UN Interagency Task Team on STI for the SDGs (IATT)'s Assessment of Major Obstacles to the International Diffusion of Technologies for the SDGs, with a Focus on Zero- and Low-Emission Technologies

A Follow-up of the *Sevilla Commitment*

Compilation of Inputs by the Secretariat of the UN Interagency Task Team on Science, Technology and Innovation for the SDGs (IATT)

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1. Introduction ---------- **3**

1.1 Objective and Scope of the Assessment ---------- *3*

1.2. Methodology ---------- *3*

1.3. Compilation and Presentation of Findings ---------- *4*

1.4 Process ---------- *4*

2. Compilation of IATT Inputs ---------- **6**

2.1 FAO (Food and Agriculture Organization) ---------- *6*

2.2 ITU (International Telecommunication Union) ---------- *8*

2.3 UNCTAD (United Nations Trade and Development) ---------- *10*

2.4 UNDESA (United Nations Department of Economic and Social Affairs) ---------- *14*

2.5 UNECA (United Nations Economic Commission for Africa) ---------- *21*

2.6 UNEP (United Nations Environment Programme) ---------- *24*

2.7 UNESCO (United Nations Educational, Scientific and Cultural Organization) ---------- *28*

2.8 UNFPA (United Nations Population Fund) ---------- *31*

2.9 WIPO (World Intellectual Property Organization) ---------- *39*

3. Template for United Nations Inter-Agency Task Team on Science, Technology and Innovation for the SDGs (IATT) Inputs ---------- **45**

1. Introduction

Technology is a critical enabler for accelerating the achievement of the Sustainable Development Goals (SDGs) as recognized by the establishment of the Technology Facilitation Mechanism in the Addis Ababa Action Agenda. Advances in zero- and low-emission technologies are also crucial for delivering on the Paris Agreement. However, obstacles to technology diffusion have been recognized by Member States as hindering implementation of the SDGs.

The Fourth Financing for Development Forum (FFD4), convened in Sevilla in June 2025, adopted the outcome document - the *Seville Commitment*, which reaffirmed Member States' collective commitment to strengthening the means of implementation of the 2030 Agenda for Sustainable Development. In this context, Member States underscored the centrality of science, technology and innovation (STI) in enabling transformative progress across all Sustainable Development Goals (SDGs), and requested an assessment of barriers to technolofy diffusion.

In particular, paragraph 59 (q) of the *Seville Commitment* stipulates:

"*We request the Interagency Task Team on STI for the Sustainable Development Goals to undertake an assessment of the major obstacles that hamper international diffusion of technologies for the Goals, including zero- and low-emission technologies, and to provide recommendations to overcome these obstacles*."

This intergovernmental mandate establishes a clear basis for undertaking the present assessment. By identifying the obstacles that impede technology diffusion, and making recommendations to overcome them, the Interagency Task Team on STI for the SDGs (IATT) will support Member States' in scaling technology solutions commensurate with the ambition of the 2030 Agenda.

This mandate builds on IATT's original mandate in the Addis Ababa Action Agenda to "promote coordination, coherence, and cooperation within the UN System on STI related matters, enhancing synergy and efficiency, in particular to enhance capacity-building initiatives". At present, the IATT includes 51 UN entities and is co-convened by UN Department of Economic and Social Affairs (UNDESA) and UN Trade and Development (UNCTAD).

1.1 Objective and Scope of the Assessment

This assessment compiles assessments from IATT members on obstacles to the international diffusion of technologies critical for achieving the SDGs, with a focus on zero- and low-emission technologies, as well as recommendations on how to overcome these obstacles.

1.2. Methodology

The assessment was conducted through a simple, structured survey to all IATT Members, inviting contributions on:

- major obstacles to international technology diffusion for the SDGs;
- specific challenges related to zero- and low-emission technologies; and
- recommendations to overcome these obstacles.

1.3. Compilation and Presentation of Findings

All submissions are compiled in this document to:

- serve as a reference for policymakers and stakeholders to enhance technology diffusion for the SDGs;
- contribute to UN system capacity building initiatives for technology diffusion;
- encourage new partnerships among IATT members on technology diffusion; and
- inform relevant inter-governmental forums, including the STI Forum and Financing for Development processes.

1.4 Process

The call for inputs was launched on 18 January 2026, followed by a dedicated briefing at the IATT's global coordination meetings and three reminders. The initial deadline for inputs was 23 April 2026, and was extended to 29 May 2026.

Inputs were submitted by the following IATT members, listed in alphabetical order:

FAO (Food and Agriculture Organization)

ITU (International Telecommunication Union)

UNCTAD (United Nations Conference on Trade and Development)

UNDESA (United Nations Department of Economic and Social Affairs)

UNECA (United Nations Economic Commission for Africa)

UNEP (United Nations Environment Programme)

UNESCO (United Nations Educational, Scientific and Cultural Organization)

UNFPA (United Nations Population Fund)

WIPO (World Intellectual Property Organization)

2. Compilation of IATT Inputs

2.1 FAO (Food and Agriculture Organization)

2.1.1 Major obstacles to international diffusion of technologies for the SDGs

1) Global investment in agrifood research and development (R&D) has slowed sharply over the past decade. Between 1980-2015, real agrifood R&D spending grew 2.7 percent annually, but dropped to 1.9 percent between 2015 and 2021.

2) The private sector accounted for nearly 50 percent of the global investment on agrifood R&D in 2021, up from around 32 percent in 1980. The dramatic decline in public sector R&D investments is concerning, as it is pivotal for agrifood systems transformation. 3) Further reductions in agrifood R&D investments are possible, as Member States allocate resources toward competing priorities such as defense. Public sector agrifood R&D financing delivers amongst the highest returns of any type of public investments.

4) Public financing is critically important for areas the private sector underinvests in (e.g. climate resilience, small-scale producers, nutrition, sustainability, public goods) and for driving productivity, reducing poverty and strengthening food security.

5) While the innovation pipeline consists of both mature and emerging innovations, there is a significant agrifood innovation access gap persisting for millions of farmers and food consumers globally, limiting progress on productivity, health and nutrition, sustainability and poverty.

6) National agricultural research systems may not effectively be leveraging the broader human, technical, infrastructure, institutional and financial innovative capabilities of all key stakeholders in the national innovation system.

7) Many existing mature technologies supported by robust evidence remain unavailable, unaffordable and/or un-adapted to local needs and contexts, lacking financial or business models for their scaling for impacts on food security.

8) Fragmented policies, limited technical capacity, underinvestment in R&D, and weak delivery systems continue to constrain development, adoption and scaling of agrifood innovations.

9) Systemic data, information and evidence gaps and limitations persist, hindering effective development, adoption and scaling for impact of agrifood innovations for food security. Behavioral, social and psychological barriers can also limit innovation uptake and impact.

10) Inclusive innovation can occur when robust evidence, context specific solutions, multilevel partnerships, inclusive value chain entrepreneurship, effective institutions, and improved innovation access are supported by an enabling policy environment.

11) For effective use of financial and other resources, it is necessary to continually measure and monitor what innovations (or innovation bundles) work best, and in what contexts or enabling environments. Improved data collection systems are critical for decision-making and resource allocation, along with improving monitoring, evaluation and learning systems (MEL).

2.1.2 Specific obstacles to the international diffusion of zero- and low-emission technologies

Renewable energy technologies are very useful in the context of zero- and low emission technologies. However, high investment cost and lack of technical expertise and access to these technologies are becoming obstacles for wider adoption. In addition, enabling policies are needed to ensure that these technologies are governed and applied for smallholder context to promote wider adoption.

2.1.3 Recommendations to enable the international diffusion of technologies for the SDGs

1. Adoption and scaling of technologies for sustainable agricultural development. Technologies are an important accelerator and enabler to make agrifood systems more efficient, inclusive, resilient and sustainable. However, the adoption and scaling of technologies requires long-term targeted finance.

2. Addressing risks and promoting equity, inclusion and access to technologies. The potential of digital technologies combined with other agricultural technologies should be better utilized to narrow digital divides in order to achieve the Sustainable Development Goals, while coordinated and more coherent global digital capacity development efforts are needed. Emerging technologies, including artificial intelligence, should be inclusive and serve all stakeholders, especially in the assessment of risks and opportunities to avoid exclusion.

3. Strengthening complementary enablers and policy frameworks for technology adoption and scaling. Complementary enablers including infrastructure, education, training, better science communication, foresight-driven technology exploration, testing, and scaling through technology hubs and knowledge-sharing platforms could improve adoption and use of technologies at scale. These efforts should ensure safety, acceptability, and gender and youth inclusion, and should bring low- and middle-income countries on board to avoid technological divides.

4. Promoting multi-stakeholder engagement and partnerships for development, adoption and scaling. Co-development processes, adoption and scaling require multi-stakeholder engagement through agricultural innovation systems. The involvement of key agricultural stakeholders, including ministries of agriculture, research and extension institutions, producers'

organizations and agripreneurs from the perspective of agricultural innovation systems is crucial for co-creation, adoption, scaling and sustainability of technological adoption.

2.1.4. Additional resources

FAO (2022). FAO Science and Innovation Strategy https://openknowledge.fao.org/server/api/core/bitstreams/e9d1ee6c-c0f1-4312-9a1a-c09ba0a4fbdc/content , FAO Publication.

2.2 ITU (International Telecommunication Union)

2.2.1 Major obstacles to international diffusion of technologies for the SDGs

The absence of essential digital infrastructure presents a significant obstacle to the diffusion of technologies, especially in low and lower-middle-income countries, restricting access to learning and economic opportunities. Digital infrastructure stands as a cornerstone for the digital economy and is linked with 70% of the Sustainable Development Goal (SDG) targets. However, according to the ITU's Digital Infrastructure Investment Initiative, an estimated USD 1.6 trillion is needed to close the digital infrastructure gap through 2030. Building the necessary digital infrastructure to achieve universal connectivity requires substantial investment, but challenges such as demand fragmentation, missing core infrastructure, and execution risks continue to deter it.

2.2.2 Specific obstacles to the international diffusion of zero- and low-emission technologies

Energy constraints affecting digital infrastructure
Type of technology and relevance to the SDGs:
Energy-efficient ICT networks, data centres and digital systems supporting SDGs 7, 9, 12 and 13.

Description of obstacles:
Deployment of low-emission digital infrastructure is constrained by limited access to reliable electricity, high energy costs and challenges in integrating renewable energy sources, particularly in developing countries.

Evidence or examples:
ITU work on green and climate-resilient ICT infrastructure identifies energy availability and grid reliability as major constraints to expanding broadband and digital services in underserved areas.

Impacts:
Energy constraints increase deployment costs, limit network coverage and slow the diffusion of low-emission digital solutions.

