SCIENTIFIC AND TECHNOLOGICAL COMMUNITY
MAJOR GROUP POSITION PAPER

2025 HIGH-LEVEL POLITICAL FORUM
FOR SUSTAINABLE DEVELOPMENT

# FIVE YEARS TO COURSE CORRECT – SCIENCE AND ENGINEERING FOR A WORLD OFF-TRACK

INTERNATIONAL SCIENCE COUNCIL
WORLD FEDERATION OF ENGINEERING ORGANIZATIONS

This paper is published by the International Science Council (ISC) and the World Federation of Engineering Organizations (WFEO) as coordinators of the Scientific and Technological Community Major Group, for the 2025 High-level Political Forum for Sustainable Development.

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**Lead coordinator:** James Waddell (ISC)

**Authors:** Michael Johan Pérez Calderón (Universidad del Tolima), Francis P. Crawley (Committee on Data), Annekathrin Ellersiek (Science Platform Sustainability 2030, Research Institute for Sustainability), Varea Dawn Vaurasi (National University of Samoa), Nelson Grima (International Union of Forest Research Organizations), Espen Holst Hansen (The Norwegian College of Fishery Science), Hélène Jacot des Combes (University of the South Pacific, International Science Council), Alexander Ryota Keeley (Kyushu University, aiESG, Inc.), Yonglong Lu (Xiamen University, Scientific Committee on the Problems of the Environment), Rohimah Mohamud (Universiti Sains Malaysia), Michelle Mycoo (The University of the West Indies, ISC SIDS Liaison Committee), Léa Nacache (International Science Council), Sarva Mangala Praveena (Universiti Putra Malaysia), Frances Separovic (Australian Academy of Science), Yannick Useni Sikuzani (Université de Lubumbashi, Académie Congolaise des Sciences), Tianren Yang (China Association for Science and Technology, University of Hong Kong), and Lili Zhang (Computer Network Information Center, Chinese Academy of Sciences).

**Review:** Peter Bridgewater, Australian National University

**Contributors:** Anne-Sophie Stevance (ISC), Morgan Seag (ISC), Anda Popovici (ISC), Apolónia Drábová (ISC), William Kelly and K. N. Gunalan (WFEO)

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**About the International Science Council**

The International Science Council (ISC) works at the global level to catalyze and convene scientific expertise, advice and influence on issues of major concern to both science and society. The ISC is a non-governmental organization with a unique global membership that brings together more than 250 international scientific unions and associations, national and regional scientific organizations including academies and research councils, international federations and societies, and young academies and associations.

**About the World Federation of Engineering Organizations**

The World Federation of Engineering Organizations (WFEO) is the international organization for the engineering profession. Founded in 1968, under the auspices of UNESCO, WFEO brings together national engineering institutions from some 100 nations and represents more than 30 million engineers.

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**FOREWORD**

With five years remaining until the 2030 deadline, the Sustainable Development Goals (SDGs) are increasingly seen as a distant set of aspirations vanishing into the distance. At the halfway point in 2023, global assessments made clear that progress was off track. Since then, overlapping crises — climate extremes, geopolitical conflict, economic volatility, and growing mistrust in public institutions — have only deepened. In this challenging context, the promise of the 2030 Agenda is slipping further from reach.

Yet there are positives — around the world, scientific and engineering communities are stepping up. From biodiversity and human health to digital transformation and disaster resilience, they are developing the knowledge, tools, and collaborations needed to address complex, systemic challenges. But progress is not a given. While scientific and technical capabilities have never been stronger, they remain underutilized in decision-making — sidelined by institutional silos, politicization, or a lack of appropriate interfaces.

Closing this gap is not optional. Connecting scientific and engineering expertise with public institutions, communities, and policy frameworks through science-policy interfaces is essential for SDG delivery. It requires a renewed commitment to evidence-informed governance — one that values participation, transparency, and context-relevant solutions. This imperative is strongly reflected in the theme of the 2025 High-Level Political Forum: *"Advancing sustainable, inclusive, science- and evidence-based solutions for the 2030 Agenda for Sustainable Development and its Sustainable Development Goals for leaving no one behind."*

This is the call that the International Science Council (ISC) and the World Federation of Engineering Organizations (WFEO), as co-organizing partners of the Scientific and Technological Community Major Group, bring to the 2025 Forum. We urge stronger investment in the systems and relationships that enable science and engineering to contribute meaningfully to inclusive sustainable development.

While this year's position paper engages with the five SDGs under in-depth review in 2025 — SDG 3 (Health), SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth),

SDG 14 (Life Below Water), and SDG 17 (Partnerships for the Goals) — its scope extends beyond them. These goals are deeply relevant entry points for exploring how science and engineering can help drive integrated, cross-cutting progress across the full 2030 Agenda.

Organized around seven key themes, this paper presents 17 case studies contributed by members of the global science and engineering communities. These case studies show what becomes possible when knowledge, policy, and society are brought into alignment. They span diverse geographies and approaches — from coral reef restoration in Belize and inclusive data governance in humanitarian settings, to school-based microplastics monitoring in Malaysia. What unites them is a shared commitment to impact: a view of science and engineering not as distant disciplines, but as engaged practices working alongside communities and decision-makers to shape better futures.

Rebuilding trust. Strengthening cooperation. Embedding evidence in action. These are not abstract goals — they are the enabling conditions for SDG success. And they are still within reach, if we choose to act with urgency and resolve.

Salvatore Aricò, Jacques de Méreuil

**INTRODUCTION**

As the global community passes the midpoint of the 2030 Agenda, progress on the Sustainable Development Goals (SDGs) remains deeply uneven. Many targets are off track, and in some areas — including climate, biodiversity, and equity — we are witnessing regression. The need for coordinated, evidence-informed responses is more urgent than ever.

This position paper from the International Science Council (ISC) and the World Federation of Engineering Organizations (WFEO), co-organizing partners of the Scientific and Technological Community Major Group at the United Nations, presents a body of evidence and actionable insights in support of SDG implementation at the 2025 High-Level Political Forum.

It highlights how science, engineering, and technology are being mobilized to inform public policy, guide investment decisions, and co-develop inclusive solutions. Across sectors and regions, researchers and practitioners are working with communities, governments, and other stakeholders to translate knowledge into tangible outcomes.

All featured case studies were submitted through an open global call launched by the ISC and WFEO in early 2025. The submissions span all world regions and reflect the work of academic institutions, national academies, scientific unions, NGOs, and public agencies. Selected case studies were chosen based on their relevance, clarity of impact, and potential to inform action and policy.

More broadly, this paper reflects a growing consensus: the world does not lack knowledge — but it lacks robust mechanisms to connect diverse forms of knowledge, including scientific, technical, Indigenous, and local expertise, with decision-makers, institutions, and

communities. Strengthening the science-policy interface is essential not only for achieving the SDGs, but for building trust by society in evidence-informed governance and enabling more inclusive, resilient, and context-sensitive responses to global challenges.

To this end, this paper is structured around seven thematic entry points that represent priority areas for science–policy–society engagement:

1. **The importance of international scientific cooperation in addressing global challenges** — highlighting how collaboration across borders and disciplines enables shared solutions and strengthens global resilience.
2. **Science as a tool for cooperation and peacebuilding** — exploring science's role in governing shared resources, fostering trust, and navigating geopolitical complexity.
3. **Harnessing technology for sustainable development** — showing how innovation can serve the common good when governed transparently, ethically, and inclusively.
4. **Bridging science, policy, and plural knowledge for transformative action** — highlighting efforts to strengthen the science–policy interface through inclusive, context-sensitive, and collaborative approaches that draw on diverse forms of expertise.
5. **Multistakeholder and transdisciplinary collaboration to advance integrated SDG implementation** — demonstrating the value of co-designed, context-specific solutions to accelerate integrated SDG outcomes.
6. **Building capacity and fostering diverse leadership in science** — highlighting initiatives that expand participation, strengthen inclusion, and prepare the next generation of scientists, engineers, and knowledge brokers to engage in policy and societal challenges.
7. **Public engagement and science literacy as foundations for trust in science** — featuring efforts to enhance transparency, counter misinformation, and empower communities to engage meaningfully with science and evidence.

Together, these themes highlight both the contributions of science and engineering to SDG progress and the enabling conditions required to strengthen their impact — from more inclusive governance to better knowledge systems.

By offering concise, grounded, and transferable examples, this paper aims to support delegates to the 2025 High-Level Political Forum — and all those working to advance the 2030 Agenda — in recognizing and mobilizing science and engineering as tools for sustainable, inclusive development both to 2030 and what comes next.

## KEY MESSAGES

**1. The future of global scientific collaboration is at risk, jeopardizing progress on the SDGs.** Geopolitical tensions, the securitization of research, and growing restrictions on scientific freedom are undermining international cooperation at a time when collective action is essential. To safeguard science and engineering as global public goods, governments and

funders must strengthen Science, Technology, and Innovation (STI) ecosystems and protect the right to participate in and benefit from science[1].

**2. Amid these growing challenges, science and engineering must be leveraged as tools for peace and cooperation.** One pressing example is ocean governance, where environmental degradation and resource competition intersect. A shared stewardship approach integrating resilience strategies can turn potential conflicts into sustainable cooperation. Science and engineering must play a central role in peace-building efforts, through technology governance and environmental management.

**3. Emerging technologies, including digital and biotechnology, can accelerate sustainability when governed responsibly.** In particular, Artificial Intelligence is reshaping society, science systems and decision-making, with the potential to advance all 17 SDGs. However, its use must be guided by policies that uphold ethical principles, transparency, and human rights to avoid exacerbating inequalities and undermining scientific integrity[2]. The UN must play a leading role in shaping global governance to ensure these technologies serve the common good.

**4. Insufficient financial and policy commitments are restraining progress despite scientific breakthroughs.** Science, engineering, technology, and innovation remain critical drivers of SDG progress, with breakthroughs in areas such as human health and climate resilience providing solutions for SDGs 3, 5, 8, 14, and 17. Over the past decade, the UN STI Forum has showcased successful examples of scientific cooperation driving sustainable development. However, mechanisms for scaling these efforts such as the UN's Technology Facilitation Mechanism remain under-resourced.

