trustworthy and impactful AI
- Advancing women's leadership is a shared responsibility across governments, industry, academia, standards bodies, civil society and individuals

Calls to action for governments, industry, academia, standards bodies and civil society:

- Support and mentor the next generation of women in technology, from education to leadership
- Remove barriers and create opportunities for women to lead within their own organizations
- Recognize the need for diverse perspectives and multi-disciplinary skillsets
- Champion inclusive AI that reflects the diversity of the communities it serves
- Foster enabling environments that empower women to innovate and shape the future of AI



Figure 89: Panelists on advancing women's leadership in AI and standards

27 From human rights principles to ICT and AI standards: Perspectives from IEC, ISO and ITU

27.1 Introduction

Standards bodies are increasingly engaging with OHCHR guidance on the application of international human rights law to digital technologies, while also drawing on the Council of Europe's risk-based frameworks on AI and emerging technologies.

A panel discussion on [*From human rights principles to ICT and AI standards: Perspectives from IEC, ISO and ITU*](#) moderated by **Daniel Pap**, Legal Advisor at the Council of Europe, welcomed **Wafa Ben Hassine**, Chief of Digital Technologies and Human Rights at OHCHR; **Boris Inderbitzin**, External Relations Officer at IEC; **Cindy Parokkil**, AI Policy Lead and Capacity Building Programme Manager at ISO; and **Olivier Alais**, Programme Coordinator at ITU.



Figure 90: Panelists on human rights and standards

Daniel Pap opened the session by situating it within the week's broader AI governance discussions and their recurring challenge: moving from principles to practice. He noted the Council of Europe's role as convenor, given its Framework Convention on Artificial Intelligence, an international treaty which sets legal obligations grounded in human rights, democracy and the rule of law, and its HUDERIA (Human Rights, Democracy and Rule of Law Impact Assessment) methodology developed to translate those obligations into practice.

He noted that ISO and IEC participated as observers and contributors in the negotiation of the Framework Convention and contributed to HUDERIA, the Council of Europe and ITU have a

renewed memorandum of understanding (2025) building on cooperation dating back to the 1970s, and the Council of Europe cooperates with OHCHR on thematic questions.

He also referenced the 2025 International AI Standards Summit organized by IEC, ISO and ITU at which a statement of intent, the Seoul Statement, was issued to build cooperation and deepen the understanding of the interplay between human rights and international standards.

Box 14: The Seoul Statement

Launched at the International AI Standards Summit on 2 December 2025, the Seoul Statement is a joint commitment by IEC, ISO and ITU recognizing the value of international standards in advancing AI for an inclusive, open, sustainable, fair, safe and secure digital future for all. Through it, the three organizations commit to:

- Actively incorporate socio-technical dimensions in standards development
- Deepen the understanding of the interplay between international standards and human rights, recognizing both their importance and universality
- Strengthen an inclusive, dynamic multistakeholder community to develop and apply international standards for the design, deployment and governance of AI
- Enhance public-private collaboration on AI capacity building

Wafa Ben Hassine highlighted the progress made in recent years, and particularly in recent months. A session held the same week on AI oversight mechanisms saw in-depth discussion on how technical standards and human rights can and should reinforce one another, one example among a broader trend of political commitments increasingly translating into concrete action. The Freedom Online Coalition's statement on technical standards and AI was cited as another example of how Member State commitments can help shape and drive practical initiatives.

She pointed to a growing body of initiatives to translate high-level commitments into impact:

- OHCHR, together with the European Commission and ITU, recently launched the report on their co-organized Seminar on Human Rights and ICT Standardisation held in Brussels in April 2026 with the supported by the EU-funded StandICT.eu, INSTAR and InDiCo Global projects.
- In Australia, the Australian Human Rights Commission works closely with Standards Australia, a structured mechanism connecting national human rights expertise with standards development activities alongside engineers, data scientists, policymakers and industry stakeholders.
- In Europe, the European Telecommunications Standards Institute (ETSI) has approved a human rights checklist, establishing a test phase for a human rights assessment of standards development as an exploratory process.
- OHCHR participated in ISO's Capacity Building Journey, which connected technical and policy representatives from 15 Member States to discuss the role of standards in AI governance.

- OHCHR has also worked with Member States and civil society on draft guidelines on human rights and technical standards, proposed last month, to give engineers practical tools for the standards they develop.

Wafa Ben Hassine noted that standards have a role in operationalizing and building the tools needed for AI governance with a rights-respecting approach, drawing on the Council of Europe's HUDERIA framework and experience with the EU AI Act.

She also affirmed OHCHR's readiness to continue contributing as a partner, drawing on its 2023 report, "Human rights and technical standard-setting processes for new and emerging digital technologies" (A/HRC/53/42), and its 2025 follow-up study, "Tech and Human Rights Study: Making technical standards work for humanity – New pathways for incorporating international human rights into standards development for digital technologies," as well as on the B-Tech project's experience working directly with companies.

27.2 Perspectives from standards bodies

Boris Inderbitzin from IEC noted that the Seoul Statement was another milestone in an IEC journey that began with a 2022 conference on "AI with Trust" organized by IEC and the Swiss Federal Department of Foreign Affairs, which examined how legislation, standardization and conformity assessment interact.

He noted that IEC and ISO's jointly developed standards reference compliance with the legal requirements applicable to a given use case. Because standards are generic and multi-purpose while human rights considerations are highly context-specific, standards need to build in enough openness and flexibility for users to factor in the relevant legal and human rights considerations for their particular use case, if they are applicable. He added, however, that some standards already explicitly flag that users may need to consider human rights as part of their legal assessment.

He set out a five-layer model, shared across IEC and ISO, for understanding the AI governance landscape:

- Binding international law
- Non-binding soft law
- National law
- Voluntary instruments, including international standards
- The normative power of what is technologically possible, largely shaped by the private sector

Convergence and interoperability across these five layers are essential, and international standards are, in his view, a key tool for achieving it. He noted that interoperability is being discussed both at the UN Global Dialogue on AI Governance and within the Council of Europe's ongoing work on HUDERIA.

To illustrate how the layers interact, he used the example of AI incident reporting: the threshold that triggers a reporting obligation and the authority to be notified typically derive from national law, but the information to be reported is largely consistent across countries and international value chains. IEC and ISO, in collaboration with OECD, are jointly developing an AI incident reporting standard that can be applied across these value chains.

Cindy Parokkil from ISO noted that inclusivity is a key theme in the Seoul Statement and OHCHR's 2023 and 2025 reports on the relationship between technical standards and human rights.

She noted that being at the table is not the same as participating effectively. Meaningful participation requires the knowledge and tools to contribute, which is why capacity building is closely linked to inclusivity in practice.

ISO's AI Policy and Standards Capacity Building Program has brought together 15 developed and developing countries, pairing each country's national regulator with its national standards body in the same room.

Over roughly nine months, the programme has produced results including:

- Malaysia's national AI office has launched an initiative called MY-AI Standards positioning standards as the foundational layer of AI governance
- Egypt's national AI guidelines and strategy now incorporate ISO/IEC standards and the national standards body as key partners
- Uganda's draft national CET strategy references standards
- The government of the Netherlands has launched an international AI standards strategy that references ISO's capacity-building journey

She noted that these examples show that standards can play a practical role in national AI governance as tools for policy implementation.

She also cautioned that standards, while valuable, do not solve every problem, and that understanding their effect requires looking at the specific context in which an AI system is deployed. She pointed to AI impact assessment as a concrete use case that reveals how context determines human rights risks.

To that end, she presented a new ISO/IEC project to conduct an impact assessment of an AI system within a public procurement context using ISO/IEC standards and linking the assessment to legal requirements and frameworks such as the Council of Europe's HUDERIA.

Olivier Alais from ITU highlighted that building trust, accountability and inclusivity in the digital economy requires translating human rights into technical terms and processes.

Summarizing the findings of a recent survey of experts participating in ITU standardization work, he noted that experts see the relevance of human rights to their work but need more guidance on practical approaches. The survey found strong demand for the sharing of good practices emerging across standards bodies, targeted training and AI tools for human rights risk assessments. In addition, An ITU study on approaches to human rights across various standards bodies found that awareness is growing across bodies but practice remains uneven, with a shared challenge in translating broad human rights principles into concrete engineering requirements.

He noted that ITU members are discussing a guideline for addressing human rights in the ITU standards development process, potentially comprising:

- Examples and personas illustrating how standards may affect different users and communities
- Screening questions to spot risks early, for example: Who could be affected by the draft standard? Is the collection or processing of data limited to what is necessary? Would affected users be able to understand when and how the technology affects them? Are there mechanisms to detect, report and address errors, misuse or harm?
- Adding a section on "human rights considerations" to draft standards

Along with new ITU training courses, the upcoming guideline aims to support the integration of human rights more systematically, practically and consistently across the standardization process.

27.3 Key takeaways

- The session underscored the importance of a socio-technical approach: human rights considerations need to be understood in the specific context in which a technology is developed and deployed, rather than treated as a generic add-on to technical standards.
- Progress is being made on the interplay between human rights and technical standards with practical initiatives across OHCHR, the Council of Europe, IEC, ISO and ITU, as well as national-level examples cited from Australia, Malaysia, Egypt, Uganda and the Netherlands.
- A multi-stakeholder approach, bringing human rights experts, regulators, policymakers, engineers and civil society into the standardization process, was repeatedly highlighted as essential to this work.
- The session illustrated the cooperation already underway between OHCHR, the Council of Europe, IEC, ISO and ITU, reflecting a shared recognition that embedding human rights into international standards will require sustained, joint efforts going forward.

28 GeoGPT and OneEarth: Empowering global geoscientists

28.1 Introduction

Addressing global challenges such as climate change, natural hazards, biodiversity loss and sustainable resource management requires stronger international scientific collaboration. As AI reshapes scientific research, promoting an open, equitable and transparent AI + Earth Science research paradigm has become increasingly important. The Zhejiang Lab and Zhejiang Deep-time Digital Earth International Research Center are developing scientific programmes for global collaboration in Earth science and sharing scientific resources in advancing international geoscience research.

A workshop on [*GeoGPT and OneEarth: Empowering global geoscientists*](#) explored how AI-enabled scientific and technological public goods can further strengthen global collaboration in Earth system science. The discussions highlighted the evolution from GeoGPT to OneEarth as representative scientific public goods and examined how open scientific infrastructures, foundation models and multilateral collaboration networks can support geoscientists worldwide while contributing to open science and global technology governance.

The workshop echoed the principles of UNESCO's Recommendation on Open Science and its Recommendation on the Ethics of Artificial Intelligence, which promote openness, transparency, international scientific collaboration, equitable access to scientific knowledge and responsible AI development. These international frameworks provide an important policy foundation for building trustworthy AI ecosystems that support global scientific collaboration as well as interoperability, reproducibility and responsible innovation.

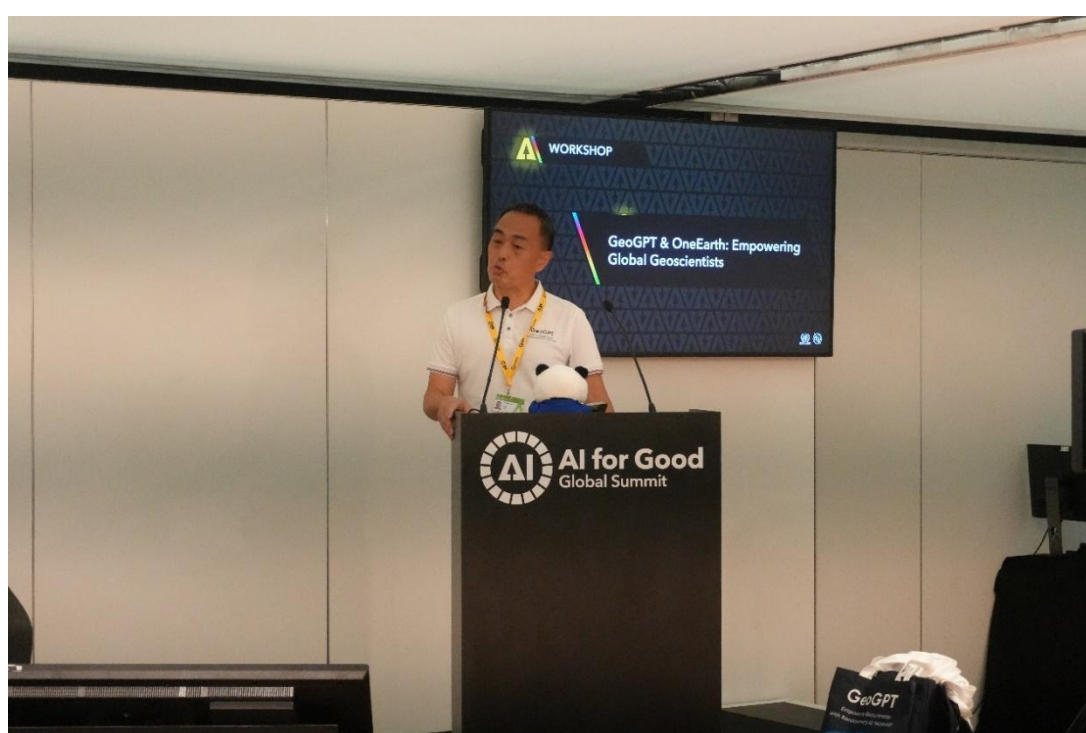


Figure 91: Yitian Xiao, Chief Scientist at the Zhejiang DeepTime Digital Earth International Center

28.2 Open, equitable and transparent AI + Earth science research

John Ludden, Co-Chair of the GeoGPT Governance Committee, opened the workshop by discussing the principles of an open, equitable and transparent AI-enabled Earth science research paradigm. The presentation emphasized that Earth science has always relied on international collaboration and that the emergence of AI further reinforces the importance of openness, transparency and shared scientific resources in supporting scientific discovery.

The presentation highlighted that trustworthy AI for scientific research should be built on transparent methodologies, verifiable scientific evidence, explainable AI systems and internationally interoperable scientific data. As AI becomes increasingly integrated into scientific workflows, governance mechanisms will need to evolve to help ensure that AI

technologies remain scientifically rigorous, ethically responsible and beneficial to the global research community. Particular attention was given to strengthening cooperation among governments, research institutions, international organizations and standards bodies to establish internationally accepted frameworks supporting responsible AI for Earth science.

28.3 GeoGPT: Empowering global geoscientists

Grant Michael Boquet, Senior Research Fellow at Zhejiang Lab, presented GeoGPT, a family of specialized AI models developed for the geoscience domain, encompassing LLMs, vision-language multimodal models, and geoscience scientific multimodal models. The presentation highlighted how the GeoGPT family supports scientific research by integrating multimodal data understanding with domain-specific scientific reasoning. GeoGPT has been developed in accordance with internationally recognized data format standards established by the ISO and the International Union of Geological Sciences (IUGS), enabling interoperability with global geological databases.

The presentation also introduced the development of the Petroleum Geology Knowledge System (PGKS-1.0) through collaboration among 17 research institutions. Developed using an AI-driven knowledge engineering approach, PGKS-1.0 has completed expert review and has been accepted by the IUGS Commission for the Management and Application of Geoscience Information (IUGS-CGI) for global release. This work was presented as an example of how AI can facilitate the construction and sharing of standardized geoscience knowledge resources within the international scientific community.

Practical demonstrations illustrated how GeoGPT applies multimodal fusion technologies to intelligent geological structure identification and combines domain-specific reasoning capabilities to support oil and gas reservoir prediction and mineral resource assessment. Additional case studies demonstrated the rapid construction of three-dimensional geological models compliant with Open Geospatial Consortium (OGC) standards in complex geological environments, as well as improved mineral prediction through multi-source data integration. The presentation also emphasized that standardized data processing workflows contribute to the verifiability and reproducibility of research outcomes, demonstrating the potential of GeoGPT to accelerate the digital transformation of geoscience research.

The presentation highlighted that responsible AI for Earth science depends not only on technological innovation but also on internationally recognized governance frameworks and interoperable scientific infrastructures. Future international standardization could further strengthen transparency, scientific reproducibility, AI governance and trusted data sharing across global Earth science research communities.

28.4 International standards supporting AI-enabled geoscience

GeoGPT highlights the value of internationally recognized standards in enabling interoperable AI-enabled geoscience research. Existing standards and specifications developed by organizations such as ISO, IUGS and OGC provide common foundations for scientific data exchange, metadata interoperability, geospatial information sharing and collaborative scientific research. As foundation models become increasingly integrated into Earth science research, continued international standardization will play an important role in supporting trustworthy, reproducible and interoperable AI-enabled scientific workflows.

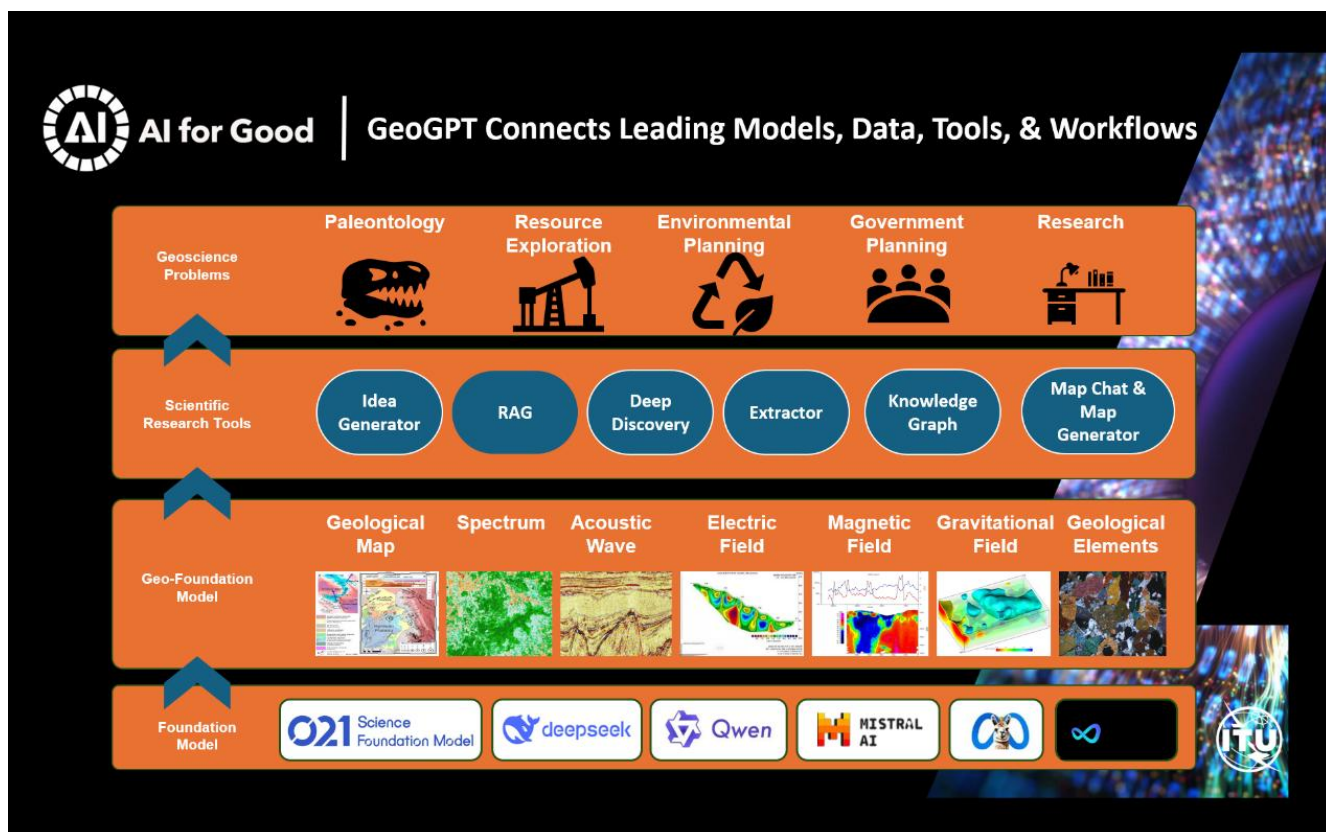


Figure 92: GeoGPT architecture and representative application scenarios

28.5 OneEarth: A global public good for Earth system Science

Richard Chuchla, Co-Chair of the GeoGPT Governance Committee, presented OneEarth as an open, intelligent scientific public good designed to serve the global Earth science community. The presentation introduced OneEarth as an integrated scientific infrastructure that brings together the Earth Science Data Network, GeoData Foundations, geoscience domain models, task scheduling systems, a four-dimensional Earth engine and a scientist workbench, providing researchers with a unified environment that supports the complete scientific workflow from data acquisition to publication.

The presentation highlighted how OneEarth delivers unified access to scientific data resources and computational capabilities through standardized interfaces, enabling researchers to efficiently discover, access, process and analyse Earth system science data. The platform's four-dimensional Earth engine was presented as a powerful capability for dynamic visualization and analysis of spatiotemporal information, while the scientist workbench provides interactive tools to support scientific exploration and collaborative research.

Application examples demonstrated how OneEarth supports global climate change monitoring and natural disaster early warning through integrated AI and Earth science capabilities. These examples illustrated the value of open scientific infrastructures and scientific public goods in enabling international collaboration, facilitating knowledge sharing, and accelerating scientific discovery across the global Earth science community.

The presentation highlighted that open scientific platforms require not only advanced AI capabilities but also standards for governing scientific data, metadata, computational interfaces and collaborative research workflows. Continued international standardization could further strengthen interoperability among scientific platforms, improve data portability, and support trusted AI-enabled scientific infrastructures serving the global research community.

For example, the Deep-time Digital Earth international scientific programme promotes global collaboration by establishing interoperable scientific infrastructures for Earth science. Through standardized data protocols, open access mechanisms, and international collaboration networks, DDE enables researchers from different countries and disciplines to share scientific data and knowledge more effectively. The programme also aligns with internationally recognized standards, including ISO geographic information metadata standards and OGC geospatial interoperability standards, providing an important foundation for AI-enabled scientific collaboration.

28.6iEarth: Multimodal embedding of Earth system science data and responses to global challenges

Gong Peng, Professor, Vice-President and Pro-Vice-Chancellor at the University of Hong Kong, presented iEarth, focusing on multimodal embedding technologies for Earth system science data and their applications in addressing global challenges. The presentation explored how heterogeneous Earth science data (including observations, scientific knowledge and domain-specific information) can be integrated through AI technologies to support multidisciplinary scientific research and improve understanding of complex Earth system processes.

The presentation demonstrated how multimodal embedding enables AI systems to establish semantic connections across different data modalities, facilitating knowledge discovery and supporting scientific analysis that would otherwise require substantial manual effort. By providing unified representations of diverse scientific information, AI can enhance cross-disciplinary research and improve the effectiveness of scientific decision-making in addressing environmental and societal challenges.

The presentation emphasized that AI-enabled multimodal data integration represents an important capability for future Earth system science, enabling researchers to better utilize increasingly diverse scientific resources while strengthening collaboration across disciplines and institutions.

The presentation underscored the growing importance of standardized multimodal data representations and interoperable scientific data models for AI-enabled Earth system science. Future international standardization could support common semantic representations, multimodal data interoperability and AI-ready scientific datasets, enabling broader collaboration across the international Earth science community.

28.7Case studies of AI-enabled geoscience research

Mike Stephenson, Founding President of Deep-time Digital Earth, shared case studies illustrating the application of AI in geoscience research. The presentation highlighted practical experiences in applying AI technologies to scientific research workflows and

demonstrated how AI can enhance scientific productivity, improve research efficiency and support knowledge discovery across Earth science disciplines.

28.8 AI + Earth Science: Advancing Human Sustainability

Hans Thybo, Distinguished Professor at the Deep-Earth Exploration Laboratory of the Chinese Academy of Geological Sciences and Chief Scientist of the Deep-Time Digital Earth Zhejiang International Research Center, discussed the role of AI in advancing human sustainability through Earth science. The presentation explored how AI-enabled Earth science can contribute to addressing challenges related to climate change, environmental sustainability, natural resource management and other issues of global significance, highlighting the broader societal value of integrating AI with Earth science research.

28.9 Key messages from the presentations

Across the technical presentations, several common messages emerged.

AI is becoming an increasingly important enabling capability for Earth system science, supporting scientific reasoning, knowledge discovery, multimodal data integration and intelligent research workflows. Open scientific platforms and scientific and technological public goods – including AI models, data infrastructures and collaborative research environments – can broaden access to advanced research capabilities and promote more inclusive participation in scientific discovery.

The presentations also underscored the importance of internationally interoperable data standards, transparent AI methodologies, and open scientific collaboration as essential foundations for trustworthy and reproducible AI-enabled research. Together, these elements contribute to strengthening the global Earth science ecosystem and accelerating scientific innovation through international cooperation.

28.9.1 Global prospects for AI + Earth science collaboration

The workshop emphasized open science, interoperable data and platforms, responsible AI governance, equitable access, international standards, and stronger global partnerships.

Participants generally agreed that the increasing adoption of AI in Earth science requires stronger international cooperation not only in scientific research, but also in data governance, open scientific infrastructures and trusted AI ecosystems. The discussion highlighted several common priorities for the international community:

- Promoting open and interoperable scientific infrastructures to support global Earth science research
- Strengthening international partnerships among research institutions, international organizations and scientific communities
- Advancing transparent, trustworthy and responsible AI governance for scientific research;
- Expanding equitable access to AI capabilities through open scientific platforms and shared technological resources
- Enhancing collaboration to address global challenges in support of the United Nations Sustainable Development Goals

28.9.2 Standardization perspectives

The workshop identified several areas where international standards could further accelerate AI-enabled Earth science research, highlighting opportunities for future standardization in areas such as:

- Interoperable Earth science data and metadata supporting AI applications
- Provenance, traceability and reproducibility of AI-assisted scientific research
- Evaluation methodologies for Earth science foundation models and scientific AI agents
- Interoperable scientific public goods and collaborative research platforms
- Governance frameworks supporting trustworthy, open and equitable AI for scientific research

Participants also recognized the importance of continued collaboration among ITU, ISO, UNESCO, IUGS, OGC and the broader international scientific community in advancing these areas.



Figure 93: Speakers at the workshop on GeoGPT and OneEarth

28.10 Key outcomes

The workshop highlighted several key messages regarding the future development of AI-enabled Earth science and international collaboration.

AI is reshaping Earth science research. AI is transforming Earth science from predominantly hypothesis-driven research towards increasingly data-intensive and AI-

assisted scientific discovery, enabling researchers to analyse complex, multimodal scientific data more efficiently and accelerate scientific innovation.

Scientific and technological public goods are expanding access to AI-enabled research capabilities. Platforms such as the Deep-time Digital Earth international scientific programme and OneEarth demonstrate how open scientific infrastructures, standardized data protocols and open science principles can broaden access to scientific data, computational resources and AI technologies for researchers worldwide.

International standards provide an essential foundation for trustworthy AI in Earth science. The workshop highlighted the importance of internationally recognized standards and governance frameworks – including the work of ITU, ISO, UNESCO, IUGS and OGC – in supporting interoperable scientific data, reproducible research, transparent AI methodologies and trusted scientific collaboration. Future standardization efforts may further strengthen AI-ready scientific data, interoperable research platforms and evaluation methodologies for AI-enabled scientific discovery.

Practical applications demonstrate the growing impact of AI on scientific research. Case studies presented throughout the workshop illustrated how AI technologies can significantly improve research efficiency, support scientific knowledge extraction, enhance multimodal data analysis and enable new approaches to complex scientific problems across multiple Earth science disciplines.

Responsible AI requires openness, transparency and equitable access. Participants emphasized that the sustainable development of AI for Earth science depends on transparent and trustworthy AI systems, effective governance mechanisms, equitable access to scientific resources and continued support for researchers across different regions of the world.

International collaboration and standardization will be critical for future progress. The workshop underscored the importance of strengthening international partnerships, advancing standards for AI-enabled scientific research, promoting open scientific ecosystems and supporting the United Nations Sustainable Development Goals. Continued collaboration among scientific institutions, standards bodies and international organizations will be essential to building an open, interoperable and sustainable global Earth science ecosystem.