Limited adoption of standards-based low-emission technologies

Type of technology and relevance to the SDGs:

Energy-efficient network equipment, smart systems and Internet of Things (IoT) solutions relevant to SDGs 9, 11 and 13.

Description of obstacles:

Uneven awareness, capacity and participation in international standardization processes hinder adoption of energy-efficient and interoperable technologies.

Evidence or examples:

ITU standardization activities show that many developing countries face barriers to implementing relevant recommendations due to capacity and resource constraints.

Impacts:

Low uptake of standards increases lifecycle emissions, reduces interoperability and raises costs of deployment and maintenance.

Financing constraints

Type of technology and relevance to the SDGs:

Low-emission ICT infrastructure and digital climate solutions aligned with SDGs 7 and 13.

Description and impacts:

High upfront investment costs and limited alignment between digital infrastructure and climate finance frameworks restrict scaling and equitable access to low-emission technologies.

2.2.3 Recommendations to enable the international diffusion of technologies for the SDGs

Addressing these challenges requires maximizing the impact of traditional investments while also applying appropriate financing mechanisms and instruments. A collaborative approach that brings together the public sector. Development Finance Institutions (DFis), the private sector, and investors are crucial for fostering innovation, improving coordination, and ensuring transparency.

To this end, the ITU and UNCTAD launched the Digital Infrastructure Investment Catalyzer at FfD4, and as part of the SPA, to serve as a collaborative platform for UN agencies, Multilateral development banks (MDBs), investors, governments, private sector, and civil society to advance sustainable, bankable digital infrastructure investments.

2.3 UNCTAD (United Nations Trade and Development)

2.3.1 Major obstacles to international diffusion of technologies for the SDGs:

Infrastructure / computer and connectivity

Artificial Intelligence (AI) systems, including generative AI, rely on broadband networks, cloud services, semiconductors, data centres and supercomputers. These are foundational for AI-enabled public services, productivity, innovation and industrialization across SDGs 8, 9, 10 and 16, among others. A major obstacle is the pronounced "AI divide" in advanced computing infrastructure. Leading capacity in supercomputers and data centres is concentrated in a small number of countries, limiting the ability of many developing countries to adopt, adapt or develop AI.

The UNCTAD Technology and Innovation Report 2025 notes a "remarkable divide" in AI infrastructure components. The United States has around one third of the TOP500 supercomputers and more than half of overall computational performance. Data centres are also concentrated, with few developing countries hosting powerful supercomputers or large data centres beyond a small set, such as Brazil, China, India and the Russian Federation. The impacts include higher costs and dependence on external providers, as well as slower diffusion into SDG-relevant sectors. A critical challenge is the reduced ability to localize AI solutions to national contexts.

Market structure / concentration and governance

Foundation infrastructure, cloud platforms and AI services shape access to innovation across all sectors. Here, a major obstacle lies in market dominance by large multinational technology firms, characterized by "winner-takes-all" dynamics, which can allow a small set of actors to steer trajectories and capture rents. Commercial incentives may not align with inclusive SDG outcomes.

The report documents concentration in frontier-technology provision and corporate R&D, noting that only a small number of companies account for a large share of business R&D investment, while the main providers are concentrated in a few economies. The resulting impacts include barriers for latecomers, limited bargaining power for firms and users in developing countries, uneven diffusion, and the risk of widening inequalities both within and between countries.

Data access and quality

Training, validating and deploying AI requires large volumes of high-quality, diverse and unbiased data. Such data is typically unavailable in many developing countries and least developed countries, and funding for their near-future development is lacking. Data are therefore a critical socioeconomic asset, yet dynamic scale effects, whereby more users

generate more data and therefore better models, increase entry barriers and widen existing gaps.

UNCTAD TIR 2025 describes data as the primary input and emphasizes that quality and diversity are necessary for trustworthy systems, while scale effects can disadvantage latecomers. The consequences are lower model performance for underrepresented languages, contexts and experience; weaker public-sector and SME adoption; and risks to equity and inclusion.

Skills and absorptive capacity

The adoption and productive use of AI require skills ranging from basic data and digital literacy to advanced AI engineering expertise and practical experience in the application of AI in IT and other fields such as education, agriculture, R&D and finance. Many countries remain at an early stage of AI readiness and lack dedicated strategies and instruments to address AI-specific needs. Skills gaps therefore constrain both adoption and local innovation, particularly where AI is used as a foundational technology linked to other technologies.

These conditions reduce diffusion into SDG sectors, limit the capability to adapt AI responsibly and effectively, and increase the risk that benefits will accrue primarily where skills are already concentrated.

2.3.2 Specific obstacles to the international diffusion of zero- and low-emission technologies (AI-related)

Energy intensity of AI infrastructure

AI can support SDG 7 and SDG 13 through applications in energy-system optimization, including smart grids, storage management, forecasting, industrial efficiency and climate services. At the same time, AI's own energy demands create constraints on technology diffusion. Scaling AI requires data centres, supercomputers and reliable power. The report highlights that data centres account for around 1 per cent of global electricity demand in mid-year 2025, with demand likely to have increased substantially by mid-2026, and that AI is estimated to have substantial greenhouse gas emissions. AI can have an energy overhead of 10 to 40 per cent depending on many factors. Although AI can also enable efficiency-driven emissions reductions, the infrastructure burden remains a real constraint.

In contexts where grids are constrained or electricity costs are high, the operational feasibility of deploying AI for climate and energy applications is reduced. This can delay scaling in energy- and carbon-constrained settings.

Infrastructure gaps that matter more for energy-transition use cases

Many decarbonization applications require near-real-time data flows, combining IoT and AI, alongside robust connectivity and computational capacity for analytics and optimization. Yet the

"AI divide" in computational activities, and the limited ability to run data centres and high-speed data-handling networks, restrict the capacity of many energy-poor countries to deploy AI at scale.

This results in unequal diffusion of AI-enabled smart grids, demand response, predictive maintenance and system optimization. Productivity and efficiency gains that could reduce emissions are therefore likely to materialize more slowly in such countries than in energy-rich nations.

Data constraints for climate and energy applications

AI performance depends on the availability of high-quality data. For applications supporting energy transition and industrial transformation, data must be granular and reliable, and supported by interoperable systems and networked operators. TIR 2025 emphasizes that diverse, unbiased and high-quality data are essential, and that the interaction between data and AI can dynamically increase entry barriers for latecomers.

The result is a reduced ability to train and adapt predictive AI models to local contexts, ranging from industrial structures and systems development to weather patterns for agriculture. Weaker model trustworthiness and uneven access to AI further weaken potential decarbonization benefits.

Policy and governance fragmentation around AI

Deploying AI in critical infrastructure, including energy, transport and industry, requires governance frameworks that ensure accountability, transparency, safety and liability. However, TIR 2025 characterizes international AI governance as fragmented and stresses the need for deeper international cooperation.

This fragmentation raises the costs of cross-border solutions in areas such as compliance, security and accountability, leading to slower diffusion of AI for climate-relevant challenges.

2.3.3 Recommendations to enable the international diffusion of technologies for the SDGs (AI-focused, actor-led)

Build shared and scalable AI-readiness foundations (infrastructure, data, skills) as explicit priorities

Member States should lead through national digital, industrial and STI strategies, with support from UN entities, including IATT members, and development partners. The rationale is that UNCTAD TIR 2025 identifies infrastructure, data and skills as the three leverage points that determine countries' preparedness.

Establish shared digital public infrastructure (DPI) approaches for AI access and public goods

This should be led by UN system secretariats, Member States, and relevant technical agencies and partners. The report's policy takeaways propose shared digital public infrastructure, including a

possible global shared facility model analogous to CERN, in order to broaden access and reduce barriers linked to concentration.

Coordinate and harmonize open innovation resources to lower entry barriers

UN entities, research institutions and Member States, working with trusted technology innovation hubs, should take the lead. The report recommends better coordination of fragmented open-source AI resources, including interoperable repositories and common standards, to improve access while addressing quality and security needs.

Create or strengthen an international capacity-building and technology-transfer hub for AI

UN system secretariats and Member States should lead this effort, potentially modelling it on existing climate-technology cooperation mechanisms. The report's policy takeaways propose a global hub or network modelled on the United Nations Climate Technology Centre and Network to facilitate capacity-building, technical assistance and technology transfer to developing countries.

Promote accountability through AI disclosure and impact assessment frameworks

Governments and regulators, international standard-setting bodies, and industry should lead in this area. TIR 2025 proposes public disclosure mechanisms for AI systems, with ESG-like parallels, potentially moving from voluntary to mandatory reporting once standards are established, while also supporting trust and responsible diffusion.

Strengthen South–South and regional cooperation for diffusion and policy coherence

Developing-country governments, regional institutions and UN partners should play the leading role. The report highlights South–South collaboration through regional innovation hubs and expert networks, as well as the potential role of regional arrangements in sharing best practices and developing coherent AI policies.

2.3.4. Additional resources (from/explicitly referenced in the source)

UNCTAD (2025). Technology and Innovation Report 2025: Inclusive Artificial Intelligence for Development. United Nations Conference on Trade and Development, Geneva.

TOP500 (2024). TOP500 Supercomputer Rankings. Used to describe cross-country concentration in computational performance.

Data Center Map (2024). Referenced regarding geographic concentration of data centres.

European Commission, Joint Research Centre (2023). The EU Industrial R&D Investment Scoreboard. Evidence on concentration of global corporate R&D investment (top corporate R&D investors).

United Nations Economic and Social Council (2024). Impact of Artificial Intelligence on the Digital and Data Transformation in the Electricity Sector (ECE/ENERGY/GE.6/2024/3). Referenced

for estimates on AI, data centres, electricity demand, and potential emissions reductions from efficiency improvements.

2.4 UNDESA (United Nations Department of Economic and Social Affairs)

2.4.1 Major obstacles to international diffusion of technologies for the SDGs

UNDESA's work on SDG-critical technologies identifies the following cross-cutting obstacles that impede the international diffusion of technologies critical for achieving all the SDGs. While evidence is drawn primarily from energy, digital, health, agriculture, and transport technology domains, the obstacles identified reflect systemic barriers that cut across all SDG-relevant technology areas.

Persistent financing gaps and high cost of capital

Across SDG-critical technology domains — from renewable energy and digital infrastructure to health diagnostics, agricultural innovation, and transport systems — the most pervasive barrier is the persistent gap in access to affordable long-term finance. Many developing countries face high capital costs, elevated debt burdens, limited fiscal space, and restricted access to long-term finance. Financing costs alone can account for up to 40% of the levelized cost of electricity for solar projects in LDCs. Similar dynamics constrain investment in health technologies, precision agriculture, and digital systems in LDCs, LLDCs, and SIDS.