**5. A mission-driven, transdisciplinary approach to science and engineering is essential to accelerate sustainability.** Transdisciplinary approaches that bring together natural and social scientists, engineers, policy-makers, funders, and communities are essential to co-designing holistic solutions that address the interconnected challenges of climate, biodiversity, pollution, and social equity. However, realizing this potential requires a major shift in research funding – from short-term, project-based models to sustained, problem-oriented investments that align with global sustainability priorities[3].

**6. Diverse leadership strengthens the credibility and impact of science-informed solutions.** The persistent underrepresentation of women and marginalized groups in scientific leadership[4] and beyond weakens the global science system and limits the scope of innovation. Achieving gender equality in science is not just about fairness – it is about enhancing the relevance, quality, and impact of scientific knowledge. Structural barriers must be dismantled through institutional reforms, transparent monitoring, and proactive policies that ensure equal access to leadership, resources, and decision-making. As scientific institutions play a critical role in shaping global priorities, ensuring diverse leadership will enhance the credibility, inclusivity, and effectiveness of knowledge-informed solutions for sustainable development.

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[1] Find out more: https://council.science/our-work/right-to-science/
[2] Find out more: https://council.science/publications/ai-science-systems/
[3] Find out more: https://council.science/news/science-missions-for-sustainability-pilots-launch-to-transform-science-and-deliver-real-world-solutions/
[4] Find out more: https://council.science/our-work/gender-equality/

**7. Trust in science is crucial for ensuring the effective use of scientific knowledge in policy.** However, it is increasingly challenged by political polarization and mis- and disinformation. When trust is compromised, the capacity for coordinated global action diminishes. As a universal language for cooperation, science—grounded in evidence, observation, and peer review—must be inclusive and communicated transparently. Continuously strengthening science-policy interfaces can ensure science remains a trusted tool for policy.

**8. The relation between science and society evolves with dynamics both in science and in society.** Declining trust in the multilateral system, growing barriers to international scientific cooperation, skepticism toward scientific research, monitoring and assessment, and decreasing financial support at multiple levels and in different regions all signal the need to revisit the terms under which science operates in society — particularly regarding its freedom and responsibility. At the same time, the increasing interconnectedness of ecological, economic, and social systems, alongside the urgent need to pursue shared goals and safeguard global commons, offers a vital opportunity to reaffirm the relevance of science in society and to rebuild public trust.

## THEME 1: The importance of international scientific cooperation in addressing global challenges

**THEME FRAMING:** Global progress on the SDGs depends not only on national action, but on the strength of international cooperation. Yet today, this cooperation faces unprecedented pressures. Geopolitical divisions, inadequate funding, restrictions on data sharing, reduced mobility, and growing disinformation threaten science as a global public good just when we need it most.

The case studies featured under this theme remind us that cross-border scientific collaboration is not an abstraction — it is a daily engine of problem-solving, capacity-building, and resilience. Whether enabling open data infrastructures for the SDGs, or developing interoperable policies for crisis response, these examples show that science is a connective force, building common ground across national borders, sectors, and stakeholder interests.

They also highlight a central truth: science has the greatest impact when it is open, trusted, and embedded in networks that link knowledge to action. International partnerships — between research institutions, governments, and communities — make it possible to pool expertise, share data responsibly, and co-develop solutions that no one country could achieve alone.

- **Case study 1: Open science infrastructures partnership for SDG capacity building in the Global South**
- Author: Lili Zhang, Computer Network Information Center, Chinese Academy of Sciences, International Program Office, Global Open Science Cloud Initiative
- Geographical scope: Kenya, East Africa, Asia, Global South, Global

**Topline summary**

This case study demonstrates how international collaboration on digital infrastructure can address entrenched scientific inequities and accelerate SDG implementation. The Global

Open Science Cloud[5] (GOSC) initiative showcases how open, interoperable platforms — co-developed with Global South institutions — can democratize access to research tools and data. It is a model of science cooperation grounded in equity, inclusion, and shared benefit.

**Challenge and the role of science**

While the SDGs call for universal access to science, many countries in the Global South face persistent barriers: fragmented digital systems, poor internet connectivity, insufficient data access, and a shortage of trained personnel. These challenges deepen inequalities in scientific capacity and limit the use of evidence in policy and planning.

To address this, CODATA and the Computer Network Information Center (CNIC) of the Chinese Academy of Sciences launched the GOSC initiative in 2021. The initiative, grounded in the principles of the 2021 UNESCO Recommendation on Open Science and complementary to initiatives such as the African Open Science Platform[6], seeks to create a globally inclusive digital research environment. GOSC partners span over 30 countries and aim to develop e-infrastructure that supports the SDGs through distributed computing, open data, and collaborative platforms.

In Kenya — one of GOSC's regional pilot sites — local partners such as the African Institute for Capacity Development (AICAD) and China Science and Technology Cloud (CSTCloud) co-developed the GOSC Kenya Cloud Federation[7]. This hub directly supports work on:

- SDG 2 (Zero Hunger),
- SDG 3 (Good Health and Well-being),
- SDG 13 (Climate Action),
- and SDG 17 (Partnerships for the Goals).

**Actions and impacts**

Following consultations with researchers, infrastructure providers, and data specialists, GOSC developed an open-source, interoperable platform for large-scale data sharing and analysis. In early 2024, the GOSC Kenya Cloud Federation was officially launched, offering cloud computing, data visualization tools, AI model training, and collaborative coding environments.

Key scientific contributions include:

- Integrated datasets supporting SDGs 2, 6, 11, 13, and 15, including climate indicators, land use data, and big data tools for biodiversity.
- A virtual collaboration environment (VCE) that enables real-time access to resources, teamwork across institutions, and varying levels of data openness.
- A series of training workshops at Jomo Kenyatta University of Agriculture and Technology (JKUAT) and follow-up sessions involving participants from Egypt, Cameroon, Uganda, South Africa, and Kenya — including 30 Kenyan researchers (7 of them women).

[5] Find out more: https://codata.org/initiatives/making-data-work/global-open-science-cloud/
[6] Find out more: https://aospea.org/
[7] Find out more: https://e-aosp.goscloud.net/

Importantly, future Kenyan GOSC nodes are expected to work with the Kenya National Bureau of Statistics (KNBS) to integrate open science tools into national SDG monitoring systems — a step endorsed by Kenya's Open Government Partnership.

Beyond Kenya, GOSC is expanding across Asia and Africa, including in Mongolia and Bangkok. The initiative's visibility is further enhanced through the International Symposium on Open Science Clouds.

**Key takeaways**

- The GOSC Kenya Cloud Federation shows how global partnerships can reduce digital inequalities and strengthen local scientific ecosystems.
- Participatory design and co-ownership with Global South institutions are essential to building trust and relevance in open science systems.
- Science–policy–community collaboration is embedded in the project through training, data co-development, and future alignment with national statistics offices.
- This case study illustrates the role of open science as a practical enabler of SDG progress and a foundation for inclusive international cooperation.

- **Case study 2: Enabling reliable and trustworthy crisis response – Open science-based data policies for global resilience**
- Author: Francis P. Crawley, Committee on Data (CODATA)
- Geographical scope: Global

**Topline summary**

This case study illustrates how international scientific cooperation can directly strengthen global crisis response through inclusive and ethically grounded data governance. The UNESCO–CODATA initiative provides a clear example of how open science values, when translated into actionable guidance, can help align global and local responses during emergencies — reinforcing trust and interoperability across jurisdictions.

**Challenge and the role of science**

Effective crisis response — whether to pandemics, disasters, or armed conflict — depends on timely, ethical, and cross-border data sharing[8]. Yet many parts of the world continue to face fragmented data governance, poor interoperability, and weak institutional coordination. These challenges often delay life-saving interventions and exacerbate vulnerabilities, especially for marginalized communities.

To address these gaps, the UNESCO–CODATA Working Group on Data Policies for Times of Crisis Facilitated by Open Science (DPTC)[9] developed a globally consultative, science-informed framework. The framework integrates multiple internationally recognized standards — including the FAIR (Findable, Accessible, Interoperable, Reusable), CARE (Collective Benefit, Authority to Control, Responsibility, Ethics), and TRUST (Transparency, Responsibility, User focus, Sustainability, Technology) principles — and provides a basis for responsible and inclusive data policies before, during, and after crises.

[8] Find out more: https://council.science/publications/protecting-science-in-times-of-crisis/
[9] Find out more: https://codata.org/initiatives/data-policy/dptc/

By bridging disciplinary, institutional, and geographical divides, the initiative contributes directly to:

- SDG 3 (Good Health and Well-being)
- SDG 5 (Gender Equality)
- SDG 9 (Industry, Innovation, and Infrastructure)
- SDG 13 (Climate Action)
- SDG 16 (Peace, Justice, and Strong Institutions)
- SDG 17 (Partnerships for the Goals)

**Actions and impacts**

The DPTC initiative produced a suite of tools for practical use by intergovernmental agencies, national governments, and humanitarian actors. These include a policy guidance document, an implementation checklist, and a rapid-deployment factsheet — all designed to embed ethical and interoperable data practices into emergency response frameworks.

Insights from recent crises shaped the framework's development. For example:

- During the COVID-19 pandemic, the DPTC assessed how countries managed cross-border health data sharing.
- In the aftermath of the 2023 Türkiye–Syria earthquake, it examined how humanitarian agencies addressed ethical and technical challenges in managing data flows.
- Similar analyses were conducted in the contexts of Ukraine, Gaza, and Sudan, where conflict has disrupted access to scientific resources, health data, and biobanks.

These real-world applications helped refine the DPTC tools for greater relevance and responsiveness. The resulting guidance has since been shared with stakeholders across Europe, Asia, Africa, and the Americas and aligned with global policy frameworks including the UNESCO Open Science Toolkit, the Sendai Framework for Disaster Risk Reduction, WHO's International Health Regulations, and the UNDRR/ISC Hazard Information Profiles.