28.11 Standardization opportunities

Throughout the workshop, participants identified several opportunities where international standardization could further accelerate AI-enabled Earth science research and strengthen global scientific collaboration.

Priority areas include:

- AI-ready Earth science data and metadata supporting interoperable scientific research
- Provenance, traceability and reproducibility of AI-assisted scientific workflows
- Evaluation methodologies for Earth science foundation models and scientific AI agents
- Interoperability among scientific public goods, collaborative research platforms and AI infrastructures

- Governance frameworks supporting trustworthy, transparent, and equitable AI for scientific research
- Standardized approaches for integrating multimodal scientific data across disciplines
- Capacity-building frameworks supporting the global adoption of AI-enabled scientific research



Figure 94: Speakers at the workshop on GeoGPT and OneEarth

29 Advancing AI in networks

29.1 Introduction

The integration of AI into telecommunication ecosystems represents a profound architectural shift, transitioning networks from transparent pipelines into intelligent, adaptive infrastructures.

Opening a workshop on [*Advancing AI in networks*](#) convened by ITU-T Study Group 13, **Kangchan Lee**, Vice-Chair of ITU-T Study Group 13, and **Marco Carugi**, Rapporteur for Question 20/13 (IMT networks and AI/ML: Requirements and architecture) in ITU-T Study Group 13, underscored the significance of this transition, noting that the industry has reached a critical juncture where AI is no longer an auxiliary feature but a foundational requirement and enabler for next-generation telecommunications.

The core objective of this workshop was to showcase and analyze the latest standardization milestones, functional frameworks and operational practices enabling the effective integration of AI capabilities in network operations (AI for networks) and the enhancement of the network capabilities to take full advantage of AI support (networks for AI).

Service providers and network operators provided their views on the network evolution enabled by AI, including emerging challenges, requirements and application scenarios.

Four foundational technology pillars, which are currently under standardization within ITU-T Study Group 13, were discussed:

- **Generative AI:** Shifting from static telemetry automation to conversational, multi-turn capabilities
- **Digital twin networks:** Establishing real-time virtual reflections of physical networks for closed-loop testing
- **Semantic-aware networking:** Moving beyond bit-level transport to interpret data meaning and user intent
- **Autonomous networks:** Defining architecture frameworks and metric-driven lifecycles for systems to self-configure, self-optimize and self-heal

Antonio De Domenico, Principal Engineer at Huawei France, presented an in-depth analysis of the intersection between LLMs and telecommunication tasks¹.

While customer care still accounts for roughly 46% of current telco AI deployments, a substantial 34% of overall operational expenditure remains dedicated to network operations. Mobile network operators are seeking to monetize inference and compute capabilities inside data centres and edge topologies.

Consequently, standardization efforts focus on building explainable, reproducible, trustable evaluation frameworks that incorporate diverse KPIs beyond basic accuracy. Looking forward, the technical track is shifting from evaluating single-turn responses to building infrastructure for multi-turn evaluations, where autonomous coding and operational agents invoke tools, execute reasoning loops and adaptively modify the environment. [Y.Benchframe-GenAI](#) is an ongoing standardization effort on generative AI benchmarking within ITU-T Study Group 13.

¹ See presentation- [Recent Progress on Standardization Efforts Around Benchmarking AI in Telecom Networks](#)

Box 15: Technical Report TR.GenAI-Telecom

An ITU-T Technical Report on "[Potential requirements and methodology for deploying and assessing generative AI models in telecom networks](#)" covers potential requirements on generative AI knowledge of telecom networks, functional requirements, impactful use cases, model assessment methodologies and risk analysis.

Ved P. Kafle, Research Manager at Japan's National Institute of Information and Communications Technology and Rapporteur for Question 22/13 (Enhanced information-centric networking and emerging network technologies) in ITU-T Study Group 13, delivered an extensive walkthrough of the digital twin network standardization lifecycle². A digital twin network serves as a complete virtual representation of a physical network, enabling real-time interactive mapping.

He detailed the foundational architecture consisting of three functional layers (physical network, network digital twin, and network application) interacting via double closed loops. The inner closed-loop handles high-speed, automated control adjustments directly within the digital twin layer, while the outer closed-loop executes longer-cycle system optimization via broad network applications.

Box 16: Digital twin network (DTN) standards from ITU-T Study Group 13

- [ITU-T Y.3090](#): Reference architecture and DTN framework
- [ITU-T Y.3091](#): Capability levels and evaluation methods
- [ITU-T Y.3092](#): Integration of DTNs into network management and orchestration systems
- [ITU-T Y.3093](#): Framework and functional requirements for the data domain
- [ITU-T Y.3094](#): Requirements for the DTN data model domain, effectively defining how the system processes information

Xiaou Liu, Deputy Director of the AI Research Center at the China Telecom Research Institute, presented the operational realities and standardization roadmap for autonomous networks³. China Telecom has actively anchored its cloud-network operating system capabilities for autonomous networks within standards bodies, including ITU, ETSI, TMF and GSMA.

The presentation gave an overview of China Telecom's broader AI standardization footprint before turning to ITU standards for autonomous networks, starting with the [Y.3061](#)

² See presentation [Digital Twin Networks for AI-Driven Control](#)

³ See presentation [Autonomous Networks: Practice and Standardization](#)

architecture framework, which positions knowledge as a first-class architectural component via the Knowledge Base Subsystem (KBS). He explained how autonomous networks leverage a "data flywheel" effect: raw network data (work orders, alarm logs, expert experience, and both structured and unstructured operational data) are continuously cleaned and structured to feed specialized telecom LLMs. These models then output high-value operational rules, which dynamically update the network's knowledge repositories. This data-to-knowledge lifecycle is formalized in [Y.3064](#) (knowledge management for autonomous networks).

The session also covered [Y.3062](#) (trustworthiness evaluation), [Y.3063](#) (effectiveness measurement), the ongoing draft ITU standards [Y.aias-reqts](#) and [Y.terms-AIAN](#), and [Supplement 94](#) to the ITU-T Y.2300-series.

Yong Xiao, Professor at Huazhong University of Science and Technology, presented a compelling paradigm shift targeted at breaking the traditional Shannon capacity bottleneck⁴. While classical communications treat all data bits equally, semantic-aware networking exploits machine- and human-shared semantic domains to transmit, interpret and optimize data based on underlying meaning and downstream task utility.

He clarified that semantic-aware networking moves completely beyond the "AI4Net" (using AI as an external tool for legacy protocols) and "Net4AI" (treating the network as a basic pipeline for distributed AI data) models. Instead, semantic-aware networking represents an "AI in Net" reality, where AI and network routing natively fuse to deliver intent-driven quality of experience (QoE).

The presentation highlighted key theoretical breakthroughs driven directly by ITU requirements, including – but not limited to – implicit semantic-aware networking (iSAN) frameworks for cognitive reasoning over missing context, and physical-layer semantics (pSAN) to achieve zero-shot knowledge transfer across varying radio-frequency environments. These requirements are being consolidated in the ongoing draft ITU standard [Y.RA-SAN](#) (requirements and reference architecture of semantic-aware networking).

Box 17: Technical Report TR.Reqts-SAN

An ITU-T Technical Report on "*Requirements of semantic-aware networking in future networks*" identifies requirements for semantic-aware networks to enable automated data representation, analysis, processing and learning in future networks, including IMT-2020 (5G).

29.2 Operators' views and emerging paradigms

Hiroshi Yamamoto, Director and Head of the Standardization Office at NTT, addressed the critical infrastructure and energy limitations facing modern AI development. AI models like

⁴ See presentation [Semantic-Aware Networking: Recent Progress in Theory, Standardization, and Prototyping](#)

GPT-4 require significant power, consuming approximately 40,000 MWh – equivalent to the output of 40 nuclear power plants – per training cycle. Furthermore, regional constraints, particularly in Tokyo where 64% of Japanese data centre floor area is concentrated, have created severe bottlenecks – grid development has failed to keep pace with demand, leading to power supply wait times of up to 10 years for new data centres.

To resolve these challenges, NTT proposes the "Watt-Bit Collaboration" framework under the Innovative Optical and Wireless Network (IOWN) vision⁵. Instead of transmitting electricity to urban-located data centres, this approach co-locates compute clusters directly with power plants and utilizes ultra-high-speed, low-latency all-photonic networks to transmit data "bits" rather than electrical "watts", reducing cable installation costs to approximately 1/100th of traditional budgets. In parallel, NTT is pursuing a complementary track to reduce AI resource demand: optimizing the AI model itself through its energy-efficient "tsuzumi 2" architecture. Relevant ITU work includes the standard ITU-T [Y.3335](#) (framework of low-latency and energy-efficient networks) from ITU-T Study Group 13 and the draft standard [L.WBC-FR](#) on distributed DC workload shifting under development in ITU-T Study Group 5.

Liang Liang, AI Frontier Technology Research Manager at China Mobile, provided an analytical operational path charting the transformation of networks from basic content delivery pipelines into dedicated inference infrastructures⁶.

He categorizes this evolution into two strict operational requirements:

- **Distributed agent inference:** Requiring predictable inference performance with stable Time-to-First-Token and Time-per-Token latencies across distributed edge clusters. The primary network-facing entry point for this optimization is Key-Value Cache management. Rather than forcing redundant pre-fill computations at every node, future networks must intelligently schedule, transmit, store, and reuse Key-Value Caches across federated clouds and storage layers.
- **Agent-to-agent collaboration:** As goal-oriented autonomous AI agents interact directly, the underlying network must natively handle unified agent identity management, dynamic task-oriented networking across administrative domains, new agent traffic forwarding (spanning models, tokens, memory, and feature vectors, not just text/voice/video), and multimodal interaction with predictable, low-latency performance to enable near-human real-time interaction.

Xiaoou Liu, representing China Telecom, laid out the unified evolutionary path integrating communication infrastructure and AI towards the Internet of Agents (IoA):

- **Unified theoretical origin of communications and AI:** Communications and large language models share a common theoretical foundation: Shannon information theory and conditional probabilistic reasoning. Two parallel three-stage evolution paths for communication and AI were sorted out, with agent-to-agent intent interaction identified as the convergence milestone that launches the IoA era.
- **Infrastructure transformation driven by mass heterogeneous agents:** Mass agents surge multimodal token traffic and turn basic bit pipelines into intent-native networks.

⁵ See presentation [Watt-Bit Collaboration and the IOWN Vision](#)

⁶ See presentation [Future Networks Supporting AI Development: From AI in Networks to Networks for Agentic AI](#)

China Telecom's full-stack XiRang features a five-in-one integrated framework. Its on-site practices feed into ITU standards, while unified architecture from ITU-T Study Group 13 enables cross-operator AI agent interoperation.

- **Standardization for long-term IoA interoperation:** Two verified operational cases were shared: a 40-algorithm base station AI system cuts power use by 700 million kWh annually and provincial QiMing LLM clusters boost fault handling efficiency by 30%. Standardized agent-agent interaction and distributed inference will be essential to support trillion-node semantic collaboration by 2035.

Dinh-Thuy Phan-Huy, Fellow at Orange, Referent of Orange Expertise/Networks and Researcher at Orange Innovation, delivered a critical assessment focused on balancing the "two faces" of AI's environmental impact: the energy savings driven by network automation versus the exponential energy demand triggered by conversational AI scaling⁷. Current data centre electricity demand is projected to grow by 30% by 2030, with a single complex inference call on models like GPT-4 and Gemini 2.0 consuming roughly 24 Wh.

To safely scale these capabilities without triggering catastrophic grid degradation, she presented three concrete *Net4AI* use cases:

- **Multimodal AI assistants (without XR):** Targeting an end-to-end roundtrip feedback delay below 1.1 seconds for over 90% of video inference calls to match natural human conversation flows.
- **Network-edge split rendering for XR/VR/robotics:** Deploying sustainable edge clouds providing less than 10 milliseconds of latency and up to 250 Mbps throughput strictly within confined geographic hotspots where physical device autonomy demands it.
- **Trusted, isolated access to generative AI:** Using IMT-2020 (5G) network slicing and local breakout features to isolate enterprise-grade operational AI traffic completely from the public internet default slice.

29.3 Challenges and standardization opportunities

A panel discussion moderated by **Marco Carugi** explored the complexities of integrating AI into telecommunication infrastructures, addressing critical needs for cross-industry standardization, energy management and the evolution of network architecture.

Hiroshi Yamamoto focused on the systemic energy challenges facing modern infrastructures, arguing that electrical grids and communication networks must establish tighter collaboration. He noted that this work is still at an early stage and pointed to ITU as the platform through which cross-industry standardization on this interface could be pursued.

Liang Liang emphasized that networks supporting AI agents require functional improvements beyond standard performance metrics, specifically citing the need for robust identity management and secure transmission protocols for inter-agent communication.

Dinh-Thuy Phan-Huy distinguished between "AI for network" (operational energy efficiency) and "Network for AI" (strategic business challenges). She emphasized that operators should protect their value by focusing on digital sovereignty and high-security

⁷ See presentation - [Network for AI & AI for Network: Balancing Environmental Impacts](#)

environments, ensuring they remain essential infrastructure providers rather than being reduced to "dumb pipes" for over-the-top service providers.

Responding to an audience question on the future of orchestration in an AI-driven network, one panelist described an evolution towards a "translation layer" in which large models become the core engine of network operations – moving from today's early integration of LLMs into operational processes towards agents that interact directly with live network environments to self-evolve, supported by technologies such as digital twins.

In closing, **Hiroshi Yamamoto** added that addressing AI's challenges will require breaking down silos and fostering a stronger culture of cross-organizational cooperation, since no single industry or standardization group can solve these challenges alone.



Figure 95: Panel discussion on challenges and standardization opportunities

29.4 Conclusion

The workshop confirmed that AI integration in telecommunication networks has graduated from theory to operational reality. And, as networks evolve into "Internet of Agents" (IoA) infrastructures, requirements are shifting from basic bit-rate optimization to high-level intent interpretation and semantic utility.

The workshop identified some urgent standardization needs:

- **Agent benchmarking in telecommunication networks:** The development of business-oriented, rigorous and transparent benchmarking frameworks to assess the performance (including accuracy, but also in relation to efficiency, energy and other

performance dimensions) of agents in telecommunication use cases will accelerate the deployment of agents in telecommunication networks.

- **Semantic-based multi-agent communications and interaction protocols:** ITU should accelerate standardization work on semantic machine-to-machine interaction, including enhancements to [Y.ICI-AN-reqts](#) and other ongoing work related to semantic communications.
- **Enhancements of semantic communication frameworks:** Industry collaboration is required to enhance semantic frameworks, e.g. by defining technical verification rules that prevent semantic poisoning and adversarial manipulation while ensuring data integrity across shared knowledge layers.
- **Formal verification for autonomous controls:** Standards such as the ongoing draft [Y.DTN-NetVerification](#) are urgently needed to ensure that self-evolving network agents remain safely bounded, explainable and controllable by human operators.



Figure 96: Speakers at the workshop on advancing AI in networks

30 AI on the menu: Transforming digital food

30.1 Introduction

A workshop on *[AI on the Menu: Transforming Digital Food Systems](#)* explored how AI can contribute to resilient and inclusive agri-food systems. Discussions examined practical AI applications, organizational transformation, collaborative research initiatives and the governance and standardization frameworks needed to scale AI responsibly.

AI is rapidly transforming global agri-food systems by enabling more efficient, resilient and sustainable approaches to agricultural production, food processing, distribution and humanitarian response. AI technologies are increasingly supporting precision agriculture, climate-smart farming, digital advisory services, food safety, supply chain optimization and food security forecasting. Together, these innovations have the potential to improve agricultural productivity while strengthening resilience to climate change, reducing food loss and enhancing the sustainability of agri-food systems.

As AI adoption accelerates, however, technological innovation alone will not be sufficient to deliver these benefits. AI-enabled food systems require trusted digital infrastructure, interoperable data ecosystems, responsible governance and internationally harmonized standards to ensure that AI solutions remain transparent, scalable and inclusive. Building these foundations will enable governments, farmers, humanitarian organizations, industry and researchers to share information securely and collaborate more effectively across the food value chain.

The Workshop also elaborated on the activities of the [Global Initiative on AI for Agri-Food Systems](#) led by ITU, the Food and Agriculture Organization of the United Nations (FAO), the World Food Programme (WFP) and the International Fund for Agricultural Development (IFAD), which works towards strengthening collaboration between the United Nations, governments, standards bodies, academia, industry and civil society in advancing trustworthy AI for agri-food systems.

30.2 Opening

Seizo Onoe, Director of the ITU Telecommunication Standardization Bureau, and **Charles Spillane**, Chief Scientist at FAO, highlighted the transformative potential of AI in improving agricultural productivity, strengthening food security, enhancing climate resilience and supporting more sustainable and inclusive agri-food systems.



Figure 28.1: Seizo Onoe, Director of the ITU Telecommunication Standardization Bureau, and Charles Spillane, Chief Scientist at FAO

Sebastian Bosse, Head of the Interactive & Cognitive Systems Group at Fraunhofer HHI and Technical Chair of the Global Initiative on AI for Agri-food Systems, underscored that

international standards are fundamental to building trusted, interoperable and scalable AI ecosystems, enabling countries to harness AI safely and consistently while fostering global collaboration and innovation. He highlighted that standardization work is underway on digital agriculture under the newly established Question 11/20 (Digital agriculture: from smart farm and production to safe and secure consumption) in ITU-T Study Group 20.



Figure 28.2: Sebastian Bosse, Head of the Interactive & Cognitive Systems Group at Fraunhofer HHI and Technical Chair of the Global Initiative on AI for Agri-food Systems

Global Initiative on AI for Agri-food Systems

The Global Initiative on AI for Agri-food Systems, launched during the AI for Good Global Summit 2025, provides a collaborative platform for advancing the use of AI coupled with other emerging technologies across the agri-food domain. Building on earlier work such as the ITU-FAO Focus Group on AI and IoT for Digital Agriculture (FG-AI4A), the initiative brings together governments, UN agencies, standards organizations, academia, industry, and civil society to accelerate collaboration on AI research, digital technology integration, capacity-sharing and proof-of-concept (PoC)/implementation.

The Global Initiative supports responsible AI by promoting knowledge exchange, pilot projects, technical guidance, capacity building, and international cooperation across food safety, nutrition, climate resilience, and humanitarian response to build resilient agri-food systems. By driving practical implementation and linking it to ITU-T's standards work, it aims to ensure that AI-enabled agri-food systems are interoperable, inclusive, transparent, and scalable, while supporting sustainable development and resilient agri-food systems worldwide.

He also introduced the [Global Initiative on AI for Agri-food Systems](#), emphasizing its role in bringing together governments, UN agencies, academia, industry, farmers' organizations and standards bodies to accelerate the responsible adoption of AI within this domain. The work of this Global Initiative builds on the [ITU-FAO Focus Group on AI and IoT for Digital Agriculture](#). The report from this Focus Group have formed the basis for ITU work including:

- [ITU-T Y.Suppl.82](#): Standardization gaps and roadmap for AI and IoT in digital agriculture)
- [ITU-T. Suppl.83](#): Optimizing digital agriculture with best practices for integrating AI and IoT
- [YSTR.DataModelling-Agri](#): Data processing, management and analytics with AI for digital agriculture

30.3 Digital food futures: Innovation for people and planet

The first session explored how AI is being applied across agriculture, humanitarian response and food security to improve decision-making, strengthen resilience and support sustainable development. While the speakers represented diverse organizations and perspectives, they shared a common vision that AI should serve as an enabling technology that empowers people, strengthens institutions and improves collaboration rather than replacing human expertise. Throughout the session, practical examples demonstrated that successful AI adoption depends on trusted data, strong partnerships and digital ecosystems capable of supporting innovation at scale. The session was moderated by **Magan Naidoo**, Chief Data Officer at WFP.



Figure 97: Simon Winter, Vice-President for Reimagining Humanitarian Nutrition Security at the Rockefeller Foundation

Simon Winter, Vice-President for Reimagining Humanitarian Nutrition Security at the Rockefeller Foundation, highlighted the increasingly complex global landscape for food and

nutrition security. Climate change, conflict, environmental degradation, economic instability and declining humanitarian funding have created interconnected crises that require new approaches capable of linking humanitarian response with long-term resilience building. While unprecedented volumes of agricultural, nutrition, climate and humanitarian data are now available, these information resources remain fragmented across organizations, limiting their usefulness for operational decision-making.

To address this challenge, he introduced the Reimagining Humanitarian Nutrition Security (RHNS) initiative, which seeks to integrate existing information systems rather than creating new data silos. The initiative combines Earth observation, nutrition surveillance, climate forecasting, conflict monitoring, agricultural information and farmer advisory services into shared decision-support systems capable of supporting anticipatory action and strengthening resilience before crises occur. AI provides the analytical capability needed to transform these diverse datasets into actionable intelligence that can improve humanitarian planning and resource allocation.

Drawing on research undertaken in Haiti, Somalia and the Philippines, he emphasized that local stakeholders consistently valued trusted and locally relevant information over simply increasing the quantity of available data. Reciprocal data sharing, local ownership, institutional capacity building and practical decision support were identified as critical enablers of successful AI adoption. The presentation concluded by outlining plans for an international RHNS Data Community that will coordinate work on AI-enabled food security, predictive malnutrition, food price monitoring and anticipatory action.

Caroline Gaju, Senior Technical Specialist at IFAD, presented IFAD's experience in applying AI to strengthen rural livelihoods and improve agricultural resilience. She described AI as an enabling technology that supports data-driven decision-making, climate adaptation, digital advisory services and improved market access, forming a central element of IFAD's ICT4D Strategy and its vision for digital transformation in agriculture.

The presentation highlighted IFAD's priorities for 2025-2030, including the development of digital public infrastructure (DPI), farmer registries, inclusive digital finance and AI-enabled agricultural extension services. These initiatives recognize that AI can only achieve sustainable impact when supported by interoperable digital infrastructure capable of connecting farmers, advisory services, markets and governments.

A practical example was provided through the Smart Farm Project in Rwanda and Ethiopia, which combines weather forecasting, crop disease prediction and farm-level analytics to deliver localized recommendations through SMS and mobile applications in local languages. More than 58,700 farmers have already been onboarded towards a target of 130,000 beneficiaries, demonstrating the potential for AI-enabled advisory systems to operate successfully at scale.

John Colmey, Senior Strategic Adviser and Co-Founder of Global Landscapes Forum, explored how AI can support more sustainable and nature-positive food systems by improving decision-making across agricultural landscapes. He emphasized that AI should not only increase agricultural productivity but also strengthen biodiversity conservation, climate resilience and ecosystem management. By integrating environmental, agricultural, and socio-economic information, AI enables farmers, policymakers, investors and local communities to make faster, more localized and evidence-based decisions.

He highlighted the importance of AI applications across precision weather forecasting, soil intelligence, supply chain optimization, digital traceability, biodiversity monitoring and landscape planning. These technologies can improve resource efficiency, reduce harmful agricultural inputs, enhance climate adaptation and increase transparency throughout global food systems.

Based on the work of the Global Landscapes Forum, he stressed that the success of AI will ultimately depend on trust, inclusion and public-good outcomes. Trusted data, transparent methodologies, interoperable digital systems, effective governance and equitable access are essential to ensuring that AI benefits farmers and communities, particularly smallholders and producers in developing countries. He concluded that AI-enabled food systems should remain human-governed, science-guided and grounded in local landscape realities.



Figure 98: John Colmey, Senior Strategic Adviser and Co-Founder of Global Landscapes Forum

Ezekiel Brooks, Chief Technology Officer at US Hunger, examined how organizations themselves must evolve to benefit fully from AI. Rather than describing AI as another technology cycle, he argued that AI represents a permanent shift in how organizations operate, make decisions and deliver services. Successful adoption therefore requires organizations to rethink their workflows instead of simply automating existing processes.

He argued that organizations often attempt to build a "faster horse" by accelerating inefficient processes instead of redesigning them to better serve beneficiaries. AI should instead reduce operational burdens through smarter intake processes, natural language processing, intelligent document handling and workflow automation, enabling staff to devote more time to relationship building, strategic decision-making and direct engagement with communities experiencing food insecurity.

The presentation emphasized that AI should strengthen organizations without replacing the people who drive their missions. Responsible implementation therefore requires governance, workforce development, organizational learning and human oversight to ensure that AI enhances institutional effectiveness while maintaining trust with communities.

Michael Tsan, Partner & Global AI Lead at Dalberg Advisors, introduced the "AI Collaborative: Food Security," an international initiative designed to accelerate AI innovation through collaborative research, shared infrastructure and coordinated action. The presentation noted that approximately 30% of the global population experiences moderate or severe food insecurity, driven by climate change, conflict, economic shocks and the continuing impacts of recent global crises. He highlighted that the principal constraint on AI adoption is no longer technological capability, but rather the lack of coordination, trusted data and shared infrastructure.

The Collaborative is organized around three strategic pillars: improving the prediction of food crises through AI-enabled forecasting; accelerating the development of climate-resilient crops using AI throughout the breeding process; and providing AI-powered advisory tools that help smallholder farmers increase productivity while reducing costs. Current activities include multi-signal forecasting initiatives involving WFP, the World Bank, CGIAR, NASA Harvest, AI-assisted crop breeding programmes, and AI-enabled advisory platforms delivered through organizations such as One Acre Fund and Digital Green. The presentation emphasized that transformative impact would come from developing shared infrastructure that no single institution can build independently. Priorities include interoperable data systems, common standards for data sharing and model integration, shared agricultural taxonomies and language resources, and feedback mechanisms linking farm-level observations with forecasting and breeding programmes.

30.4 Scaling AI for food systems: Standards and international Cooperation

The second session was moderated by **Indran Naidoo**, Director of the Independent Office of Evaluation at IFAD. Building on the practical applications mentioned in the previous session, the second session explored the foundational elements required to scale AI across agri-food systems. Discussions focused on trusted data ecosystems, semantic interoperability, standardization, governance and international collaboration, highlighting that AI can only achieve its full potential when supported by common standards, shared data models and interoperable digital infrastructure. Speakers emphasized that while AI technologies continue to evolve rapidly, ensuring that AI systems can exchange, interpret and act on information consistently across organizations and countries remains one of the sector's greatest challenges.

Diva Avaya Sharma, Founder of Cognitio Labs, shifted the discussion from AI algorithms to the information systems that underpin global food trade and food safety. She observed that every food shipment is accompanied by a complex collection of documents including certificates of analysis, laboratory reports, supplier specifications, audit reports and traceability records which collectively determine whether products are accepted, rejected, recalled or released into international markets. Rather than viewing these documents as administrative requirements, she described them as the foundation of trust within global food systems.

The presentation highlighted that many challenges affecting international food trade stem not from AI limitations but from fragmented digital ecosystems. Differences in certification schemes, incompatible traceability systems and inconsistent documentation standards increase transaction costs and create barriers for producers, particularly small and medium-

sized enterprises. Through examples such as laboratory testing and contamination monitoring, she demonstrated that trusted AI depends upon interoperable information systems capable of exchanging verifiable data across organizational and national boundaries.

Girmaw Abebe Tadesse, Principal Scientist and Manager for the AI for Good Lab at Microsoft, focused on the role of AI in addressing agricultural and food security challenges across Africa. He emphasized that, despite rapid advances in AI, many countries continue to face barriers including limited connectivity, insufficient computing infrastructure, fragmented agricultural data and shortages of digital skills. These challenges highlight the importance of developing AI ecosystems that are responsive to local needs and supported by strong national institutions. The presentation introduced ADAPT-Africa (AI-enabled Data for Agricultural Products and Transformation), an initiative that combines Earth observation, AI and open agricultural data to improve decision-making across the agricultural sector. The programme seeks to generate standardized datasets describing cropland, crop types, field boundaries and agricultural indicators while strengthening national statistical systems and supporting AI-powered services such as agricultural insurance, climate adaptation and digital advisory programmes.