Limited absorptive capacity – Skills, institutions, and enabling conditions

Effective technology diffusion depends not only on technology availability but on the capacity of recipient countries to adopt, adapt, operate, and maintain technologies over time. Across SDG domains, weak absorptive capacity manifests as shortages of technical and vocational skills; inadequate standards and quality infrastructure for product certification and regulation; limited research capabilities to adapt technologies to local contexts; and underdeveloped supply chains and after-sales service networks. Evidence from national SDG implementation reviews documents clean technology abandonment rates of 20–40% within two years due to absent service networks — a pattern common across technology areas. Where absorptive capacity is weak, imported technologies are less likely to be sustained, replicated, or integrated into productive transformation strategies.

Intellectual property barriers and underuse of TRIPS flexibilities

Intellectual property (IP) protections, while essential to incentivize innovation, can in practice exceed what is necessary and limit diffusion, particularly in developing country contexts. This applies across sectors: pharmaceuticals and health technologies, agricultural biotechnology, renewable energy systems, and digital platforms. International agreements provide important

flexibilities — including compulsory licensing and government procurement provisions under TRIPS — but developing countries have systematically underused these mechanisms due to information gaps, limited legal capacity, and political pressure from trading partners. UNDESA analysis highlights that TRIPS technology transfer provisions have not produced the intended development impact, and that more deliberate approaches — including collaborative R&D, technology co-development, and co-ownership models — are required.

Institutional and governance fragmentation

A recurring obstacle across SDG technology domains is the fragmentation of institutional responsibility across ministries and levels of government without effective cross-sectoral coordination. National technology strategies, energy efficiency mandates, digital transformation plans, and agricultural extension programs frequently exist in policy silos that prevent integrated implementation. In many countries enacted policies are not implemented due to absent enforcement capacity, monitoring systems, and coordinating mechanisms. The UN E-Government Survey 2024 similarly identifies persistent gaps between national digital strategy and local government implementation capacity, creating last-mile barriers to equitable access to technology-enabled services across SDG domains.

Digital and enabling infrastructure deficits – A cross-cutting prerequisite

Effective diffusion of SDG-critical technologies — including smart energy systems, precision agriculture, e-health, and digital public services — depends on a foundation of reliable electricity, broadband connectivity, transport and logistics networks, standards and quality infrastructure, and capable public institutions. Where these foundations are weak, technologies may be imported but cannot be adapted to local needs, maintained over time, or integrated into productive transformation strategies. The UN E-Government Survey 2024 documents significant “last mile” gaps, with many local governments lacking the budgets, technical expertise, and infrastructure needed to operationalize digital services even where national platforms exist. AI governance deficits — including absent regulatory frameworks and public-sector skills gaps — are emerging as an additional barrier to diffusion of AI-enabled technologies across multiple SDG domains.

Supply chain fragmentation, geopolitical risks, and unilateral trade measures

Supply chains for frontier and clean technologies are concentrated in a small number of countries and firms, while access to critical minerals, key components, and specialized manufacturing capabilities remains deeply uneven. Export restrictions, regulatory divergence, and geopolitical tensions raise costs and reduce opportunities for developing countries to participate in higher-value production segments. UNDESA analysis highlights that these systemic risks have intensified since 2022, with industrial policy uncertainty compounding structural disadvantages facing LDCs and SIDS. Unilateral trade measures — including carbon border

adjustment mechanisms and domestic content requirements in major economies — risk further distorting technology access for countries without equivalent policy capacity to respond, slowing diffusion and raising the cost of the energy and SDG transition.

2.4.2. Specific obstacles to the international diffusion of zero- and low-emission technologies

Building on the cross-cutting obstacles identified above, UNDESA's experience in SDG7 implementation, national climate plans alignment, and climate-energy policies for low-carbon climate resilient development highlights the following obstacles that are specific to — or significantly intensified in — the context of zero- and low-emission energy technologies relevant to SDG7 and SDG13.

Renewable energy (solar PV, wind. Mini-grids)– Financing, Intellectual property and technology transfer barriers

Solar PV, wind energy, and decentralized mini-grid systems are directly relevant to SDG7 (affordable and clean energy) and SDG13 (climate action). The primary obstacle is the persistent cost of capital gap: in sub-Saharan Africa and Small Island Developing States (SIDS), project financing rates routinely exceed 15–20%, compared to 2–5% in OECD markets, reflecting risk perceptions that are often disproportionate to actual project performance. Currency risk and underdeveloped local capital markets compound this problem. IP protections on key components of renewable energy systems — including advanced solar cell designs, wind turbine control software, power electronics, and battery chemistries — constrain local manufacturing and adaptation in developing countries. The absence of compulsory licensing frameworks or IP transfer conditionalities in public climate finance limits LDCs' and SIDS' ability to develop domestic clean energy industries. Developing countries that have not made full use of available TRIPS flexibilities in the energy sector due to information gaps and political pressure. Falling unit costs of clean energy and growing energy security imperatives provide positive momentum but are insufficient on their own to overcome these structural constraints.

Clean cooking technologies – Policy, affordability, and last-mile delivery barriers

Clean cooking technologies — including improved biomass cookstoves, biogas systems, and electric cooking — are directly relevant to SDG7.1, SDG3 (health), and SDG5 (gender equality). Despite technology availability, approximately 2.1 billion people still rely on traditional biomass. Diffusion is constrained by import tariffs on equipment, inconsistent quality standards, the absence of subsidy mechanisms, and critically, absent supply chain and after-sales service infrastructure in rural areas. These barriers disproportionately affect rural women and girls and represent a specific SDG7 diffusion failure that general finance reforms alone will not resolve.

Energy efficiency technologies (building systems, industrial processes) – Institutional and governance barriers

Energy efficiency technologies—relevant to SDG7.3, SDG9, SDG11, and SDG12—face governance fragmentation as a primary obstacle. Responsibility is split across energy, construction, and industry ministries without effective cross-sectoral coordination. National energy efficiency action plans are frequently not reflected in building codes, procurement mandates, or utility tariff structures. In many countries enacted efficiency policies are not implemented due to the absence of enforcement capacity and monitoring systems, resulting in a persistent "efficiency gap" between technically feasible improvements and actual deployment rates.

Grid-scale storage and smart grid technologies – Infrastructure and technical capacity barriers

Battery storage, grid management software, and smart metering systems are critical enabling technologies for SDG7 and SDG9 (resilient infrastructure). Their diffusion is constrained by weak transmission and distribution infrastructure in many developing countries, which cannot accommodate variable renewable energy at scale without significant upgrades. Equally critical is the shortage of engineers and technicians with skills in grid modernization, power electronics, and energy management systems. In Pacific Island states, high shares of solar generation have been curtailed due to grid stability constraints rather than resource limitations, representing a significant lost opportunity for clean energy access and cost reduction.

Electric vehicles (EVs) and charging infrastructure – Market readiness, standards, and trade policy constraints

EVs are relevant to SDG7, SDG11 (sustainable cities), and SDG13. In developing countries, diffusion is constrained by high upfront cost premiums relative to internal combustion engine vehicles, limited EV-compatible grid infrastructure, and fragmented charging standards. National EV policy frameworks frequently lack provisions for second-life battery markets, end-of-life management, or domestic manufacturing incentives — creating long-term sustainability concerns that discourage adoption. Countries achieving rapid EV uptake have done so through demand-side subsidies and domestic content requirements that other countries are constrained from replicating due to trade agreement obligations, highlighting how trade policy asymmetries compound clean technology access gaps.

Digital infrastructure gaps as a compounding barrier to clean energy diffusion

The diffusion of zero- and low-emission energy technologies is increasingly dependent on digital infrastructure: data platforms for grid management and demand forecasting, satellite monitoring of emissions, AI-driven energy optimization, and interoperable digital public infrastructure for subsidy delivery and customer registration. The UN E-Government Survey 2024 and DESA analysis show that digital divides — in connectivity, data governance, and AI

regulatory capacity — directly compound clean energy access gaps, particularly in LDCs and SIDS. Countries without functioning digital public infrastructure face specific additional barriers in deploying smart grids, monitoring clean cooking programs on scale, or administering emissions-linked incentive schemes. Addressing digital infrastructure gaps must be treated as an integral component of clean energy technology diffusion strategies.

2.4.3.Recommendations to enable the international diffusion of technologies for the SDGs

In response to the mandate established in paragraph 59(q) of the Sevilla Commitment, UNDESA recommends the following evidence-based measures to accelerate international technology diffusion for the SDGs, with a focus on zero and low-emission, climate-energy technologies.

Reform concessional and blended finance instruments to systematically de-risk renewable energy and clean energy projects in LDCs and SIDS

Multilateral development banks (MDBs), bilateral development finance institutions (DFIs), and the Green Climate Fund should scale up first-loss guarantee instruments, local currency financing facilities, and risk-sharing mechanisms specifically designed for renewable energy, mini-grids, and clean cooking. Lead actors: MDBs, bilateral DFIs, GCF, and recipient country finance ministries. UNDESA recommends that the Technology Facilitation Mechanism (TFM) facilitate peer exchange on effective de-risking models, drawing on documented successes from existing programs.

Integrate mandatory technology transfer provisions into climate and development finance conditionalities

Publicly funded research and procurement of clean energy technologies should include technology transfer obligations, including local manufacturing requirements, IP licensing commitments, and joint R&D provisions. The IATT, co-convened by UNDESA and UNCTAD, is well-positioned to develop guidance on how trade and IP frameworks can be better aligned with SDG7 and Paris Agreement technology objectives, including recommendations for reform of TRIPS flexibilities as applied to clean energy technologies.

Strengthen national policy and regulatory enabling environments for energy transition technologies

Countries should be supported to develop integrated national energy transition roadmaps that align NDCs, national SDG7 targets, and long-term low-emission development strategies (LT-LEDS) within a single policy framework. This includes enacting fit-for-purpose regulatory frameworks for clean cooking, storage, green hydrogen, and EVs. UNDESA experience supporting Voluntary National Reviews demonstrates that countries with integrated SDG-climate policy frameworks deploy clean energy technologies at meaningfully faster rates than those with fragmented approaches.

Scale up regional and South-South technology cooperation platforms

Regional technology cooperation mechanisms and bilateral South-South clean energy partnerships—should be systematically supported and expanded. These platforms reduce the cost of knowledge transfer, enable adaptation of technologies to local contexts, and build domestic technical capacity. A dedicated knowledge-sharing facility under the TFM can also be considered to catalogue and disseminate replicable models for clean energy technology deployment drawn from developing country experience.

Invest in human capital and institutional capacity for clean energy technology deployment

Targeted investment in TVET (technical and vocational education and training) and university-level programs in renewable energy engineering, grid modernization, and energy management is essential to close technical capacity gaps. Donors and MDBs should condition a portion of energy sector financing on workforce development components. This is directly linked to SDG4 (quality education) and SDG8 (decent work), reinforcing the cross-SDG synergies that are central to integrated policy and implementation of SDGs.