**Key takeaways**

- The DPTC framework provides a practical, open science–based model for developing reliable and ethical data policies and support real-time, interoperable crisis response.
- Open science principles (FAIR, CARE, TRUST) strengthen transparency, accountability, and collaboration in emergency contexts.
- Real-world application of DPTC tools — including policy guidance and checklists — supports decision-making in diverse crisis settings (e.g., COVID-19, Türkiye–Syria earthquake, Ukraine, Gaza, Sudan).
- This case exemplifies how international scientific cooperation can build trust and enable more coordinated, equitable responses to complex emergencies.

## THEME 2: Science as a tool for cooperation and peacebuilding

**THEME FRAMING:** In a world increasingly marked by political fragmentation, competition over shared resources, and accelerating environmental degradation, science holds a critical yet underutilized role: as a tool for cooperation, shared governance, and peace. This is especially urgent in contexts where ecosystems and resource systems — such as rivers, forests, or the ocean — span national boundaries, or where global commons, including the atmosphere and digital infrastructure, require collective stewardship.

Science diplomacy[10] can foster trust where politics falter. It enables shared understanding, evidence-informed negotiation, and long-term partnership, even in geopolitically sensitive contexts. In this spirit, science and engineering should be recognized not only as sources of innovation and knowledge, but as instruments of diplomacy and conflict prevention.

The case studies featured in this section — focused on the management of tuna fisheries in the Pacific and combatting illegal logging to prevent misuse and conflict — show what is possible when countries pool their scientific capacities and commit to joint evidence-informed decision-making.

- **Case study 3: Management of tuna fisheries in the Pacific Small Island Developing States**
- Author: Hélène Jacot des Combes, University of the South Pacific, International Science Council
- Geographical scope: Pacific Small Island Developing States

**Topline summary**

This case study highlights how regional cooperation, grounded in science, can transform the governance of a shared natural resource into a foundation for sustainability and peace. Through joint monitoring, modeling, and evidence-informed decision-making, Pacific Small Island Developing States (SIDS) have successfully developed a collective approach to managing tuna stocks — a resource vital to their economies and sovereignty. It demonstrates the power of science not only to guide sustainable practices but also to strengthen political cohesion across nations.

**Challenge and the role of science**

The Western and Central Pacific Ocean produces 60% of the world's tuna — nearly 3 million metric tons annually, worth close to $7 billion. For Pacific SIDS, tuna fisheries are not just a commercial asset but a national lifeline: in some countries, fisheries account for 70–80% of government revenue. The challenge lies in ensuring that this crucial shared resource is managed sustainably amid environmental pressures and geopolitical complexities.

Pacific SIDS face significant disparities in national capacity, reliance on foreign-operated fleets, and exposure to climate impacts. To support sustainable management, two regional organizations provide critical scientific and governance support:

- The Pacific Community (SPC) delivers data on stock monitoring, local demand, and climate modeling.

[10] Find out more: https://council.science/our-work/science-diplomacy/

- The Pacific Islands Forum Fisheries Agency (FFA) assists 17 member countries with fisheries management, economic policy, and enforcement coordination.

This partnership has helped governments translate scientific data into policy, supporting SDG 14 (Life Below Water) and SDG 13 (Climate Action), while also contributing to SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth) through the protection of marine ecosystems and the livelihoods they sustain.

**Actions and impacts**

Scientific monitoring and modeling: Onshore catch analysis and onboard video monitoring feed into dynamic models simulating tuna lifecycles and distribution patterns. These models account for variables such as water temperature, salinity, ENSO phases, and nutrient levels — allowing forecasts of stock movement and abundance under different climate scenarios.

Cooperative governance through the Parties to the Nauru Agreement (PNA)[11]: Eight Pacific SIDS — the Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands, and Tuvalu — formed the PNA to jointly manage their tuna resources. By pooling authority, they achieved stronger negotiating power and developed policies that would have been difficult to enforce individually. Key measures include:

- A Vessel Day Scheme that caps fishing days per country to maintain sustainable catch levels.
- Restrictions on fish aggregating devices to reduce overfishing.
- Prohibition of juvenile tuna discard and enhanced protection for whale sharks.

This science-informed, regionally coordinated approach has increased Pacific SIDS' capacity to manage their own resources, reduced reliance on external actors, and reinforced peaceful cooperation over shared ocean space.

**Key takeaways**

- Science-based monitoring and modeling are central to sustainable resource management and regional cohesion in the Pacific.
- Through the PNA, Pacific SIDS have built a governance model rooted in shared data, joint policy, and collective sovereignty.
- The case demonstrates how science can serve as a neutral and trusted foundation for peacebuilding, economic resilience, and climate adaptation — especially where natural resources span borders.
- With science as a common reference point, Pacific Island nations have been able to transform a potentially divisive issue — the governance of a critical, shared resource — into a model of cooperative sustainability.

- **Case study 4: Using international science cooperation to combat illegal logging: A global assessment to inform UN biodiversity governance**

[11] Find out more: https://www.pnatuna.com/

- Author: Nelson Grima, International Union of Forest Research Organizations
- Geographical scope: Global

**Topline summary**

This case exemplifies the power of global scientific networks to address complex policy challenges. By connecting researchers across continents and disciplines, the initiative synthesized both technical evidence and governance insights, providing integrated scientific expertise into international environmental negotiations. It offers a compelling example of how international cooperation can strengthen science–policy interfaces and reinforce multilateral environmental agreements.

**Challenge and the role of science**

Illegal logging and the associated timber trade is an ongoing challenge for biodiversity, economic justice, and global climate stability. Despite international efforts, these activities are often entangled with organized crime, corruption, and weak governance — challenges that cut across national borders.

To confront this, the Collaborative Partnership on Forests (CPF) commissioned the International Union of Forest Research Organizations (IUFRO) to lead a global scientific assessment under the Global Forest Expert Panels (GFEP) initiative[12]. The goal: synthesize current knowledge on the drivers, impacts, and governance gaps surrounding illegal logging, and provide actionable evidence for international policy-making.

This assessment mobilized 50 experts from 21 countries and 11 disciplines, offering a compelling example of coordinated, interdisciplinary, and cross-border scientific collaboration. It directly contributes to:

- SDG 12 (Responsible consumption and production) – by addressing unsustainable and illicit timber practices;
- SDG 15 (Life on land) – through analysis of forest ecosystem impacts;
- SDG 16 (Peace, justice and strong institutions) – by framing illegal logging as a governance and justice issue.

**Actions and impacts**

The assessment's findings were presented at the 13th Conference of the Parties to the Convention on Biological Diversity (CBD COP13) through high-level engagements and strategic dialogues with national delegations and international organizations.

IUFRO amplified the science through formal statements, targeted policy briefs, and informal consultations. These efforts yielded concrete policy impact: CBD Decision XIII/3, paragraph 57, echoed the report's recommendations, urging Parties to strengthen forest governance, promote legal timber trade, and establish verification mechanisms. While the assessment was not formally cited, its influence shaped the final negotiated text—demonstrating how timely, science-based input can steer international policy outcomes.

[12] Find out more: https://www.iufro.org/programmes/scipol-illegal-timber-trade-2016

This case illustrates the importance of proactive, networked science: sustained engagement and strategic communication allowed scientific evidence to meaningfully inform biodiversity governance at the global level.

**Key takeaways**

- Illegal logging is a multidimensional challenge requiring responses beyond trade controls—such as data standardization, institutional reform, and anti-corruption measures.
- Global scientific assessments can directly influence multilateral negotiations when paired with deliberate policy engagement strategies.
- The GFEP initiative demonstrates how coordinated science–policy cooperation can produce actionable guidance for cross-sectoral governance.
- **This case reinforces the value of science as a global public good: collaboration across geographies and disciplines is essential to address transboundary sustainability challenges.**

## THEME 3: Harnessing technology for sustainable development

**THEME FRAMING:** Technologies offer transformative potential for sustainable development — but only when guided by ethical norms and deployed with equity in mind. From AI and biotechnology to satellite monitoring and large-scale renewables, science and engineering must lead the way in ensuring that innovation serves both people and planet — not just profit.

AI, for instance, is reshaping how we process data, manage risk, and monitor sustainability. Integrated into science systems, it can accelerate SDG implementation — but without clear scientific and ethical standards, it will deepen inequality and weaken trust.

Biotechnology and bio-based innovations can help decarbonize industry and restore degraded ecosystems, but only when tested, monitored, and embedded within broader socio-ecological systems. Renewable energy technologies, when thoughtfully deployed, can do more than reduce emissions. In some contexts — such as solar or wind installations on degraded land — they can support land restoration and help revive rural livelihoods. However, care must be taken to manage trade-offs, including competition with food production or biodiversity loss from land-use change.

The case studies presented under this theme show how technologies are being shaped, scaled, and governed through science-informed approaches to address concrete sustainability challenges. From industrial carbon capture in Norway to science-led ESG modelling in Japan and integrated clean energy transitions in Qinghai, each example demonstrates the value of responsible, evidence-informed innovation for SDG implementation.

- **Case study 5: From research to impact: transforming sustainability data disclosure from cost to investment through science-based AI modelling**

- Author: Alexander Ryota Keeley, Kyushu University, aiESG, Inc.
- Geographical scope: Japan and Asia

**Topline summary**

This case study shows how technologies like artificial intelligence can be harnessed for the public good when grounded in academic research and developed with transparency and integrity. By translating research from Kyushu University into practical AI tools for sustainability reporting, the initiative illustrates how science-based innovation ecosystems can drive responsible investment and advance the SDGs.

**Challenge and the role of science**

As expectations for corporate Environmental, Social, and Governance (ESG) transparency increase, many companies struggle with the high cost, complexity, and inconsistency of reporting processes. Manual disclosures often introduce bias and lack comparability, undermining their value for decision-makers and public accountability.

At the same time, the rapid growth of AI and data infrastructure offers an opportunity to transform ESG disclosure into a strategic asset. This case highlights how research at Kyushu University — combining environmental data science, machine learning, and policy modeling — laid the foundation for a university spin-off, aiESG, Inc., to develop AI-based ESG assessment tools. These tools are built to be transparent, traceable, and objective, helping companies align with global frameworks like the EU Corporate Sustainability Reporting Directive (CSRD) and the Taskforce on Nature-related Financial Disclosures (TNFD)[13].