Jan Christian Redlich, Chief Technology Officer at Bonn Systems, examined one of the least visible but most fundamental barriers to scaling AI: the absence of shared semantic meaning across food system data. Using the example of brewer's spent grain, he demonstrated that identical physical products may have very different value depending on factors such as moisture content, nutritional composition, intended use, traceability and regulatory requirements. AI systems cannot make reliable decisions from isolated numerical values alone; they require contextual information that defines what data mean.

To address this challenge, he presented AgriFoodLoop, a research initiative that uses knowledge graphs and shared semantic models to connect information across food systems. By enabling machine-readable meaning to travel with the data itself, semantic interoperability allows AI systems to provide more transparent recommendations, improve traceability, reduce hallucinations and support trusted decision-making across complex food supply chains. Standards are a key enabler to ensure interoperability for agri-food systems and support decision-making across the value-chain.

30.5 Conclusion and key takeaways

The workshop demonstrated that AI is becoming a powerful enabler of more resilient, sustainable and inclusive agri-food systems. Across both sessions, speakers showcased AI applications spanning humanitarian response, agricultural advisory services, food safety, biodiversity conservation, supply chain traceability and climate resilience. A common message was that AI should complement human expertise rather than replace it, empowering farmers, researchers, policymakers and humanitarian organizations to make timelier, informed and evidence-based decisions while ensuring that technology remains human-centred and responsive to local needs.

A recurring theme throughout the discussions was that the success of AI depends not only on advances in algorithms, but also on the availability of trusted data, interoperable digital infrastructure and robust governance frameworks. Speakers consistently emphasized that fragmented information systems, inconsistent data models and the absence of semantic interoperability remain significant barriers to scaling AI across food systems. Building trusted

digital ecosystems supported by transparent governance, shared data standards, DPI and international collaboration was identified as essential for enabling AI to operate reliably across organizations, sectors and national borders.

The workshop also highlighted the important role of international standardization in accelerating the responsible adoption of AI for agriculture. The [Global Initiative on AI for Agri-food Systems](#) supports collaboration among governments, UN agencies, standards bodies, academia, industry and civil society to advance trustworthy AI and promote interoperable digital ecosystems for food.

The discussions identified opportunities for ITU to continue supporting the development of international standards. The workshop identified several priorities for international standardization, including standards for AI-enabled digital agriculture, agricultural security, trusted data sharing and governance, guidance on trustworthy AI, and interoperability between AI, Earth observation, digital twins and other emerging technologies to support climate-smart agriculture. The [Global Initiative on AI for Agri-food Systems](#) can support these efforts by providing an open collaborative platform for stakeholders to share experiences, identify common needs, encourage the adoption of international standards, and promote standards' implementation through pilot projects, knowledge exchange and capacity building.

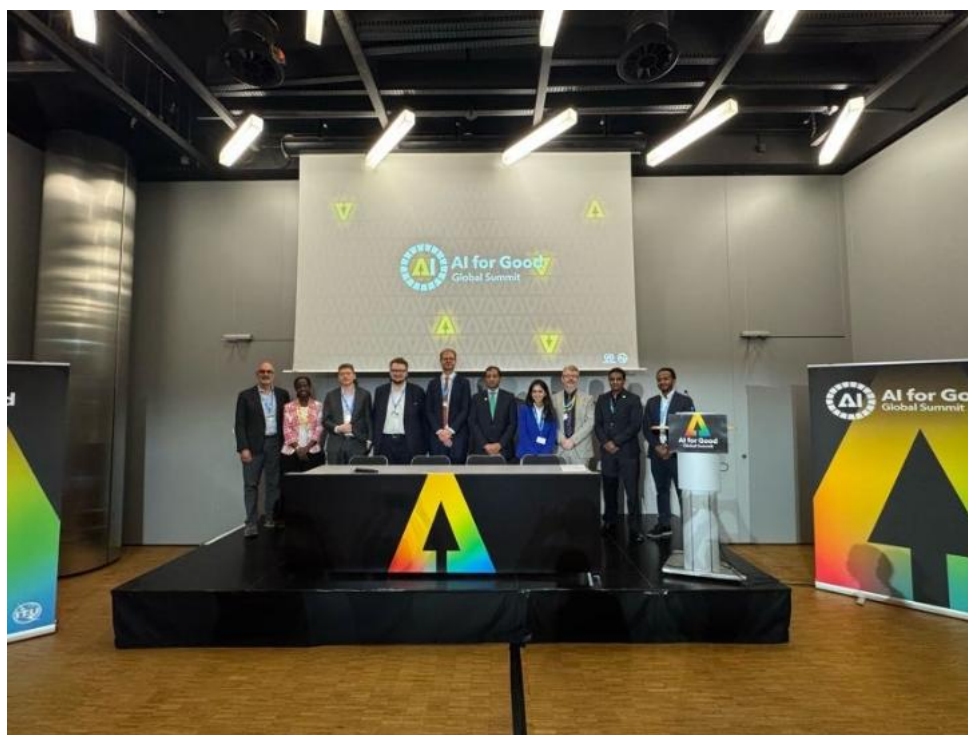


Figure 99: Speakers at the workshop on AI for agri-food systems

31 AI benchmarking and AI-powered testing

31.1 Introduction

A workshop on [AI benchmarking and AI-powered testing](#) showcased ongoing ITU standardization activities as well as initiatives and projects of other parties in the

development of AI monitoring and benchmarking frameworks that support AI/ML users in assessing the effectiveness, robustness and reliability of AI/ML systems. It also highlighted emerging AI based tools that can be used to support testing procedures and automate evaluation workflows.

As AI matures, the need for standards to promote efficiency and sustainability grows more important. Current AI and ML models are trained based on existing data and underlying assumptions regarding their operational context. Given the dynamic nature of real-world environments, these changes can result in AI model degradation, leading to reduced predictive accuracy or diminished decision quality as data and concepts evolve. To address these issues, it is essential to identify and monitor relevant parameters using defined metrics. Accordingly, selecting appropriate monitoring strategies tailored to the use case, data properties and organizational objectives is crucial for maintaining the long-term reliability and effectiveness of AI/ML systems.

The workshop consisted of two sessions, with the first session dedicated to AI benchmarking and its monitoring and second session focused on AI-enabled testing.

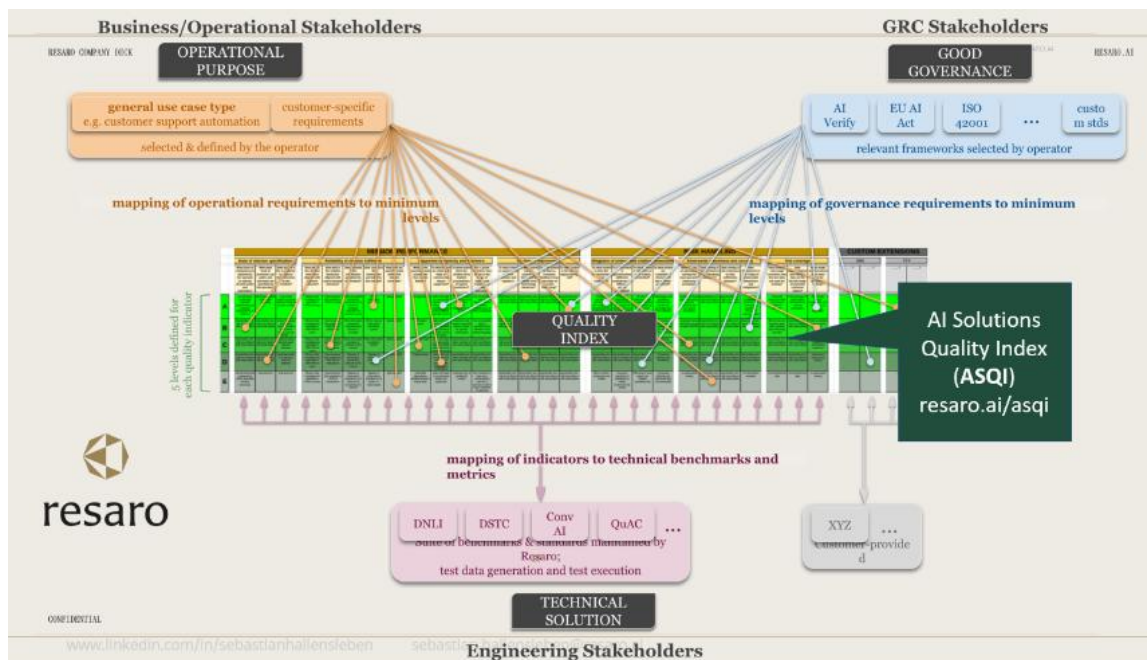
Opening remarks were delivered by **Ritu Ranjan Mittar**, Member at the Telecom Regulatory Authority of India. The first session was moderated by **Denis Andreev**, Advisor of [ITU-T Study Group 11 \(Protocols, testing and combating counterfeiting\)](#), and the second was moderated by **Artem Volkov**, Associate Professor at St. Petersburg State University of Telecommunications (SPbSUT) and Scientific Consultant at Russia's National Research Institute of Telecommunications.

31.2 AI benchmarking and monitoring

The primary objectives of this session were to explore comprehensive metrics and benchmarking methods for evaluating the performance of AI models, with a particular focus on identifying and addressing performance degradation. It aimed to discuss monitoring strategies that can be adapted to the unique requirements of different use cases to help ensure ongoing reliability and effectiveness.

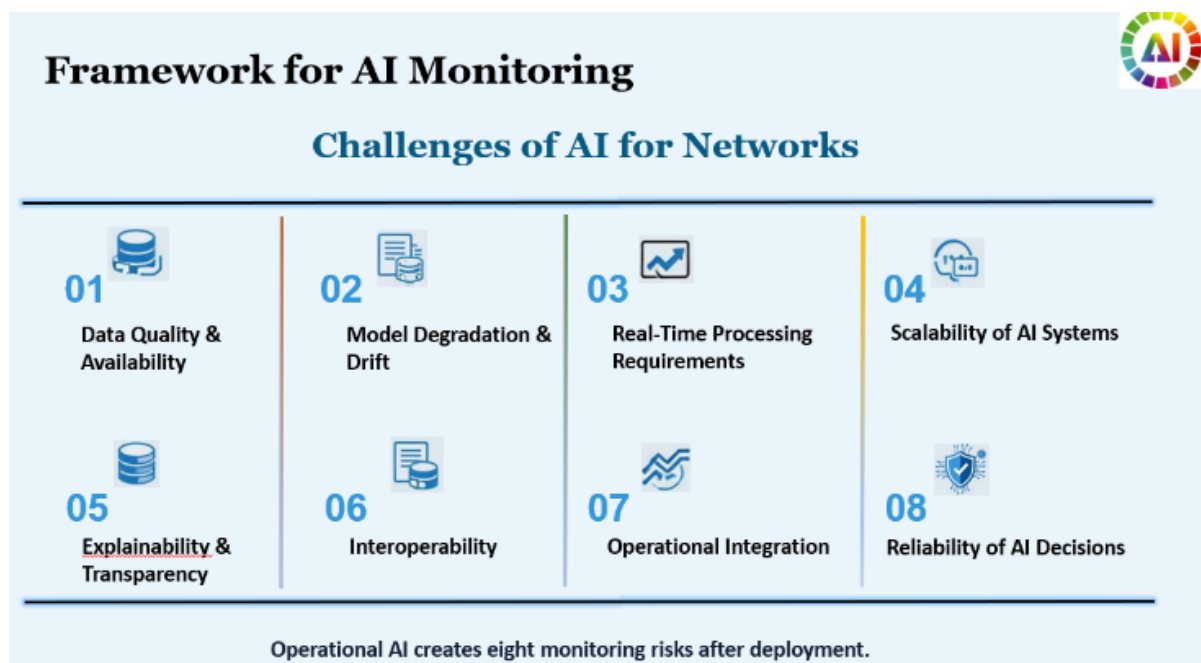
Sebastian Hallensleben, Chief Trust Officer at Resaro and Chair of CEN-CENELEC JTC21 (Artificial intelligence), gave a presentation titled *"Describing and measuring AI quality: a standardised approach."* He highlighted that, over the past decade, the focus in AI governance has been on trustworthiness and risk as well as regulation and compliance. This also reflects in standardization. The presentation explored going beyond standards supporting regulation towards standards enabling competitive AI markets, as well as going beyond trustworthiness towards standards for AI quality. The recently initiated ETSI TS 104 306 *"Quality Index for the use-case-specific characterization of AI solutions (AI Solutions Quality Index)"* will cover this.

Figure 100: AI quality presented by Sebastian Hallensleben, Chief Trust Officer at Resaro and Chair of CEN-CENELEC JTC21



During the discussion it was highlighted that the AI Solutions Quality Index aims to make AI quality understandable and comparable by translating technical performance into a limited set of clear, use-case-specific indicators readable by non-engineers. These quality levels should be supported by technical tests wherever possible, with human-subject testing used only when technical assessment cannot fully capture the required quality dimension.

Figure 101: Framework for AI monitoring



Huifen Wang, Director of the Multimodal Large Model Research Center at China Telecom Research Institute, gave a presentation titled *"AI monitoring and benchmarking to detect and mitigate its performance degradation: Overview of ITU-T SG11 activities."* She highlighted that AI monitoring is becoming increasingly important to ensure the long-term reliability, effectiveness and trustworthiness of AI systems, particularly in network environments. The presentation emphasized the need to consider both AI for network and network for AI perspectives and presented ITU-T Study Group 11 standardization activities addressing AI monitoring frameworks, key metrics, KPIs and relevant parameter sets, including work related to [ITU-T Q.4081](#) (Methods and metrics for monitoring machine learning/artificial intelligence in future networks including IMT-2020) and the draft ITU standards [Q.MP-GenAI](#) (Monitoring parameters of network supporting generative artificial intelligence services), [Q.MP-LLM-FN](#) (Computing power resource measurement model and parameters for large language model inference in future networks) and [Q.NMP-LLMT](#) (Network monitoring parameters for large language model training). It also identified existing gaps and potential directions for future standardization, including approaches to addressing both AI-specific and network-specific challenges.

ITU-T Study Group 11 is developing a portfolio of standards for AI monitoring in telecommunications, covering AI-for-network performance monitoring, network support for generative AI traffic identification, and resource monitoring for LLM inference and training. This work aims to help ensure reliable, efficient and measurable operation of AI systems across telecom networks. During the discussion, participants highlighted gaps between current AI capabilities and network requirements, as well as potential directions for future standardization of AI monitoring in networks.

AI/AI Agents Sandbox Testing. Structure

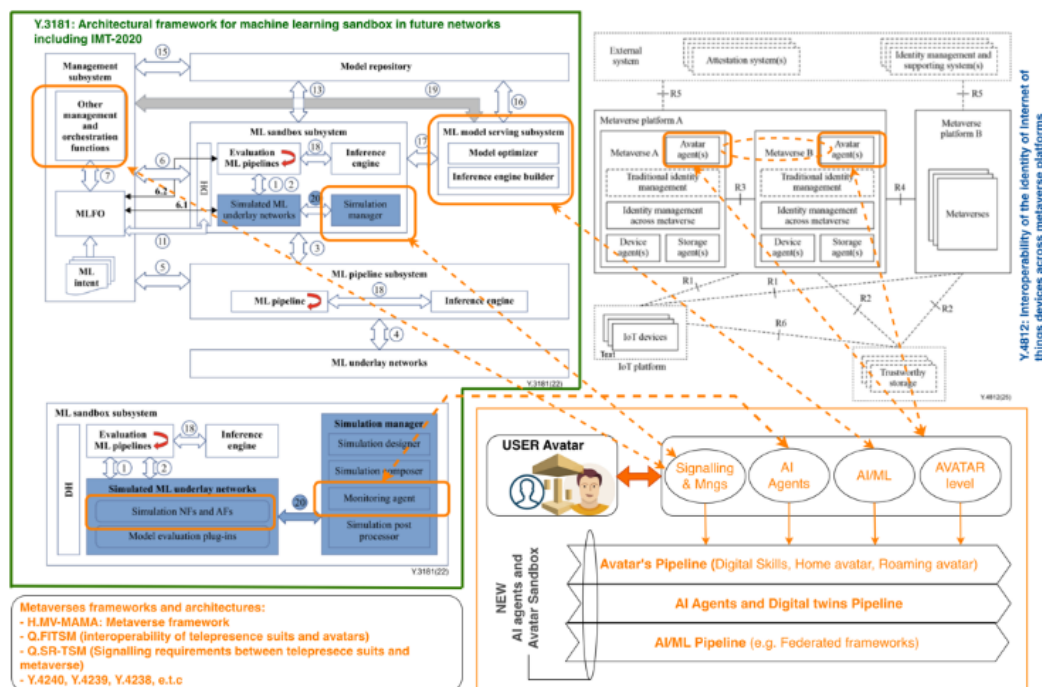


Figure 102: AI agents sandbox testing structure

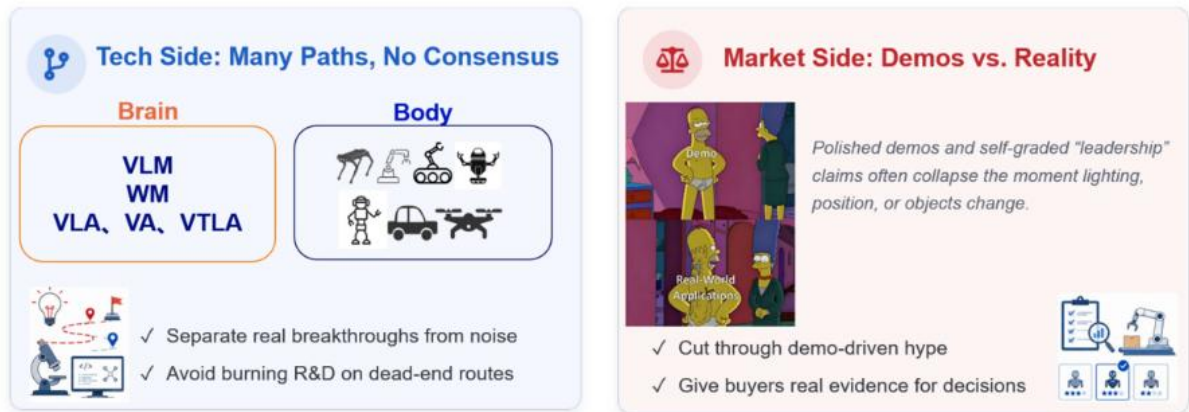
Andrey Koucheryavy, Professor and Head of the Network and Data Transmission Department at SPbSUT, gave a presentation titled *"Central Eurasia Sandbox for AI Benchmarking"* (co-authored by Anna Abramova, Director of the MGIMO AI Centre, and Alexey Borodin, Director General of the Regional Commonwealth in the field of Communications (RCC)). He highlighted that the Central Eurasia AI/ML sandbox, developed in line with [ITU-T Y.3181](#) (Architectural framework for machine learning sandbox in future networks including IMT-2020), can provide a practical environment for testing and benchmarking AI/ML systems. The presentation emphasized that emerging forms of avatar-based communication require a structured AI agents sandbox testing framework, supported by dedicated benchmarking scenarios and metrics such as avatar capacity, home and roaming ratios, and traffic characteristics. It also underlined the need to extend the existing AI/ML sandbox approach defined in ITU-T Y.3181 to address new avatar-based communication paradigms and support the development of standardized benchmarking scenarios and methodologies for these evolving environments.

During the discussion it was highlighted that a testing framework should be developed for avatar-based communication. This work should define common benchmarking scenarios, metrics and methodologies to help ensure scalable, interoperable and trustworthy testing of emerging AI-driven environments.

Weimin Zhang, Deputy Director of the Embodied Intelligence and Robotics Department at the AI Institute of CAICT and Chair of Working Group 8 (Evaluation and benchmarking) in the ITU Focus Group on Embodied AI for Multimedia Technologies, gave a presentation titled *"From LLM Evaluation to Embodied AI Benchmarking: Towards Real-World Intelligence Assessment."* She highlighted that AI benchmarking methodologies are evolving from traditional large language model evaluation towards real-world assessment of embodied and physical AI systems. Building on CAICT's experience with "FactTesting" and the development of the "EAI Bench" framework, the presentation emphasized the limitations of static benchmarks and introduced a more comprehensive evaluation paradigm covering perception, reasoning, planning, action execution, robustness, safety and cross-embodiment generalization in dynamic physical environments. It also presented real-world testing methodologies for embodied AI, including real-robot benchmarking, structured task libraries and evaluation metrics based on practical experimental cases, while underlining the importance of standardization to support reproducible, scalable and trustworthy benchmarking frameworks for next-generation physical AI systems.

Embodied AI Benchmarking is Now an Urgent Industry Need **CAICT** 中国信通院

As embodied AI races from lab demos to real-world deployment, the field **urgently needs a common yardstick** to compare technologies and guide adoption decisions.



Embodied-AI benchmarking is the bridge between technical innovation and real-world application.

Figure 103: Embodied AI benchmarking

During the discussion it was highlighted that AI evaluation is rapidly shifting from static digital benchmarks toward continuous real-world intelligence assessment. Existing benchmarks for LLMs and AI agents are increasingly insufficient for evaluating embodied AI systems operating in dynamic physical environments. Future benchmarking frameworks should incorporate real-world interaction, long-horizon task execution, robustness, safety, cross-platform deployment and lifecycle monitoring. ITU-T Study Group 21 has delivered a series of international standards on assessment and benchmarking and is now extending this methodology to embodied AI with the aim of building a unified, comparable yardstick for capability evaluation.

31.2.1 Key ITU standards and ongoing standardization activities

The session highlighted relevant ITU standards including [ITU-T Q.4081](#), [ITU-T Y.3181](#) and [H.770.1](#) (Service scenarios and high-level requirements for metaverse cross-platform interoperability) and continued work within ITU-T Study Group 11 to develop frameworks for monitoring and benchmarking AI systems to support the assessment of their effectiveness, robustness and reliability. Relevant activities include AI model and EAI system benchmarking methodologies. ITU standards under development include:

- [Q.MP-GenAI](#): Monitoring parameters of network supporting generative artificial intelligence services
- [Q.MP-LLM-FN](#): Computing power resource measurement model and parameters for large language model inference in future networks
- [Q.NMP-LLMT](#): Network monitoring parameters for large language model training

- [Q.SR-TSM](#): Signalling requirements for interactions between telepresence suits and avatars in the metaverse
- [Q.FITSM](#): Framework of interoperable telepresence suits for metaverse
- [X.mp2p-srdtf](#): Managed P2P communications: Signalling requirements for digital twin federation

31.3 AI-enabled testing

The objectives of this session focused on exploring the integration of AI into testing processes, specifically the development of AI-based testing procedures, automatic generation of test scripts and the use of advanced test tools.

In addition, the session addressed the important question of how AI systems itself should be assessed and whether testing methodologies should target specific issues. It discussed the implementation and interoperability of AI-enabled testbeds, considering future directions for standardization work in this rapidly evolving field.

Together, these aims reflect a commitment to advancing robust, efficient and interoperable AI-driven testing frameworks that support the ongoing reliability and effectiveness of AI systems.

31.3.1 Key discussion points

Giulio Maggiore, Network Digital Application at Fibercop, gave a presentation titled *"Network Digital Twins 4 Testing: AI to enhance testing and optimization."* He highlighted that network digital twins for testing (NDT4Testing) can serve as an enabler for addressing the growing complexity of modern telecommunication networks. The presentation emphasized that traditional testing approaches are increasingly insufficient for multi-vendor, AI-driven and highly automated network environments, and that deterministic, reproducible and protocol-accurate digital environments are needed to validate network behaviour before deployment. It also underlined that standardized digital twins can support safer, earlier and more reliable validation of conformance, interoperability and automation logic, reducing ambiguity and operational risks while improving overall network quality.

The discussion emphasized that current telecom testing approaches are no longer adequate for increasingly complex, multi-vendor and AI-driven networks, with participants highlighting issues such as late-stage validation, interoperability ambiguities and lack of reproducibility. A key point raised was the need for a deterministic and standardized network digital twin framework to enable early, repeatable and cross-vendor testing aligned with formal specifications. The proposed way forward is to advance NDT4Testing within ETSI as a collaborative work item, focusing on defining common architectures, models and interfaces, while progressively delivering technical specifications and reusable digital assets to support conformance, interoperability and automation testing across the network lifecycle. It was agreed that continued collaboration between ITU-T Study Group 11 and ETSI TC INT (Core network and interoperability testing) is needed.



NDT4TESTING AS AN ETSI DIGITAL ASSET



Standardized Digital Framework

NDT4Testing delivers a standardized framework positioning ETSI as a digital asset provider alongside traditional specs.

Executable Standard Behavior

NDT4Testing acts as an executable form of standardized behavior, similar to TTCN-3 test suites as reference implementations.

Agile Validation Cycles

The framework enables rapid feedback between specification and implementation supporting agile validation cycles.

Trusted Vendor-Neutral Environment

Members gain access to a trusted, vendor-neutral digital environment reusable across projects and organizations.

Figure 104: Network digital twins for testing

Mohammad Hammoudeh, Chair Professor of the Department of Information and Computer Science King Fahd University of Petroleum & Minerals, gave a presentation titled *"Adversarial AI for Model Resilience and Correctness Testing."* He highlighted that adversarial AI, including evasion, poisoning, extraction and inversion attacks, can affect both the correctness and resilience of AI models by exposing them to worst-case conditions that may not be captured through conventional evaluation methods. The presentation emphasized the need to view adversarial techniques not only as threats, but also as standardized testing instruments capable of generating rigorous and reproducible benchmarks for AI systems, complementing the monitoring of model degradation and drift addressed by ITU-T Q.4081. It also outlined possible standardization directions, including AI-generated adversarial test procedures, LLM-assisted generation of TTCN-3 (Testing and Test Control Notation version 3) test scripts, federated adversarial testbeds supported by digital twins and autonomous red-team agents, and lifecycle assurance measures covering governance, fairness, transparency and human oversight.

What Is Adversarial AI? A Brief Taxonomy

Definition. The study and practice of deliberately manipulating the inputs, training data, or queries of a machine-learning system so that it produces incorrect, degraded, or unintended outputs — and, dually, the use of such manipulations to evaluate and harden models.

Key property: *perturbations can be imperceptibly small to humans yet reliably flip model decisions (Szegedy et al., 2014; Goodfellow et al., 2015).*



Evasion

Perturbed inputs at inference time cause misclassification or wrong decisions.



Poisoning

Corrupted training data implants errors or hidden backdoor behaviours.



Extraction

Systematic queries clone model functionality or steal intellectual property.



Inference / Inversion

Outputs are exploited to reconstruct private training data or membership.

Taxonomy after Biggio & Roli (2018) and NIST AI 100-2e2023 (Vassilev et al., 2024).

Figure 105: What is adversarial AI?

Discussions converged on the message that adversarial evaluation and the drift/degradation monitoring of ITU-T Q.4081 are two halves of a single assurance problem: robustness should be measured as a worst-case, reproducible quantity and monitored continuously, not certified once. Participants raised the need for common metric vocabularies and cross-laboratory reproducibility so that robustness scores are mutually recognized, the dual-use governance of standardized attack tooling, and the opportunity to extend the TTCN-3 conformance toolchain to AI systems. The proposed way forward is to scope these as candidate work items for ITU-T Study Group 11 in liaison with ETSI TC MTS (Methods for testing and specification), ETSI TC SAI (Securing AI) and ISO/IEC JTC 1/SC 42 (AI).