Reassess the global innovation system for development needs and global public goods

The current international innovation system — including IP frameworks, R&D incentive structures, and multilateral financing mechanisms — requires reassessment to better serve global development needs and the production of global and regional public goods. UN DESA's Economic Analysis and Policy Division recommends better use of existing TRIPS flexibilities in developing countries, where information gaps and political pressure have historically suppressed their use despite legal availability. Collaborative R&D models, technology co-development and co-ownership arrangements, and clean technology solutions explicitly designed to build resilience in vulnerable communities should be actively supported. Given the global positive externalities of clean energy adoption in developing countries — in the form of mitigation and avoided emissions — there is a strong case for a revitalized multilateral mechanism to accelerate this transition.

Build shared interoperable digital public infrastructure as a foundational investment for technology diffusion

Countries should invest in whole-of-government digital public infrastructure (DPI) — covering digital identity, payment systems, data exchange, and secure cloud platforms — as a foundational enabler for deploying SDG-critical technologies, including clean energy monitoring systems, subsidy delivery, and climate data platforms. This requires moving from fragmented pilot projects to coherent national approaches. Financing should be targeted to the weakest links — especially local governments in LDCs, LLDCs, and SIDS — supporting not only initial deployment but maintenance, cybersecurity, and long-term resilience. International

cooperation should promote open standards, digital public goods, AI regulatory coherence, and South-South and triangular cooperation.

2.4.4. Additional Resources

FFD4 (2025). *Sevilla Commitment (Compromiso de Sevilla), Fourth International Conference on Financing for Development*. Available at: https://www.un.org/ffd/ffd4

IEA, IRENA, UN, World Bank, and WHO (2025). *Tracking SDG7: The Energy Progress Report*. Available at: https://trackingsdg7.esmap.org/

IRENA (2024). *World Energy Transitions Outlook 2024: 1.5°C Pathway*. Available at: https://www.irena.org/Publications/2024/World-Energy-Transitions-Outlook-2024

ITU (2025). *Measuring Digital Development: Facts and Figures 2025*.

SEforALL (2023–2024). *Clean Cooking Data Hub and Country Action Agendas*. Available at: https://www.seforall.org/data/clean-cooking

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UN DESA (2024). "United Nations E-Government Survey 2024". Available at: https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2024

UN DESA / UN E-Government Knowledgebase (n.d.). *E-Government Development Index (EGDI) Data Center*.

UN DESA / UN E-Government Knowledgebase (n.d.). *Local Online Service Index (LOSI)*.

UNDESA and DSDG (2024). "Synergies between SDG7 and Nationally Determined Contributions: Evidence from Asia-Pacific Countries". Available at: https://sdgs.un.org/publications

UNESCAP (2024). *Asia-Pacific SDG Progress Report*. Available at: https://www.unescap.org/kp/2024/asia-pacific-sdg-progress-report-2024

UNFCCC Technology Mechanism (2023). *Technology and Climate Change: Accelerating Solutions for Action in Developing Countries*. Available at: https://unfccc.int/ttclear

United Nations (2023). *Global Roadmap for Accelerated SDG7 Action in Support of the 2030 Agenda for Sustainable Development and the Paris Agreement*. Available at: https://sdgs.un.org/topics/energy

World Bank and ESMAP (2019, updated 2022). *Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers*. Available at: https://www.esmap.org/mini-grids-for-half-a-billion-people/

2.5 UNECA (United Nations Economic Commission for Africa)

2.5.1 Major obstacles to international diffusion of technologies for the SDGs

Smart agriculture tools—such as precision input application and data-driven farming—reduce input costs and increase yields, demonstrating that ICT tools can lower production costs while enhancing food security. For example, farmers in Kenya who used soil data platforms and digital weather forecasts increased their maize yields by 15% while reducing fertilizer costs by 20% (IFAD). In Nigeria, access to e-extension services upgraded 26 extension centers with ICT tools, ultimately reaching 140,000 beneficiaries (World Bank, 2020). These examples highlight the crucial role of such technologies in achieving the SDGs, particularly Goals 2, 8, 12, and 13.

However, several obstacles—including digital skills gaps, limited internet access, and inadequate technical support—affect the effectiveness of technology adoption in the agriculture sector. Consider the Esoko platform, launched in Ghana in 2005 to provide farmers with direct access to weather updates, market prices, and agronomic advice via their mobile phones. Leveraging frontier technologies such as mobile communications, cloud-based data analytics, and SMS-based information delivery, Esoko aimed to empower smallholder farmers by increasing their bargaining power while reducing harvest losses. The platform harnessed mobile connectivity to disseminate real-time market and weather data and used digital tools for two-way communication and feedback between farmers and extension agents, ensuring timely access to critical agricultural information.

Despite promising uptake in the initial stages, farmers' long-term engagement remained very low. In Northern Ghana, 81.4% of farmers were aware of the digital services available, but only 12.1% consistently used them. The primary reasons were low digital literacy, limited internet access, and inadequate technical support. These obstacles impede the adoption and expansion of farming technology by preventing farmers from learning about and trusting the technology. Furthermore, such impediments perpetuate inequality, as farmers with higher levels of connectivity and education adapt more quickly to technological innovations than those in rural settings. Unsustainable financing also led to financial deficits once donor support was withdrawn; platforms struggled to generate sufficient revenue from farmers who were either unwilling or unable to pay for SMS-based services.

Nevertheless, opportunities exist to create a digitalization pathway for smallholders that is sensitive to the current and future structural limitations of smallholder agriculture—including low literacy and limited access to digital tools—to ensure that agricultural digitalization reaches its full potential in Africa.

2.5.2. Specific obstacles to the international diffusion of zero- and low-emission technologies

Technologies such as small-scale solar and off-grid systems have increased affordability in the energy sector by bypassing large, centralized energy infrastructures. Small-scale solar and off-grid systems reduce rural electrification costs by up to 70% compared to conventional transmission expansion (IEA, 2022). In South Africa, a smart metering pilot demonstrated cost-saving potential by installing 3,500 cloud-hosted smart meters, resulting in a reduction of electricity distribution losses from 26% to 6% (South African Local Government Association). Easy Solar has provided solar energy and life-enhancing products to over one million people in Sierra Leone and Liberia, saving 10,000 tons of CO_2 annually. The company operates more than 150 sales points, employs nearly 1,000 people, and generates 250 MWh of clean energy, highlighting the significant role of such technologies in achieving the SDGs, particularly Goals 7, 9, 12, and 13.

However, challenges—including poor maintenance, weak business models, lack of technical support, and insufficient financial sustainability—affect the impact of technology adoption in the energy sector. For instance, the Mpanta solar mini-grid in Zambia is a well-documented case showing how a successful pilot project could not maintain its operation in the long run. The project, a 60 kW solar mini-grid launched in 2013, initially succeeded in delivering power to rural residents and companies but ultimately became unsustainable and non-operational due to governance, financial, and operational obstacles. Although recognized as a success story and one of the first community-established mini-grids in Zambia, the project could not maintain continuous power service provision.

This case highlights wider problems related to mini-grids in Zambia and across Africa, including a lack of financial and technical sustainability. Such obstacles undermine reliance on off-grid energy solutions, slowing diffusion and scaling while disproportionately limiting equitable access for low-income rural communities that depend most on these technologies.

2.5.3.Recommendations to enable the international diffusion of technologies for the SDGs

Strengthening governance of frontier technologies:

The governance of frontier technologies should maximize their benefits while minimizing associated risks, taking into account each country's national plans, priorities, and aspirations. This involves establishing responsive legal, regulatory, and administrative frameworks, along with strong institutions to oversee their implementation.

Harnessing partnerships to advance frontier technologies:

Partnerships are vital for gaining access to resources (funding, talent, and infrastructure), sharing the risks of failure, and navigating complex market entry rules. As the costs of research and development, infrastructure, and technology acquisition increase, partnerships between countries, businesses, and academia are expanding.

Promoting research and development, innovation, and entrepreneurship:

Africa needs to grow its research and development base by increasing funding, creating centers of excellence in frontier technology development and adaptation, and improving the policy and regulatory environment for commercializing, seeding, and attracting technology startups (which in turn drives R&D investment).

De-risking investment in frontier technologies:

Investing in frontier technologies entails considerable risk, particularly during the early stages of research and development. These risks are especially pronounced for smaller firms and startups, which often lack the financial resilience to absorb potential losses.

Building human capital for the future:

Efforts to broaden access and enhance performance are urgently needed to empower the population—especially youth and women—with the technology, entrepreneurial, creative, and problem-solving skills required to use, design, and produce knowledge products.

Investing in hard and soft infrastructure:

Accelerating the adoption of frontier technologies will require substantial investment in both hard and soft infrastructure at the national and regional levels.

2.5.4. Additional Resources

ECA (2026). Growth through innovation: harnessing data and frontier technologies for Africa's economic transformation, https://repository.uneca.org/entities/publication/e06ada07-a490-43bf-a1a7-d53a1c6b2e89 , ECA Publication.

2.6 UNEP (United Nations Environment Programme)

2.6.1 Major obstacles to international diffusion of technologies for the SDGs

Drawing on recent work of Scientific and Technical Advisory Panel (STAP) on emerging technologies, four major obstacles stand out.

Weak enabling systems for digital, clean, and environmental technologies.

Technologies such as distributed renewables, electric mobility, green hydrogen, digital MRV, geospatial monitoring, traceability systems, FinTech, and blockchain-enabled platforms can support decarbonization, transparency, resource efficiency, financial inclusion, and ecosystem management. However, diffusion is often constrained by weak infrastructure, unreliable connectivity, fragmented data systems, limited interoperability, insufficient technical skills, and inadequate long-term operation and maintenance capacity (STAP, 2026; UNCTAD, 2025). STAP found that these underlying requirements are often underestimated, especially for data-intensive systems. This is particularly relevant to SDGs 7, 8, 9, 10, 11, 12, 13, 14, and 15.

Institutional, governance, and regulatory fragmentation.

Technologies relevant to the SDGs often require clear mandates, standards, safeguards, data governance, trusted verification systems, and cross-sector coordination. These elements are frequently weak or fragmented, especially where technologies cut across finance, environment, industry, and public services (OECD, 2024; STAP, 2026). For example, blockchain can support supply-chain transparency, carbon-credit tracking, and environmental accountability, but its uptake is constrained by regulatory complexity, trust deficits, weak institutional readiness, and unresolved data-governance issues (Fatima & Carè, 2026; OECD, 2024). This is particularly relevant to SDGs 6, 7, 8, 9, 12, and 13.

Finance and pilot-to-scale constraints.