The initiative directly supports:

- SDG 13 (Climate Action) through climate risk analysis,
- SDG 12 (Responsible Consumption and Production) through supply chain and sustainability performance monitoring, and
- SDG 9 (Industry, Innovation and Infrastructure) by enabling responsible digital innovation.

**Actions and impacts**

aiESG, Inc. translated Kyushu University's scientific expertise into patent-pending AI models capable of delivering real-time analysis of ESG data. These models draw on a wide range of datasets — including emissions data, supply chain maps, workforce metrics, and media analysis — to offer companies comprehensive sustainability insights.

In partnership with Kanadevia Corporation, aiESG's tools were applied to support TNFD reporting and strategic planning by conducting comparative scenario analyses that highlighted the climate and investment benefits of transitioning to waste-to-energy systems. These outputs informed both climate strategy development and investor engagement. While formal third-party assurance is not yet mandated, aiESG has established collaborative frameworks with auditing firms such as Deloitte to enhance the credibility of its outputs. The tools are already being used by more than 30 major listed companies in

[13] Find out more: https://www.kyushu-u.ac.jp/en/researches/view/293/

Japan, including NEC Corporation[14] and The Norinchukin Bank[15], to support nature-related risk disclosures and ESG reporting.

Scaling responsible ESG solutions:

- Reduced costs and complexity of ESG reporting for clients;
- Improved data consistency and credibility across corporate disclosures;
- Enabled more strategic, forward-looking use of ESG data for risk mitigation and planning.

The model is now being used beyond Japan — including in Indonesia's energy transition — and is being adopted by companies and institutions across Asia and globally.

**Key takeaways**

- AI is being applied to ESG reporting with growing potential to improve standardization, accessibility, and disclosure quality, particularly where large datasets and real-time analysis are needed to meet evolving regulatory and investor demands.
- By bridging academic research and private-sector practice, aiESG has developed scalable tools that aim to address ESG reporting challenges, with uptake across listed companies, financial institutions, and public agencies in Japan.
- The case study illustrates how science-based innovation can support more informed investment decisions and sustainability governance, contributing to SDG-aligned strategies in both corporate and policy contexts.
- Recognition of the approach includes peer-reviewed research in scientific journals[16] and external acknowledgments through media coverage[17] [18] and international mentions[19].

- **Case study 6: Turning industrial $CO_2$ into aquaculture feed: Large-scale microalgae cultivation in Northern Norway**
- Author: Espen Holst Hansen, The Norwegian College of Fishery Science
- Geographical scope: Norway

**Topline summary**

This case study demonstrates how industrial biotechnology — grounded in scientific research and enabled by university–industry partnerships — can convert waste emissions into a sustainable input for aquaculture. It highlights how emerging technologies can

[14] Find out more: https://jpn.nec.com/sustainability/ja/eco/pdf/NEC-tnfd-j.pdf
[15] Find out more: https://www.nochubank.or.jp/sustainability/backnumber/pdf/2024/climate_nature.pdf
[16] Please see the bibliography to find out more.
[17] Find out more: https://www.nikkei.com/article/DGXZQOUC20CZU0Q3A720C2000000/
[18] Find out more: https://www.forbes.com/sites/forbesasiateam/2023/08/28/forbes-asia-100-to-watch-2023/?sh=450d426475a1
[19] Find out more: https://nature4climate.org/wp-content/uploads/2024/10/nature-tech-report.pdf

simultaneously address climate change, industrial decarbonization, and food system resilience through context-specific innovation.

**Challenge and the role of science**

Industrial sectors remain major contributors to greenhouse gas emissions, with carbon capture and utilization (CCU) technologies offering untapped potential to mitigate their climate impacts. In Northern Norway, researchers from UiT – The Arctic University of Norway partnered with Finnfjord AS, a ferrosilicon producer, to develop a biotechnology solution: cultivating marine microalgae using $CO_2$ from industrial flue gas.

The scientific challenge was multifaceted. It involved selecting microalgal strains that could thrive in high-$CO_2$ environments while producing lipid- and protein-rich biomass. Optimizing light intensity, temperature, and nutrient inputs was essential to scaling production. In addition, the team had to design large, stable photobioreactors and conduct life cycle assessments to ensure that the environmental benefits of using captured $CO_2$ outweighed the resource inputs.

This approach directly supports:

- SDG 13 (Climate Action) by piloting a CCU strategy,
- SDG 9 (Industry, Innovation and Infrastructure) through industrial-scale bioengineering, and
- SDG 14 (Life Below Water) by developing sustainable feed inputs for aquaculture.

**Actions and impacts**

Over a 10-year collaboration, UiT and Finnfjord scaled photobioreactor technology from 600-liter units to a 300,000-liter industrial reactor. These systems were used to:

- Identify robust microalgal strains with high productivity under $CO_2$-rich conditions;
- Refine growth protocols, including mixing, light, and nutrient strategies;
- Integrate $CO_2$ injection from industrial flue gas;
- Pilot the use of microalgae biomass as aquaculture feed for Atlantic salmon.

Early aquaculture trials showed improved fish health and strong nutrient profiles. These promising results informed the design of a planned 3 million-liter reactor, aiming to demonstrate circular, carbon-negative production at scale.

Commercial interest is growing, particularly among fish feed producers and aquaculture companies, though further scale-up is necessary to meet market demand. The initiative has also catalyzed broader conversations about decarbonizing heavy industry and building localized bioeconomy ecosystems in the Arctic region.

**Key takeaways**

- This case shows how $CO_2$ emissions can be transformed into economic and ecological value when innovation is science-led and cross-sectoral.

- University–industry partnerships were essential to advancing the research, securing funding, and adapting technologies to real-world constraints.
- The use of local, large-celled microalgal strains facilitated more manageable photobioreactor design, increasing scalability.
- The initiative serves as a replicable model for industrial decarbonization, particularly in coastal or high-emissions regions with aquaculture potential.
- By aligning industrial, environmental, and food system goals, the project exemplifies how emerging technologies can address multiple SDGs through integrated, place-based innovation.

- **Case study 7: Renewable energy meets ecological restoration: Co-benefits of solar energy in high-altitude Qinghai, China**
- Author: Yonglong Lu, Xiamen University, Scientific Committee on the Problems of the Environment (SCOPE)
- Geographical scope: Hainan Tibetan Autonomous Prefecture, Qinghai Province, China

**Topline summary**

This case demonstrates how technologies — particularly renewable energy systems — can deliver sustainable development when combined with ecological science and inclusive governance. In Qinghai, a high-altitude region vulnerable to desertification and marginalization, the deployment of solar energy infrastructure was part of an integrated model that restored degraded land, reduced emissions, and created new livelihoods. It underscores the power of science–technology partnerships to drive equitable, ecosystem-based transitions.

**Challenge and the role of science**

The Qinghai–Tibet Plateau is ecologically fragile and socioeconomically disadvantaged. Communities in Hainan Tibetan Autonomous Prefecture face multiple pressures: short growing seasons, degraded land, and a reliance on traditional pastoralism that is increasingly exposed to market and environmental shocks.

Addressing these challenges required an integrated approach to restore ecosystems while diversifying livelihoods. Scientists from the Chinese Academy of Sciences (CAS), along with partners from leading universities, played a central role in designing this transformation. Their contributions included:

- Satellite-based vegetation mapping and permafrost monitoring to inform land use and ecological restoration;
- Development of solar and hybrid hydro-solar systems using local climatic and topographical data;
- Agricultural science inputs such as improved yak breeds and rotational grazing protocols to enhance livestock productivity without damaging fragile alpine ecosystems.

The initiative contributes to multiple SDGs:

- SDG 1 (No Poverty) and SDG 8 (Decent Work) by creating jobs and increasing incomes;
- SDG 7 (Affordable and Clean Energy) through expanded solar infrastructure;
- SDG 13 (Climate Action) via large-scale emissions reduction;
- SDG 15 (Life on Land) through restoration of degraded land.

**Actions and impacts**

The cornerstone of this initiative is the Talatan Photovoltaic Park, built on a nearly desertified site at 3,000 meters elevation. The park now spans 42,000 hectares and generates more than 21 billion kilowatt-hours of electricity annually — enough to offset 70 million tons of $CO_2$ over its lifetime.

The solar infrastructure also contributes to ecological recovery by modifying the local microclimate — reducing wind erosion, lowering evaporation, and increasing nighttime soil moisture. However, these benefits are part of a broader, science-led restoration strategy. Remote sensing, environmental modeling, and field trials have guided revegetation efforts, resulting in the restoration of over 14,900 hectares of degraded land, with vegetation cover reaching 80% in just five years. Beyond ecological impacts, the project has catalyzed inclusive rural development. The "PV + grazing" model integrates solar energy production with managed livestock grazing, creating a positive relationship between infrastructure and agriculture.

The initiative has:

- Saved an estimated 7.2 million yuan annually in feed costs;
- Created 1,726 permanent jobs, nearly one-third held by local residents;
- Increased household income by 20–30% in surrounding communities;
- Supported the formation of 18 village cooperatives that govern land use and economic benefit-sharing.

**Key takeaways**

- Integrated approaches combining renewable energy, ecological science, and local governance can drive sustainable transitions in fragile environments.
- The Talatan PV Park is not just an energy project but a landscape-scale sustainability intervention that links climate, biodiversity, and livelihoods.
- Scientific evidence was foundational in every step, from siting infrastructure to optimizing grazing and ensuring environmental benefits.
- The project offers a replicable model for arid and high-altitude regions globally, including Central Asia and the Andes.
- Its success reflects the importance of multi-stakeholder engagement, policy support, and scientific coordination to scale complex sustainability solutions.

- **Case study 8: Science for smarter cities: Using urban systems research to reshape commuting in China's megacities**
- Author: Tianren Yang, China Association for Science and Technology, University of Hong Kong
- Geographical scope: China

**Topline summary**

This case exemplifies the role of science in driving locally tailored, equity-focused urban planning. By developing decision-ready tools grounded in spatial and behavioral data, the research team bridged science and public policy to support more sustainable and inclusive urban commuting strategies. The initiative shows how science can go beyond informing policy to shaping it directly — advancing implementation of the SDGs through targeted systems thinking.