Marija Jankovic, Senior Researcher at the Information Technologies Institute of the Centre for Research and Technology Hellas (CERTH/ITI) and Chair of ETSI TC MTS, gave a presentation titled *"Lifecycle Based Testing of AI Enabled Systems: An ETSI Standardized Methodology."* She highlighted that ETSI TR 103 910 – a technical report on AI testing, test methodology and test specification for ML-based systems – describes a standardized lifecycle-based testing methodology for ML-based systems across the full lifecycle, covering stages from data preparation and training to validation, deployment, operation and monitoring. It was emphasized that ML-based systems cannot be assessed only through classical software testing approaches, as their behaviour is probabilistic, context-dependent and influenced by data quality, model design, deployment conditions and runtime drift. It also explained how ETSI TR 103 910 translates these challenges into concrete test items, acceptance criteria, test objectives and test methods for each lifecycle phase. A second key message was that the six quality criteria in TR 103 910 were not created from a blank page. Model relevance, correctness, robustness, avoidance of unwanted bias, security and explainability were distilled through a structured review of the EU High-Level Expert Group Ethics Guidelines for Trustworthy AI, the OECD AI Principles, ISO/IEC TR 24028:2020 (a

technical report providing an overview of trustworthiness in AI) and ISO/IEC 25059:2023 (Quality model for AI systems). The presentation further positioned ETSI TR 103 910 within the broader ETSI TC MTS AI testing portfolio, together with TR 104 119 on documentation and TS 104 008 on continuous audit-based conformity assessment and introduced the next ETSI work item that will extend the methodology to generative and agentic AI through the AI Solutions Quality Index.

OPENING · TR 103 910 CLAUSES 4-5



Classical vs. ML-Based Testing: Six Challenges Behind It

	CLASSICAL SOFTWARE TESTING	TESTING ML-BASED SYSTEMS
Specification	Complete, deterministic spec	Open-context: purpose & context can't be fully specified (5.1)
Behaviour	Deterministic and repeatable	Stochastic by nature; a natural error rate is expected (5.2)
Pass / fail logic	Binary: pass or fail	Statistical: weighted by probability of occurrence (5.2)
Root cause of failure	A coding bug in the source	A model, data or pipeline defect (5.5)
Confidence in output	Code coverage as a proxy	High confidence score does not guarantee a correct decision (5.3)

OC Open-Context Specification
Purpose, context and realization can never be fully specified.

SD Stochastic, Not Deterministic
A natural error rate must be accepted, not eliminated.

OF Opaque, Fragile Models
A high confidence score does not guarantee a correct decision.

FD Fair Decision-Making
Bias can enter through data, algorithm design or deployment.

NF New Fault & Failure Models
Classical bug / fault / error concepts fall short for ML.

VV Verification ≠ Validation
Validation must span the full ML lifecycle, not just a final test.

Figure 106: Classical vs. ML-based testing

Discussions highlighted how standards-based AI testing can move beyond one-time model evaluation and support trust across the whole lifecycle. Key points include the need for common quality metrics, the difficulty of assessing generative and agentic AI, and the importance of aligning testing, documentation and continuous assessment. A practical way forward is to connect ETSI TR 103 910 and the forthcoming work on the AI Solutions Quality Index with ITU, ISO/IEC and other international initiatives, so that AI benchmarking and AI testing can rely on shared terminology, comparable quality criteria and concrete use cases.

Boris Wrubel, an independent expert on software testing, gave a presentation titled "Practical Experiences with AI-Supported Test Automation: Insights from Day-to-Day Projects with Selenium." He highlighted practical, hands-on findings from applying AI tools including GitHub Copilot, ChatGPT and Claude to real Selenium-based test automation projects over several months. The presentation distinguished three levels of AI support – assistance, code optimization/refactoring, and complete code generation – and illustrated each with concrete project examples and measured cost and effort data. It emphasized that while AI-generated code is often functionally correct, it is frequently not maintainable, tends to overlook existing framework patterns and naming conventions, and requires significant

human oversight and verification. The presentation also highlighted the benefits of retrieval-augmented generation (RAG) for injecting framework-specific knowledge, which measurably improved output quality and maintainability.

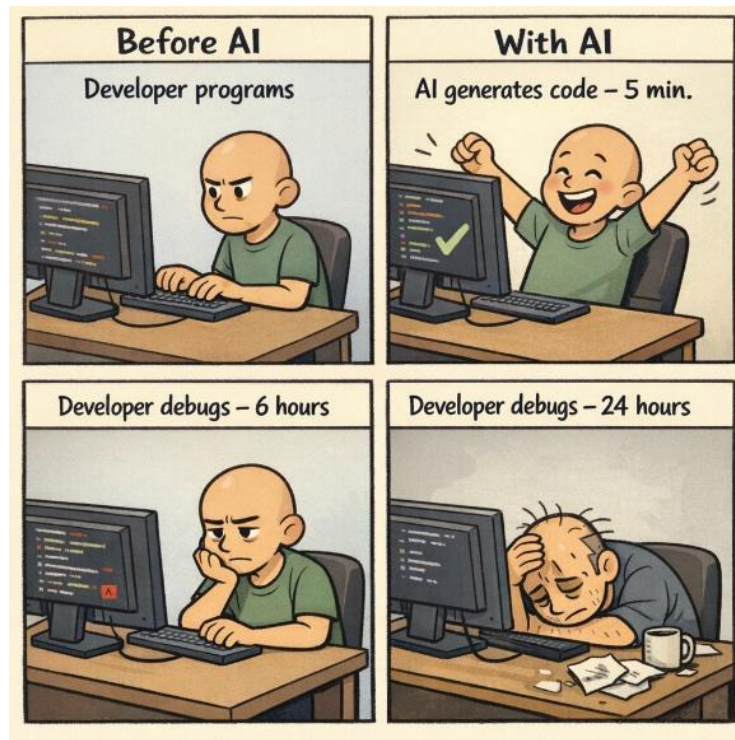


Figure 107: AI generated code impact on debugging

During the discussion it was highlighted that AI-generated code should not be adopted blindly. The same quality and maintainability standards that apply to human-written code should also apply to AI-generated code, rather than deploying generated one-off code directly into production environments.

31.3.2 Key ITU standards and ongoing activities

During the session it was noted that the ITU standardization landscape supports the NDT4Testing vision and broader AI-driven testing environments for future networks. [ITU-T Y.3090](#) defines digital twin networks as virtual representations of physical networks for analysis, emulation and control, enabling deterministic and reproducible testing. Together with [ITU-T Y.3061](#) and related Y-series work on autonomous networks and AI-driven operations, these activities provide foundations for digital twin-based testing, interoperability and autonomous network validation. The development of relevant test specifications can be considered by ITU-T Study Group 11.

The session also highlighted the need to extend [ITU-T Q.4081](#) with adversarial robustness metrics, while recognizing [ITU-T Y.3172](#) as the architectural framework for ML in future networks. Potential ITU-T Study Group 11 work includes adversarial robustness metrics, reference benchmark suites, TTCN-3 extensions for AI testing, interoperable testbed frameworks, and assurance and reporting mechanisms aligned with ETSI, ISO/IEC and other standards bodies.

The session further emphasized the need of lifecycle-based testing for AI-enabled systems, covering data preparation, training, validation, deployment, operation and monitoring, using criteria such as relevance, correctness, robustness, bias avoidance, security and explainability. ETSI TC MTS work including ETSI TR 103 910, TR 104 119 and TS 104 008 were welcomed as useful inputs for practical and comparable AI assurance. ITU-T Study Group 11 was encouraged to collaborate with ETSI TC MTS and ETSI TC INT on respective areas.

31.4 Key takeaways

Overall, the workshop underlined the need for ITU to continue developing standards to help ensure that AI systems and AI-enabled testing environments are reliable, interoperable, measurable and trustworthy throughout their lifecycle. Participants examined current gaps and potential opportunities for future standardization efforts in evaluation methodologies and benchmarking approaches for AI, fostering advancement in this critical field.

AI monitoring: from static models to end-to-end observability: The workshop noted that ITU-T Q.4081 provides a general monitoring framework for single static AI/ML models, while further standardization is needed to address dynamic and distributed model evolution, cross-framework interoperability, root-cause analysis and industry-specific monitoring parameters. Future work on AI for networks should therefore move towards dynamic, interoperable and sector-wide monitoring approaches.

From the network for AI perspective, work items such as Q.MP-GenAI, Q.MP-LLM-FN and Q.NMP-LLMT have started to define monitoring parameters for generative AI services and LLM inference and training. However, additional work is needed on traffic identification, heterogeneous computing resources, cross-layer correlation and cloud-edge-device collaboration. The longer-term direction should be an end-to-end unified monitoring architecture that provides full-stack observability from the physical network to AI service-level objectives, forming a closed loop with model-level AI monitoring. Further consideration may also be needed on how the AI Solutions Quality Index could be harmonized with ITU standards and incorporated into monitoring frameworks.

AI/AI-agent sandboxes for avatar-based communication: The emergence of avatar-based communication and AI-driven environments creates a need for structured AI/AI-agent sandbox frameworks supported by harmonized benchmarking scenarios and metrics. ITU-T Study Group 11 could consider new work on benchmarking AI/AI-agent sandboxes for various forms of avatar-based communication.

Real-world and embodied AI benchmarking: AI benchmarking is moving from the evaluation of isolated model capabilities towards the assessment of integrated intelligent systems operating in real-world environments. Future assessment frameworks should combine benchmarking and deployment evaluation within a unified, lifecycle-oriented methodology. Priority areas for international standardization include embodied AI benchmarking methodologies, real-world evaluation metrics, automated AI-enabled testing systems, safety assessment for physical AI and interoperable testing platforms.

Digital twin-based testing and ITU priorities: Future telecom networks shaped by AI, automation and increasing complexity require a shift from static, late-stage testing to continuous, deterministic and model-based validation. Digital twin technologies, including those described in ITU-T Y.3090, can support reproducible and standardized testing, while

TTCN-3 remains a key basis for executable and interoperable test specifications. From an ITU perspective, further work is needed to standardize architectures and interfaces for digital twin-based testing, connect these approaches with autonomous network frameworks such as ITU-T Y.3061, and define common data models, scenarios and validation methods for AI-driven network behaviour. Identified gaps include cross-domain interoperability, reproducibility of AI-based decisions and validation of intent-driven automation, which may require new or extended standards and technical reports.

Adversarial AI as a testing instrument: Adversarial AI was recognized as a potential standardized tool for testing AI-based systems. Worst-case adversarial benchmarks can complement average-case accuracy measures, while AI-generated test cases, TTCN-3 scripts and federated adversarial testbeds can make evaluations more automated, reproducible and comparable.

Lifecycle-wide AI testing: AI systems require lifecycle-wide, standards-based testing rather than isolated model evaluation. ETSI TR 103 910 provides a structured methodology covering business understanding, experimentation, training, system integration, deployment, operation and monitoring. It also explains why ML-based systems need a dedicated testing approach, given risks such as bias, non-deterministic behaviour, limited robustness and limited transparency.

Closer collaboration between ITU-T, ISO/IEC, ETSI and other bodies can support shared terminology, harmonized quality criteria and concrete use cases, while reducing the risk of fragmented solutions.

Actions for ITU: ITU may consider the following action points:

- Consider initiating and expanding ITU-T Study Group 11 work on AI conformity assessment frameworks, including benchmarking, monitoring and testing methodologies for AI-enabled systems.
- Assess the feasibility of adversarial AI testing (stress test of AI models) within ITU-T standardization, including robustness metrics, benchmark suites, TTCN-3 extensions and interoperable testbeds
- Advance standardization on end-to-end AI monitoring architectures, covering both AI for networks and networks for AI, with common parameters, metrics and cross-layer observability.
- Consider how the AI Solutions Quality Index could be harmonized with ITU standards and incorporated into monitoring frameworks.
- Develop frameworks for AI-agent sandboxes, including avatar-based communication, embodied AI and real-world benchmarking scenarios.
- Develop a standardized network digital twin for testing framework, including architectures, interfaces, data models and reusable validation scenarios for conformance, interoperability and autonomous network verification.

The discussion reinforced the importance of collaboration among ITU, ETSI, 3GPP, ISO/IEC JTC 1/SC 42, CENELEC JTC-21 and NIST to harmonize standardization activities for AI testing and benchmarking.

32 021 scientific foundation model: Empowering the transformation of scientific research paradigms

32.1 Introduction

AI is rapidly transforming the way scientific research is conducted. Across disciplines ranging from mathematics and chemistry to materials science, life sciences and astronomy, AI foundation models are enabling researchers to analyse increasingly complex scientific data, automate discovery, accelerate scientific reasoning and explore scientific hypotheses at unprecedented scales. Rather than serving solely as computational tools, foundation models are becoming an essential scientific capability that supports every stage of the research lifecycle – from knowledge acquisition and hypothesis generation to experimentation, analysis and scientific communication.

Against this backdrop, a workshop on [021 scientific foundation model: Empowering the transformation of scientific research paradigms](#) presented the 021 Science Foundation Model as a scientific and technological public good designed to empower scientists worldwide. Organized around the framework of "Technology Foundation – Disciplinary Empowerment – Ecosystem Co-governance," the workshop demonstrated how AI foundation models can support scientific research across multiple disciplines, including mathematics, chemistry, materials science, life sciences and astronomy. Through open-source technologies, open scientific collaboration and international partnerships, the workshop emphasized the role of AI in overcoming long-standing scientific bottlenecks while promoting a more open, collaborative and inclusive scientific ecosystem.

Beyond showcasing representative scientific applications, the workshop also examined the broader implications of AI foundation models for scientific governance and international collaboration. Discussions highlighted that realizing the full potential of AI for science requires not only technological advances but also open scientific infrastructures, internationally interoperable research ecosystems, responsible AI governance and international standards supporting transparency, reproducibility and equitable access to scientific capabilities.

The workshop echoed the principles promoted by the UNESCO Recommendation on Open Science and Recommendation on the Ethics of Artificial Intelligence, emphasizing openness, transparency, reproducibility, international scientific collaboration and equitable access to scientific knowledge. These international frameworks provide important guidance for developing trustworthy AI systems capable of supporting scientific discovery while ensuring responsible innovation across the global research community.



Figure 1. 021 Science Foundation Model Workshop.

32.2 Reinterpreting scientific data

Xue Guirong, Chief Engineer for Science Models at Zhejiang Lab, introduced the 021 Science Foundation Model as an AI foundation model designed to serve scientists across multiple research domains. Rather than targeting a single scientific discipline, the model is intended to provide a common AI capability supporting scientific knowledge understanding, reasoning, generation and discovery throughout the research lifecycle. The presentation positioned the 021 Science Foundation Model as a scientific and technological public good that enables researchers to integrate AI into everyday scientific practice, making advanced AI capabilities broadly accessible to the global scientific community.

The presentation demonstrated how foundation models can provide a shared technological foundation for scientific research by combining LLMs, multimodal understanding, scientific reasoning and domain-specific knowledge. Through open scientific collaboration and AI-enabled research workflows, the model supports knowledge retrieval, hypothesis generation, scientific analysis and interdisciplinary collaboration, helping researchers accelerate scientific discovery while reducing barriers to AI adoption. The presentation also highlighted the importance of developing AI systems that can support scientists across disciplines rather than optimizing for individual application scenarios.

Looking beyond technological capabilities, the presentation emphasized that scientific foundation models should be developed as open scientific infrastructures supporting international collaboration, shared scientific resources and collaborative innovation. By promoting openness and interoperability, AI foundation models can become common

research infrastructure that enables scientists worldwide to participate in AI-driven scientific discovery.

32.3 Molecular design

Sebastian Pios, Senior Research Fellow at Zhejiang Lab, presented how the 021 Science Foundation Model supports AI-driven molecular generation for scientific research. The presentation demonstrated how foundation models can accelerate molecular design by integrating domain knowledge with generative AI techniques, enabling researchers to efficiently explore vast chemical spaces and identify promising molecular structures for further investigation.

The presentation illustrated how AI-generated molecular candidates can support scientific research by reducing experimental search space and improving the efficiency of molecular discovery. Rather than replacing experimental validation, AI serves as an intelligent scientific assistant that guides researchers toward more promising research directions, enabling faster iteration between computational prediction and laboratory experimentation.

The presentation also emphasized that AI-enabled molecular design benefits from open scientific collaboration and shared scientific datasets, allowing researchers from different institutions to collectively advance molecular science while improving the accessibility of AI-enabled research capabilities.

32.4 OneGenome

Liu Shiping, Chief Scientist of Brain Science at BGI Research, presented applications of the OneGenome, a life science domain-specific model which is developed based on 021 Science Foundation Model and its application in rare disease research. The presentation explored how AI can support the interpretation of complex genomic and multi-omics data, helping researchers identify relationships between genetic variation, biological mechanisms and disease phenotypes that may be difficult to detect through conventional analytical methods.

Particular attention was given to AI-assisted variant interpretation for rare disease research and diagnosis. By integrating scientific literature, genomic information, phenotypic data and other biomedical evidence, life science foundation models can help researchers prioritize potentially relevant variants and improve the efficiency of analysing complex cases. Related applications may also support predictive modelling and multimodal analysis within broader biomedical research workflows.

The presentation also emphasized that the use of AI in life sciences requires careful attention to data privacy, informed consent, algorithmic bias and equitable access to advanced research capabilities. International data-sharing frameworks and open-science principles were highlighted as important foundations for responsible collaboration, particularly where genomic data are exchanged or analysed across institutions and countries.

International collaboration in AI-enabled life science research is supported by frameworks addressing data sharing, responsible governance and evaluation. The Global Alliance for Genomics and Health (GA4GH) develops frameworks supporting responsible genomic and health-data sharing, while FAIR data principles promote scientific data that are findable, accessible, interoperable and reusable.

Relevant ITU work has also explored standardized approaches to AI-based health applications. The former ITU-WHO Focus Group on AI for Health developed benchmarking and evaluation approaches for AI applications in health, illustrating the importance of common assessment methodologies for trustworthy AI-enabled diagnostics and biomedical research.

32.5 Unlocking the lensed universe

Emma Tolley, Associate Professor at EPFL, presented an international collaborative application of multimodal image-spectral models for discovering gravitational lenses. The presentation examined how AI can jointly process astronomical images and spectral information, enabling researchers to extract complementary information from different observational modalities and improve the efficiency of large-scale astronomical analysis.

Modern astronomical surveys generate substantial volumes of observational data that are increasingly difficult to analyze solely through conventional methods. Multimodal models provide a means of combining visual and spectral features within a unified analytical framework, supporting the classification and characterization of astronomical objects across large survey datasets.

The presentation highlighted international collaboration as an important component of this work. Shared astronomical datasets, interoperable research infrastructures and common approaches to data processing enable researchers from different institutions to develop, compare and validate multimodal models. It also drew attention to the importance of accounting for observational bias, model uncertainty and the reproducibility of AI-assisted measurements when such models are used for scientific analysis.

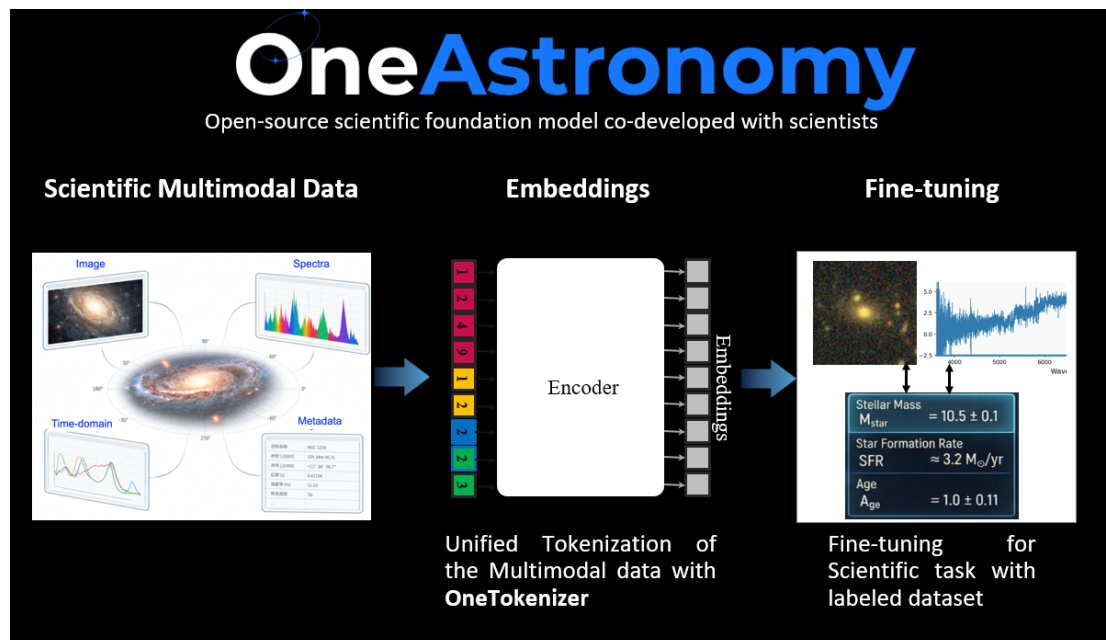


Figure 108: OneAstronomy: A multimodal image-spectral model for astronomy analysis

32.6 Re-renaissance of research in astronomy

Liu Jifeng, Deputy Director General of National Astronomical Observatories of China, presented on how astronomy has repeatedly transformed human civilization, from enabling agricultural calendars to driving the scientific revolution and expanding our understanding of the universe. Today, the field is entering the era of exascale data, with next-generation observatories producing unprecedented volumes of multimodal observations. While these datasets hold the potential for groundbreaking discoveries, they also exceed the analytical capacity of individual researchers.

This talk introduces the vision of a "Re-Renaissance" in astronomy, where AI revitalizes the entire scientific discovery process. It presents a comprehensive AI ecosystem that spans intelligent telescope scheduling, foundation models for multimodal astronomical data analysis, human-AI collaborative discovery and the OneAstronomy model, which integrates astronomical knowledge and research workflows. These AI capabilities enable astronomers to efficiently analyze massive datasets, uncover hidden patterns and accelerate the search for new physical laws.

Beyond empowering professional researchers, the talk explores how AI can democratize astronomical research. Through the OneUniverse platform, students, educators, citizen scientists and enthusiasts will be able to learn astronomy, interact with AI-powered scientific tools, analyze real observational data and collaborate with professional astronomers. By combining AI with global participation, this vision aims to transform astronomy into a truly inclusive scientific endeavour and usher in a new era of discovery for humanity.

32.7 Reshaping logic

Lei Zhang, Associate Professor of Mathematics at the National University of Singapore, explored how AI is reshaping mathematical research by supporting the transformation of mathematical proofs from informal reasoning into formally verifiable representations. The presentation demonstrated how recent advances in LLMs, symbolic reasoning and automated theorem proving are enabling closer collaboration between mathematicians and AI systems, significantly improving the efficiency of formal proof construction and verification.

Rather than replacing human mathematical creativity, AI was presented as an intelligent research partner capable of assisting researchers in constructing rigorous logical arguments, identifying inconsistencies and accelerating the formalization of mathematical knowledge. These capabilities allow mathematicians to devote greater attention to conceptual innovation while relying on AI to support verification and logical consistency.

The presentation also discussed the broader implications of formal reasoning for scientific research. As AI becomes increasingly involved in scientific discovery, formal knowledge representation and machine-verifiable reasoning may contribute to improving scientific reproducibility, facilitating knowledge sharing, and strengthening confidence in AI-assisted scientific research across multiple disciplines.

32.8 OnePorous

Anna Stepashkina, Research Expert at Zhejiang Lab, presented OnePorous, an AI-driven approach to porous material design. The presentation examined how generative AI can

support the exploration of complex material design spaces and assist researchers in identifying candidate porous structures for further computational and experimental investigation.

Porous materials may involve a wide range of possible structural configurations, making conventional trial-and-error approaches time-consuming. OnePorous was presented as a means of using AI to accelerate this process by generating candidate structures and supporting the analysis of relationships between material structures and their expected properties.

The presentation highlighted the role of AI as an enabling tool within the materials research workflow. By supporting the early stages of structure generation and candidate selection, AI-driven methods can reduce the number of options requiring subsequent validation and allow researchers to focus experimental and computational resources on more promising material designs.

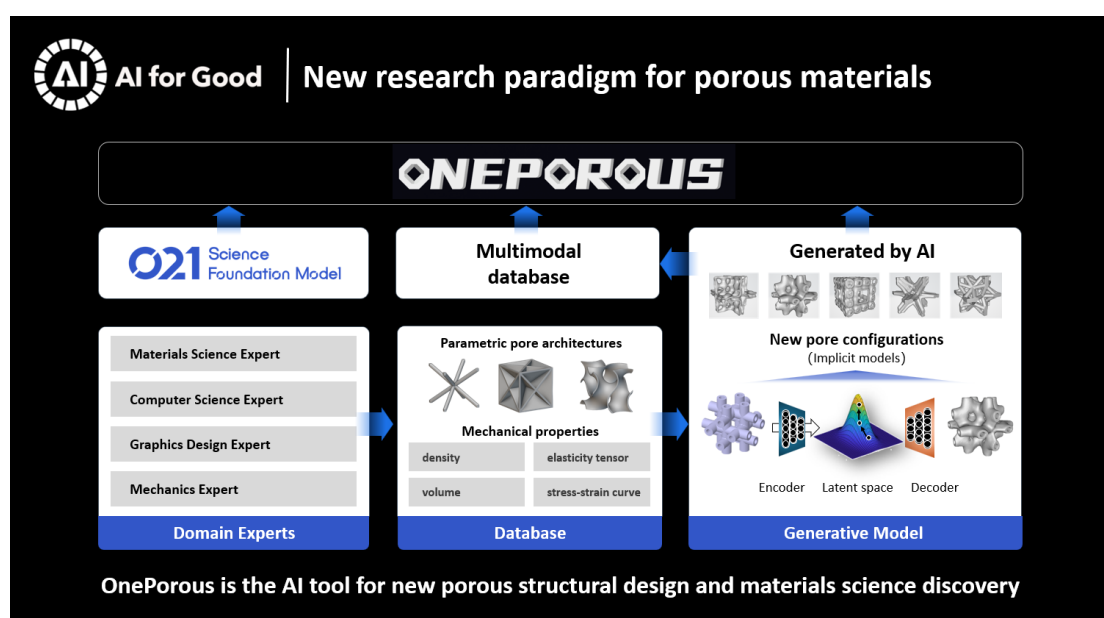


Figure 109: OnePorous: AI-driven porous material generation and design.

32.9 What happens when AI reinterprets scientific data?

The workshop concluded with a roundtable discussion on how science foundation models are transforming the methods, organization, validation and communication of scientific research. The panel brought together **Liu Jifeng**; **Susanne Pedersen**, Director of the Science and Knowledge Centre at the International Union for Conservation of Nature; **Tomasz Kacprzak**, Professor for High-Performance Computing at the University of Applied Sciences and Arts Northwestern Switzerland; **Amal Kasry**, Chief of Basic Science, Engineering, Technology and Innovation in the Sciences Sector at UNESCO; and **Xue Guirong**, with **Richard Chuchla**, Co-Chair of the GeoGPT Governance Committee, serving as moderator.

The discussion examined the changing relationship between hypothesis-driven research and data-intensive scientific discovery. Panelists noted that AI can help researchers explore large solution spaces, identify patterns across complex scientific data, and generate new research

directions. At the same time, participants emphasized that scientific intuition, causal reasoning and expert judgement remain essential to the formulation and interpretation of scientific questions. AI was therefore viewed not as a substitute for scientists, but as a new research capability that changes how scientists interact with data, models and knowledge.

A second major theme concerned the reproducibility and verifiability of AI-assisted scientific research. As foundation models increasingly contribute to hypothesis generation, data analysis, simulation and scientific writing, participants highlighted the need to document how AI-generated outputs are produced, evaluated and validated. Transparent research workflows, traceable data and model provenance, and clear reporting of model uncertainty were identified as important conditions for maintaining scientific integrity.

Panelists also discussed interdisciplinary capacity building. Science foundation models increasingly operate across traditional disciplinary boundaries, requiring closer collaboration between AI researchers and domain scientists. This development creates a need for new scientific competencies, including the ability to understand model limitations, assess AI-generated evidence and integrate computational methods with domain-specific scientific reasoning. Participants noted that universities, research institutions and scientific communities will need to adapt training programmes and research incentives accordingly.