Many promising technologies remain stuck at the pilot or demonstration stage because of high upfront costs, weak risk-sharing mechanisms, limited long-term finance, and uncertain business models (GEF IEO, 2025; STAP, 2026). This is especially relevant for clean industrial technologies, green hydrogen, circular systems, digital monitoring, and green FinTech. For example, Fatima and Carè (2026) note that global FinTech funding fell from USD 92 billion in 2021 to USD 30 billion in 2023, while the SDG financing gap in developing countries has widened substantially, limiting the scaling of inclusive digital finance and sustainability applications. This is particularly relevant to SDGs 7, 8, 9, 12, and 13.

Unequal access, limited evidence, and dependency risks.

International technology diffusion is also constrained by unequal access to data, finance, skills, digital infrastructure, and intellectual property (Byrne & Ockwell, 2013; UNCTAD, 2025). Technologies may benefit better-resourced actors while excluding small firms, smallholders, women, Indigenous Peoples, and low-capacity countries. A key additional obstacle is weak evidence on real-world outcomes: recent evidence shows that many claims about the transformative role of emerging technologies still rest on projected benefits rather than robust empirical evidence (Fatima & Carè, 2026). This limits informed investment, weakens policy confidence, and increases the risk that diffusion reproduces dependency, vendor lock-in, or uneven access rather than equitable SDG progress (Fatima & Carè, 2026; Florin, 2023; STAP, 2026). This is particularly relevant to SDGs 1, 5, 8, 10, 11, 16, and 17..

2.6.2. Specific obstacles to the international diffusion of zero- and low-emission technologies

Drawing on STAP's recent work on emerging technologies, four specific obstacles affect the international diffusion of zero- and low-emission technologies.

Weak enabling infrastructure and system readiness.

Zero- and low-emission technologies—such as distributed renewables, battery storage, electric mobility, smart grids, green hydrogen, renewable-powered desalination, green ammonia, and low-carbon industrial processes—are highly relevant to SDGs 6, 7, 9, 11, 12, and 13. Their diffusion is often constrained by inadequate grid infrastructure, weak transmission and distribution systems, limited charging and storage infrastructure, water and land constraints, and insufficient operation and maintenance capacity (STAP, 2026; UNEP, 2025). STAP's recent analysis of case studies on smart grids, electric mobility, and clean hydrogen shows that technology deployment depends on supporting infrastructure, planning systems, regulatory readiness, and long-term institutional ownership—not on hardware alone (STAP, 2026). These constraints slow diffusion and can limit uptake to better-resourced countries, cities, or firms.

Policy, regulatory, and standards gaps.

Many low-emission technologies require clear policy signals, standards, certification systems, procurement rules, and safeguards. For example, green hydrogen, green ammonia, low-carbon cement, digital MRV, and battery value chains depend on credible standards for emissions accounting, safety, sustainability, transaction integrity, and environmental performance (OECD, 2024; STAP, 2026). Without harmonized standards and regulatory clarity, countries face uncertainty about technology choices, and investors delay commitments, leading to persistent and debilitating fragmentation of markets for low-emission products. This is particularly relevant to SDGs 7, 9, 12, 13, and 17.

Financing and barriers to scaling.

Zero- and low-emission technologies often involve high upfront costs, uncertain revenue models, immature supply chains, and perceived technology risks, creating significant obstacles to moving them from the pilot stage to widespread adoption and commercial scale. This is especially acute for green hydrogen, industrial decarbonization, advanced storage, circular materials, and low-emission transport systems. STAP observed that many promising technologies remain concentrated in pilots or demonstrations because long-term finance, risk-sharing instruments, bankable project pipelines, and market-creation policies are insufficient (GEF IEO, 2025; STAP, 2026). This limits scaling and makes access more difficult for least developed countries, small island developing states, and lower-capacity municipalities. This is particularly relevant to SDGs 1, 7, 8, 9, 10, 11, 12, 13, and 17.

Environmental, equity, and supply-chain risks.

Low-emission technologies can reduce emissions while creating new pressures, including critical mineral demand, land and water use, battery waste, brine discharge, pollution risks, and rebound effects (Florin, 2023; STAP, 2026). They can also create dependency on imported technologies, proprietary systems, or concentrated suppliers. Without lifecycle assessment, safeguards, local capacity-building, and inclusive business models, diffusion may deepen inequalities or shift environmental burdens to countries and communities with weaker bargaining power. This is particularly relevant to SDGs 8, 10, 12, 13, 15, and 17..

2.6.3.Recommendations to enable the international diffusion of technologies for the SDGs

STAP's experience suggests that the international diffusion of technologies for the SDGs should be approached as a systems, governance, and capacity-building challenge—not only as a technology-transfer challenge. STAP identified four recommendations that, if implemented correctly, could help enhance and accelerate the diffusion of technologies for the SDGs.

Build enabling systems before and alongside technology deployment.

National governments, with support from UN entities, multilateral development banks, GEF agencies, and development partners, should prioritize the infrastructure and institutional conditions that allow technologies to function and scale. The required infrastructure and conditions include reliable connectivity, interoperable data systems, digital public infrastructure, technical skills, maintenance capacity, and long-term hosting and ownership arrangements. This is particularly relevant for digital MRV, geospatial monitoring, distributed renewables, electric mobility, green hydrogen, traceability platforms, and blockchain applications linked to SDGs 7, 8, 9, 10, 11, 12, 13, 14, and 15. Evidence from multiple sources shows that infrastructure, data, and skills are often binding constraints on effective technology use, especially in developing countries (STAP, 2026; UNCTAD, 2025).

Strengthen anticipatory governance, standards, and safeguards.

Governments, standard-setting bodies, UN agencies, and regional organizations should support clear regulatory frameworks, technology standards, data governance rules, environmental and social safeguards, and accountability mechanisms. This is essential for technologies such as AI, digital finance, blockchain, digital MRV, green hydrogen, low-carbon materials, and environmental monitoring systems. OECD guidance emphasizes that governance must keep pace with rapidly evolving technologies through foresight, stakeholder engagement, agile regulation, and international cooperation (OECD, 2024). Safeguards should address data protection, algorithmic bias, cybersecurity, surveillance risks, lifecycle impacts, and equity.

Move from pilots to scalable, financeable pathways.

International financial institutions, climate and environment funds, governments, and private investors should use blended finance, guarantees, innovation windows, procurement, risk-sharing instruments, and market-creation policies to help promising technologies move beyond demonstration. Evidence from the Global Environment Facility Independent Evaluation Office (GEF IEO) and STAP shows that many technology applications remain trapped at the pilot stage without sustained finance, policy alignment, and scaling pathways (GEF IEO, 2025; STAP, 2026). This is particularly important for clean industrial technologies, circular economy systems, low-emission transport, renewable mini-grids, storage, and green hydrogen.

Prioritize equity, local capacity, and evidence of outcomes.

UN entities, governments, research institutions, and implementing agencies should invest in local innovation systems, South–South cooperation, open and interoperable knowledge platforms, and participatory approaches involving women, youth, Indigenous Peoples, local communities, small firms, and smallholders. Technology diffusion should build domestic capabilities rather than deepen dependency on imported proprietary systems (Byrne & Ockwell, 2013). Finally, technology initiatives should include monitoring, learning, and longitudinal evaluation, since recent evidence shows that claims about SDG impact often remain stronger than demonstrated outcomes (Fatima & Carè, 2026).

2.6.4. Additional Resources

Byrne, R., & Ockwell, D. (2013). Low carbon development, poverty reduction and innovation system building. Sussex Energy Group, SPRU.

Fatima, R., & Carè, R. (2026). Exploring the role of emerging technologies in advancing sustainable development goals (SDGs) in developing countries: A comprehensive review. Current Opinion in Environmental Sustainability, 79, 101606. https://doi.org/10.1016/j.cosust.2026.101606

Florin, M.-V. (Ed.). (2023). Ensuring the environmental sustainability of emerging technologies. EPFL International Risk Governance Center.

Global Environment Facility Independent Evaluation Office (2025). Integration for greater impact: Eighth comprehensive evaluation of the GEF. Global Environment Facility. Washington D.C.

OECD (2024). Framework for anticipatory governance of emerging technologies. OECD Publishing.

Scientific and Technical Advisory Panel (2026). Emerging technologies and the GEF: A STAP information note. Scientific and Technical Advisory Panel (STAP) of the Global Environment Facility. Washington, DC.

UNCTAD (2025). Technology and innovation report 2025: Inclusive artificial intelligence for development. United Nations.

UNEP (2025). Global Environment Outlook 7: A future we choose. United Nations Environment Programme.

2.7 UNESCO (United Nations Educational, Scientific and Cultural Organization)

2.7.1 Major obstacles to international diffusion of technologies for the SDGs

A major obstacle to the international diffusion of advanced technologies for the SDGs is **unequal access to scientific infrastructure and equipment**, particularly in developing countries. Many technologies, such as **synchrotron radiation facilities, advanced microscopy, or quantum computing platforms**, require costly infrastructure and highly specialized environments. This limits their availability and creates structural dependency on a small number of countries, restricting broader participation in knowledge production.

A second key challenge relates to **technical and engineering capacity gaps**. Even when access to infrastructure is possible, the lack of trained personnel to operate, maintain, and adapt technologies locally significantly constrains their effective use. This is particularly evident in fields requiring advanced data analysis, calibration, and maintenance expertise.

A third obstacle is **the fragmentation of information and limited visibility of existing capacities and needs**. In many cases, infrastructure exists but is underutilized due to the absence of mechanisms to connect it with potential users. The lack of a structured, global overview of available facilities and corresponding research needs limits opportunities for sharing

infrastructure and building effective partnerships. In response, **UNESCO is currently developing a global mapping of scientific infrastructure and needs, including a database and platform designed to facilitate matching between available capacities and user demand across regions**.

UNESCO's experience illustrates these challenges. Through its **Remote Access to Lab Equipment initiative, researchers in Africa and crisis-affected regions** have been able to access equipment such as X-ray diffractometers and high-performance computing remotely. While this approach helps mitigate infrastructure gaps, it also highlights persistent barriers related to connectivity, training, and sustained collaboration.

Lastly, international technology diffusion and capacity-building efforts frequently fail because investments are driven by global market trends rather than empirical evidence of a recipient country's baseline needs. Funding is heavily skewed toward profit-driven applications (e.g., generative AI models or applications) while neglecting the "foundational enablers" of a strong AI ecosystem—namely, secure digital infrastructure, local talent pipelines, and robust regulatory frameworks and supervisory capacities. This reactive, "gap-filling" approach to financing misallocates resources and prevents the sustainable deployment of AI. Assessments conducted using UNESCO's *Readiness Assessment Methodology (RAM)* under the *Recommendation on the Ethics of AI (2021)*—implemented in over 75 countries reveal persistent deficits in governance structures and public R&D spending. For instance, without targeted investments in foundational frameworks, emerging economies remain unprepared to ethically govern or scale imported AI applications, leading to underutilization and ethical risks. This uneven investment pattern exacerbates global economic disparities and widens the AI readiness divide. It leaves lower-income regions reliant on external solutions that are ill-suited to local contexts, thereby reducing global competitiveness and diminishing technological sovereignty in the Global South.