**Challenge and the role of science**

Rapid urbanization and spatial transformation in China's megacities — such as Shanghai and Shenzhen — are generating complex challenges for sustainable urban mobility. Long and inefficient commutes contribute significantly to carbon emissions, air pollution, and spatial inequality. Despite the availability of vast transport data, traditional planning tools often fail to identify hidden structural issues: mismatches between jobs and housing, unequal access across sectors, and evolving patterns of land use and transport development.

To address these challenges, researchers at the University of Hong Kong developed a series of urban systems science tools designed to inform smarter, fairer commuting policies. Drawing on transportation planning, spatial analytics, and social science, the team developed evidence-informed approaches that allowed planners to detect where — and for whom — commuting is most inefficient or unequal.

This science-led approach directly supports progress on:

- SDG 11 (Sustainable Cities), by promoting equitable access and better spatial planning;
- SDG 13 (Climate Action), by identifying ways to reduce commuting-related emissions;
- SDG 10 (Reduced Inequalities), by uncovering and addressing job-housing disparities.

**Actions and impacts**

Three core scientific tools were developed and applied:

- A counterfactual commuting model was used in Shanghai to isolate the effects of spatial changes — such as polycentric development — on commute times, helping assess whether new urban forms were improving mobility outcomes.
- A sector-specific excess commuting framework identified hidden inefficiencies, revealing that workers in certain industries (e.g., communications and electronics) faced longer, more indirect commutes due to poor job-housing alignment.

- A multi-source data integration model combined mobile data, travel surveys, and behavioral models to generate accurate commuting maps for Shenzhen, Hong Kong, and other cities. This enabled policymakers to simulate the effects of policy scenarios such as transit investment and zoning reform.

These tools have informed decision-making in planning departments in Shanghai, Guangzhou, and Shenzhen, where they have been used to support transit-oriented development, zoning reform, and strategic transport investment. In Hong Kong, the models have been incorporated into senior civil servant training, bridging scientific evidence with long-term planning capacity.

The approach has also gained international visibility. Findings were featured in the UN-Habitat Global Urban Lectures[20], reaching practitioners in over 100 countries and expanding the impact of the research globally.

**Key takeaways**

- Urban systems science can directly inform public policy, helping city governments design more targeted, inclusive, and sustainable mobility solutions.
- Science-based tools can reveal inequities hidden in aggregate data, enabling decision-makers to act on the structural drivers of inequality and emissions.
- Institutional uptake in major Chinese cities — including Shanghai, Guangzhou, Shenzhen, and Hong Kong — shows how research can translate into practical reforms in zoning, transit, and civil service planning.
- Global dissemination through platforms like UN-Habitat supports cross-regional learning and replication, embedding systems thinking into the next generation of urban practice.

## THEME 4: Bridging science, policy, and plural knowledge for transformative action

**THEME FRAMING:** Delivering on the SDGs requires more than scientific insight — it demands mechanisms that connect knowledge to action in ways that are inclusive, trusted, and fit for context. Yet across many systems, the science–policy interface remains fragmented, episodic, or inaccessible to those outside elite or disciplinary circles. Strengthening this interface means building sustained, transparent, and participatory processes that bring together diverse actors — including scientific advisory bodies, Indigenous leaders, and civil society — and value multiple forms of expertise.

This theme explores how such transformations are taking shape. Whether through national dialogues that align scientific councils across ministries or roundtables that embed Indigenous perspectives in climate and reef management, these examples point to new models for evidence-informed decision-making. They illustrate that science can be a connector — not only of data and disciplines, but of people, institutions, and knowledge systems.

[20] Find out more: https://www.youtube.com/watch?v=1ZToS_hdAQ0

- **Case study 9: Coordinating science advice across government: Germany's national dialogue between scientific advisory councils**
- Author: Annekathrin Ellersiek, Science Platform Sustainability 2030, Research Institute for Sustainability (RIFS)
- Geographical scope: Germany

**Topline summary**

Germany's Dialogue between Scientific Councils illustrates how institutional innovation can help embed science within national governance systems. By enabling structured, cross-ministerial exchange among advisory bodies, the initiative strengthens the science-policy interface and supports SDG-aligned policy-making across sectors. It offers a replicable model for countries seeking to overcome siloed approaches to science advice and foster integrated sustainability strategies.

**Challenge and the role of science**

Effective SDG implementation requires robust science-policy coordination and integrated decision-making across government. In Germany, this principle is reflected in the country's National Sustainable Development Strategy (NSDS), which positions the 2030 Agenda as a shared framework across all federal ministries.

However, until recently, Germany's advisory landscape was fragmented: most ministries were supported by their own scientific councils, with little interaction between them. This created a risk of disciplinary silos and missed opportunities for coherent, cross-sectoral advice aligned with the SDGs.

To address this, the Science Platform Sustainability 2030 (wpn2030) and the Sustainable Development Solutions Network (SDSN) Germany launched the Dialogue between Scientific Councils in 2018. This platform brings together around 20 advisory councils from across federal ministries into a structured exchange, enabling them to jointly inform national sustainability processes.

The initiative contributes to multiple SDGs, including:

- SDG 16 (Peace, Justice and Strong Institutions) by enhancing the transparency and coordination of scientific input into policy;
- SDG 17 (Partnerships for the Goals) by fostering cross-sector collaboration;
- SDG 13 (Climate Action) and SDG 3 (Good Health and Well-Being) through more integrated approaches to national strategies informed by science.

**Actions and impacts**

The Dialogue has directly contributed to national SDG implementation through two key policy processes:

- In 2019, a dedicated Dialogue session focused on the upcoming quadrennial revision of the NSDS. Input from 12 participating advisory councils — several engaging with the 2030 Agenda for the first time — was synthesized in a joint report. Notably, in 2020, the Federal Ministry of Digital and Transport released its first Ministerial

Sustainability Report, reflecting uptake of the Dialogue's recommendations and signaling broader institutional alignment with SDG principles.

- In 2024, the Dialogue contributed to federal consultations for Germany's third Voluntary National Review (VNR). A formal summary report was submitted to the government and served as one of the evidence sources for shaping the VNR.

Beyond specific outputs, the Dialogue is helping to normalize a more systemic approach to science advice, encouraging ministries to align their strategies, learn from each other's advisory models, and draw on scientific knowledge to identify cross-cutting solutions. The platform's value has also been acknowledged in official evaluations, including Germany's SDG Progress Report.

Looking ahead, the next two Dialogue sessions in 2025 will focus on assessing the new German federal government's sustainability priorities, based on advisory council insights from its first months in office.

**Key takeaways**

- Fragmented science advice structures limit the ability of governments to respond effectively to sustainability challenges. Germany's Dialogue between Scientific Councils offers a concrete example of cross-sector coordination among advisory bodies.
- The platform has contributed directly to major national processes — including the NSDS revision and Voluntary National Reviews — and helped expand SDG awareness within ministries and advisory councils previously less engaged.
- Structured, recurring exchange supports continuity, institutional learning, and political relevance — allowing science to maintain influence across electoral cycles and shifting priorities.
- The initiative offers a potentially replicable model for other countries seeking to strengthen science-policy interfaces. It reinforces a broader lesson: the organization of science advice matters — and coherence among expert bodies is essential for coherence in policy implementation.

- **Case study 10: Bringing together Indigenous and Scientific Knowledge systems: Climate advice for the Great Barrier Reef**
- Author: Frances Separovic, Australian Academy of Science
- Geographical scope: Oceania

**Topline summary**

This case illustrates how climate science and Indigenous knowledge can be brought together through inclusive dialogue to inform ecosystem governance. Through a series of co-chaired roundtables, the Australian Academy of Science supported the development of climate resilience strategies for the Great Barrier Reef, demonstrating how science–policy processes can become more culturally grounded, participatory, and fit for long-term sustainability challenges.

**Challenge and the role of science**

The Great Barrier Reef (GBR), one of the world's most iconic ecosystems, faces accelerating threats from marine heatwaves, ocean acidification, and extreme weather events. Bleaching intervals are shortening, compromising the Reef's ability to recover and raising difficult policy questions about adaptation limits, intervention trade-offs, and long-term resilience.

In 2023, the Australian Government Department of Climate Change, Energy, the Environment and Water commissioned the Australian Academy of Science to provide advice on how to respond to these pressures. The aim was to support the work of the Reef 2050 Plan Independent Expert Panel through a process that integrated scientific evidence and Indigenous knowledge[21].

Science played a central role in diagnosing climate risks, assessing intervention options, and mapping future scenarios. Equally, Indigenous participants — including Eastern Kuku Yalanji woman Chrissy Grant, who co-chaired all three roundtables — helped shape the process by grounding discussions in relational, ecosystem-based understandings of Country.

The initiative contributes to:

- SDG 13 (Climate Action) – through climate risk analysis and resilience planning;
- SDG 14 (Life Below Water) – by supporting stewardship of marine ecosystems;
- SDG 17 (Partnerships for the Goals) – through inclusive knowledge co-production and engagement.

**Actions and impacts**

The Academy convened a series of three expert roundtables in 2023, each addressing a key pillar of reef governance under climate stress:

1. Climate projections and impacts (2040–2060) – assessing the science on future scenarios for the GBR under varying emissions trajectories.
2. Intervention strategies and technologies – exploring the feasibility and risks of deploying reef restoration tools at scale.
3. Communication, leadership, and integrity – addressing how to tell the truth about the Reef's future while maintaining public trust and policy momentum.

Indigenous leaders were central to each discussion, contributing perspectives on long-term ecosystem relationships, cultural values, and holistic management. Their involvement was widely recognized by participating scientists as enriching and reshaping the deliberative process. As noted by Professor Sujatha Raman, UNESCO Chair at ANU:

"The Indigenous representatives… were very adept at thinking holistically about the system — for them this is Country — and there was so much for all of us to learn from this process."