Equitable access was another central concern. Participants warned that unequal access to scientific data, computing resources, foundation models and specialist expertise could widen existing disparities between research institutions and regions. Open-source models, shared scientific infrastructures and scientific and technological public goods were therefore highlighted as important mechanisms for enabling broader participation in AI-enabled scientific research.

The discussion further considered how AI may affect scientific publishing and peer review. AI-assisted manuscript preparation, automated analysis, intelligent literature review and machine-supported peer review are creating new opportunities for scientific communication, while also raising questions about authorship, disclosure, accountability and the verification of AI-generated content. Participants emphasized the importance of maintaining scientific integrity as publication practices evolve.

32.9.1 Common priorities

Several common priorities emerged from the roundtable:

- Preserving the central role of scientific judgement while using AI to expand research capabilities
- Improving the transparency, reproducibility and verifiability of AI-assisted scientific research
- Strengthening collaboration between AI specialists and domain scientists
- Broadening equitable access to models, data, tools and computing resources
- Developing interdisciplinary skills for the next generation of scientists
- Adapting scientific publishing and peer-review practices to the growing use of AI

The roundtable identified several areas where international standards and common technical frameworks could support the responsible development and use of science foundation models.

Participants highlighted the need for common approaches to:

- AI-ready scientific data and metadata across different disciplines
- Provenance and traceability of scientific data, models and AI-generated outputs
- Documentation and reproducibility of AI-assisted scientific workflows
- Evaluation of science foundation models, including scientific accuracy, reliability, robustness, uncertainty and domain applicability
- Validation of AI-generated hypotheses, predictions, proofs, molecular structures and other scientific outputs
- Interoperability among science foundation models, domain models, scientific databases, computational tools and research platforms
- Responsible use of AI in scientific publishing, authorship, disclosure and peer review
- Governance of open scientific infrastructures and scientific and technological public goods

The discussion suggested that these areas require collaboration across standards bodies, international scientific organizations, domain communities, publishers and research institutions. Participants emphasized that standards should support scientific quality and trust without imposing rigid requirements that could restrict innovation or overlook differences among scientific disciplines.

32.9.2 United Nations frameworks

32.9.2.1 UNESCO Recommendation on Open Science

The UNESCO Recommendation on Open Science provides an international framework for open scientific knowledge, open scientific infrastructures, engagement among societal actors and dialogue with other knowledge systems. Its principles are directly relevant to science foundation models, particularly where open data, shared research tools, international collaboration and equitable participation are concerned.

32.9.2.2 UNESCO Recommendation on the Ethics of Artificial Intelligence

The Recommendation on the Ethics of Artificial Intelligence provides a global framework for responsible AI development and use. Its emphasis on transparency, accountability, human oversight, fairness, privacy and environmental and societal well-being can inform the governance of AI systems used in scientific research.

32.9.2.3 United Nations Roadmap for Digital Cooperation

The United Nations Roadmap for Digital Cooperation addresses the role of digital technologies in advancing inclusive development and international cooperation. For AI-enabled science, its objectives reinforce the importance of ensuring that scientific and technological progress is accessible across countries and does not deepen existing digital and scientific divides.

32.9.2.4 ITU AI for Good and AI-enabled scientific collaboration

The ITU AI for Good platform brings together scientists, technology developers, policymakers, international organizations and standards communities to identify practical applications of AI for sustainable development. The platform provides a global forum for showcasing AI-enabled scientific applications, building partnerships and identifying areas

where international standards and capacity-building activities could support responsible deployment.

In the context of science foundation models, ITU can provide a neutral convening platform for dialogue among AI developers, scientific communities, standards bodies and United Nations agencies. This role is particularly relevant to questions of model interoperability, open scientific infrastructure, equitable access, trustworthy AI and international collaboration.



Figure 110: Roundtable discussion on science foundation models and the transformation of scientific research paradigms

32.10 Key takeaways

The workshop highlighted several key messages concerning the role of science foundation models in the future of scientific research.

AI is becoming a foundational capability for scientific research: Across mathematics, molecular science, materials science, life sciences and astronomy, AI is supporting scientific reasoning, data analysis, knowledge discovery, candidate generation and the interpretation of complex scientific information. These capabilities are expanding the scale and speed of scientific inquiry and enabling researchers to address questions that are difficult to explore using conventional approaches alone.

Science foundation models can serve as scientific and technological public goods: The O21 Science Foundation Model demonstrated the potential of shared AI infrastructures to provide scientists across disciplines with access to common research capabilities. Open-source models, shared platforms and accessible scientific tools can lower barriers to AI adoption and enable broader participation in scientific discovery.

The most effective AI-enabled research combines AI expertise with domain knowledge:

The presentations demonstrated that meaningful scientific applications depend on close collaboration between AI researchers and domain scientists. Foundation models provide general capabilities, but scientific validity requires domain-specific knowledge, appropriate data, expert evaluation and experimental or observational verification.

Reproducibility and verifiability are central to trustworthy AI-enabled science: AI-generated outputs should be accompanied by transparent information about data sources, model configurations, analytical procedures, uncertainty and validation. These requirements become increasingly important as AI contributes more directly to scientific reasoning and decision-making.

Responsible AI requires openness, transparency, and equitable access: The sustainable development of science foundation models requires attention to privacy, intellectual property, algorithmic bias, accountability and differences in access to data and computing resources. Open scientific collaboration and capacity building are necessary to prevent AI from widening existing inequalities in global research.

Scientific publishing and evaluation practices will need to evolve: AI-assisted research is changing how scientific outputs are produced, documented, reviewed and communicated. Research communities and publishers will need appropriate practices for disclosure, attribution, validation and peer review while preserving scientific integrity.

Future progress depends on international collaboration: Science foundation models are built on scientific data, knowledge, expertise and infrastructure distributed across countries and disciplines. International cooperation will therefore be essential to the development of open scientific ecosystems, trusted shared infrastructures and scientific and technological public goods that benefit researchers worldwide.

32.11 Standardization opportunities

The workshop identified several areas where international standardization could support the development and adoption of science foundation models.

32.11.1 Scientific data and knowledge infrastructure

Standards could support the preparation and exchange of AI-ready scientific data across disciplines, including common requirements for metadata, provenance, data quality, semantic description, licensing and machine accessibility. Such work could improve the reuse of scientific resources while enabling interoperability among scientific databases, models and research platforms.

32.11.2 Evaluation of science foundation models

Common evaluation frameworks could help assess whether science foundation models are suitable for specific research tasks and domains. Relevant evaluation dimensions may include:

- Scientific accuracy and validity
- Reasoning reliability
- Robustness and generalizability

- Uncertainty estimation
- Reproducibility
- Transparency and explainability
- Domain applicability and limitations
- The quality of human-AI collaboration

Evaluation methods will need to reflect differences among disciplines. For example, mathematical proofs, molecular structures, materials candidates, genomic interpretations and astronomical predictions require different forms of scientific validation.

32.11.3 Reproducible AI-assisted scientific workflows

Standards could provide common approaches to recording the use of AI throughout the scientific workflow. This may include documenting model versions, input data, prompts or task specifications, computational environments, intermediate outputs, human interventions, validation procedures and final scientific conclusions.

32.11.4 Interoperability of scientific AI systems

As scientific research increasingly uses multiple models and platforms, interoperability will become more important. Standards could support interfaces among foundation models, domain models, scientific databases, simulation tools, laboratory systems, observational infrastructures and scientific workbenches.

32.11.5 Scientific publishing and research integrity

The use of AI in manuscript preparation, data analysis, peer review and research communication creates a need for common practices on disclosure, attribution, accountability and verification. International cooperation among scientific publishers, research institutions, standards bodies and professional communities could help develop consistent approaches.

32.11.6 Governance of scientific and technological public goods

Science foundation models intended as public goods require sustainable governance arrangements addressing openness, access, intellectual property, security, model maintenance, community participation and long-term stewardship. Shared principles and technical frameworks could help ensure that such infrastructures remain trustworthy and broadly accessible.

32.11.7 Potential ITU contribution

ITU could contribute through its convening, standardization and capacity-building roles by:

- Bringing together scientific communities, AI developers, standards bodies, publishers and United Nations agencies
- Supporting dialogue on interoperability and evaluation frameworks for science foundation models
- Promoting open and trustworthy scientific AI infrastructures
- Facilitating collaboration on AI-enabled research supporting sustainable development
- Supporting capacity building for researchers and institutions with limited access to AI expertise and computing resources

- Coordinating, where appropriate, with ISO/IEC, UNESCO, WHO, scientific unions and domain-specific standards communities to avoid duplication and fragmentation

The workshop indicated that international standards should not attempt to standardize scientific discovery itself. Their role should instead be to provide trusted foundations for data exchange, interoperability, evaluation, transparency, reproducibility and responsible collaboration, enabling scientists to innovate while maintaining scientific integrity.



Figure 111: Speakers at the 021 Science Foundation Model Workshop

Part 3

Future AI standards for Frontier Technologies

33 Testing and verification of frontier AI systems

33.1 Introduction

Rigorous testing and verification of frontier AI systems is no longer optional. It is essential for security and global trust.

A workshop on [*Testing and verification of frontier AI systems*](#) explored cutting-edge research on how advanced AI models can be tested, verified and validated before they are deployed at scale. It aimed to deliver a clear overview of today's most relevant methodologies, from stress testing complex model behaviour to evaluating system robustness under real-world conditions. By identifying where today's methods fall short, the workshop sets the stage for designing stronger, more interoperable frameworks.

The main objectives of the workshop were to:

- Discuss the research around AI system testing and verification methods
- Identify any gaps in current methodologies for AI system testing and verification
- Examine security challenges of autonomous AI agents
- Discuss opportunities for international collaboration on frontier AI systems through a multistakeholder platform to take into consideration the requirements of low- and middle-income countries

33.2 Opening session

Vijay Mauree, Head of the Strategic Tech and Academia Initiatives Division at the ITU Telecommunication Standardization Bureau, delivered the welcome address, emphasizing that frontier AI systems are moving from assisting human decision-making to reasoning, planning, generating content, interacting autonomously with digital systems and influencing critical sectors of society.

He highlighted that the workshop aimed to address one of the most consequential questions of our time: how to ensure that advanced AI systems are reliable, trustworthy and aligned with human values.

He underscored that frontier AI can accelerate scientific discovery, improve healthcare, strengthen education and advance sustainable development. At the same time, rapidly increasing capabilities raise questions about robustness, security, transparency and safety. Rigorous testing and verification are therefore essential to understand whether systems will behave reliably under both expected and unexpected conditions.

Standards were described as critical because they provide a common language, enable interoperability, support transparency and help translate high-level principles into practical implementation.

33.3 Testing, verification and frontier AI risk management

The first session explored the methods, governance models and institutional arrangements needed to test frontier AI systems.

The moderator, **Anja Kaspersen**, Director for Global Markets Development, Frontier Issues, AI and Critical Technologies at IEEE, emphasized that ethics is not a checklist, but a language for navigating uncertainty, trade-offs and uncomfortable insights. Verification gives ethical choices operational form by testing whether claims survive contact with reality.

As AI systems move from generating outputs to taking actions, the verification challenge shifts from what a model knows to what a system can do, and whether an independent party can confirm it. Verification is a practice, not an event. A system that passes a test at launch does not remain tested indefinitely. Models drift, contexts change, terminology evolves and institutional incentives shift. Assurance should therefore be designed for the lifetime of the system.

The session was framed around four questions:

- What can be measured today and with what confidence?
- Where are the methodological gaps?
- Who can verify, with what access, mandate and independence?
- Whether systems can recognize when not to answer or when to hand decisions back to humans?

Charbel-Raphaël Segerie, Executive Director of CeSIA, argued for international agreement on AI safety red lines. Competitive pressures can encourage developers to accelerate, race and cut corners, even when good practices exist. Frontier AI companies have defined voluntary internal risk thresholds, but these thresholds may erode over time as capabilities advance. He argued that risk thresholds should move from voluntary commitments to externally defined and enforceable red lines.

He highlighted the absence of uniformity across company thresholds and the risk of a race to the bottom. Common ground may already exist in domains such as offensive cyber, automated AI research and development, and some chemical and biological risk areas.

He called for a stepwise approach: first agree high-level principles and then assign technical bodies to refine definitions, evaluations and implementation mechanisms. International standardization and independent evaluations were presented as urgent and feasible next steps.

Lukas Struppek, Research Scientist at FAR.AI, focused on red teaming and stress testing AI models and safeguards. He emphasized that, as model capabilities increase, safeguards should function as strong barriers around dangerous capabilities.

Red teaming was defined as a structured, adversarial and collaborative process to understand how AI systems and their safeguards may fail before those failures occur in practice. It should be scoped, systematic and actionable, not merely an attempt to break models for demonstration purposes.

Examples showed that harmful requests may be refused in text form but can sometimes be enabled through multimodal inputs, jailbreaks or unsafe open-weight variants. In some cases, safeguards were bypassed because protections were not applied consistently across input modalities.

The key takeaway was that safeguards are improving, but they are not foolproof. Proprietary models may require expert effort to break, while open-weight models can be modified or

jailbroken much more easily. Stronger incentives and engineering practices are needed to deploy known mitigations consistently.

Franziska Weindauer, CEO of TÜV AI.Lab, presented the European perspective, emphasizing the long experience of third-party testing, inspection and certification bodies in operationalizing safety for advanced technologies. She connected AI assurance to established product safety practices, including quality management, risk management, technical documentation, conformity assessment and market surveillance.

The EU AI Act was presented as a risk-based regulatory framework. It regulates AI applications according to their risk level, with specific obligations for high-risk systems and additional rules for general-purpose and foundation models, especially those with systemic risk.

She distinguished between classical ML, generative AI and agentic AI. Classical systems often have narrower tasks and more defined inputs and outputs. Generative AI introduces open-ended inputs and outputs, while agentic AI adds autonomous planning, tool use and multi-step actions.

This evolution makes assurance more complex. Auditors need to assess not only outputs, but also workflows, tool use, development processes, safeguards and post-deployment monitoring. Testing is only one part of assurance; robust processes and lifecycle governance are also essential.

Chris Meserole, CEO of the Frontier Model Forum, introduced frontier AI frameworks, also referred to in some contexts as safety and security frameworks. These frameworks are intended to manage risks that may materialize with such scale, velocity and irreversibility that risk management needs to be front-loaded before deployment.

The core elements of such frameworks are thresholds, evaluations and safeguards, with an additional need to evaluate the safeguards themselves. Thresholds anchor the framework by defining intolerable risks or capability levels that systems should not exceed without sufficient mitigation.

Evaluations assess whether a model or system approaches or exceeds these thresholds. Safeguards then aim to prevent the relevant capabilities from being misused or accessed in harmful ways.

The discussion stressed that evaluation science for frontier AI is still immature compared with some physical safety domains. As frontier models become more capable, safeguards and evaluations of safeguard efficacy will become increasingly central to risk management.

Key takeaways

Speakers emphasized that the unit of assessment is shifting from what a model knows to what a system can do, especially as systems become more agentic and increasingly able to act in digital environments.

Themes	Key discussion points	Implications for standards and verification
Verification as practice, not event	Systems drift, contexts change, terminology evolves and institutional incentives shift. Assurance should therefore cover the lifetime of the system, not only launch day.	Standards should support lifecycle assurance, post-deployment monitoring, incident reporting and periodic reassessment.
Shared risk thresholds and red lines	Participants discussed the need for common international risk thresholds, especially in domains such as cyber, chemical, biological and automated AI research and development.	Standards can define common taxonomies, threshold-setting processes and evidence requirements for unacceptable-risk domains.
Red teaming and adversarial testing	Examples from chemical and cyber domains showed that safeguards can be bypassed, particularly through multimodal inputs or open-weight model modifications.	Testing standards should include adversarial evaluation, multimodal testing, jailbreak resistance and secure disclosure rules.
Conformity assessment	The European experience was presented as a model for moving from legal requirements to harmonized standards, manufacturer obligations, third-party assessment and market surveillance.	AI assurance should combine process audits, technical testing, risk management documentation and post-market surveillance.
Frontier AI frameworks	A frontier AI framework or safety and security framework was described as relying on three core elements: thresholds, evaluations and safeguards. Evaluations of safeguards are also needed.	International standards should harmonize frontier risk management frameworks, model capability evaluations and safeguard efficacy testing.

Table 7: Summary of themes raised and discussions around them

The session concluded that verification requires agreed thresholds, shared standards, safeguards, independent evaluation and evaluation of evaluators. Participants emphasized that trust cannot be manufactured by a single actor. Developers, independent evaluators, standards organizations, conformity assessment bodies, governments and international organizations all perform different and complementary functions.

33.4 Autonomous AI agents and agentic risk

The second session focused on autonomous AI agents. It was moderated by **Rumman Chowdhury**, CEO and Founder of Humane Intelligence.

The session explored the following questions:

- How do autonomous AI agents change the risk profile compared to human-supervised AI systems?
- What are the most credible short-term and medium-term security risks (e.g. runaway task execution, deceptive behaviour, misinformation)?
- How should responsibility and liability be allocated when agents take independent actions?
- What safeguards are essential at the design, deployment and operational stages?

- What are the current gaps in standards for autonomous AI agents? How can existing AI laws and standards be extended to cover agentic systems?

He Bo, Director of the Internet Law Research Center at CAICT, noted that agentic AI changes the governance problem because the risk shifts from static outputs to dynamic actions. Agents can plan, decide, invoke tools, access data, interact with platforms, transact on behalf of users and coordinate with other agents. This expands the potential risk surface across legal, technical, institutional and societal dimensions. Legal governance should therefore address personal data protection, consent, transparency, platform responsibility, intellectual property, consumer protection and liability for autonomous actions.

Responsibility should remain with the humans and institutions that design, deploy, control or benefit from them. Bo argued that AI agents should not be treated as legal persons. They should remain tools or products, with responsibility allocated to the actors that design, develop, control, deploy or benefit from them.

The governance perspective in China highlighted a layered legal framework, including general laws, cross-cutting AI-related regulations and sector-specific rules. Dedicated guidance for AI agents was described as supporting both safety and responsible innovation.

Legal issues include personal information protection, consent, transparency, data security, platform access, unfair competition, intellectual property, consumer protection and liability allocation. Broad authorization at the beginning of an agent task may not be meaningful if users cannot foresee how data will be processed across multiple steps.

Kitamura Hiromu, Principal Expert at the Japan AI Safety Institute, emphasized that autonomous agents operate in changing networks of relationships and ecosystems. Governance should therefore move beyond one-time testing toward continuous assurance supported by runtime governance, traceability and institutional safeguards.

Runtime governance includes dynamic permission control, action approval workflows, continuous monitoring, logging, anomaly detection, human intervention protocols and emergency shutdown mechanisms. These functions create the basis for long-term assurance.

He argued that risk is moving from models to agents, from agents to institutions and potentially from institutions to society. Therefore, assurance should include the organizations that deploy and govern AI systems. Safe agents are not enough; safe institutions are also required.

Minjae Seo, Research Scientist at the Korea AI Safety Institute, introduced the concept of memory-level bias injection. As autonomous agents increasingly use memory to store and retrieve information, malicious or biased content can influence later decisions and outputs.

He described multi-agent environments in which malicious agents can post biased or misleading comments that are later stored in the memory of benign agents. When users ask general questions, the agent may retrieve these biased memories and generate one-sided or misleading responses.

Evaluation examples included political bias, advertising bias, celebrity rumours and public figure recommendations. Some models showed high rates of biased responses when exposed to targeted memory injections.

Agent assurance requires runtime governance, including dynamic permission controls, action approval workflows, continuous monitoring, logs, anomaly detection, human intervention protocols and emergency shutdown mechanisms.

Memory-enabled agents introduce new attack surfaces. Biased or malicious information stored in memory can influence later responses and propagate through multi-agent environments.

He concluded that memory introduces a frontier threat surface for agentic systems. Defensive layers are needed to detect and mitigate bias injection, while recognizing that defining bias itself can be context dependent.

33.5 International collaboration

The final panel examined how international collaboration can support harmonized testing and verification across jurisdictions. The discussion highlighted that international standards are needed not only for interoperability, but also for comparability of evaluations, mutual recognition of testing outcomes, inclusive governance and capacity building.

Panelists distinguish between standards for interoperability and standards for evaluation or assurance standards. For frontier AI, the immediate need is often the latter: shared methods for testing, verification, reporting and assurance.

Mutual recognition of testing and certification will require trusted methodologies, transparent evidence, common reporting templates and institutional confidence in the evaluators.

The participation of developing countries was identified as essential. Capacity building should include not only data, compute and talent, but also evaluation infrastructure, security capability and governance expertise.

Multi-stakeholder collaboration should include governments, standards bodies, industry, academia, civil society, evaluators and affected communities.

For frontier AI, the immediate focus is often on evaluation standards: common methods for testing, verification, reporting, evidence collection and assurance. Standards can support mutual recognition across jurisdictions only if testing methods, evidence and evaluator competence are trusted.

Participants identified three gaps in emerging standards and real-world testing practice for frontier models and agents:

- An authority gap concerning who oversees agent actions
- A verification gap concerning whether actions and data access can be traced
- An accountability gap concerning who remains responsible when something goes wrong

Capacity building was identified as essential. Many countries may not have the infrastructure to test frontier AI systems independently and may rely on testing performed elsewhere. Capacity building should therefore include evaluation infrastructure, security capability, governance expertise, local datasets and participation in standardization.

The panel stressed that inclusive testing produces safer AI because it exposes systems to a wider range of real-world conditions. Evaluation datasets and safety tests created outside a target context may miss local linguistic, cultural and social realities.

Examples were provided showing that bias can be context-specific. For instance, age bias may be present differently in different regions, and test sentences that are grammatically correct may still be socially unrealistic in local languages.

The discussion called for co-created evaluation frameworks, feedback mechanisms, local participation and recurring updates. Standards should be adaptable and should not impose hard duplication burdens on countries with lower levels of AI governance maturity.

Key takeaways

The workshop examined how testing and verification can help ensure that frontier AI systems are reliable, trustworthy and aligned with human values as their capabilities expand from content generation to planning, tool use, autonomous action and multi-agent coordination.

The workshop highlighted that frontier AI testing and verification is both technically and institutionally complex. Participants agreed on the need for practical standards, independent testing, continuous assurance, stronger safeguards, international cooperation and inclusive capacity building.

The workshop highlighted that AI safety cannot be achieved solely at the model level. It requires governance of the broader system, including developers, users, institutions, supply chains, data flows, deployment contexts and real-world controls around dangerous materials or actions.

The panelists emphasized that verification is not a one-off compliance exercise. It is a continuous governance practice spanning the full AI lifecycle, including development, deployment, post-market monitoring and institutional accountability.

Across the discussions, a clear consensus emerged: frontier AI risk management requires internationally aligned thresholds, robust evaluations, effective safeguards, independent testing, conformity assessment and mechanisms to evaluate the evaluators. Standards were presented as the practical bridge between high-level principles and operational implementation, enabling common terminology, comparability, traceability, interoperability and mutual recognition across jurisdictions.

Some of the cross-cutting issues and gaps identified are summarized in table 8.

Gap	Why it matters	Suggested response	Role of standardization
Lack of common thresholds	Without shared risk thresholds, organizations define their own red lines and may move them as capabilities advance.	Develop internationally aligned risk thresholds for high-consequence domains.	Define common terminology, severity levels, evidence requirements and review processes.
Weak or uneven safeguards	Safeguards can be bypassed, and open-weight models are particularly difficult to control after release.	Adopt stronger safeguard design, adversarial testing and independent verification.	Standardize safeguard categories, testing protocols and benchmark reporting.
Limited independent testing	Self-assessment alone may not build public trust, especially where commercial incentives conflict with safety.	Strengthen independent evaluators, accredited laboratories and third-party conformity assessment.	Create evaluator competence criteria, audit procedures and mutual recognition mechanisms.
Agentic action risk	Autonomous agents create risks through tool use, transactions, data access and multi-step actions.	Introduce runtime controls, logging, permissions, identity and traceability for agents.	Develop standards for agent identity, authorization, audit trails and emergency controls.
Context and cultural gaps	Models may behave differently across languages, cultures and social contexts, and external test sets may miss local harms.	Co-create evaluation datasets and context-specific test scenarios with local stakeholders.	Provide frameworks for localized evaluation, documentation and bias assessment.
Capacity asymmetry	Many countries may depend on testing performed elsewhere and lack resources to verify frontier systems independently.	Build public evaluation infrastructure and regional testing capacity.	Support common toolkits, reporting templates and capacity-building curricula.

Table 8: Cross-cutting issues and gaps identified

33.6 Recommended actions

Core message

AI assurance for frontier systems needs to move from isolated model testing to continuous, independent, standards-based verification of systems, safeguards and the institutions that deploy them.

Key actions going forward identified by the workshop:

- Establish a common international vocabulary for frontier AI testing, verification, safety thresholds, red lines, safeguards, evaluations and assurance cases
- Develop harmonized testing protocols for high-consequence risk domains, including cyber, chemical, biological, automated AI research and development, and agentic tool use
- Create a framework for independent evaluator competence, including methods to evaluate the evaluators and manage conflicts of interest
- Promote lifecycle assurance requirements covering pre-deployment testing, deployment controls, runtime monitoring, incident reporting, post-market surveillance and periodic reassessment
- Advance standards for autonomous agent governance, including agent identity, authentication, authorization, memory management, logging, traceability, human override and shutdown mechanisms
- Support mutual recognition of testing and verification through common reporting templates, evidence packages, audit trails and internationally trusted conformity assessment processes
- Invest in capacity building for developing countries, including evaluation infrastructure, secure testing environments, local-language datasets, red-teaming capability and governance expertise
- Ensure that standardization processes remain inclusive, adaptive and multi-stakeholder, with meaningful participation from developing countries, civil society, academia and affected communities

34 Quantum technologies

34.1 Building the UN playbook for quantum readiness

A panel discussion on [*Building the UN playbook for quantum readiness*](#) examined how the United Nations system is approaching quantum technologies readiness. Two ideas shaped the discussion. First, quantum readiness extends well beyond the acquisition of quantum computers. It also includes institutional capability, workforce skills, public understanding and the ability to adapt existing systems. Second, readiness should be approached as a gradual process of strengthening current technologies and institutions rather than replacing them wholesale.

Preparation was described as an immediate priority as quantum technologies may have far-reaching consequences for cybersecurity, digital trust and the global economy. Concerns focused on the time required for cryptographic migration, the exposure of existing systems and the possibility that some risks are already emerging. The broader point was that planning must begin before the risks become critical.

The discussion identified several interconnected components of readiness: assessing current cybersecurity capabilities, preparing for cryptographic migration, building institutional expertise and strengthening cryptographic agility. Cryptographic agility received particular emphasis because it allows organizations to update security measures progressively without rebuilding entire systems from the ground up. This approach supports a phased transition in which existing infrastructure can be strengthened as technologies and risks evolve.

Readiness was also presented as a global capacity-building challenge. Countries will move at different speeds and disparities in scientific expertise, education, infrastructure and access to knowledge may produce a wider quantum divide. Participants therefore emphasized the importance of developing technical skills, raising public awareness, investing in education, supporting fundamental research and broadening access to quantum knowledge.

Preparing societies alongside the technologies themselves was treated as equally important. The discussion emphasized public understanding, future talent, clear communication and sustained investment in fundamental science. A statistic shared during the session indicated that approximately one-third of researchers worldwide lack knowledge of quantum technologies.

For the UN system, priorities included assessing existing infrastructure, planning within budget constraints and preparing for cryptographic migration. The discussion linked UNICC's operational experience, UNESCO's capacity-building role and ITU's quantum standards work, which can support trust, interoperability and a coordinated transition while remaining flexible as the technology evolves.