These obstacles collectively limit the scaling, adaptation, and equitable access to technologies, slowing progress towards SDGs related to health, climate, and innovation.

2.7.2. Specific obstacles to the international diffusion of zero- and low-emission technologies

Zero- and low-emission technologies face additional, more specific challenges linked to their **systemic and infrastructure-dependent nature**. These technologies, such as renewable energy systems, energy storage solutions, and advanced materials, often require integration into existing national systems (e.g. energy grids), which may not be sufficiently developed or adaptable in many countries.

A major obstacle is the **high upfront investment and long-term financing requirements**, combined with limited access to risk-sharing mechanisms. This constrains adoption, particularly in countries with limited fiscal space.

Another key barrier is the **need for local adaptation and contextualization**. Technologies developed in one context often require significant modification to be effective in different environmental, economic, or regulatory settings. This requires local research capacity and engineering expertise, which are often insufficient.

Capacity gaps are again critical, particularly in areas such as **data analysis, system optimization, and maintenance of complex systems**. Without these, even deployed technologies may not function effectively or sustainably.

UNESCO's work in capacity-building, including training on advanced analytical techniques and access to high-performance computing and AI tools, demonstrates that strengthening **human capital and technical expertise** is essential to support the uptake and long-term sustainability of such technologies.

These challenges affect not only diffusion but also the **long-term reliability and scaling** of zero- and low-emission solutions, which are central to achieving climate-related SDGs.

2.7.3. Recommendations to enable the international diffusion of technologies for the SDGs

To address these obstacles, a combination of **infrastructure sharing, capacity-building, and strengthened international cooperation mechanisms** is required.

First, promoting **shared access to scientific infrastructure**, including through remote access models, can significantly reduce barriers to entry. Initiatives such as UNESCO's Remote Access to Lab Equipment demonstrate how existing facilities can be leveraged globally to support research and innovation in under-resourced regions.

Second, there is a need to invest in **long-term capacity-building**, focusing not only on training researchers but also on developing technical and engineering expertise required for operating, maintaining, and adapting technologies locally. This should be supported by sustained partnerships between institutions in different regions.

Third, UNESCO is actively advancing a **global mapping of scientific infrastructure and needs**, supported by a dedicated database and online platform. This mechanism is designed to improve visibility of available equipment and expertise, facilitate **direct matching between research needs and existing capacities**, and support more efficient and equitable use of global scientific resources. Scaling such platforms and ensuring their uptake by Member States and institutions will be critical to overcoming fragmentation and unlocking collaboration opportunities.

Fourth, strengthening **international collaboration frameworks**, including mobility schemes, joint research programmes, and co-development approaches, is essential to move beyond one-way technology transfer towards more balanced and sustainable partnerships.

Lastly, transitioning from fragmented financing to evidence-based investment strategies. International funding for AI and digital technology diffusion must be preceded by comprehensive, localized diagnostics, leveraging tools such as UNESCO's Readiness Assessment Methodology (RAM). By pinpointing precise deficits in digital infrastructure, talent, and regulatory systems, countries and donors can prioritize investments in foundational enablers rather than just end-use applications, maximizing resource allocation and ensuring long-term sustainability. With participation of multilateral Development Banks (e.g., World Bank, CAF), bilateral technology donors, national finance and ICT ministries, and the UN system, this recommendation directly responds to the FFD4/Sevilla Commitment (para. 59(q)) by ensuring financing for technology diffusion is effectively targeted to close structural gaps, supporting SDG 10 (Reduced Inequalities) and advancing inclusive public-private partnerships (SDG 17).

2.7.4. Additional Resources

UNESCO Global AI Ethics and Governance Observatory, Global Hub:
https://www.unesco.org/ethics-ai/en/global-hub

2.8 UNFPA (United Nations Population Fund)

2.8.1 Major obstacles to international diffusion of technologies for the SDGs

Type of technology and relevance to the SDGs:
Interoperable digital health systems (e.g., beneficiary management and telemedicine), Digital Public Infrastructure (including digital civil registration systems), and digitally-enabled civic and social platforms. This includes global digital public goods (DPGs), which can underpin and accelerate each of the prior categories. These are critical for achieving SDG 3 (Health), SDG 5 (Gender Equality), SDG 10 (Reduced Inequalities) and SDG 16 (Peaceful and Inclusive Societies).

Brief description of obstacles:
UNFPA recognizes that the international diffusion of technology is hampered by vast macroeconomic barriers, such as the North-South digital divide, unequal access to foundational ICT infrastructure, and severe hardware deficits in lower-income countries. Nonetheless, this submission focuses specifically on the structural obstacles that intersect directly with our

mandate to advance sexual and reproductive health and rights (SRHR) and to end gender-based violence and harmful practices.

The primary obstacles are the pervasive threat of Technology-Facilitated Gender-Based Violence (TFGBV) - including surveillance and coercive control via digital health systems, non-consensual exposure of sensitive health and identity data, coordinated online harassment and gendered disinformation – and more structural forms such as the gender digital divide. TFGBV is an act of violence committed, assisted, or aggravated through digital means against a person on the basis of their gender. Furthermore, the gender digital divide results from unequal connectivity, a lack of digital literacy, prohibitive device costs and a reluctance in uptake and use of technology as a result of a fear for safety.
Crucially, the equitable diffusion of digital platforms is actively hindered by the underlying economic model of the technology sector. The current algorithmic prioritization of engagement and outrage - which frequently amplifies harmful and gender-based violent content - is highly profitable. Since tech gatekeepers are financially incentivised to maintain this model, many digital spaces remain hostile to women, girls and minorities. Indeed, safety concerns are consistently cited as one of the top three barriers preventing women from accessing mobile internet.[1] [2] At the structural level, this is further compounded by the structural terms on which digital infrastructure is reaching LMICs. There are documented cases of technology companies trading investment in digital infrastructure with access to data – including sensitive health data – to increase market share and profit[3].

The collection and monetization of personal data generated in these contexts represents a lucrative and largely unregulated transfer of value from some of the world's most underserved populations to the world's wealthiest companies. This dynamic risks trapping developing nations in cycles of technological dependency and potentially putting them in a position to trade their citizens' data sovereignty for basic digital infrastructure. Ensuring that LMICs are not forced into this dichotomy must become a core concern of any financing architecture promoting equity and the *Leave No One Behind principle*.

Another key obstacle is that in many cases gender inequity is embedded in how technologies are designed. The most consequential design decisions occur at the earliest stages of technology development, such as at the level of large language models (LLMs), training datasets, algorithmic architectures and the foundational assumptions that structure all

[1] UNFPA. (2021) “Making All Spaces Safe”.

[2] UNFPA (2024). “A Safe Digital Future”.

[3] https://gh.bmj.com/content/9/2/e014131

downstream applications. When these systems are built without the meaningful participation of women and girls, including those facing multiple and intersecting forms of discrimination, the resulting technologies encode the blind spots, priorities and biases of a narrow group of developers that are not representative of all users, and potential users. This initial entry point is where inequities are institutionalized, and subsequently scaled. The same economic incentives that favour engagement-driven amplification of harmful content also discourage the investment required to build inclusive training datasets and representative development teams since neither generate immediate profit. Addressing gender inequity in technology diffusion therefore requires intervention at this primary tier, rather than only second and third tier solutions. The principle of "equity by design", as advanced by the UNFPA Equity 2030 Alliance,[4] holds that inclusion must be a structural condition of technology from its conception and development rather than just a corrective measure after deployment. Technologies must be designed with, by and for all women and girls if they are to serve rather than exclude the most marginalized. This would enable greater technology diffusion by directly serving a wider audience, particularly women and girls facing multiple and intersecting forms of discrimination in LMICs.

As also outlined in *UNFPA's Digital Strategy 2026-2029*, there is also a profound risk that rapid technological advancements will disproportionately disadvantage developing countries and continuously widen the digital divide if deployed unevenly. This is particularly true without concurrent investments in human capital and building organizational "*digital dexterity*" - the readiness and capability of individuals and organizations to effectively embrace and deploy new technologies.[5]

Evidence or examples:

TFGBV is a crisis-level global megatrend. Research indicates that 38% of women globally with internet access have personally experienced online violence, and 85% have witnessed it. Adolescent girls are particularly vulnerable, with 58% reporting online harassment ranging from abusive language to threats of sexual and physical violence.[6] The rapid proliferation of digital tools often outpaces the establishment of internal data governance frameworks and security controls required to protect this highly sensitive programmatic data. [7] As such, digital health platforms are increasingly being misused as tools of intimate partner surveillance and

[4] UNFPA Equity 2030 Alliance

[5] UNFPA (2025) "Digital Strategy 2026-2029"

[6] "Making All Spaces Safe" (2021). p.19, p.21

[7] UNFPA (2025) "Digital Strategy 2026-2029"

reproductive coercion, with documented cases of perpetrators monitoring women's health-seeking behaviours and deterring access to sexual and reproductive health services.[8]

The need for and use of technological health solutions, including frontier technologies, is exponentially growing. **As women are underrepresented in data sets used to inform solutions development,** algorithms erroneously amplify male data, making women proportionally small and their concerns virtually invisible: [9] [10]

- The Institute for Health Metrics and Evaluation at the University of Washington developed a Sex Differences Visualization Tool that systematically maps sex differences across health outcomes and geographies. By quantifying and clearly visualizing these disparities, the tool can drive targeted, evidence-based policy and resource allocation.[11]
- 85% percent of AI projects are estimated to deliver erroneous outcomes due to bias in data, algorithms, or the teams responsible for managing them.[12]
- Out of 133 AI systems studied, 44.2% demonstrated gender bias, and 70% resulted in lower quality of service delivery for women and non-binary individuals.[13]
- Women represent only 20% of employees in technical roles in major machine learning companies, 12% of AI researchers and 6% of professional software developers.[14]
- Self-regulation has not delivered structural change, and digital bias remains largely unmapped.

There are significant gender equity gaps in investments and funding to both research and development on women's health and inclusive technology. Since 2011, only 5% of all funding on digital health in the US has gone to digital health startups serving women. [15] [16] [17] Investments in

[8] "A Safe Digital Future". (2024).

[9] Data2x (2022). State of Gender Data

[10] Engineering for Change (2021). Gender Bias in Data and Tech.

[11] Sex Differences Visualization Tool, Institute for Health Metrics and Evaluation, University of Washington

[12] Gartner (2018). Gartner Says Nearly Half of CIOs Are Planning to Deploy Artificial Intelligence

[13] Smith & Rustagi (2021). When Good Algorithms Go Sexist: Why and How to Advance AI Gender Equity

[14] UNESCO (2024). Generative AI: UNESCO study reveals alarming evidence of regressive gender stereotypes.