The roundtables culminated in a formal report by the Academy, synthesizing key conclusions and knowledge gaps. This report directly informed the policy advice submitted by the Reef 2050 Independent Expert Panel to the Australian Government. As a result,

[21] Find out more: https://www.science.org.au/supporting-science/science-policy-and-analysis/projects/reef-futures-roundtables

Indigenous insights and scientific evidence were both reflected in high-level decision-making on the future of reef governance.

**Key takeaways**

This case demonstrates how integrating Indigenous knowledge and scientific evidence can lead to more inclusive, legitimate, and impactful climate policy advice. Through its co-designed roundtable process, the Academy helped create a new model for science-policy dialogue — one that values different ways of knowing and centers shared responsibility for complex ecological futures.

Key insights include:

- Multistakeholder and transdisciplinary approaches can strengthen the relevance and legitimacy of science advice.
- Indigenous knowledge systems offer holistic insights essential for understanding long-term ecosystem change.
- Structured, respectful dialogue between scientific and Indigenous experts can unlock new strategies for climate adaptation.

This model of inclusive knowledge co-production may be adapted for other countries and ecosystems seeking to improve the integrity and impact of their science-policy interfaces — especially in the face of climate and biodiversity crises.

## THEME 5: Multistakeholder and transdisciplinary collaboration to advance integrated SDG implementation

**THEME FRAMING:** Solving complex sustainability challenges — such as land degradation, food insecurity, ecosystem change, and climate vulnerability — requires more than technological fixes or discipline-bound solutions. It demands collaborative frameworks that bring together diverse expertise, lived experience, and stakeholder expertise.

The case studies in this theme illustrate how multistakeholder and transdisciplinary collaboration can generate deeply contextualized, actionable solutions. From coral restoration in Belize to biotechnology uptake in Samoa, each initiative bridges divides: between science and society, between global goals and local realities, and between different knowledge systems.

Such collaboration does not happen by default — it must be intentionally designed, adequately funded, and politically enabled. Yet when done well, it accelerates integrated SDG progress by fostering mutual trust, shared ownership, and lasting impact. These examples show that when scientists, Indigenous leaders, local communities, government agencies, and civil society work together, innovation becomes not just technical, but social and institutional as well.

- **Case study 11: Science in action for community-led forest management in Upper-Katanga, DRC**
- Author: Yannick Useni Sikuzani, Université de Lubumbashi, Académie Congolaise des Sciences (ACCOS)

- Geographical scope: Upper-Katanga Province, Democratic Republic of the Congo (DRC)

**Topline summary**

This case study demonstrates how science, when integrated with multistakeholder collaboration, can help transform land-use governance in regions under intense environmental pressure. In Upper-Katanga, scientific evidence has directly supported the creation of community-managed forests, advancing ecosystem conservation, climate resilience, and inclusive governance. It offers a compelling example of how co-produced knowledge and institutional coordination can deliver measurable results for SDG implementation.

**Challenge and the role of science**

The Katangese Copper Belt in southeastern DRC — spanning Upper-Katanga and Lualaba Provinces — has experienced severe deforestation due to industrial mining, urban expansion, and subsistence farming. Between 2002 and 2015, forest cover dropped from 49% to 42%, with a deforestation rate of 0.5%, surpassing the national average. This loss has caused biodiversity decline, soil degradation, and increased vulnerability to climate change.

Their analysis revealed that forest loss in the region was primarily driven by processes known in landscape ecology as fragmentation and dissection — where natural forests are broken into smaller patches and divided by infrastructure and development. These findings informed advocacy for new land-use policies and sustainable forest management.

The research supported:

- SDG 15 (Life on Land) by promoting ecosystem restoration and sustainable land use;
- SDG 13 (Climate Action) through forest-based climate mitigation;
- SDG 17 (Partnerships for the Goals) by fostering cross-sector collaboration among scientists, policymakers, communities, and international partners.

**Actions and impacts**

Building on this scientific evidence, the University of Lubumbashi partnered with the Provincial Environmental Coordination of Upper-Katanga, local NGOs, the Food and Agriculture Organization (FAO), and the Global Environment Facility (GEF) to design and promote a new model of participatory forest governance.

Advocacy efforts contributed to the provincial government's adoption of legal decrees recognizing community-managed forests. The original target of 80,000 hectares was expanded following local interest and institutional momentum. As of 2022:

- 210,911 hectares have been placed under community management;
- An additional 123,745 hectares are awaiting formal recognition;
- In total, 334,656 hectares are now part of this participatory governance model.

This work has:

- Shifted forest governance toward community leadership;

- Strengthened local stewardship of vulnerable ecosystems;
- Created a science-informed policy model that is now being explored in other at-risk regions of the DRC and Central Africa.

**Key takeaways**

This case illustrates how science, policy, and community action can converge to address deforestation in one of Africa's most ecologically and economically complex regions. It demonstrates:

- The importance of spatial and ecological data in diagnosing degradation and targeting interventions;
- The role of multistakeholder partnerships in enabling institutional change and local empowerment;
- The value of science-informed community governance models in protecting biodiversity and enhancing climate resilience.

By integrating science with grassroots governance, this initiative advances multiple SDGs while providing a practical template for place-based environmental transformation — even in high-risk, high-conflict regions. It affirms that when diverse actors co-produce solutions, science becomes not only a diagnostic tool, but a catalyst for social and ecological change.

- **Case study 12: Ginger tissue culture for food security: A science-based partnership model for sustainable agriculture in Samoa**
- Author: Varea Dawn Vaurasi, National University of Samoa
- Geographical scope: Samoa

**Topline summary**

This case highlights how agricultural biotechnology, when combined with education and community partnerships, can support food security, rural development, and climate resilience. By introducing plant tissue culture to smallholder ginger farmers, the National University of Samoa enabled a locally grounded, science-based intervention that enhanced crop yields, reduced disease, and strengthened capacity for sustainable agriculture — demonstrating the power of multistakeholder collaboration in small island contexts.

**Challenge and the role of science**

In Samoa, smallholder farmers face significant obstacles to ginger production, including poor-quality planting material, the spread of rhizome-borne diseases, and limited access to agricultural technologies. These challenges compromise food security and rural incomes while making farming systems more vulnerable to climate-related stressors.

To address this, researchers at the National University of Samoa developed and implemented plant tissue culture techniques adapted to local needs. By creating disease-free ginger plantlets through in vitro propagation and acclimatizing them in greenhouse environments, the team offered a scientific solution to increase productivity and crop resilience.

This work contributes directly to several Sustainable Development Goals:

- SDG 2 (Zero Hunger) – by improving food security through enhanced crop yields;
- SDG 4 (Quality Education) – via training and school partnerships;
- SDG 8 (Decent Work and Economic Growth) – through support for rural livelihoods and agri-business;
- SDG 12 (Responsible Consumption and Production) – by reducing reliance on low-yield traditional methods;
- SDG 13 (Climate Action) – by fostering adaptive and resilient agricultural practices.

**Actions and impacts**

The research team refined the tissue culture method to suit Samoa's environmental and technical conditions, using low-cost sterilization techniques to produce viable ginger plantlets. Following successful laboratory and greenhouse trials, over 1,000 disease-free plantlets were distributed to farmers in high-potential production areas, including Lefaga, Aleipata, and Salelologa.

To expand impact and ensure uptake, the team conducted targeted training workshops for farmers, students, and agricultural practitioners. These sessions covered not only biotechnology and plant propagation, but also greenhouse management and sustainable farming techniques. The initiative also partnered with schools and women's groups, enabling wider community engagement and knowledge exchange.

Reported impacts include:

- Increased ginger yields and reduced disease incidence among participating farms;
- Adoption of propagation methods by agricultural educators and extension officers;
- Use of the initiative as a launchpad for new agri-business activities by women and youth groups;
- Greater confidence among farmers and community members in applying science-led approaches to local development challenges.

The initiative also normalized the use of science and technology in rural decision-making, creating a stronger foundation for long-term agricultural sustainability.

**Key takeaways**

This case demonstrates how biotechnology, when locally adapted and combined with community-driven engagement, can deliver measurable gains for sustainable agriculture in small island developing states. Key success factors included:

- Scientific innovation tailored to the needs of smallholder farmers;
- Strong collaboration between researchers, educators, farmers, and community groups;
- Capacity-building through training and educational outreach;

- Tangible improvements in productivity and climate resilience.

By bridging academic research with community priorities, the project helped institutionalize science-based agriculture in Samoa — offering a scalable model for other Pacific Islands seeking to build food systems that are more productive, inclusive, and climate-smart.

- **Case study 13: Restoring Coral Reefs in Belize: A Science-Based, Community-Led Approach to Marine Ecosystem Recovery**
- Author: Michelle Mycoo, The University of the West Indies (St. Augustine), ISC SIDS Liaison Committee
- Geographical scope: Belize

**Topline summary**

This case illustrates how science can empower community-led marine restoration, delivering long-term ecological recovery and sustainable livelihoods. In Belize, the Fragments of Hope initiative has pioneered coral restoration grounded in genetic and ecological research, while embedding scientific practices into local communities through training, stewardship, and partnerships. It offers a replicable model of place-based, science-informed collaboration to advance marine resilience and inclusive development.

**Challenge and the role of science**

The Laughing Bird Caye National Park (LBCNP), a UNESCO World Heritage Site within the Mesoamerican Reef, has suffered significant degradation due to hurricanes, warming seas, pollution, and unsustainable fishing and tourism. Coral reefs in the region are critical to biodiversity, livelihoods, and coastal protection, yet remain acutely vulnerable to climate and anthropogenic stressors.

In response, the Belizean NGO Fragments of Hope launched a coral reef restoration initiative at LBCNP focused on cultivating and replanting genetically diverse, thermally tolerant corals[22]. Scientific research shaped every stage of the process: from species selection and propagation techniques to outplanting and long-term monitoring. Importantly, science also guided training materials and reef health assessments, ensuring that restoration efforts were evidence-informed and locally contextualized.

This initiative supports multiple SDGs:

- SDG 14 (Life Below Water) – by restoring marine biodiversity and reef structure;
- SDG 1 (No Poverty) and SDG 3 (Good Health and Wellbeing) – through sustainable livelihoods and enhanced coastal wellbeing;
- SDG 17 (Partnerships for the Goals) – via collaboration across research, civil society, and government.