Overall, the discussion presented quantum readiness as a long-term institutional undertaking rather than a narrow technology project. Effective preparation will require early cybersecurity planning, gradual cryptographic migration, investment in people and scientific capacity, flexible standards and sustained international cooperation. Because countries and institutions will begin from different positions, readiness efforts will need to be adaptable, inclusive and responsive to differing levels of capability.

Conclusions

- Quantum readiness extends beyond technology acquisition and requires long-term institutional preparation
- Cybersecurity planning, cryptographic migration, institutional capability and cryptographic agility are central components of preparedness
- Education, public awareness and investment in scientific skills are essential to reducing future inequalities
- ITU's quantum standards work can support trust, interoperability and coordinated cryptographic migration
- Countries and institutions will require different approaches to readiness, reflecting their respective priorities, resources and capacities

34.2 Quantum and AI: Unlocking new frontiers through convergence

A panel discussion on [*Quantum and AI: Unlocking new frontiers through convergence*](#) explored quantum technologies and AI as interconnected developments rather than separate technological trends. Participants described their convergence as an emerging force in scientific discovery, cybersecurity and industrial innovation, with wider implications for governance, workforce development and international cooperation.

Three issues shaped the discussion. The first was the need to begin preparing for the post-quantum transition now, since information encrypted today could be stored and decrypted

once sufficiently capable quantum computers become available. The second was that this transition will be gradual, not a one-time replacement of existing infrastructure, making cryptographic agility a more durable objective. The third was the unequal distribution of investment, which may limit participation and deepen technological disparities between countries.

The discussion began with the scientific potential of convergence. AI is expected to support the quantum innovation cycle by assisting research, optimization and workforce productivity, while quantum systems may eventually accelerate highly specialized computational tasks within otherwise classical workflows. Hybrid quantum-classical architectures were presented as a practical expression of this complementarity. Recent advances in quantum error correction were also reported to have reduced the resources needed for fault-tolerant quantum computing, suggesting that practical applications may be closer than previously anticipated. Together, these developments point to a future in which scientific discovery and computational capability advance through increasingly integrated systems.

Cybersecurity was identified as one of the most immediate areas of concern. AI is already improving vulnerability detection and speeding up security analysis, but cryptographically relevant quantum computers may undermine the public-key cryptographic systems on which much of today's digital infrastructure relies. The discussion therefore emphasized the need to begin migrating towards post-quantum cryptography before large-scale quantum computers become available. The challenge, however, is not simply to develop new algorithms, but to prepare institutions and systems for a long transition. Post-quantum algorithms are already being developed and standardized, while many organizations still lack a clear inventory of the digital assets, systems and data that will need protection. Because encrypted information may be collected now and decrypted later, delay creates long-term exposure. Migration strategies should therefore begin early, proceed in phases and be supported by cryptographic agility so that systems can adapt as technologies and threats evolve.

Technological preparedness, however, is only one part of the challenge. A recurring argument was that adopting frontier technologies requires organizational transformation as much as technological investment. Quantum technologies and AI form part of a broader technological ecosystem and their adoption requires interdisciplinary collaboration across traditional institutional and technical boundaries. A systems perspective can help organizations anticipate long-term developments rather than react to individual innovations. Integration is rarely straightforward: introducing several advanced technologies at once may remove one operational bottleneck while creating new organizational challenges elsewhere. Competitive advantage will therefore depend less on acquiring individual technologies than on integrating them effectively across people, processes and institutional structures. This points to the need for interdisciplinary expertise across scientific, technical and operational domains, organizational change management alongside technological innovation, and long-term strategies focused on systems integration rather than isolated deployment.

Technological leadership thus depends on more than research excellence. It also requires manufacturing capacity, resilient supply chains, workforce development and the ability to deploy innovation at scale. Public policy should therefore strengthen the entire innovation ecosystem while maintaining an appropriate balance between public and private investment in research and development. The discussion also sounded a note of caution against

unrealistic near-term expectations which could undermine sustained investment and contribute to a potential "quantum-AI winter" if progress fails to meet those expectations.

The session also considered how countries with mid-sized innovation ecosystems can respond to a more fragmented international environment. Aligning technological development with national priorities and strategic interests was presented as compatible with international cooperation which can strengthen domestic capabilities, reduce vulnerabilities and help countries participate in global value chains that no single actor can build alone.

Questions of resilience were closely linked to questions of inclusion. Access to capital was identified as one of the main barriers to equitable participation in frontier technologies. Investment remains concentrated in a limited number of countries, creating a risk that existing divides will widen. At the same time, quantum technologies and AI depend on specialized expertise, international value chains and cross-border collaboration, making broad participation a practical condition for innovation. Participants thus called for greater recognition of emerging innovation ecosystems across developing countries, where young researchers and entrepreneurs demonstrate considerable potential despite limited resources. Expanding access to funding, infrastructure and international collaboration was seen as essential to more inclusive development. The discussion also encouraged a shift from approaches centred mainly on protecting intellectual property towards forms of cooperation that allow knowledge, talent and opportunity to circulate more widely.

Looking towards 2050, the session concluded that convergence is likely to reshape scientific discovery, industrial innovation and digital infrastructure over the coming decades. Scientific breakthroughs alone, however, will not determine who benefits. Long-term outcomes will also depend on adaptive governance, workforce capability, resilient institutions, sustained investment and international cooperation. Preparing for this future therefore requires strategies that can evolve alongside the technologies themselves.

Conclusions:

- Quantum technologies and AI are complementary and their convergence is accelerating scientific discovery and technological innovation
- Preparation for the transition to post-quantum cryptography should begin now, with migration treated as a phased, long-term process
- Competitive advantage will increasingly depend on systems integration, interdisciplinary collaboration and organizational readiness rather than the adoption of individual technologies
- Convergence has significant implications for cybersecurity, economic development, security and international governance
- Strengthening innovation ecosystems requires investment in research, workforce development, manufacturing capacity and resilient supply chains
- Broader access to capital, infrastructure and international collaboration is essential if emerging economies are to participate meaningfully

- Sustainable technological leadership will depend on balancing innovation with resilience, inclusion and responsible governance

35 Brain-computer interfaces

35.1 Introduction

Brain-computer interface (BCI) technology is emerging as one of the most transformative frontiers in AI, neuroscience and digital health. By establishing direct communication pathways between the human brain and external devices, BCI systems are creating new possibilities for restoring lost neurological functions, enhancing human-machine interaction and enabling more inclusive and intelligent societies. Recent advances in AI, sensing technologies, neuroimaging and wearable devices have accelerated the transition of BCI from laboratory research to real-world applications in healthcare, rehabilitation, industrial safety, education and accessibility. At the same time, rapid technological progress has highlighted the growing need for internationally harmonized standards to support interoperability, safety, ethical governance, privacy protection and responsible innovation. Against this background, international collaboration has become increasingly important for supporting the sustainable and trustworthy development of the global BCI ecosystem.

A workshop on [Brain-computer interface: Technology for good and application cooperation](#), held during the *AI for Good Global Summit 2026* on 8 July in Geneva, Switzerland, provided an international platform to exchange perspectives on the future of BCI technologies and global standardization. The workshop explored recent technological breakthroughs, emerging application scenarios, ethical and governance challenges, and international standards initiatives while highlighting the essential role of ITU in facilitating global cooperation.

A key outcome of the workshop was the broad consensus that international standards will be fundamental to enabling safe, interoperable and scalable BCI deployment. The workshop also announced the launch of a new report on "Global Brain-Computer Interface Industry and Standardization Development Insights 2026" from the China Brain Computer Interface Alliance and the establishment of the Alliance's Pre-research Group for Standardization of Brain-Computer Interface Technology.

35.2 ITU standardization activities in Brain-Computer Interface

As BCI technologies accelerate their transition from laboratory research to industrial applications, ITU-T Study Group 21 is studying BCI-related standardization requirements across areas including multimedia services, digital inclusion and human-machine interaction.

In July 2026, ITU-T Study Group 21 launched work to develop a new Technical Report on "Capabilities of non-invasive BCI for multimedia digital inclusion" ([FSTR-BCI](#)). The report aims to establish an indicative reference framework and capability assessment system for the application of non-invasive BCI technologies in multimedia services and digital inclusion scenarios.

BCI-related work also includes the ITU standard [ITU-T H.861.0](#) (Requirements on

communication platform for multimedia brain information – version 2), which describes a conceptual ecosystem for brain data exchange based on communication platform requirements and definitions. Starting from the context of brain data exchange in e-health, the standard outlines a functional framework model for a multimedia brain information platform and develops it into a set of communication platforms that enable both experts and non-experts to utilize brain data for monitoring and maintaining brain health status.

In addition, ITU-T Study Group 21 is developing a new Technical Paper on "Use cases of brain healthcare quotients" ([HSTP.BHQ-UC](#)) with the aim of systematically documenting application scenarios for brain healthcare quotients.

35.3 Report on global brain-computer interface industry and standardization development insights

As BCI technologies rapidly advance from research laboratories towards practical applications, industry is entering a critical stage characterized by accelerating innovation, expanding application scenarios and increasing demands for coordinated governance. However, the development of the BCI ecosystem remains highly fragmented, with significant differences across technology pathways, application requirements, evaluation methodologies and regulatory approaches. The absence of internationally harmonized standards has become an important challenge affecting interoperability, industrial collaboration and large-scale deployment. In response to these challenges, the workshop announced the launch of the report "Global Brain-Computer Interface Industry and Standardization Development Insights 2026" from the China Brain Computer Interface Alliance, providing a comprehensive analysis of global BCI technological development trends, industrial progress, application opportunities and standardization requirements.

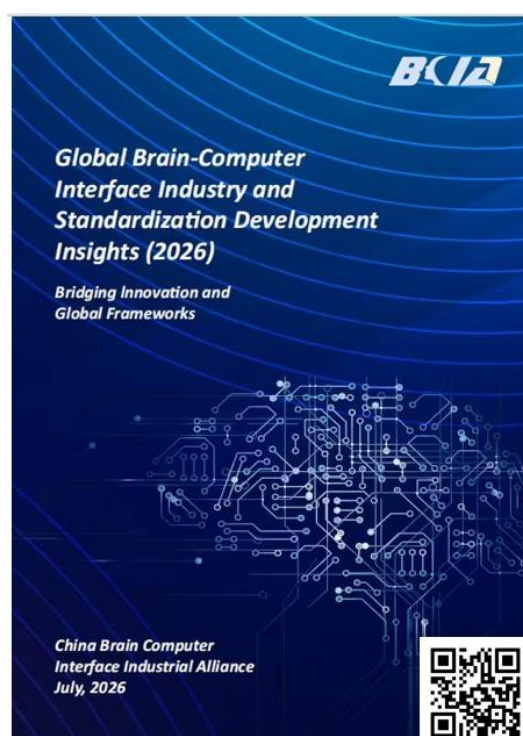


Figure 112: Report on brain-computer interface industry and standardization insights

Developed to support international cooperation on BCI standardization, the report systematically reviews the technical foundation of BCI systems, including brain signal acquisition, signal processing, AI-enabled decoding, human-machine interaction and application-oriented solutions. It analyzes emerging use cases in areas such as healthcare, rehabilitation, assistive technologies, industrial human-machine collaboration and intelligent medical services. The report further proposes a comprehensive international standardization framework consisting of four key dimensions: basic and general standards, key technical standards, application scenario standards, and technology governance standards. This framework aims to provide a structured approach for addressing current gaps in BCI standardization while supporting safe, reliable and scalable technology deployment.

The report aims to support shared understanding among global stakeholders regarding BCI development and standardization priorities. During the workshop, participants highlighted that future standardization efforts should balance technological innovation with requirements related to safety, privacy protection, ethical governance and responsible use of neural data. By providing an overview of industry trends and identifying potential areas for international collaboration, the report serves as a valuable reference for policymakers, standards organizations, researchers and industry stakeholders working towards the development of a trustworthy global BCI ecosystem.

35.4 Pre-research group for standardization of brain-computer interface technology

The development of BCI technologies requires close coordination among governments, international organizations, research institutions, standards bodies and industry stakeholders. As BCI applications continue to expand from medical rehabilitation and assistive technologies towards broader areas such as intelligent interaction, industrial collaboration and human capability enhancement, the need for a globally coordinated standardization approach has become increasingly important. Differences in technical approaches, system architectures, evaluation methods and governance frameworks have created challenges for interoperability, safety assurance and responsible deployment. To address these challenges and promote international collaboration, the workshop announced the launch of the Pre-research Group for Standardization of Brain-Computer Interface Technology, an initiative of the China Brain Computer Interface Alliance.

The Pre-research Group aims to provide a collaborative platform for stakeholders worldwide to exchange technical insights, identify emerging standardization requirements and explore potential areas for future standards development. The initiative focuses on bringing together expertise from academia, industry, research organizations and other relevant institutions to better understand the evolving BCI technology landscape and establish a common foundation for future standardization activities. Through discussions on technical frameworks, application requirements, evaluation approaches and governance considerations, the initiative seeks to support the transition of BCI technologies from fragmented innovation towards a more coordinated and sustainable global ecosystem.

The establishment of the Pre-research Group reflects the recognition that standards development should evolve in parallel with technological innovation to help ensure that emerging BCI systems are developed with considerations for safety, reliability, privacy protection, ethical responsibility and social benefit. The initiative provides an opportunity for

stakeholders from different regions and sectors to contribute to the development of globally applicable approaches. Future work of the initiative is expected to support the identification of priority standardization areas, facilitate knowledge sharing and contribute to the development of technical recommendations and frameworks for trustworthy and inclusive BCI deployment worldwide.



Figure 113: Launch of the Pre-research Group

35.5 Opening of the workshop

Wei Wei, Director-General of the Department of Science and Technology at MIIT China, highlighted the strategic importance of BCI as an emerging future industry integrating information technology and life sciences. He emphasized that BCI technologies are entering a critical transition period from research and development towards industrial application, with growing potential in healthcare, rehabilitation, accessibility, manufacturing and elderly care.

He shared China's experience in advancing BCI development through technological innovation, standardization, application expansion and ecosystem building. He stressed that international cooperation is essential to accelerate the global development of BCI technologies. He called for strengthened collaboration through international platforms; coordinated development of standards covering key technologies, applications, safety and ethics; and the establishment of governance frameworks for responsible and human-centred BCI development.

Tomas Lamanaskas, ITU Deputy Secretary-General, highlighted the significant potential of BCI technologies to improve human well-being and create new opportunities in healthcare, accessibility, education and human-machine interaction. He recognized the important contributions of China's research community and industry ecosystem in advancing BCI innovation and noted that the technology is moving beyond laboratory research towards real-world applications.

He emphasized that the rapid development of BCI also brings challenges, particularly the

fragmentation of global approaches and the lack of common standards. He noted that ITU could play an important role in facilitating international dialogue, strengthening collaboration and supporting the development of trustworthy and inclusive BCI technologies. He stressed that international standards are essential for building confidence and helping ensure safety and accessibility. He called on global stakeholders to work together to maximize the benefits of BCI while ensuring that technological progress contributes to sustainable development and benefits people worldwide.

35.6 Expert perspectives

Regaining the intention to live after relief of intractable phantom limb pain

Max Ortiz Catalan, Founder of the Center for Bionics and Pain Research, presented a case study highlighting advances in bionic technology and neurorehabilitation. He introduced the concept of the random entanglement hypothesis, proposing that phantom limb pain is associated with pathological coupling between pain-related and sensorimotor neural circuits, rather than being solely explained by cortical reorganization or visual perception mechanisms.

He highlighted the importance of restoring functional sensorimotor pathways through approaches combining motor execution training, AI, AR/VR and multimodal sensory feedback. He emphasized that evidence-based validation, including randomized controlled clinical trials, is essential for advancing personalized and mechanism-driven neurorehabilitation. His presentation demonstrated how BCI-related technologies can move beyond assistive functions towards restoring human capabilities and improving quality of life, highlighting the potential of technology-driven healthcare innovation for social good.

Governance framework, ethical considerations and standardization pathways

Anja Kaspersen, Director for Global Markets Development, Frontier Issues, AI and Critical Technologies at IEEE, focused on three core dimensions of BCI development: outdated governance systems, widespread ethical pitfalls and collaborative global standardization as a practical remedy. She elaborates each part with specific challenges and actionable international solutions.

In terms of governance, she argued that traditional data governance systems are obsolete in the context of BCI. Neural data is permanent and irreversible: closed-loop BCI continuously reshapes user identity and devices cross medical/consumer lines to fall outside traditional medical device oversight. Static, one-time consent forms built for separate transactions fail to regulate lifelong, uninterrupted neural data collection. Fragmented cross-border regulatory frameworks also creates uneven global oversight gaps.

Regarding ethical considerations, she identified two major ethical flaws in the industry. First, the rhetoric of "ethical neurotechnology" rarely becomes binding design or audit rules, allowing neural products that are legal but potentially harmful over the long term. Second, framing BCI as a speed-focused technological race ignores equity: biased hardware excludes marginalized populations, creating ethical blind spots. She cited the UNESCO Recommendation on the Ethics of Neurotechnology as core ethical guardrails.

Concerning standardization pathways, global cross-disciplinary standardization is proposed as the actionable solution. International technical committees develop unified BCI terminology,

shared independent testing protocols and iterative standards that translate ethics into verifiable engineering constraints. Since BCI spans medicine, consumer technology and engineering with no single institutional owner, expert collaboration can help build incremental, inclusive global standards able support balanced, responsible BCI governance.

Autonomous and non-surgical implant for brain-computer symbiosis

Deblina Sarkar, Associate Professor at MIT, introduced a novel approach to brain-computer symbiosis through an autonomous and non-surgical implantable system. She presented a new paradigm that moves beyond conventional BCI approaches based on surgically implanted electrodes by combining distributed nanoelectronics with biological carriers. The proposed architecture aims to enable wireless, minimally invasive interaction between electronic systems and neural tissues.

She highlighted that the core innovation lies in the use of subcellular-scale wireless electronic devices capable of autonomously reaching targeted areas within the brain, maintaining long-term coexistence with neural systems, and enabling precise neuromodulation. This approach provides a potential pathway toward future injectable BCI systems, advanced bioelectronic medicine and human capability enhancement. Her presentation demonstrated how emerging interdisciplinary technologies at the intersection of nanotechnology, neuroscience and AI could expand the possibilities of future BCI applications while also raising the importance of safety, reliability and responsible technology development.

Clot or bleed? The future of brain diagnostics

Sarah Aboerjaib, Founder of ScansX, presented the vision of bringing first-line brain diagnostics closer to patients through AI-enabled, non-invasive technologies. Focusing on the challenge of rapidly distinguishing between brain clots and brain bleeding, she introduced a portable diagnostic approach that integrates near-infrared sensing, radio-frequency technologies and AI to support early stroke screening and triage outside traditional hospital environments.

She emphasized that the proposed solution is designed to complement, rather than replace, established clinical imaging technologies such as CT and MRI. By enabling rapid assessment in pre-hospital and primary care settings, AI-driven multimodal sensing technologies have the potential to improve access to timely neurological care, particularly in time-sensitive emergency scenarios. Her presentation highlighted a shift from hospital-centred neurological diagnosis towards more accessible, patient-centred healthcare models, demonstrating the role of emerging technologies in improving healthcare equity and expanding the societal impact of BCI-related innovations.

Applications and collaborations

A panel discussion moderated by **Liang Liyan**, Senior Engineer at CAICT, welcomed **Sebastian Tam**, Chief Technology Officer of the Brain-Computer Division at Entropy Base Technology; **Javier Minguéz**, Co-Founder and Chief Scientific Officer of Bitbrain; **Olivier Oullier**, CEO and Co-Founder of Inclusive Brains; and **Sarah Aboerjaib** to explore practical applications and collaboration opportunities in the BCI ecosystem.

The panelists discussed emerging BCI applications in areas including sleep health

management, stroke screening and human–machine collaboration in industrial environments. They shared insights into innovative solutions such as closed-loop neural stimulation for sleep-related applications, portable multimodal sensing technologies for accessible healthcare, and BCI-enabled systems to enhance workplace safety and interaction efficiency. The discussion highlighted that large-scale adoption of BCI technologies requires not only continued technological innovation but also strong foundations in data security, privacy protection, ethical governance and international standards. Participants emphasized the importance of protecting neural data rights, strengthening cross-sector collaboration and promoting global cooperation to support the responsible and sustainable development of the BCI industry.

AI deployment in radiology

Lurii A. Vasilev, Chief Officer of Radiology at the Moscow Health Care Department and Medical Director of the Moscow Center for Diagnostics & Telemedicine, shared experiences from Russia’s large-scale deployment of AI in radiology, with a particular focus on neuroimaging applications. He introduced Moscow’s efforts since 2020 to develop AI-enabled medical imaging infrastructure, including the creation of a public medical dataset library and the MosMedAI platform, which supports AI deployment across more than 2,200 medical institutions.

He highlighted the role of AI in improving the efficiency and accuracy of neurological diagnosis, including applications in stroke and hemorrhage detection, multiple sclerosis lesion segmentation and quantitative brain analysis. He emphasized that clinical evidence demonstrates the advantages of human-AI collaboration, with radiologists supported by AI achieving significantly improved diagnostic performance compared with standalone AI systems. He concluded that the future of medical AI depends on continuous clinical validation and the balanced evaluation of technological, social and economic benefits, reinforcing the importance of trustworthy AI deployment in healthcare.

Key aspects of BCI standardization

A panel discussion on the role of international standards in supporting the sustainable growth and responsible deployment of BCI technologies welcomed **Anja Kaspersen**; **Deblina Sarkar**; and **Sheng Tiancheng**, Senior Engineer at CAICT. The discussion was moderated by **Max Ortiz Catalan**.

Panelists exchanged perspectives on topics including international standard frameworks, technical specifications, healthcare and industrial application requirements, and data ethics and governance. Participants agreed that global collaboration is essential to establish a coordinated BCI standards ecosystem that balances technological innovation with neural data privacy, safety and ethical considerations. The panel emphasized the importance of strengthening cross-border cooperation among industry, academia and research institutions, and highlighted that open and inclusive standards will help improve interoperability, support responsible technology deployment and enable long-term growth of the global BCI industry.

35.7 Conclusion

The workshop highlighted that BCI is rapidly transitioning from experimental research towards practical deployment, with significant opportunities in healthcare, rehabilitation, accessibility, industrial collaboration and human-machine interaction.

A key takeaway from the workshop was the critical role of international standards in supporting the safe, reliable and scalable development of BCI technologies. Participants emphasized the need for coordinated efforts to establish common frameworks covering fundamental requirements, key technologies, application scenarios and technology governance. In particular, issues related to neural data protection, ethical governance, interoperability and clinical validation were identified as important areas requiring continued international collaboration.

The workshop took steps towards advancing global BCI cooperation, including with the launch of the report "Global Brain-Computer Interface Industry and Standardization Development Insights 2026" from the China Brain Computer Interface Alliance and the Alliance's Pre-research Group for Standardization of Brain-Computer Interface Technology. Moving forward, ITU can continued to play an important role in facilitating dialogue and promoting standards cooperation to help ensure that BCI technologies develop in a responsible, inclusive and human-centred manner that maximizes benefits for society.

36 Acknowledgements

The organizers would like to acknowledge the speakers of the various sessions who kindly accepted to share their insights during the International AI Standards track of the AI for Good Global Summit 2026.