[15] Nasdaq (2022). The value of investing in Women's Health

[16] Forbes (2018). Women's Healthcare Comes Out Of The Shadows: Femtech Shows The Way To Billion-Dollar Opportunities

[17] Rockhealth (2020) Femtech is expansive - it's time to start treating it as such

femtech are growing, yet only 4% of the global VC tech investments in life sciences go to women-focused technologies.[18]

Impacts on diffusion, scaling, or equitable access:

TFGBV has a profound chilling effect. When women and girls self-censor or withdraw from digital spaces to prevent abuse, their voices are silenced including in public spaces such as democratic processes and journalism. TFGBV restricts their access to essential digital services, widens the gender digital divide, and reinforces patriarchal power structures, fundamentally undermining the equitable diffusion of technology for sustainable development.

2.8.2. Specific obstacles to the international diffusion of zero- and low-emission technologies

Brief description of obstacles:

The tech-industry significantly contributes to the climate crisis through energy-intensive operations, data centres, and electronic waste generation. A major structural obstacle to equitable diffusion is that innovation and decision-making about these systems are heavily centred in higher-income countries, with the systems then deployed in low- and middle-income countries. Decisions are also increasingly concentrated within the private-sector rather than with publicly-elected officials. Furthermore, an overreliance on technology to address climate change may obscure the need for participatory approaches centred on the experiences of those most adversely affected, including, disproportionately, women and girls.

Evidence or examples:

While emerging technologies like machine learning for hazard forecasting and IoT for water management are currently being deployed, the ability of communities to adopt these tools is severely hampered by the digital divide, which results from unequal connectivity, lack of access to devices, and differing digital skill sets. For example, women in low- and middle-income countries are 19 per cent less likely than men to use the mobile Internet, with the widest gaps in South Asia and sub-Saharan Africa.[19]

Impacts on diffusion, scaling, or equitable access:

When technology is developed by a relatively narrow set of actors who lack the perspective and context of the most marginalised, systems are optimised according to the assumptions and priorities of dominant groups. Consequently, the deployment of climate-resilient technologies risks reproducing and amplifying discrimination, leaving vulnerable women and girls further behind.[20]

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[18] FemTech Health (2022) FEMTECH Industry Landscape Overview Q4 2021

[19] "A Safe Digital Future". (2024).

[20] Ibid.

2.8.3. Recommendations to enable the international diffusion of technologies for the SDGs

Legislate "Safety by Design" to prevent and mitigate TFGBV: The equitable diffusion of technology is impossible if digital spaces remain hostile to women and girls. Since the perpetuation of harmful material is currently a profitable business model, it is unrealistic to expect the technology sector to sacrifice profit based solely on voluntary normative guidance. Member States must enact and enforce regulatory frameworks that compel technology companies to adopt "safety by design" principles from the outset. As championed by UNFPA's global '*bodyright*' campaign, human bodies and personal digital data must be afforded the same robust legal protection online as copyrighted materials.[21] Addressing this requires comprehensive programming and legal frameworks to hold both perpetrators and digital platforms accountable.[22] These frameworks must also be interoperable across jurisdictions as TFGBV is inherently a cross-border issue in which national legislation alone is insufficient to hold global platforms accountable.

Mandate "Equity by Design" from the earliest stages of technology development: Achieving equitable technology diffusion requires that gender equity be built into the earliest and most foundational stages of technology development. It is often too late to meaningfully address once systems are widely used and circulated. In line with the Equity 2030 Alliance's principle of "Equity by Design," financing frameworks and procurement standards must require that technologies demonstrate inclusive design practices from the start, and ensure that the resulting technological products serve all women and girls. This means mandating participation of women and girls from LMICs in the design of training datasets, model architectures and product governance structures for LLMs and other foundational technologies. Introducing gender equity impact assessments as a condition of public investment is critical, similar to environmental impact requirements. It is important for the international community to acknowledge that the same commercial incentives driving engagement-based amplification of harmful content also actively discourage investment in inclusive design. Thus, regulatory and financing mechanisms need to compensate for this market failure directly by establishing “Equity by Design” as a universal requirement across all technology development, particularly for emerging and frontier technologies, establishing the realities and needs of the most marginalized women and girls as a baseline requirement. Global digital public goods (DPGs), as openly governed and standards-based resources, offer a particularly important opportunity to embed equity by design at scale. The international community should ensure that DPG certification standards explicitly require inclusive design practices, robust and diverse dataset representation and demonstrated consideration of the

[21] UNFPA. (2026). “UNFPA Resource Compendium on Technology-Facilitated Gender-Based Violence”.

[22] UNFPA. (2024). “A Framework for TFGBV Programming, UNFPA”.

needs of marginalized women and girls as conditions of recognition and financing.

Integrate Safe and Ethical Standards ("Do No Harm"): The technology sector's prevailing "move fast and break things" methodology is in direct contradiction with the fundamental humanitarian imperative to "do no harm." We recommend mandating comprehensive risk-benefit analyses prior to the diffusion of any new technology, as this ultimately leads to better and more tailored products for end-consumers, benefitting all parties. Policymakers and technologists must evaluate potential data privacy violations, physical security risks, and social harms (e.g., reputational damage) to ensure that marginalised populations are not exploited during the digital transition.[23] This is particularly critical for technologies handling sensitive reproductive and health data, where breaches can directly enable TFGBV including doxxing, stalking and blackmail. Furthermore, organizations must establish comprehensive AI governance frameworks that mitigate algorithmic bias, ensure data privacy by design, and operate within defined ethical guardrails.

Invest in Meaningful Connectivity and Digital Inclusion: To realise the benefits of digital technologies, significant investment must be directed towards equitable availability of technology, including meaningful connectivity where bandwidth is reliable and sufficient. Crucially, this expansion must be underpinned by robust data security frameworks to prevent the exploitation of users in new and emerging markets. This requires moving beyond basic digital literacy to cultivate true digital dexterity. Overcoming this requires programmes that recruit and retain women and other marginalised populations in leadership and innovation teams throughout the technology sector, ensuring that diffused technologies reflect a broader spectrum of users.

Shift from Fragmented Pilots to Standardised Digital Architectures: To achieve the SDGs, the international community must stop funding isolated, disconnected technology pilots. We recommend pooling investments to build "Digitally Enabled" public sectors that prioritise interoperable systems, robust ICT core infrastructure, and workforce digital capacity. We must prioritise cost-effective solutions and use existing digital public goods rather than developing new ones from scratch.The establishment of centralised hubs - such as UNFPA's *Digital Center of Excellence* - provides the necessary standard digital solutions, technical governance, and advisory support required to bridge the gap from innovation pilot projects to standardised, impactful interventions. This in turn will enable the sustainable and ethical scaling of technologies across borders with humans always in control.

[23] UNFPA (2023). “Guidance on the Safe and Ethical Use of Technology to Address Gender-based Violence and Harmful Practices”.

2.8.4. Additional Resources

UNFPA Official Publications & Strategic Documents

UNFPA (2021). *Technology-facilitated Gender-based Violence: Making All Spaces Safe.* Technical Division, Gender and Human Rights Branch.
UNFPA (2023). *Guidance on the Safe and Ethical Use of Technology to Address Gender-based Violence and Harmful Practices: Implementation Summary.*
UNFPA (2024). *A Framework for TFGBV Programming.* Co-developed with Australia's eSafety Commissioner on behalf of the Global Partnership for Action on Gender-Based Online Harassment and Abuse.
UNFPA (2024). *Navigating Megatrends: The ICPD Programme of Action for a Sustainable Future – ICPD30 Think Piece: A Safe Digital Future.*
UNFPA (2025). *UNFPA Digital Strategy 2026-2029.*
UNFPA (2025). *UNFPA Editorial and Style Guide.* Media and Communications Branch.
UNFPA (2026). *UNFPA Resource Compendium on Technology-Facilitated Gender-Based Violence.*
UNFPA Equity 2030 Alliance. "Equity by Design" principles.

External Research, Industry & Academic Sources

Data2x (2022). *State of Gender Data.*
Engineering for Change (2021). *Gender Bias in Data and Tech.*
FemTech Health (2022). *FEMTECH Industry Landscape Overview Q4 2021.*
Forbes (2018). *Women's Healthcare Comes Out Of The Shadows: Femtech Shows The Way To Billion-Dollar Opportunities.*
Gartner (2018). *Gartner Says Nearly Half of CIOs Are Planning to Deploy Artificial Intelligence.*
Institute for Health Metrics and Evaluation, University of Washington. *Sex Differences Visualization Tool.*
Nasdaq (2022). *The value of investing in Women's Health.*
Rockhealth (2020). *Femtech is expansive - it's time to start treating it as such.*
Smith, G., & Rustagi, I. (2021). *When Good Algorithms Go Sexist: Why and How to Advance AI Gender Equity.* Stanford Social Innovation Review.
UN DESA. *Overcoming digital divides.* (General structural reference).
UNESCO (2024). *Generative AI: UNESCO study reveals alarming evidence of regressive gender stereotypes.*

2.9 WIPO (World Intellectual Property Organization)

2.9.1 Major obstacles to international diffusion of technologies for the SDGs

1. Economy and Cross-Cutting Technologies

- Uneven diffusion and technology use gaps

Despite faster initial adoption of newer technologies, intensity of use remains highly unequal. Africa adopts most technologies between 10 and 50 years after the global average, depending on the technology. While digital technologies show encouraging convergence with Asia in some cases exceeding advanced economy usage levels, low-income countries remain largely excluded from frontier technologies such as generative AI due to limited connectivity, inadequate infrastructure, and digital skills shortages.

- Multidimensional digital inequality and infrastructure vulnerability

Digital inequality in developing economies operates across multiple dimensions simultaneously: infrastructure gaps, technology generation differences, limited digital literacy, and affordability barriers. Only 12% of Africans had 5G access in 2023, compared to 74% of Europeans. Critically, Sub-Saharan Africa faces disproportionate connectivity disruptions from submarine cable damage, which translates to internet shutdowns, creating substantial economic losses and compounding digital exclusion.

- Weak infrastructure

Renewable energy, EVs, and hydrogen cannot scale without co-investment in physical systems. Grid upgrades, transmission networks, charging infrastructure, and hydrogen pipelines are severely underdeveloped in most developing countries. In developing countries, even mini-grid and off-grid solutions are insufficient once basic needs are met, as households and enterprises require grid connections for higher-wattage applications and productive use.

- Financing and affordability barriers

Upfront capital requirements remain prohibitive for many technological adopters, especially in low-income contexts. Access to precision agriculture technologies, for example, remains out of reach for many small sized farmers due to their high upfront costs. This is compounded by the lack of credit access or project finance mechanisms that many farmers in lower-income groups and developing economies face.