**Actions and impacts**

Fragments of Hope has restored over 82,000 coral fragments to degraded reef zones in LBCNP over the past decade. Scientific monitoring confirms that 89% of transplanted corals survived after 13 years, with many colonies reproducing sexually between 2014 and 2017 —

[22] Find out more: https://fragmentsofhope.org/

a rare achievement in reef restoration globally. These ecological gains have been matched by social and economic impact:

- Local fishers, tour operators, and community leaders were trained in coral propagation and monitoring, supported by a tailored three-day course and field manual.
- Community-based practitioners now lead restoration efforts, reducing dependence on outside expertise and building local ecological stewardship.
- Tourism has rebounded, with visible improvements in reef health drawing visitors and restoring local incomes.
- Regional replication: Fragments of Hope has facilitated peer-to-peer exchanges and technical workshops in Jamaica, Mexico, Colombia, and St. Barth's, building wider regional capacity with support from partners such as the GEF Small Grants Programme, MAR Fund, and The University of the West Indies.

This sustained model of collaboration has helped transform reef restoration into a locally owned, regionally shared solution for marine resilience and economic recovery.

**Key takeaways**

This case shows how science-based restoration, when embedded in local leadership and community practice, can deliver lasting environmental and social impact. Key elements of success include:

- Long-term monitoring and adaptive management grounded in coral ecology and genetics;
- Skill-building and ownership by coastal communities, enhancing sustainability and reducing dependency;
- Strong partnerships across NGOs, universities, and government, enabling replication and scaling.

As climate stress on coral reefs intensifies, this initiative offers a tested pathway for linking marine science with inclusive development and climate adaptation — grounded in local knowledge, enabled by science, and supported through collaborative governance.

## THEME 6: Building capacity and fostering diverse leadership in science

**THEME FRAMING:** The global science system cannot achieve its full potential while excluding large segments of the population from participation and leadership. Across disciplines and regions, persistent inequities limit who is recognized, resourced, and empowered to lead scientific inquiry and shape research agendas. These gaps not only undermine fairness — they weaken the capacity of science to serve society, respond to complex global challenges, and earn public trust.

Diverse leadership enhances the credibility, relevance, and impact of science-informed decision-making. Yet, structural barriers — such as opaque selection procedures, lack of policy frameworks, and underinvestment in capacity-building — continue to constrain

progress. Addressing these challenges requires deliberate action: collecting disaggregated data, reforming institutional practices, and creating new spaces where marginalised voices and knowledge systems can thrive.

The case studies featured under this theme demonstrate that change is possible. They highlight how gender equity initiatives, inclusive digital learning environments, and culturally responsive pedagogy can foster new forms of leadership and unlock untapped potential. Building capacity and inclusion is not just about fairness — it is fundamental to scientific excellence, innovation, and sustainability.

- **Case study 14: Reforming Science from Within: Advancing Gender Equality in Global Scientific Organizations**
- Author: Léa Nacache, International Science Council
- Geographical scope: Global

**Topline summary**

This case demonstrates how global scientific institutions are taking deliberate steps to confront gender inequality in their ranks. By combining data-driven research with peer learning and institutional engagement, the initiative led by the ISC, IAP, and SCGES equips scientific organizations to identify and reform internal practices. It shows that building inclusive leadership is not only an equity issue but essential to strengthening the credibility, legitimacy, and future-readiness of science itself.

**Challenge and the role of science**

Women remain underrepresented in scientific leadership globally. While they comprise roughly 33% of researchers worldwide, women hold only 12% of membership in many science academies — and even fewer positions in decision-making bodies. These gaps are often perpetuated by opaque nomination procedures, weak policy frameworks, and deeply embedded institutional cultures that reinforce exclusion. The result is a science system that reflects and reproduces inequality, rather than challenging it.

In response, the International Science Council (ISC), InterAcademy Partnership (IAP), and Standing Committee for Gender Equality in Science (SCGES) launched a global initiative to assess and reform practices across scientific organizations[23]. Here, science serves a dual role: as both the object of institutional reform and the driver of change through research, benchmarking, and evidence-informed guidance.

The initiative directly supports:

- SDG 5 (Gender Equality) – by advancing equity in scientific institutions;
- SDG 16 (Peace, Justice and Strong Institutions) – through inclusive and accountable governance;
- SDG 17 (Partnerships for the Goals) – via global collaboration for systemic change.

**Actions and impacts**

[23] Find out more: https://council.science/our-work/gender-equality/

The project implements a dual-track research and engagement strategy involving over 250 organizations, including academies, international unions, and professional societies. Core components include:

1. A global survey collecting gender-disaggregated data on membership, leadership, nomination and election processes, equality policies, and institutional structures — enabling organizations to track progress since baselines set in 2015 and 2020.
2. A qualitative study capturing the lived experiences of scientists through interviews and written submissions. These explore informal norms, barriers to recognition and leadership, and organizational culture — including testimonies about discrimination, exclusion, and drivers of inclusion.

Together, these efforts provide institutions with a rich evidence base to assess their performance, identify gaps, and reform outdated practices. Early findings have already highlighted promising practices (such as gender-focused working groups, inclusive reforms, and more flexible evaluation criteria) as well as critical weaknesses (especially in data monitoring and leadership pathways).

The initiative has also launched global peer-learning spaces, including expert group consultations and knowledge-sharing events. A major report and toolkit of recommendations is expected by the end of 2025, aiming to provide organizations with practical strategies to implement change. Preliminary results will be shared in July 2025, creating momentum for reform in advance of the global release.

**Key takeaways**

This case study shows how science can be both transformative and self-reflective — generating the evidence and accountability needed to reform the structures of science itself. The ISC–IAP–SCGES initiative responds to deep-seated gender imbalances by generating data, creating dialogue, and enabling institutions to evolve through evidence-informed practice.

Key contributions include:

- Expanding gender data collection and performance monitoring across scientific institutions;
- Encouraging policy reforms in membership and leadership selection;
- Strengthening internal mechanisms, including gender equality committees and inclusive governance structures;
- Promoting peer exchange to spread effective practices and support mutual learning.

This work builds capacity for long-term change and offers a global benchmark for inclusion in science governance. By engaging organizations in reflection, reform, and cooperation, it models how science can lead the way in transforming itself — for the benefit of equity, excellence, and global progress on the SDGs.

- **Case study 15: Immersive design and ancestral knowledge for inclusive education and climate action in Vaupés, Colombia**
- Author: Michael Johan Pérez Calderón, Universidad del Tolima
- Geographical scope: Colombia

**Topline summary**

This case illustrates how immersive technology, Indigenous knowledge systems, and participatory pedagogy can converge to transform education and climate awareness in marginalized communities. In Colombia's Amazonian region of Vaupés, a virtual laboratory developed through community co-design offers a new model for digital inclusion and intercultural dialogue. It demonstrates how science, when embedded in relational, co-creative practices, can catalyze social innovation aligned with SDGs 4, 10, and 13.

**Challenge and the role of science**

In Vaupés—a biodiverse yet underserved region of Colombia—communities face systemic barriers including digital exclusion, fragmented education systems, and erosion of ancestral knowledge. These challenges undermine both cultural continuity and the ability to respond effectively to climate change.

To address these intersecting issues, the Universidad del Tolima partnered with Indigenous and rural communities to co-develop a practice-based methodology that blends critical pedagogy, immersive design, and digital storytelling. Science played a transformative role by shaping an interactive platform that recognizes ancestral knowledge as legitimate and essential, not peripheral, to educational and environmental solutions.

This effort directly contributes to:

- SDG 4 (Quality Education) – by promoting intercultural, inclusive learning environments
- SDG 10 (Reduced Inequalities) – through equitable digital access and cultural empowerment;
- SDG 13 (Climate Action) – via knowledge-sharing rooted in Indigenous ecological stewardship.

**Actions and impacts**

The project's central innovation is the creation of a virtual laboratory in the metaverse, co-designed with Vaupés communities and accessible via Wi-Fi[24]. Through participatory tools such as social mapping, action research, and qualitative data collection, the platform was built to reflect local realities, languages, and values.

Key impacts include:

- Expanded digital inclusion: Communities with limited internet infrastructure now have meaningful access to culturally grounded digital learning spaces.

[24] Find out more: https://mjohan.art/vaupes

- Revitalization of cultural heritage: Over 320 audiovisual works — including microdocumentaries, podcasts, and multilingual storytelling galleries — have been co-produced, preserving and activating Indigenous languages and ritual knowledge.
- Strengthened intergenerational networks: Engagement has grown from 180 participants in 2022 to over 310 in 2024, fostering collaboration between elders, youth, educators, and artists.
- Policy and program influence: The platform has generated empirical data that informs intersectional, culturally responsive education policy and social innovation strategies.
- Scalability and adoption: At least five institutions — including public schools and community media — have adopted aspects of the model. It has been featured in cultural showcases such as the *Maloka Virtual del Vaupés* and *Museo Virtual SENA*[25], enhancing its visibility.

The platform functions as a real-time laboratory for educational practice and evaluation. Ethnographic journals, interviews, and impact indicators are continuously used to improve the approach and document its effects.

**Key takeaways**

- This case demonstrates how immersive technologies, aligned with Indigenous knowledge and culturally rooted pedagogy, can address educational inequity, promote cultural resilience, and support community-led climate action.
- Developed through the VÍNCULO project (*Voces Interactivas para la Construcción Libre del Conocimiento*), the initiative reimagines science as a collaborative, inclusive, and context-specific practice.
- The virtual lab functions not as a static repository but as a living archive and educational commons — open-access, culturally rooted, and community-driven.
- It offers a replicable model for inclusive digital education in remote or underserved areas, demonstrating how science can become a shared practice of care, learning, and transformation.
- By centering plural knowledge systems and local leadership, the initiative affirms that science is not only about discovery — it is also about belonging, empowerment, and building sustainable futures.

## THEME 7: Public engagement and science literacy as foundations for trust in science

**THEME FRAMING:** Trust in science cannot be taken for granted — it is built through transparency, participation, and relevance. As global challenges grow more complex and urgent, so too does the need for scientific knowledge to inform decision-making. Yet this requires more than publishing research or issuing expert advice. It requires that science be understood, valued, and owned by the public – and the scientific community understand that communication of their work is part of the scientific endeavor.