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Laura Schade	Senior Energy Engineer	UK Department for Energy Security and Net Zero	From data centres to climate goals: International standards for a more energy efficient AI	Workshop	Speaker
Molly Webb	Founder and CEO	Energy Unlocked	From data centres to climate goals: International standards for a more energy efficient AI	Workshop	Speaker
Thomas Spencer	Senior Energy Analyst	IEA	From data centres to climate goals: International standards for a more energy efficient AI	Workshop	Speaker
Cyrille Brisson	Global Data Center Segment Leader, Electrical Sector	Eaton	From data centres to climate goals: International standards for a more energy efficient AI	Workshop	Speaker
Priyanka Dasgupta	Associate Project Manager for Communications	International Electrotechnical Commission (IEC)	From data centres to climate goals: International standards for a more energy efficient AI	Workshop	Speaker
Gilles Fayad	Director of Development	AI commons	The future of AI native communication networks	Workshop	Speaker
Madisen Taylor	Director	AI Commons	The future of AI native communication networks	Workshop	Moderator
Sam Klein	Director	The Concordance Project	The future of AI native communication networks	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Mpho Lethoko McNamee	Group Chief of Corporate Affairs	Telkom Limited	The future of AI native communication networks	Workshop	Speaker
Joongi Kim	CTO and Co-founder	Lablup Inc.	The future of AI native communication networks	Workshop	Speaker
Zeinab Nezami	AI Data Engineering Lead	GSMA	The future of AI native communication networks	Workshop	Speaker
Abdelhamied A. Ateya	Associate Professor, Department of Electronics & Communications Engineering, Faculty of Engineering	Zagazig University	The future of AI native communication networks	Workshop	Speaker
Lasha Tabidze	Chief Digital Operations Officer	VEON	The future of AI native communication networks	Workshop	Speaker
Shivagami Gugan	Chief Technologist for Middle East and Africa, Amazon Web Services (AWS)	Amazon	The future of AI native communication networks	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Carlee Joe-Wong	Sense of Wonder Group Professor of Electrical and Computer Engineering in AI Systems	Carnegie Mellon University	The future of AI native communication networks	Workshop	Speaker
Riccardo Trivisonno	Head of Network Architecture	Huawei Technologies Co., Ltd.	The future of AI native communication networks	Workshop	Moderator
Paul Kennedy	Chief of Staff	Zindi Africa	The future of AI native communication networks	Workshop	Speaker
Nada Golmie	NIST Fellow	National Institute of Standards and Technology (NIST)	The future of AI native communication networks	Workshop	Speaker
Merouane Debbah	Director of the 6G Center	Khalifa University of Science and Technology	The future of AI native communication networks	Workshop	Speaker
Wei Meng	Director of standards and open source planning	ZTE Corporation	The future of AI native communication networks	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Mei Lin Fung	Chair	IEEE SSIT Sustainability Technical Committee	The future of AI native communication networks	Workshop	Speaker
Gyu Myoung Lee	Professor	Liverpool John Moores University (LJMU)	The future of AI native communication networks	Workshop	Speaker
Ammar Muthanna	Professor, Scientific consultant	St. Petersburg State University of Telecommunications, National Research Institute of Telecommunications	The future of AI native communication networks	Workshop	Speaker
Liya Yuan	Senior Engineer	ZTE Corporation	The future of AI native communication networks	Workshop	Speaker
Vishnu Ram OV	Independent Research Consultant	International Telecommunication Union (ITU)	The future of AI native communication networks	Workshop	Moderator
Thomas Basikolo	Programme Coordinator	International Telecommunication Union (ITU)	The future of AI native communication networks	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Amir Banifatemi	Chief Responsible AI Officer	Cognizant	The future of AI native communication networks	Workshop	Speaker
Antonio De Domenico	Principal Researcher	Huawei Technologies Co., Ltd.	The future of AI native communication networks	Workshop	Speaker
H.E. Mr. Serge Wilmes	Minister of the Environment, Climate and Biodiversity Minister for the Civil Service	The Government of Luxembourg	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Fritz Pickhardt	Project Lead, AI Innovation Lab (KI-Reallabor)	Federal Agency for Technical Relief (THW), Germany	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Patrick Ebel	Researcher	Google	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Anacláudia Rossbach	Under-Secretary-General and Executive Director	UN-Habitat	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Costanza Bonadonna	President	International Association of Volcanology and	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
		Chemistry of the Earth's Interior			
Jesper Dramsch	Scientist	ECMWF	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Jessica Rapson	Director	Algorithmic Governance Foundation	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Rakiya A. B. Babamaaji	Deputy Director at Strategic Space Applications Department	National Space Research and Development Agency, Nigeria	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Arif Albayrak	Senior Research Engineer	University of Maryland, Baltimore County (UMBC)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Florian Pappenberger	Director-General	European Center for Midrange Weather Forecasting (ECMWF)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Jumpei Takami	Associate Expert in Remote Sensing for Disaster Management	United Nations Office for Outer Space Affairs (UNOOSA)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Hwirin Kim	Chief of Hydrological and Water Resources Services Section	World Meteorological Organization (WMO)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Moderator
Lorenzo Nava	Senior Lecturer and AI+ Senior Fellow	King's College London	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Celeste Saulo	Secretary-General	World Meteorological Organization (WMO)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Elena Xoplaki	Senior Scientist	CMCC Foundation – European Mediterranean Centre on Climate Change	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Pierre-Philippe Mathieu	ESA Implementation Manager, Civil Security from Space (CSS)	European Space Agency (ESA)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Monique Kuglitsch	Innovation Manager	Fraunhofer Heinrich Hertz Institute (HHI)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Muralee Thummarukudy	Director of the Coordination Office of the G20 Initiative on Land	United Nations Convention to Combat Desertification (UNCCD)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Moderator
Bilel Jamoussi	Deputy Director of TSB & Chief, Study Groups & Policy Department (SPD)	International Telecommunication Union (ITU)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker
Thomas Schoos	Master of Ceremonies	Ministry of Environment, Climate and Biodiversity, Luxembourg Government	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Moderator
Kamal Kishore	Special Representative of the United Nations Secretary-General for Disaster Risk Reduction	United Nations Office for Disaster Risk Reduction (UNDRR)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Jennifer Selby	Master of Ceremonies	Fraunhofer Heinrich Hertz Institute (HHI)	AI in disaster resilience: Bridging science, standards and innovation	Workshop	Moderator
Seizo Onoe	Director of the Telecommunication Standardization Bureau (TSB)	International Telecommunication Union (ITU)	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Teoman Sanalan	Senior Expert on Environmental and Climate Technologies and Sustainability	Republic of Türkiye Ministry of Environment, Urbanization and Climate Change	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Jon Turnbull	Environment x AI lead	Google	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Thomas Spencer	Senior Energy Analyst	IEA	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Bjorn-Soren GIGLER	Senior Digital and Green Transformation Specialist	European Commission	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Lisa Rivalin	Senior Staff Systems Engineer	Meta	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Luis Adrián Salazar	Professor	Latin University of Costa Rica	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle		Moderator
Gabriela Haenel	Co-founder and Chief Product Officer	Resilio solutions	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Xavier Merlin	Board Member	ARCEP	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Bridgette Bell McAdoo	Chief Sustainability Officer	Genesy Cloud Services	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Jean-Manuel Canet	Senior Manager, Climate Biodiversity	Orange	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Hiroshi Yamamoto	Head of Standardization Office, R&D Planning Department	NTT Corporation, Japan	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Leona Verdadero	Programme Specialist	UNESCO	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Moderator
Susanna Kallio	Head of Sustainability Standardization	Nokia	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Boris Gamazaychikov	Co-Founder, CEO	Sustainable AI Group	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Ivana Drobnjak	Professor	University College London (UCL)	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Tim Smolcic	Global Head of Strategic Partnerships	HSBC	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Vijay Karia	CEO	OptiCloud	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Moderator
Yolanda Martinez	Senior Advisor on Digital Public Infrastructure and AI	International Telecommunication Union (ITU)	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Moderator
Joaquim Barris	Team Lead, Data Services	United Nations Framework Convention on Climate Change (UNFCCC)	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Gitta Kutyniok	Bavarian AI Chair for Mathematical Foundations of Artificial Intelligence	Ludwig-Maximilians Universität München	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Moderator
Qi Shuguang	Vice Deputy Engineer, China Telecommunication Technology Labs (systems)	China Academy of Information and Communications Technology (CAICT)	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Moderator
Golestan Sally Radwan	Chief Digital Officer	United Nations Environment Programme (UNEP)	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Sasha Luccioni	Co-Founder, Chief Scientific Officer	Sustainable AI Group	From standards to science to action: Implementing and scaling sustainable AI across its lifecycle	Workshop	Speaker
Dennis Chornenky	CEO	Domelabs AI	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker
Andrew Whytock	Head of Thought Leadership, Life Sciences Segment	Siemens AG	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker
TSAI-TA LAI	Co-founder, Chairman of the Board, and Chief Executive Officer	Metis TechBio	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker
Jicui Dong	Unit Head, Product Policies, Access and Manufacturing Support Unit	World Health Organization (WHO)	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker
Dong Min	Deputy Director, Institute of Cloud Computing and Digitalization	China Academy of Information and Communications Technology	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Anne Stake	Beneficial Deployments	Anthropic	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker
Pascal Mayer	CEO	Alphanosos	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker
Vaibhava Lakshmi Ravideshik	Research Lead	Massachusetts Institute of Technology	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker
Yu Zhao	Research Fellow	Western Institute of Computing Technology	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker
Alex Aliper	President	Insilico Medicine	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker
YU Xiaohui	President	China Academy of Information and Communications Technology (CAICT)	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Simão Campos	Counsellor, AI for Health standards	International Telecommunication Union (ITU)	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Moderator
Seizo Onoe	Director of the Telecommunication Standardization Bureau (TSB)	International Telecommunication Union (ITU)	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Speaker
Noah Luo	Chair of ITU-T SG 21	Huawei Technologies Co., Ltd., China	AI for manufacturing: Pharmaceutical industry workshop on innovation, applications and standards	Workshop	Moderator
Minjae Seo	Research Scientist	Korea AI Safety Institute (Korea AISI)	Testing and verification of frontier AI systems	Workshop	Speaker
Charbel-Raphaël Segerie	Executive Director CeSIA - French Center for AI Safety Expert to the EU, Expert Forum on AI	European Commission AI Office	Testing and verification of frontier AI systems	Workshop	Speaker
Lukas Struppek	Research Scientist	FAR.AI	Testing and verification of frontier AI systems	Workshop	Speaker
Kato Steven Mubiru	CEO and Co-Founder	Crane AI Labs	Testing and verification of frontier AI systems	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Balaraman Ravindran	Head of the Wadhvani School of Data Science and AI	IIT Madras	Testing and verification of frontier AI systems	Workshop	Speaker
Chris Meserole	CEO	Frontier Model Forum	Testing and verification of frontier AI systems	Workshop	Speaker
Franziska Weindauer	CEO	TÜV AI.Lab	Testing and verification of frontier AI systems	Workshop	Speaker
Hiromu Kitamura	Principal Expert	Japan AI Safety Institute (J-AISI)	Testing and verification of frontier AI systems	Workshop	Speaker
HE Bo	Director of the Internet Law Research Center	China Academy of Information and Communications Technology (CAICT)	Testing and verification of frontier AI systems	Workshop	Speaker
Rachel Adams	CEO	Global Centre for AI Governance	Testing and verification of frontier AI systems	Workshop	Speaker
Rumman Chowdhury	CEO and Founder	Humane Intelligence	Testing and verification of frontier AI systems	Workshop	Moderator
Vijay Mauree	Head – Strategic Tech and Academia Initiatives Division, TSB	International Telecommunication Union (ITU)	Testing and verification of frontier AI systems	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Bilel Jamoussi	Deputy Director of TSB & Chief, Study Groups & Policy Department (SPD)	International Telecommunication Union (ITU)	Testing and verification of frontier AI systems	Workshop	Speaker
Irakli Beridze	Head of Centre for Artificial Intelligence and Robotics	United Nations Interregional Crime and Justice Research Institute (UNICRI)	Testing and verification of frontier AI systems	Workshop	Speaker
Anja Kaspersen	Director for Global Markets Development, Frontier Issues & Critical Technologies	IEEE	Testing and verification of frontier AI systems	Workshop	Moderator
Bilel Jamoussi	Deputy Director of TSB & Chief, Study Groups & Policy Department (SPD)	International Telecommunication Union (ITU)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Moderator
Alissa Starzak	Chief Legal Officer	Cloudflare	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Andrew Sanchez	CEO & Co-Founder	Udio	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Anil Kumar Lahoti	Chairman	Telecom Regulatory Authority of India, India	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Arielle Roth	Administrator	National Telecommunications and Information Administration, United States	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Babak Hodjat	Chief Technology Officer AI	Cognizant	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Burce Gultekin	Chief Data & Analytics Officer (CDAO)	IKEA Retail (Ingka Group)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Calista Redmond	Vice President of Global AI Initiatives	NVIDIA	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Carlos Manuel Baigorri	Chairman and CEO	National Telecommunication Agency (ANATEL), Brazil	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Dennis Chornenky	CEO	Domelabs AI	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Erez Askal	Head of the National AI Directorate	Prime Minister's Office, Israel	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Gilles Thonet	Deputy Secretary-General	International Electrotechnical Commission (IEC)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Guillaume Lardeux	SVP, Head of Office of CEO, Transformation and IT	Genesys Cloud Services	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Dr. Takuo Imagawa	Vice-Minister for International Affairs	Ministry of Internal Affairs and Communications, Japan	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Mr. Alessio Butti	Secretary of State for Technological Innovation and Digital Transition	Department for Digital Transformation, Italy	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Mr. Alonso Zeledon Carazo	Vice Minister	Ministry of Science, Innovation, Technology and Telecommunications, Costa Rica	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
H.E. Mr. Grigoriy Borisenko	Deputy Minister	Ministry of Digital Development, Communications and Mass Communications of the Russian Federation	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Mr. Kyeongman Kim	Deputy Minister, Ministry of Science and ICT	Republic of Korea	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Mr. Mondli Gungubele	Deputy Minister	Ministry of Communications and Digital Technologies, South Africa (Republic of)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Mr. Zhaslan Madiyev	Deputy Prime Minister and Minister of Artificial Intelligence and Digital Development	Government of the Republic of Kazakhstan	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Ms. Josephine Teo	Minister for Digital Development and Information and	Ministry of Digital Development and Information,	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
	Minister-in-charge of Smart Nation and Cybersecurity	Singapore (Republic of)			
H.E. Ms. Lerato Dorothy Mataboge	Commissioner for Infrastructure and Energy (I&E)	African Union	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Ms. Niamh Smyth	Minister of State	Department of Enterprise, Tourism, and Employment, Ireland	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Ms. Paula Bogantes Zamora	Minister of Science, Innovation, Technology and Telecommunications	Costa Rica	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Hatem Dowidar	Telecommunications and technology expert leader. Non-executive Director	Vodacom Group	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Issam Eid	Chief Marketing Officer and Partner	Telecom Review	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Jerremy Holland	Director of AI Research	Apple	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
John Giusti	Chief Regulatory Officer	GSMA	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
John Higgins	Co-Lead of the Standards Promotion Program of SC on AI	International AI Governance Association (IAGA)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Juha Heikkilä	Adviser for International Aspects of Artificial Intelligence, Directorate-General for Communications Networks, Content and Technology	European Commission	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Lan Xue	Dean	Institute for AI International Governance of Tsinghua University (I-AIIG)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Lasha Tabidze	Chief Digital Operations Officer	VEON	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Leonardo Cervera Navas	Secretary General of the European Data	European Union	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
	Protection Supervisor's Office				
Melike Yetken Krilla	Head of International Organizations	Google	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Mpho Lethoko McNamee	Group Chief of Corporate Affairs	Telkom Limited	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Natasha Crampton	VP, Chief Responsible AI Officer	Microsoft	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Raquel Brízida Castro	Vice Chairwoman of the Board of Directors	ANACOM - Autoridade Nacional de Comunicações, Portugal	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Rim Belhassine Cherif	Chair, Network of Women in ITU-T (NoW in ITU-T), Chief Innovation and Strategy Officer	Tunisie Télécom	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Roman V. Yampolskiy	Faculty member, Department of	University of Louisville	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
	Computer Science and Engineering				
Sasha Rubel	Head of Public Policy for Generative AI	Amazon Web Services (AWS)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Seizo Onoe	Director of the Telecommunication Standardization Bureau (TSB)	International Telecommunication Union (ITU)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Serame Taukobong	Group Chief Executive Officer	Telkom SA SOC Ltd	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Virginia Dignum	Full professor of Responsible Artificial Intelligence	Umeå University	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Wang Jian	Founder of Alibaba Cloud, Director	Zhejiang Lab	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Wanjin Park	Vice President, Tech Strategy Department, AX Future Technology Institute	KT	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Xiao Ran	Vice President	Huawei Technologies Co., Ltd.	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
YU Xiaohui	President	China Academy of Information and Communications Technology (CAICT)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Khaled Soufi	President	International Organization for Standardization (ISO)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Mr. Mark Schaan	Deputy Minister	Innovation, Science and Economic Development Canada (ISED)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Dr. Bosun Tijani	Honourable Minister	Federal Ministry of Communications, Innovation and Digital Economy, Nigeria	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Ayman Essam	Chief External Affairs Officer	Vodacom Group	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Ashley Carr	Partner	DLA Piper	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Matthias Kloth	Head of the Digital Governance and Sport Department	Council of Europe	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Mihnea Costoiu	Rector	National University of Science and Technology POLITEHNICA Bucharest, Romania	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Mashael Al Hammadi	Assistant Undersecretary for Digital Government Affairs	Ministry of Communications and Information Technology of the State of Qatar	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
H.E. Dr. Shaikh Abdulla bin Ahmed Al Khalifa	Minister of Transportation and Telecommunications	Ministry of Transportation and Telecommunications, Bahrain (Kingdom of)	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
H.E. Cina Lawson	Minister for Digital Economy and Digital Transformation	Ministère de l'Economie Numérique et de la Transformation Digitale, Togo	AI foundation: Digital trust and AI infrastructure for all	Roundtable	Participant
Louis Amara	Project Coordinator	Swiss TXT	AI and audiovisual accessibility for digital inclusion	Panel (Solutions Stage)	Speaker
Anna Matamala	Professor	Universitat Autònoma de Barcelona, Spain	AI and audiovisual accessibility for digital inclusion	Panel (Solutions Stage)	Moderator
Estella Oncins	Associate professor	Universitat Autònoma de Barcelona	AI and audiovisual accessibility for digital inclusion	Panel (Solutions Stage)	Speaker
Simão Campos	Counsellor, AI for Health standards	International Telecommunication Union (ITU)	AI and audiovisual accessibility for digital inclusion	Panel (Solutions Stage)	Speaker
H.E. Mr. Lecheng Li	Minister	Ministry of Industry and Information Technology, People's Republic of China	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Anna Matamala	Professor	Universitat Autònoma de Barcelona, Spain	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Moderator
Bret Jordan	Chief Security Strategist	Afero	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Rongwei Ren	Standards Director	National Embodied AI Robotics Innovation Center(China)	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Emily Chen	General Manager, Open Source Strategy and Ecosystem	Dexmal & RoboChallenge Committee	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Heung Youl Youm	Professor (emeritus), Dept. of Information Security Engineering	Soonchunhyang University, Korea (Rep. of)	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Andres Marafioti	Multimodal Research Lead	Hugging Face	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Lyn Wang	Regional Manager (EU&ME)	Unitree	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Yonghua Lin	Vice President and Chief Engineer	Beijing Academy of Artificial Intelligence	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Shin-Gak Kang	ITU FG-EAI Vice-Chair; Special Research Fellow	Electronics and Telecommunications Research Institute (ETRI)	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Moderator
Weimin Zhang	Deputy Director of the Embodied Intelligence and Robotics Department, AI Institute	China Academy of Information and Communications Technology (CAICT)	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Moderator
Marija Jankovic	Research Associate, CERTH/ITI Chair	ETSI TC MTS Greece	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Avinash Agarwal	Deputy Director General (International Relations)	Department of Telecommunications (DoT), Ministry of Communications, India	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Yuntao Wang	ITU FG-EAI Chair, Q5/21 Rapporteur	China Academy of Information and Communications Technology (CAICT), China	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Moderator
Boxun Li	CTO		Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Andrea Cavallaro	Professor	EPFL	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Sebastian Hallensleben	Chief Trust Officer, Resaro, Germany/Singapore, Chair	CEN-CENELEC JTC21, Europe	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Seizo Onoe	Director of the Telecommunication Standardization Bureau (TSB)	International Telecommunication Union (ITU)	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Wuqiang Yang	Professor	University of Manchester	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Noah Luo	Chair of ITU-T SG 21	Huawei Technologies Co., Ltd., China	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Bilel Jamoussi	Deputy Director of TSB & Chief, Study Groups & Policy Department (SPD)	International Telecommunication Union (ITU)	Embodied AI for multimedia technologies: From perception to human collaboration	Workshop	Speaker
Wafa Ben-Hassine	Chief of Digital Technology and Human Rights Section	OHCHR	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Speaker
Matthias Kloth	Head of the Digital Governance and Sport Department	Council of Europe	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Speaker
Erich Kieck	Director of Capacity Building	International Organization for Standardization (ISO)	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Speaker
Jeremy Ng	Legal	World Bank Group	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Harry Verweij	Ambassador-at-large and Special Envoy on AI	Netherlands	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Speaker
Gilles Thonet	Deputy Secretary-General	International Electrotechnical Commission (IEC)	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Moderator
Cindy Parokkil	AI Policy Lead and Capacity Building Programme Manager	International Organization for Standardization (ISO)	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Moderator
Boris Inderbitzin	External Relations Officer	International Electrotechnical Commission (IEC)	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Moderator
Daniel Pap	Legal Adviser	Council of Europe	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Speaker
Nevine Tewfik		Ministry of Communications and Information Technology (MoICT), Egypt	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Mauricio Gibson	Head of International AI Governance	UK Department for Science, Innovation and Technology (DSIT)	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Speaker
Michel Roberto Oliveira de Souza	Human Rights Officer	OHCHR	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Speaker
Susanne Kuchs	ISO/IEC JTC 1/SC 42 WG on AI Risk and Impact Assessment	DAKKS	Operationalizing AI impact assessment — The interplay between law-based frameworks and international standards	Workshop	Speaker
H.E. Mr. Lecheng Li	Minister	Ministry of Industry and Information Technology, People's Republic of China	Brain-computer interface: Technology for good and application cooperation	Workshop	Speaker
Javier Minguez	Co-founder and CSO	Bitbrain	Brain-computer interface: Technology for good and application cooperation	Workshop	Speaker
Sebastian Tam	Chief Technology Officer	Brain-Computer Division at Entropy Base Technology	Brain-computer interface: Technology for good and application cooperation	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Ran D Balicer	Deputy-DG & Chief Innovation Officer	Israel	Brain-computer interface: Technology for good and application cooperation	Workshop	Speaker
Tiancheng Sheng		China Academy of Information and Communications Technology (CAICT) Beijing	Brain-computer interface: Technology for good and application cooperation	Workshop	Speaker
Sarah Aboerjaib	Founder	ScansX	Brain-computer interface: Technology for good and application cooperation	Workshop	Speaker
Max Ortiz Catalan	Scientist and humanitarian		Brain-computer interface: Technology for good and application cooperation	Workshop	Moderator
Deblina Sarkar	Associate Professor, Founder	MIT, Cahira Technologies Inc	Brain-computer interface: Technology for good and application cooperation	Workshop	Speaker
Liyan Liang	Senior Engineer	China Academy of Information and Communications Technology (CAICT)	Brain-computer interface: Technology for good and application cooperation	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
YU Xiaohui	President	China Academy of Information and Communications Technology (CAICT)	Brain-computer interface: Technology for good and application cooperation	Workshop	Moderator
Li Wenyu	Director Intellectual Property and Innovation Development Center	China Academy of Information and Communications Technology (CAICT)	Brain-computer interface: Technology for good and application cooperation	Workshop	Moderator
Olivier Oullier	Co-Founder & CEO, Inclusive Brains; Visiting Professor	Mohamed Bin Zayed University of Artificial Intelligence (MBZUAI)	Brain-computer interface: Technology for good and application cooperation	Workshop	Speaker
Tomas Lamanauskas	Deputy Secretary-General	International Telecommunication Union (ITU)	Brain-computer interface: Technology for good and application cooperation	Workshop	Speaker
Anja Kaspersen	Director for Global Markets Development, Frontier Issues & Critical Technologies	IEEE	Brain-computer interface: Technology for good and application cooperation	Workshop	Speaker
Chang Xin	Vice President of Standardization and	Huawei Technologies Co., Ltd.	AI foundation model evaluation and standards	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
	Industry Development				
Nicolas Mialhe	Co-Founder	AI Safety Connect	AI foundation model evaluation and standards	Workshop	Speaker
Yonghua Lin	Vice President and Chief Engineer	Beijing Academy of Artificial Intelligence	AI foundation model evaluation and standards	Workshop	Speaker
Maxime Stauffer	Founder and CEO	Simon Institute for Longterm Governance (SI)	AI foundation model evaluation and standards	Workshop	Speaker
Kangchan Lee	SG13 Vice-chair, WP2/13 Chair, JCA-AI Chair, Director of the Strategic Standards Research Section	ETRI	AI foundation model evaluation and standards	Workshop	Speaker
Peter Danenberg	Senior Software Engineer	Google DeepMind	AI foundation model evaluation and standards	Workshop	Speaker
Yuntao Wang	ITU FG-EAI Chair, Q5/21 Rapporteur	China Academy of Information and Communications	AI foundation model evaluation and standards	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
		Technology (CAICT), China			
Shivagami Gudan	Chief Technologist for Middle East and Africa, Amazon Web Services (AWS)	Amazon	AI foundation model evaluation and standards	Workshop	Speaker
Latif Ladid	Founder & President, IPv6 FORUM, Chair, AI & Blockchain Global Forum, Founder of EU Public Safety Fo	3GPP PCG Board	AI foundation model evaluation and standards	Workshop	Moderator
Wang Jian	Founder of Alibaba Cloud, Director	Zhejiang Lab	AI foundation model evaluation and standards	Workshop	Speaker
Arnaud Taddei	Global Security Strategist	Broadcom	AI foundation model evaluation and standards	Workshop	Speaker
Wei Kai	Director, Artificial Intelligence Institute	China Academy of Information and Communications Technology (CAICT)	AI foundation model evaluation and standards	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Gilles Thonet	Deputy Secretary-General	International Electrotechnical Commission (IEC)	AI foundation model evaluation and standards	Workshop	Speaker
YU Xiaohui	President	China Academy of Information and Communications Technology (CAICT)	AI foundation model evaluation and standards	Workshop	Speaker
Li Tian	Head of Standards Strategy	ZTE Corporation	AI foundation model evaluation and standards	Workshop	Speaker
Noah Luo	Chair of ITU-T SG 21	Huawei Technologies Co., Ltd., China	AI foundation model evaluation and standards	Workshop	Speaker
Bilel Jamoussi	Deputy Director of TSB & Chief, Study Groups & Policy Department (SPD)	International Telecommunication Union (ITU)	AI foundation model evaluation and standards	Workshop	Speaker
Stéphanie Herlin	Co-founder	Korabench.ai	AI foundation model evaluation and standards	Workshop	Speaker
Aline Matta	Head of Geneva Office and Head	UN Innovation Technology	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
		Accelerator for Cities (UNITAC)			
Karen Lassmann	Head of Smart City and Data Management	Senate Chancellery, Berlin	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Tatiana Roque	Secretary of Science and Technology	Rio de Janeiro, Brazil	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
H.E. Dr. Yasir Al Naqbi	Director General of GovAcademy	Department of Government Enablement (DGE), Abu Dhabi	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Peter Sailer	Project Director for the International Smart Cities Network	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Moderator
Judit Kozenkow	Economist, Foresight Strategist and Founder	Kozenkow Advisory	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Antonio Jara	Executive Board Member	Libelium	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Marco Camisani Calzolari	Founder of Cyberhumanism; Member of Italy's National AI Committee Pres. of the Council of Ministers		Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Anita Perera	KM AI Lead	Accenture	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Moderator
Christina Kitsos	Mayor of Geneva; President	Global Cities Hub	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Gamze Hakli Geray	Co-Leader of the U4SSC Thematic Group	Digital Transformation Assessment of People-Centred Cities	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
H.E. Ms. Angellah	Minister	Ministry of Communication and	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Jasmine Mbelwa Kairuki		Information Technology, Tanzania			
H.E. Mr. William Kabogo Gitau	Cabinet Secretary	Ministry, Information, Communications and the Digital Economy, Kenya	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Kamelia Kemileva	Co-Director, Programmes and Administration	Global Cities Hub	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Moderator
Paola Cecchi Di Meglio	Professor, Harvard University and Vice Chair	Steering Committee of the Global Initiative on AI & Virtual Worlds	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Martin Brynskov	Founding Board Director and Standardisation Lead	Open & Agile Smart Cities & Communities (OASC)	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Dino Cataldo Dell'Accio	Deputy Chief Executive	United Nations Joint Staff Pension Fund (UNJSPF)	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Sameer Chauhan	Director	United Nations International Computing Centre	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Seizo Onoe	Director of the Telecommunication Standardization Bureau (TSB)	International Telecommunication Union (ITU)	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Okan Geray	Chair	Senior Digital City Strategy Advisor, Digital Dubai and U4SSC Chair	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Cristina Bueti	Counsellor	International Telecommunication Union (ITU)	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Moderator
Hyoung Jun Kim	Chair, ITU-T Study Group 20	International Telecommunication Union (ITU)	Cities that think and act: Agentic AI, physical AI and the citiverse	Workshop	Speaker
Mario Tavares Moyron	Chief Privacy Officer	Genesys	Designing the trust management for Agentic AI	Workshop	Speaker
Nick Adam	Senior Vice President, Deputy	State Street	Designing the trust management for Agentic AI	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
	CISO, Global Head of Fusion & Security Operations				
Anthony Carmoy	Technical Director, France Titres - Agence nationale des titres sécurisés (ANTS)	Ministry of Interior	Designing the trust management for Agentic AI	Workshop	Speaker
Ward Duchamps	Director of Strategy for AI Cybersecurity Products	Thales	Designing the trust management for Agentic AI	Workshop	Speaker
Zhiyuan HU	Director of Security Research	vivo Mobile Communication	Designing the trust management for Agentic AI	Workshop	Moderator
Henk Birkholz	Co-Founder & CTO	XOR	Designing the trust management for Agentic AI	Workshop	Speaker
Li Li	Chief Scientist of Standards	Huawei Technologies Co. Ltd.	Designing the trust management for Agentic AI	Workshop	Speaker
William Carter	AI Policy and Product Strategy Lead	Google Knowledge and Information (K&I)	Designing the trust management for Agentic AI	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Mark Keating	Principal Security Solutions Architect	Amazon Web Services (AWS)	Designing the trust management for Agentic AI	Workshop	Speaker
Samuel Waymouth	AI Security Compliance Specialist	Amazon Web Services (AWS)	Designing the trust management for Agentic AI	Workshop	Speaker
Maximilian Nickel	Research Director	Meta	Designing the trust management for Agentic AI	Workshop	Speaker
Pam Dixon	Founder & Executive Director	World Privacy Forum	Designing the trust management for Agentic AI	Workshop	Speaker
Andrey Belevtsev	Senior Vice President, Head of Technology & AI	Sberbank	Designing the trust management for Agentic AI	Workshop	Speaker
Yuliya Shlychkova	Vice President, Global Public Affairs	Kaspersky	Designing the trust management for Agentic AI	Workshop	Speaker
Laurent Beaumoïs	Founder	MeetLoyd	Designing the trust management for Agentic AI	Workshop	Moderator
Guangming Liu	Director of AI security	vivo	Designing the trust management for Agentic AI	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Yuntao Wang	ITU FG-EAI Chair, Q5/21 Rapporteur	China Academy of Information and Communications Technology (CAICT), China	Designing the trust management for Agentic AI	Workshop	Speaker
Debora Comparin	Standardization Expert	Thales Digital Identity & Security	Designing the trust management for Agentic AI	Workshop	Moderator
Naying Hu	Senior Business Executive of AI Institute	China Academy of Information and Communications Technology (CAICT)	Designing the trust management for Agentic AI	Workshop	Moderator
Arnaud Taddei	Global Security Strategist	Broadcom	Designing the trust management for Agentic AI	Workshop	Speaker
Seizo Onoe	Director of the Telecommunication Standardization Bureau (TSB)	International Telecommunication Union (ITU)	Designing the trust management for Agentic AI	Workshop	Speaker
Amir Banifatemi	Chief Responsible AI Officer	Cognizant	Designing the trust management for Agentic AI	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Xuan Phuc	Researcher, Agentic AI	Thales Cybersecurity and Digital Identity	Designing the trust management for Agentic AI	Workshop	Moderator
James C. Owens	Chief Legal and Policy Officer	Nuro	Future Networked Car symposium	Workshop	Speaker
Mike Braisher	Head of Automated Vehicle Engineering, Centre for Connected and Autonomous Vehicles	Department for Transport, United Kingdom	Future Networked Car symposium	Workshop	Speaker
You-Jun CHOI	Principal Researcher/Lab leader	Korea Automotive Technology Institute	Future Networked Car symposium	Workshop	Speaker
Nicola Concer	Head of Product Marketing for Automotive Processors	NXP	Future Networked Car symposium	Workshop	Speaker
Georg Doll	CTO, Automotive & Mobility	Microsoft	Future Networked Car symposium	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Sooji Yeom	Global Program Sr. Manager	MORAI	Future Networked Car symposium	Workshop	Speaker
Duncan Kay	Head of Vehicle Engineering	Department for Transport, United Kingdom	Future Networked Car symposium	Workshop	Moderator
Rémi Bastien	Strategic Advisor to the CEO	FISITA	Future Networked Car symposium	Workshop	Speaker
Stéphane Buffat	Director	Renault LAB	Future Networked Car symposium	Workshop	Speaker
Ganesh Jayaram	Regulatory Affairs & Standardization Lead. Chair, EG-ComAD/WG1	Volkswagen Group (CARIAD)	Future Networked Car symposium	Workshop	Speaker
Jan Luehmann	OICA TC Chairman, EG-ComAD/WG3 Chair, EG-ComAD Co-Chairman	OICA	Future Networked Car symposium	Workshop	Speaker
T. Russell Shields	Chair	CITS	Future Networked Car symposium	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Roger C. Lanctot	President	Mobile Satellite Users Association	Future Networked Car symposium	Workshop	Moderator
William Gouse	International Technical Affairs, Global Ground Vehicle Standards	SAE International	Future Networked Car symposium	Workshop	Moderator
Christian Thiele	Senior Director, Global Ground Vehicle Standards	SAE International	Future Networked Car symposium	Workshop	Speaker
Daniel Quirke	Senior Manager, Global Technical Assurance	Wayve	Future Networked Car symposium	Workshop	Speaker
Gil Bernabeu	Chief Technology Officer	GlobalPlatform	Future Networked Car symposium	Workshop	Speaker
Daniel Smith	Deputy General Counsel, Regulatory and compliance matters	Waymo	Future Networked Car symposium	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
James Hunt	CEO and CTO	aicas	Future Networked Car symposium	Workshop	Speaker
Wang Tong	Head of European operations	China Automotive Technology & Research Center	Future Networked Car symposium	Workshop	Speaker
Alexander K Epstein	Chief of Vehicle Regulations	United Nations Economic Commission for Europe (UNECE)	Future Networked Car symposium	Workshop	Speaker
Alicia Montoya	Head of Industry Development	Swiss	Future Networked Car symposium	Workshop	Speaker
Christofer Dutz	Director	Apache Software Foundation	Mobile AI for Good: Ubiquitous, open, accountable, inclusive	Workshop	Speaker
Mathias Gabrysch	Senior Advisor for Ecosystem Development	GTI	Mobile AI for Good: Ubiquitous, open, accountable, inclusive	Workshop	Speaker
Wei Wang	Professor of East China Normal University, Secretary-General	CAST UN Consultative Committee on Open Source Innovation (CCOSI)	Mobile AI for Good: Ubiquitous, open, accountable, inclusive	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Jianmin Wang	Dean of the School of Software at Tsinghua University, Chairman	CAST UN Consultative Committee on Open Source and Innovation	Mobile AI for Good: Ubiquitous, open, accountable, inclusive	Workshop	Speaker
Zhang Dong	EVP	China Mobile	Mobile AI for Good: Ubiquitous, open, accountable, inclusive	Workshop	Speaker
Hatem Dowidar	Telecommunications and technology expert leader. Non-executive Director	Vodacom Group	Mobile AI for Good: Ubiquitous, open, accountable, inclusive	Workshop	Speaker
Ali Taha Koç	Chief Executive Officer	Turkcell	Mobile AI for Good: Ubiquitous, open, accountable, inclusive	Workshop	Speaker
Sergio Mujica	Secretary-General	International Organization for Standardization (ISO)	Mobile AI for Good: Ubiquitous, open, accountable, inclusive	Workshop	Speaker
Bilel Jamoussi	Deputy Director of TSB & Chief, Study Groups & Policy Department (SPD)	International Telecommunication Union (ITU)	Mobile AI for Good: Ubiquitous, open, accountable, inclusive	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Tracey Forrest	Research Director, Transformative Technologies	Centre for International Governance Innovation (CIGI)	Quantum and AI: Unlocking new frontiers through convergence	Panel (Frontier Stage)	Speaker
Romi Sumaria	Chief Commerical Officer	QAI Ventures	Quantum and AI: Unlocking new frontiers through convergence	Panel (Frontier Stage)	Speaker
Connie Kuang	Portfolio Manager, Emerging Technologies Research	World Economic Forum	Quantum and AI: Unlocking new frontiers through convergence	Panel (Frontier Stage)	Speaker
Kelly Richdale	Senior Advisor	SandboxAQ	Quantum and AI: Unlocking new frontiers through convergence	Panel (Frontier Stage)	Moderator
Alessandro Curioni	Fellow, Vice President, Europe & Africa and Director	IBM	Quantum and AI: Unlocking new frontiers through convergence	Panel (Frontier Stage)	Speaker
Filipe Beato	Manager, Technology & Innovation	Centre for Frontier Technologies and Innovation, World Economic Forum	Building the UN playbook for quantum readiness	Panel (UN AI Hub Stage)	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Amal Kasry	Chief of Basic Science, Engineering, Technology, and Innovation Section	Division of Ethics, Research and Technology, UNESCO	Building the UN playbook for quantum readiness	Panel (UN AI Hub Stage)	Speaker
Sameer Chauhan	Director	United Nations International Computing Centre	Building the UN playbook for quantum readiness	Panel (UN AI Hub Stage)	Speaker
Gillian Makamara	Programme Coordinator	International Telecommunication Union (ITU)	Building the UN playbook for quantum readiness	Panel (UN AI Hub Stage)	Speaker
Claire Leibowicz	Director of AI, trust and society	Partnership on AI	AI and multimedia authenticity standards	Workshop	Speaker
Abigail Sellen	VP and Distinguished Scientist	Microsoft Research UK	AI and multimedia authenticity standards	Workshop	Speaker
Harsh Vardhan Nagar	Privacy and ML Security Researcher	National Forensic Sciences University (NFSU)	AI and multimedia authenticity standards	Workshop	Speaker
Apostolos Symeonidis	M.P.P Graduate - Researcher	Sciences Po Paris	AI and multimedia authenticity standards	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Weronika Nitecka		Sciences Po Paris	AI and multimedia authenticity standards	Workshop	Speaker
Fatma Aksu	PhD Researcher	University of Bologna	AI and multimedia authenticity standards	Workshop	Speaker
Simone Teglia		Sapienza University of Rome	AI and multimedia authenticity standards	Workshop	Speaker
Killian Foloppe		Geneva Graduate Institute	AI and multimedia authenticity standards	Workshop	Speaker
Iman Attia	Privacy and ML Security Researcher	EPFL	AI and multimedia authenticity standards	Workshop	Speaker
Mario Schweikert	Young Researcher	German Research Center for AI RPTU	AI and multimedia authenticity standards	Workshop	Speaker
Emanuel Lukawiecki	Senior Policy Analyst	Carleton University	AI and multimedia authenticity standards	Workshop	Speaker
Marilena Hyeraci	Of Counsel	Chiomenti	AI and multimedia authenticity standards	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Thomas Bause Mason	Director of Standards Development	SMPTE	AI and multimedia authenticity standards	Workshop	Speaker
Juyuan Tang	Research Scientist	China Academy of Information and Communications Technology (CAICT)	AI and multimedia authenticity standards	Workshop	Speaker
Balaraman Ravindran	Head of the Wadhvani School of Data Science and AI	IIT Madras	AI and multimedia authenticity standards	Workshop	Speaker
Philippe Rixhon	Chair of the Management Board	Valunode OÜ, Tallinn, Estonia	AI and multimedia authenticity standards	Workshop	Speaker
Leonard Rosenthol	Technical Pillar Co- Lead, AMAS and Chief Scientist	Adobe	AI and multimedia authenticity standards	Workshop	Moderator
Alessandra Sala	Chair	AI and Multimedia Authenticity Standards Collaboration	AI and multimedia authenticity standards	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Bilel Jamoussi	Deputy Director of TSB & Chief, Study Groups & Policy Department (SPD)	International Telecommunication Union (ITU)	AI and multimedia authenticity standards	Workshop	Speaker
Amir Banifatemi	Chief Responsible AI Officer	Cognizant	AI and multimedia authenticity standards	Workshop	Speaker
Thomas Wiegand	Executive Director	Fraunhofer Heinrich Hertz Institute (HHI)	AI and multimedia authenticity standards	Workshop	Speaker
Cristina Alexandra Trifan	Director of Operations	Datambit	AI and multimedia authenticity standards	Workshop	Speaker
Xavier Bruni	Co-founder	TrustMyContent	AI and multimedia authenticity standards	Workshop	Speaker
Camila Alejandra Beltrán Reyes	Lawyer, AI Governance & Technology Policy	AI Safety Colombia Hub	AI and multimedia authenticity standards	Workshop	Speaker
Tomasz Kacprzak		University of Applied Sciences and Arts Northwestern Switzerland FHNW	021 Scientific Foundation Model: Empowering the transformation of scientific research paradigms	Workshop	Speaker
Shiping Liu	Chief Scientist	BGI Research	021 Scientific Foundation Model: Empowering the	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
			transformation of scientific research paradigms		
Jifeng Liu		National Astronomical Observatories, CAS	021 Scientific Foundation Model: Empowering the transformation of scientific research paradigms	Workshop	Speaker
Emma Tolley		EPFL	021 Scientific Foundation Model: Empowering the transformation of scientific research paradigms	Workshop	Speaker
Sebastian Viktor Pios	Theoretical chemist and Senior Research Fellow	Zhejiang Lab	021 Scientific Foundation Model: Empowering the transformation of scientific research paradigms	Workshop	Speaker
Anna Stepashkina	Theoretical physicist and Research Expert	Zhejiang Lab	021 Scientific Foundation Model: Empowering the transformation of scientific research paradigms	Workshop	Moderator
Guirong Xue	Chief Engineer for Science Models	Zhejiang Lab	021 Scientific Foundation Model: Empowering the transformation of scientific research paradigms	Workshop	Speaker
Richard Chuchla	Co-chair	GeoGPT Governance Committee	021 Scientific Foundation Model: Empowering the	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
			transformation of scientific research paradigms		
Lei Zhang	Associate Professor of Mathematics	National University of Singapore	021 Scientific Foundation Model: Empowering the transformation of scientific research paradigms	Workshop	Speaker
Liesbeth Roelens	Researcher	Telefónica	Agentic AI: Architecture and standards for next-generation AI Agents	Workshop	Speaker
Wiebke Hutiri	Senior Research Scientist	Sony Research	Agentic AI: Architecture and standards for next-generation AI Agents	Workshop	Speaker
Fabian Schenker	Generative AI Blackbelt, Applied AI Engineering	Google	Agentic AI: Architecture and standards for next-generation AI Agents	Workshop	Speaker
Simon Lucas	Full professor of AI, School of Electronic Engineering and Computer Science	Queen Mary University of London	Agentic AI: Architecture and standards for next-generation AI Agents	Workshop	Speaker
Enrique Molero	Principal AI Researcher	GSMA	Agentic AI: Architecture and standards for next-generation AI Agents	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Wafae Bakkali	Tech Lead Generative AI	Google	Agentic AI: Architecture and standards for next-generation AI Agents	Workshop	Speaker
Paul Kennedy	Chief of Staff	Zindi Africa	Agentic AI: Architecture and standards for next-generation AI Agents	Workshop	Speaker
Lina Bariah	Senior Researcher	Khalifa University of Science and Technology	Agentic AI: Architecture and standards for next-generation AI Agents	Workshop	Speaker
Antonio De Domenico	Principal Researcher	Huawei Technologies Co., Ltd.	Agentic AI: Architecture and standards for next-generation AI Agents	Workshop	Speaker
Wanjin Park	Vice President, Tech Strategy Department, AX Future Technology Institute	KT	Agentic AI: Architecture and standards for next-generation AI Agents	Workshop	Speaker
Jean-Paul Kneib			GeoGPT and OneEarth: Empowering global geoscientists	Workshop	Speaker
Peng Gong			GeoGPT and OneEarth: Empowering global geoscientists	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Irina Artemieva	Distinguished Professor, Deep-Earth Exploration Laboratory	Chinese Academy of Geological Sciences	GeoGPT and OneEarth: Empowering global geoscientists	Workshop	Speaker
Hans Thybo	Distinguished Professor, Deep-Earth Exploration Laboratory	Chinese Academy of Geological Sciences	GeoGPT and OneEarth: Empowering global geoscientists	Workshop	Speaker
Grant Michael Boquet	Senior Research Fellow	Zhejiang Lab	GeoGPT and OneEarth: Empowering global geoscientists	Workshop	Speaker
Yitian Xiao	Chief Scientist, Deep-Time Digital Earth (DDE)	Zhejiang International Research Center	GeoGPT and OneEarth: Empowering global geoscientists	Workshop	Moderator
Mike Stephenson	Founding President	Deep-time Digital Earth	GeoGPT and OneEarth: Empowering global geoscientists	Workshop	Moderator
Richard Chuchla	Co-chair	GeoGPT Governance Committee	GeoGPT and OneEarth: Empowering global geoscientists	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
John Ludden	Co-chair	GeoGPT Governance Committee	GeoGPT and OneEarth: Empowering global geoscientists	Workshop	Speaker
Kangchan Lee	SG13 Vice-chair, WP2/13 Chair, JCA-AI Chair, Director of the Strategic Standards Research Section	ETRI	Advancing AI in networks	Workshop	Speaker
Xiaouu Liu	Vice President, AI Research Institute, China Telecom Jiangxi and Deputy Director, AI Research Center	China Telecom Research Institute	Advancing AI in networks	Workshop	Speaker
Dinh-Thuy Phan-Huy	Orange Fellow, Researcher on Future Mobile Networks	Orange	Advancing AI in networks	Workshop	Speaker
Ved Kafle	Research Manager	National Institute of Information and Communications Technology (NICT)	Advancing AI in networks	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Hiroshi Yamamoto	Head of Standardization Office, R&D Planning Department	NTT Corporation, Japan	Advancing AI in networks	Workshop	Speaker
Liang Liang	AI Frontier Technology Research Manager	China Mobile (Hong Kong) Innovation Research Institute	Advancing AI in networks	Workshop	Speaker
Marco Carugi	Rapporteur for ITU-T Q20 of SG13 and Senior Consultant	Huawei Technologies Co., Ltd.	Advancing AI in networks	Workshop	Moderator
Antonio De Domenico	Principal Researcher	Huawei Technologies Co., Ltd.	Advancing AI in networks	Workshop	Speaker
Yong Xiao	Professor, School of Electronic Information and Communications	Huazhong University of Science and Technology	Advancing AI in networks	Workshop	Speaker
Jamal Alshanfari	Head of Health Office to World Health Organization (WHO)	Sultanate of Oman Permanent Mission	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Joyce Nabende	Senior Lecturer	Makerere Univeristy	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Arijit Patra	Senior Principal Scientist	UCB	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Sarah Aboerjaib	Founder	ScansX	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Natalie Raffoul	Managing Partner	Brion Raffoul LLP	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Aishwarya Karnataki	Founder, Glovatrix AI for Accessibility Innovator Creator of Fifth Sense and Mira	Glovatrix	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Nancy Pignataro	Associate External Relations Officer, External Relations Division	World Intellectual Property Organization (WIPO)	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Moderator
Dalila Hamou	Director, External Relations Division	World Intellectual Property Organization (WIPO)	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Alain Labrique	Director of the Department for Data, Digital Health, Analytics and AI	World Health Organization (WHO)	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Xiao Liu	Physician Scientist	Microsoft AI	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Marc LeCoultre			AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Moderator
Sameer Pujari	Lead AI for health	World Health Organization (WHO)	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Moderator
Bilel Jamoussi	Deputy Director of TSB & Chief, Study Groups & Policy Department (SPD)	International Telecommunication Union (ITU)	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Guy Parsons	Technology Lead	Wellcome Trust	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Rose Nakasi	Researcher	Makerere University	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Habiba Mizouni	Medical Doctor, Specialist in Radiology	Tunisian Ministry of Health	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Aline Conchon	Director of EU and International Affairs	Ministry of Health, France	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Paul Byrne	Executive Director of Education, Innovation and Artificial Intelligence	Medical Council of Ireland	AI for health: Scaling impact through standards, investment and intellectual property	Workshop	Speaker
Diva Avaya Sharma	Founder	Cognitio Labs	AI on the menu: Transforming digital food systems	Workshop	Speaker
Charles Spillane	Chief Scientist	Food and Agriculture Organization of the United Nations (FAO)	AI on the menu: Transforming digital food systems	Workshop	Speaker
Caroline Gaju	Senior Technical Specialist	International Fund for Agricultural Development (IFAD)	AI on the menu: Transforming digital food systems	Workshop	Speaker
John Colmey	Senior Strategic Adviser and Co-	CIFOR-ICRAF	AI on the menu: Transforming digital food systems	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
	Founder, Global Landscapes Forum Senior Director				
Jan Christian Redlich	Chief Technology Officer	Bonn Systems GmbH	AI on the menu: Transforming digital food systems	Workshop	Speaker
Simon Winter	Vice President, Reimagining Humanitarian Nutrition Security	Rockefeller Foundation	AI on the menu: Transforming digital food systems	Workshop	Speaker
Magan Naidoo	Chief Data Officer	United Nations World Food Programme (WFP)	AI on the menu: Transforming digital food systems	Workshop	Moderator
Girmaw Abebe Tadesse	Principal Scientist and Manager, AI for Good Lab	Microsoft	AI on the menu: Transforming digital food systems	Workshop	Speaker
Sebastian Bosse	Head of the Interactive & Cognitive Systems Group	Fraunhofer Heinrich Hertz Institute (HHI)	AI on the menu: Transforming digital food systems	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Ezekiel Brooks	Chief Technology Officer	U.S. Hunger	AI on the menu: Transforming digital food systems	Workshop	Speaker
Michael Tsan	Partner & Global AI Lead	Dalberg Advisors	AI on the menu: Transforming digital food systems	Workshop	Speaker
Seizo Onoe	Director of the Telecommunication Standardization Bureau (TSB)	International Telecommunication Union (ITU)	AI on the menu: Transforming digital food systems	Workshop	Speaker
Benjamin Questier	Master of Ceremonies	Ministry of the Environment, Climate and Biodiversity, Luxembourg Government	AI on the menu: Transforming digital food systems	Workshop	Moderator
Indran Naidoo	Director, Independent Office of Evaluation	The International Fund for Agricultural Development (IFAD)	AI on the menu: Transforming digital food systems	Workshop	Moderator
Weimin Zhang	Deputy Director of the Embodied Intelligence and Robotics Department, AI Institute	China Academy of Information and Communications Technology (CAICT)	AI benchmarking and AI-powered testing	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Marija Jankovic	Research Associate, CERTH/ITI Chair	ETSI TC MTS Greece	AI benchmarking and AI-powered testing	Workshop	Speaker
Ritu Ranjan Mittar	Member	Telecom Regulatory Authority of India (TRAI)	AI benchmarking and AI-powered testing	Workshop	Speaker
Denis Andreev	ITU-T SG11 Advisor, Coordinator of ITU C&I Programme	International Telecommunication Union (ITU)	AI benchmarking and AI-powered testing	Workshop	Moderator
Boris Wrubel		Austria	AI benchmarking and AI-powered testing	Workshop	Speaker
Mohammad Hammoudeh	Chair Professor, Department of Information and Computer Science	King Fahd University of Petroleum & Minerals, Kingdom of Saudi Arabia	AI benchmarking and AI-powered testing	Workshop	Speaker
Giulio Maggiore	Network Digital Application	Fibercop, Italy	AI benchmarking and AI-powered testing	Workshop	Speaker
Andrey Koucheryavy	Professor, Head of the Network and Data	SPbSUT, Russian Federation	AI benchmarking and AI-powered testing	Workshop	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
	Transmission Department				
Alexey Borodin	Director General	Regional Commonwealth in the field of Communications (RCC)	AI benchmarking and AI-powered testing	Workshop	Speaker
Huifen Wang	Director of Multimodal Large Model Research Center	China Telecom Research Institute	AI benchmarking and AI-powered testing	Workshop	Speaker
Sebastian Hallensleben	Chief Trust Officer, Resaro, Germany/Singapore, Chair	CEN-CENELEC JTC21, Europe	AI benchmarking and AI-powered testing	Workshop	Speaker
Anna Abramova	Director	MGIMO AI Centre, Russian Federation	AI benchmarking and AI-powered testing	Workshop	Speaker
Artem Volkov	Associate Professor, Saint Petersburg State University of	National Research institute of telecommunications, Russian Federation	AI benchmarking and AI-powered testing	Workshop	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
	Telecommunications, Scientific consultant				
Philippe Metzger	Secretary-General & CEO	International Electrotechnical Commission (IEC)	From principles to practice: The role of international standards in AI	Panel (Centre Stage)	Speaker
Sergio Mujica	Secretary-General	International Organization for Standardization (ISO)	From principles to practice: The role of international standards in AI	Panel (Centre Stage)	Speaker
Seizo Onoe	Director of the Telecommunication Standardization Bureau (TSB)	International Telecommunication Union (ITU)	From principles to practice: The role of international standards in AI	Panel (Centre Stage)	Speaker
Charlotte Kan	Freelance journalist		From principles to practice: The role of international standards in AI	Panel (Centre Stage)	Moderator
H.E. Ms. Rose Pola Pricemou	Presidential Advisor on New Technologies and Artificial Intelligence	Republic of Guinea	Advancing women's leadership in AI and standards	Panel (Solutions Stage)	Speaker
Rim Belhassine Cherif	Chair, Network of Women in ITU-T (NoW in ITU-T), Chief	Tunisie Télécom	Advancing women's leadership in AI and standards	Panel (Solutions Stage)	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
	Innovation and Strategy Officer				
Lisa Bechtold	Head of Group Risk Management	Nestlé	Advancing women's leadership in AI and standards	Panel (Solutions Stage)	Speaker
Karen Mulberry	Senior Manager of Technology Policy	IEEE Standards Association (IEEE SA)	Advancing women's leadership in AI and standards	Panel (Solutions Stage)	Speaker
Jonathan Nagao	Director of Data and AI	World Bank Group	Advancing women's leadership in AI and standards	Panel (Solutions Stage)	Speaker
May Thi Aye	Project Officer	International Telecommunication Union (ITU)	Advancing women's leadership in AI and standards	Panel (Solutions Stage)	Moderator
Hala Hibri	Ambassador	Swiss Chapter of Women in AI	Advancing women's leadership in AI and standards	Panel (Solutions Stage)	Moderator
Alessandra Sala	Chair	AI and Multimedia Authenticity Standards Collaboration	Advancing women's leadership in AI and standards	Panel (Solutions Stage)	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Liya Yuan	Senior Engineer	ZTE Corporation	Advancing women's leadership in AI and standards	Panel (Solutions Stage)	Speaker
Sasha Luccioni	Co-Founder, Chief Scientific Officer	Sustainable AI Group	Advancing women's leadership in AI and standards	Panel (Solutions Stage)	Speaker
Serame Taukobong	Group Chief Executive Officer	Telkom SA SOC Ltd	Connecting intelligence: AI-native networks and the power of standards	Panel (Centre Stage)	Speaker
Erik Ekudden	Chief Technology Officer	Ericsson	Connecting intelligence: AI-native networks and the power of standards	Panel (Centre Stage)	Speaker
Pallavi Mahajan	Chief Technology and AI Officer	Nokia	Connecting intelligence: AI-native networks and the power of standards	Panel (Centre Stage)	Speaker
Ali Taha Koç	Chief Executive Officer	Turkcell	Connecting intelligence: AI-native networks and the power of standards	Panel (Centre Stage)	Speaker
Ebtesam Almazrouei	Executive Director, Office of AI and Advanced Technology, Dept of Finance, CEO & Founder of AIE3	Chairperson of UN AI for Good Impact Initiative, Chair of the AI for Good Impact Initiative	Connecting intelligence: AI-native networks and the power of standards	Panel (Centre Stage)	Moderator