- Low absorptive capacity and human capital gaps

Advanced economies absorb foreign knowledge far faster than developing regions with the US replicating an Indian breakthrough invention three times faster than India itself. Africa and Latin America produce valuable research that flows readily to advanced economies yet lack institutional capacity to convert external science into local innovation, with science-to-patent timelines of 13 to 14 years compared to under 10 years within Asia. In clean energy, shortages of skilled engineers, technicians, and installers remain fundamental bottlenecks for clean technology deployment.

- Regulatory and approval barriers

Regulatory frameworks are a crucial, often underappreciated, determinant of diffusion speed. Genetically modified crops require an average of 16.5 years from discovery to regulatory approval. Yet where streamlined processes exist, adoption accelerates markedly: South Africa achieved 80% GM cotton adoption in five years, compared to roughly ten years in the United States. Slow, fragmented, or unpredictable approval regimes across agriculture, energy, and digital technologies impose significant diffusion costs. Technology-specific characteristics such as modularity, capital intensity, and systems integration requirements mean that one-size-fits-all regulatory approaches can be counterproductive.

- Concentration of knowledge flows and intellectual property requirements

Global innovation remains concentrated in the US, Western Europe, and East Asia, which dominate both creation and absorption of technological knowledge. Most patents for new technologies are held by high-income country entities. As markets mature, patent thickets may proliferate, and licensing could become costly and complex. This could create delays for inventors in developing economies who wish to build on new technologies.

- Political economy barriers, trade fragmentation, and hard-to-abate sectors

Fossil fuel incumbents actively resist clean technology transitions. Diverging industrial policies and tariff regimes risk fragmenting markets that drove cost reductions. In hard-to-abate industrial sectors (steel, cement, chemicals), responsible for around one-third of global CO_2 emissions, the technologies needed for deep decarbonization remain at demonstration or pilot stage, with high capital costs and long development cycles.

2. Green Technology Diffusion

- Misaligned policy and market incentives

Persistent policy and market conditions that may not fully reflect environmental externalities, alongside gaps in recognizing the broader social value of innovation, can limit incentives for sustainable technology investment and diffusion.

- Structural, institutional, and capacity constraints

Structural, institutional, and capacity-related challenges continue to affect the enabling environment for effective and equitable cross-border technology transfer.

- Fragmented knowledge transfer and complementary gaps

Fragmented knowledge transfer processes remain a barrier; while intellectual property systems play a critical role, they are most effective when complemented by technical expertise, capacity-building, and access to finance.

3. Health Technologies

- Limited IP awareness and institutional capacity

Low intellectual property awareness and limited capacity among innovators and key stakeholders, including regulators, investors, lawmakers, and policymakers, lead to underutilization of IP systems.

- Insufficient innovation and manufacturing infrastructure

Investment in STEM infrastructure, prototyping facilities, and local manufacturing capacity remains insufficient.

- Financing constraints and undervaluation of IP

Access to financing is limited, and intellectual property is rarely recognized as a viable asset for funding.

- Weak innovation ecosystem linkages

Weak linkages between academia, industry, and broader innovation ecosystems constrain collaboration, knowledge exchange, and the ability to scale health technologies effectively.

2.9.2. Recommendations to enable the international diffusion of technologies for the SDGs

1. Economy and Cross-Cutting Technologies

- Invest in digital and physical infrastructure, including connectivity resilience

Governments and development partners should prioritize broadband connectivity, submarine cable redundancy, and mobile network upgrades in Sub-Saharan Africa and other vulnerable regions. Simultaneously, multilateral climate finance should target grid modernization, transmission upgrades, and charging systems in developing countries and complement rather than substitute for grid investment needed to support productive use and economic development.

- Design stable, equitable demand-pull policies tailored to technology characteristics

Given that technology characteristics fundamentally shape adoption pathways, policy design must be technology specific. For example, for clean technologies, modular technologies (solar panels) require different interventions than complex systems (e.g. hydrogen and industrial carbon capture storage technologies). Stable, long-term frameworks such as feed-in tariffs, auctions, purchase incentives, and emissions standards reduce investment uncertainty. Carbon pricing, where feasible, corrects competitive distortions. Distributional impacts must be explicitly addressed, linking incentives to income thresholds.

- Streamline regulatory and approval frameworks

Regulatory processes across agriculture, energy, and digital sectors should be modernized and, where possible, harmonized internationally to reduce approval timelines without sacrificing safety. South African GM crop example demonstrates that streamlined processes can dramatically accelerate diffusion. Regulatory sandboxes and mutual recognition frameworks can facilitate faster deployment of proven technologies in developing countries.

- Invest in absorptive capacity, human capital, and leapfrogging

Sustained investment in education, technical training, research institutions, and skills for green sectors is essential. Policies promoting researcher mobility and international scientific exchange strengthen knowledge networks. Developing countries should be supported by leveraging leapfrogging opportunities such as adopting digital and clean technologies without replicating earlier development stages, as demonstrated by mobile money and off-grid solar innovation in Africa.

- Reinvigorate international technology transfer

The STI Forum and FfD Forum should strengthen multilateral technology transfer frameworks through South-South and triangular cooperation, joint R&D and demonstration programs, and support for national technology adaptation capacities. Global value chains should be leveraged as channels for knowledge upgrading.

- Balanced IP frameworks and coordinated public investment for Sectors where additional support is needed

Balanced IP policy can encourage investments in innovation while encouraging follow-on inventions. Practices such as patent pools, including standard essential patents (SEPs) and humanitarian licensing can help overcome the issue of accessing relevant proprietary technologies.

In addition, sustained public R&D can encourage diffusion of relevant technologies in areas where the market does not, while international standards coordination reduces fragmentation and cross-border trade costs.

- Prevent trade fragmentation and strengthen multilateral governance

Dialogue is needed to prevent tariff escalation and supply chain concentration in critical minerals and batteries. Diversifying clean technology supply chains, through industrial development support to new producer countries, reduces geopolitical vulnerabilities while broadening economic opportunities.

2. Green Technology Diffusion

1. Strengthen enabling environments for innovation and sustainability

Member States and stakeholders should consider strengthening enabling environments that support innovation, sustainability, and the diffusion of green technologies.

2. Enhance international cooperation and collaborative deployment mechanisms

International cooperation on green technology diffusion can be further strengthened through mechanisms such as WIPO GREEN, as well as licensing models and collaborative platforms that improve access to, and deployment of technologies across borders.

3. Adopt a holistic, people-centered approach to technology transfer

A holistic, people-centered approach to technology transfer is encouraged, integrating IP systems with capacity-building, trusted intermediaries, and governance frameworks to support sustainable and inclusive outcomes.

3. Health Technologies

- Enhance IP training and awareness for innovators and all related stakeholders.
- Invest in STEM labs, prototyping, and local manufacturing capacity.

- Support innovation financing by recognizing IP as an asset and offering fee concessions.
- Strengthen the IP and innovation ecosystem to support local R&D, clinical research and manufacturing by building strong industry-academia partnerships.
- Address legal and regulatory barriers facing local medical innovators and entrepreneurs.

2.9.3. Additional Resources

WIPO (2026). World Intellectual Property Report 2026: Technology on the Move. Accessible online at: https://www.wipo.int/en/web/world-ip-report/2026/index.

WIPO Economic Research Working Papers No. 91, 2026, How Do New Technologies Diffuse? https://www.wipo.int/publications/en/details.jsp?id=4835&plang=EN

WIPO Economic Research Working Papers No. 92, 2026, The Changing Geography of the International Diffusion of Technological Knowledge https://www.wipo.int/publications/en/details.jsp?id=4836&plang=EN

WIPO Economic Research Working Papers No. 93, 2026, Diffusion of Genetically Modified Crop Technology https://www.wipo.int/publications/en/details.jsp?id=4837&plang=EN

WIPO Economic Research Working Papers No. 94, 2026, Understanding Technology Diffusion in the Agricultural Sector, https://www.wipo.int/publications/en/details.jsp?id=4838&plang=EN

WIPO Economic Research Working Papers No. 95, 2026, Diffusion of Clean Technologies: Patterns, Mechanisms, and Future Challenges https://www.wipo.int/publications/en/details.jsp?id=4839&plang=EN

WIPO Economic Research Working Papers No. 96, 2026, Digital transformations in developing economies: From the first-mile infrastructure to the end-user finger tips https://www.wipo.int/publications/en/details.jsp?id=4840&plang=EN

WIPO GREEN's ongoing study on the obstacles to green technology

3. Template for United Nations Inter-Agency Task Team on Science, Technology and Innovation for the SDGs (IATT) Inputs

Assessment of Obstacles to International Technology Diffusion for the SDGs

United Nations Inter-agency Task Team on Science, Technology and Innovation for the SDGs (IATT) Inputs

Guidance Notes for Contributors

- Inputs must be strictly factual, reflecting the entity's experience and evidence.
- All inputs will be uploaded to the dedicated UN TFM website for full transparency.
- Entities may submit more than one input if departments or sub-units address technologies in different thematic areas related to the SDGs.
- The compilation of all inputs from UN IATT will not interpret or harmonize divergent views.

Deadline for the Submission: May 29th, 2026

1. **Entity Name**

2.**Focal Point Name**

3.**Title**

4.**Email**

5.**Department/Office**

6.**Major obstacles to international diffusion of technologies for the SDGs**

From the experience of your entity and department, please identify and describe, based on the latest evidence, the main obstacles to the international diffusion of **technologies for the SDGs** which may include, but are not limited to, financial, policy and regulatory, institutional and governance, infrastructure, and technical and engineering capacity obstacles.

For each obstacle, please provide:
1. Type of technology and relevance to the SDGs
2. Brief description of obstacles
3. Evidence or examples (country/region/project experiences, if available)
4. Impacts on diffusion, scaling, or equitable access

(Suggested length: 300-400 words)

7.**Specific obstacles to the international diffusion of zero- and low-emission technologies**

From the experience of your entity and department, please identify and describe, based on the latest evidence, obstacles specific to the international diffusion of **zero- and low-emission technologies for the SDGs**.

For each obstacle, please provide:
1. Type(s) of technology and relevance to the SDGs
2. Brief description of obstacles
3. Evidence or examples (country/region/project experiences, if available)
4. Impacts on diffusion, scaling, or equitable access

(Suggested length: 300-400 words)

8.**Recommendations to enable the international diffusion of technologies for the SDGs**

Based on your entity's experience, please describe core recommendations that would address the obstacles identified above which may include, but are not limited to, recommendations on policy, institutional arrangements, financing or investment measures, capacity-building, partnerships, and data and knowledge infrastructure. Please be specific about the actors who would lead on these recommendations.

- Evidence-based
- Linked to the SDGs and the *Sevilla Commitment* mandate (para. 59(q))

(Suggested length: 300–400 words)

9.**Additional Resources**

Please list titles and links or references to analytical work, case studies, or data sources that support this assessment.