[25] Find out more: https://bit.ly/3O5gw0L

This is increasingly difficult in a landscape shaped by polarization, disinformation, and systemic inequities in education and access. When public trust erodes, the ability to mobilize science for the common good falters — undermining progress across the SDGs, from climate action to health to sustainable production.

This theme explores how public engagement and science literacy can help rebuild and sustain that trust. The case studies featured here illustrate approaches that democratize science — by inviting people into the process, valuing local knowledge, and making science a tool for everyday agency. In doing so, they show that public engagement is not an add-on to science — it is a precondition for its impact.

- **Case study 16: Citizen science for microplastics monitoring: Empowering Malaysian schools through environmental literacy**
- Author: Sarva Mangala Praveena, Universiti Putra Malaysia
- Geographical scope: Perak, Malaysia

**Topline summary**

This case study demonstrates how citizen science, when integrated into school curricula, can generate both scientific data and environmental awareness in underserved areas. In Perak, Malaysia, secondary school students and teachers were equipped to monitor microplastics in local freshwater ecosystems—building scientific skills, local ownership, and public engagement. The initiative shows how science education, when rooted in community experience, can foster trust and agency—key enablers of SDG implementation.

**Challenge and the role of science**

Microplastics pollution presents mounting environmental and public health challenges, yet inland water bodies remain under-monitored in Malaysia. Scientific attention has focused largely on marine ecosystems, leaving freshwater contamination poorly understood—especially in rural areas. This lack of localized data and awareness impedes action toward:

- SDG 3 (Good Health and Well-being) – due to unmonitored public exposure to pollutants;
- SDG 12 (Responsible Consumption and Production) – by limiting behavioral change around plastic use;
- SDG 14 (Life Below Water) – through insufficient upstream intervention.

To address this, Universiti Putra Malaysia, in collaboration with the Green Growth Asia Foundation and UNDP's Youth Environment Living Labs, launched a participatory initiative to embed environmental science in schools. By training students and teachers in microplastics sampling and classification, the project empowered communities to produce their own evidence and connect pollution to local sources[26]. Science served not only as a diagnostic tool, but as a participatory process for engagement and action.

**Actions and impacts**

[26] Found out more: https://yell.my/mapping-of-microplastic-pollution-in-peraks-local-ecosystems/

The project developed a tailored curriculum module for secondary school students, focused on practical, low-cost environmental sampling. Teachers and students were trained to:

- Collect water from local rivers and lakes;
- Use basic microscopy to identify microplastics;
- Record findings through geotagged photographs.

This hands-on approach helped students connect environmental degradation to everyday behaviors, such as littering and improper waste disposal. The visual documentation also served as a storytelling mechanism—enabling students to present their findings to classmates, families, and community leaders.

Key impacts included:

- Baseline data generation: The project produced the first localized assessments of microplastics contamination near participating schools.
- Curriculum integration: Teachers incorporated findings into science lessons, reinforcing the relevance of classroom learning.
- Behavioral change: Students led awareness campaigns and initiated plastic reduction efforts, including school-wide clean-up drives.
- Community engagement: The initiative stimulated dialogue among students, parents, and local authorities about pollution and sustainable practices.
- Scalability: The Green Growth Asia Foundation plans to expand the model to Langkawi via the Eco-Schools Malaysia program, indicating replication potential.

By combining accessible tools with local relevance, the initiative bridged gaps between scientific knowledge and public trust, and between data production and civic action.

**Key takeaways**

- This case study highlights the potential of citizen science to democratize environmental monitoring and build trust in science at the community level.
- Through school-based microplastics sampling, students in Perak became agents of knowledge and change — linking environmental evidence to local behavior and advocacy.
- The initiative delivered multiple benefits: strengthened environmental literacy among students and teachers, new community-level datasets on freshwater pollution, tangible reductions in single-use plastic and waste through student-led campaigns and cleanups, and a replicable model for science engagement in education systems across the Global South.

- **Case study 17: A–Z science and health literacy for young learners in Malaysia**
- Author: Rohimah Mohamud, Universiti Sains Malaysia
- Geographical scope: Kota Bharu, Kelantan, Malaysia

**Topline summary**

This case study demonstrates how early science and health education, when rooted in local languages, creative pedagogy, and peer-based facilitation, can build trust in science from a young age. By using a colorful A–Z activity book and interactive workshops, the initiative helped children in underserved communities connect foundational scientific concepts with everyday life—strengthening science literacy, public health awareness, and youth empowerment in alignment with the SDGs.

**Challenge and the role of science**

In rural and underserved regions of Malaysia, access to engaging, culturally relevant science education remains limited. Many students rely on rote memorization and lack exposure to hands-on learning or critical health information. This weakens long-term outcomes in:

- SDG 3 (Good Health and Well-being) – by limiting early awareness of hygiene, disease prevention, and healthy practices;
- SDG 4 (Quality Education) – due to low engagement and underdeveloped STEM literacy;
- SDG 9 (Industry, Innovation, and Infrastructure) – where digital learning tools remain underutilized.

To address this, a pilot program was launched in Kelantan, combining scientific content with creative, bilingual resources for young learners. Science was not only the subject matter—it shaped the pedagogy, combining public health, biology, and emerging tech with project-based and participatory learning[27]. Sessions were facilitated by local youth, creating a multiplier effect of trust and peer-to-peer communication.

**Actions and impacts**

The initiative delivered a comprehensive literacy model through two core components:

1. An illustrated A–Z science and health activity book introducing terms like "A for Antibody" and "Z for Zoonosis" through stories and activities;
2. A set of 16 simplified health pamphlets co-developed with the Immunology Department of Universiti Sains Malaysia.

These were delivered via the SPECIAL module (STEM Enrichment, Project-Based Learning, English Development, etc.) using the KECAPi methodology (Kreatif, Eksploratif, Cakna IT, Aktif, Progresif)—a locally developed pedagogical framework emphasizing creativity and digital exploration.

Workshops included:

- Group projects guided by trained youth facilitators (ages 15+);
- AI-assisted Q&A sessions using ChatGPT;
- VR simulations and hands-on model-making (e.g., building clay cell structures);
- Student-led presentations, field trips to laboratories, and science center visits.

[27] Find out more: https://kecapmalaysia.org/

Notable impacts included:

- Over 80% of students volunteered for public speaking roles and formed after-school "science squads";
- 30% average improvement in vocabulary and numeracy as measured by pre/post assessments;
- Parental feedback indicated improved home hygiene and greater interest in health topics;
- 20 youth trained as Trainers of Trainers, now ready to lead the program's expansion to other communities.

The project has already laid the groundwork for broader adoption, with proposals under way to establish a state-endorsed STEM Education Hub and a community-based STEM Center, ensuring sustainability and integration into local educational infrastructure.

**Key takeaways**

- This initiative exemplifies how community-based, youth-led science education can spark meaningful engagement with science, even in resource-limited settings.
- It combines scientific accuracy with creative pedagogy, digital innovation, and intergenerational learning to advance multiple SDGs.
- The use of bilingual resources, low-cost materials, and local leadership makes the model scalable and adaptable to underserved contexts globally.
- The project demonstrates how grassroots initiatives can influence education policy and reshape learning systems to be more inclusive, participatory, and future-ready.

## CONCLUSIONS

The case studies featured in this paper — spanning fields from biotechnology and data governance to climate adaptation and inclusive education — offer a clear message: science and engineering are not on the sidelines of sustainable development. They are embedded in its delivery. When supported by the right conditions, they provide not only tools and technologies, but also frameworks for participation, trust-building, and systemic change.

Yet realizing this potential at scale requires overcoming persistent barriers. As the 2023 Global Sustainable Development Report highlights, science-policy-society systems remain fragmented, underfunded, and inequitable. Key challenges include weak interfaces between knowledge and decision-making, underinvestment in science and technology capacity in the Global South, limited access to data, and structural exclusion from scientific leadership and agenda-setting. These challenges are not technical — they are institutional and political. And they can be addressed.

Drawing on the evidence presented in this paper, we offer the following suggestions to Member States and the UN system at the 2025 High-Level Political Forum:

1. **Build institutional frameworks that connect science and engineering to decision-making**: Move beyond isolated and ad hoc science advice toward durable infrastructures that support ongoing collaboration between researchers, engineers,

policymakers, and communities. This includes long-term investment in science–policy interfaces, boundary-spanning roles, and knowledge-brokering institutions at all levels.

2. **Make co-production and public participation standard practice**: Design policy and research processes to include communities, Indigenous knowledge experts and holders, youth, and civil society from the outset. Effective science and engineering solutions emerge from shared ownership rather than top-down dissemination.
3. **Tackle structural exclusion in science systems and beyond**: Remove the systemic barriers that prevent women, early-career researchers, Indigenous knowledge experts and holders, and marginalized groups from participating fully in science and engineering. Prioritize diversity in leadership, funding, and agenda-setting to strengthen the legitimacy and relevance of scientific work.
4. **Strengthen knowledge translation and data infrastructures for local impact**: Invest in the mechanisms that turn research into results: open and interoperable data systems, digital public infrastructure, inclusive monitoring tools, and platforms that connect evidence to policy in real time — especially in under-resourced settings.
5. **Safeguard international scientific cooperation across divides**: Protect and promote cross-border collaboration, even amid political tensions. Scientific and engineering cooperation must remain a global public good — enabling shared learning, equitable capacity-building, and collective progress on global challenges.
6. **Strengthen science literacy and engagement to build public trust**: Support education, communication, and participatory initiatives that make science and engineering accessible, transparent, and responsive to societal needs. Rebuilding trust requires dialogue, not just dissemination — and demands that people see their concerns, values, and voices reflected in how science is used and governed.

In the face of converging crises and constrained timelines, it is no longer enough to ask what science and engineering can do. The question is: **what will we enable them to do?** The case studies in this paper provide a compelling answer. It is time to build on their lessons, scale their successes, and place knowledge at the heart of the path forward.

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