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Boris Inderbitzin	External Relations Officer	International Electrotechnical Commission (IEC)	From Human Rights Principles to ICT and AI Standards: Perspectives from IEC, ISO and ITU	Panel (Solutions Stage)	Speaker
Daniel Pap	Legal Adviser	Council of Europe	From Human Rights Principles to ICT and AI Standards: Perspectives from IEC, ISO and ITU	Panel (Solutions Stage)	Moderator
Wafa Ben Hassine	Chief, Digital Technologies and Human Rights Section	Office of The United Nations High Commissioner for Human Rights (OHCHR)	From Human Rights Principles to ICT and AI Standards: Perspectives from IEC, ISO and ITU	Panel (Solutions Stage)	Speaker
Olivier Alais	Program Coordinator	International Telecommunication Union (ITU)	From Human Rights Principles to ICT and AI Standards: Perspectives from IEC, ISO and ITU	Panel (Solutions Stage)	Speaker
Cindy Parokkil	AI Policy Lead and Capacity Building Programme Manager	International Organization for Standardization (ISO)	From Human Rights Principles to ICT and AI Standards: Perspectives from IEC, ISO and ITU	Panel (Solutions Stage)	Speaker
Adele Taylor	Chief Executive Officer	NoFilter	[Invitation only] Media literacy in the age of AI	Lunch	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Tom Varghese	AI Lead, Global Product Public Policy	TikTok	[Invitation only] Media literacy in the age of AI	Lunch	Moderator
Alain Labrique	Director of the Department for Data, Digital Health, Analytics and AI	World Health Organization (WHO)	[Invitation only] Media literacy in the age of AI	Lunch	Speaker
Tonee Ndungu	Founder	Kytabu Inc.	[Invitation only] Media literacy in the age of AI	Lunch	Speaker
Seizo Onoe	Director of the Telecommunication Standardization Bureau (TSB)	International Telecommunication Union (ITU)	[Invitation only] Media literacy in the age of AI	Lunch	Speaker
Alessandra Sala	Chair	AI and Multimedia Authenticity Standards Collaboration	[Invitation only] Media literacy in the age of AI	Lunch	Speaker
Bilel Jamoussi	Deputy Director of TSB & Chief, Study Groups & Policy Department (SPD)	International Telecommunication Union (ITU)	[Invitation only] Media literacy in the age of AI	Lunch	Speaker
Maria Ressa	Nobel Peace Prize Laureate; Co-Founder and CEO	Rappler	AI, media, and the information integrity challenge	Panel (Centre Stage)	Speaker

Name	Job title	Organization	Session on AI Standards Track	Session type	Speaker / Moderator
Ann E. Greenberg	President & Founder	Entertainment AI™	AI, media, and the information integrity challenge	Panel (Centre Stage)	Speaker
Jaden Xie	Co-founder and President	PixVerse	AI, media, and the information integrity challenge	Panel (Centre Stage)	Speaker
Alessandra Sala	Chair	AI and Multimedia Authenticity Standards Collaboration	AI, media, and the information integrity challenge	Panel (Centre Stage)	Speaker & Moderator
