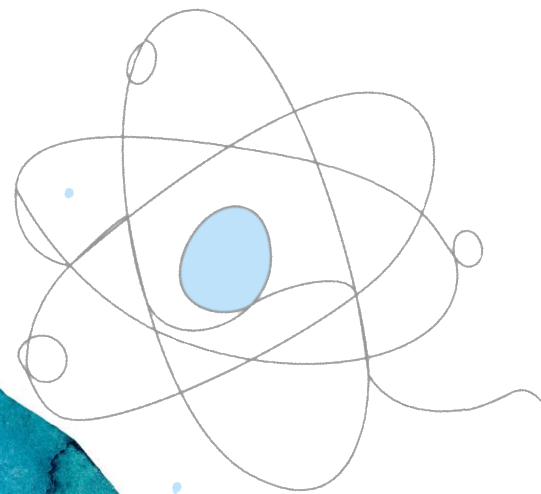


POLICY BRIEF

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Repositioning science, technology and innovation for sustainable development in Caribbean SIDS



UNITED NATIONS

ECLAC

Introduction

Key messages

- ***Integrate science, technology and innovation (STI) into national and regional sustainable development action plans and priorities:*** STI should be embedded as a central pillar of sustainable development with defined objectives, implementation mechanisms and dedicated resource allocations.
- ***Establish formal STI regional and national institutions and strengthen coordination:*** This requires establishing and formalizing interministerial bodies with defined authority on STI as a core enabler for productive development, multisectoral national, regional and international engagement, and budgetary alignment to harmonize sectoral innovation needs and ensure research agendas support national sustainable development priorities.
- ***Effective human capital and integrate diverse knowledge systems:*** investment in human capital while actively valuing and integrating diverse forms of knowledge is required for building resilient and relevant STI ecosystems.
- ***Strengthen data infrastructure:*** invest in robust data infrastructure to support evidence-informed planning and enable the tracking of innovation performance and societal outcomes of STI interventions. This includes developing nationally relevant STI indicators. Advanced interoperable data systems must underpin efforts to advance STI, accelerating the digitization and access of environmental, economic, and research data.
- ***Effective communication and outreach strategies:*** effective communication strategy for science, technology and innovation policy implementation should prioritize tailored, clear and accessible messaging for diverse stakeholders, from policymakers to vulnerable groups, local and indigenous communities.

Caribbean small island developing States face a complex convergence of structural vulnerabilities that profoundly threaten their long-term development. These challenges include acute climate vulnerability (manifesting as hurricanes, sea-level rise, salination, biodiversity loss, sargassum influxes and drought), limited land and natural resources, high dependence on imported food, and challenging geographic and economic isolation due to small domestic markets. Compounding these issues are significant fiscal constraints, high debt levels and persistent brain drain, which collectively limit investment in long-term resilience and development strategies.

While Caribbean SIDS increasingly recognize the transformative potential of STI to drive resilience, sustainability and economic diversification, this crucial input remains critically underfunded, underrepresented and inadequately integrated into national, regional and global policy settings and planning frameworks. The Caribbean allocates a mere 0.1–0.2% of its GDP to research and development, substantially below the 2% or more invested by leading science economies like the Republic of Korea or the United States of America. This underinvestment, heavily concentrated in a few larger economies within Latin America and the Caribbean, leaves smaller economies with minimal scientific capacity. Furthermore, existing national STI strategies are often outdated or disconnected from core sustainable development policies, such as those addressing climate change, biodiversity, energy production or sustainable tourism.

As a result, STI institutions across the region struggle to meet the demands of rapid advancements in this field. Significant gaps in coordination, institutional mandates and data systems limit the region's ability to respond effectively to emerging sustainability challenges. Moreover, existing systems often overlook or marginalize grassroots, local, and indigenous knowledge and community-driven innovation, thereby limiting the scope for inclusive, culturally grounded responses to environmental risks (CANARI, 2023; OEWG, 2025).

Despite these pervasive challenges, promising initiatives demonstrate the potential of STI. Projects such as the Resilient Islands Programme successfully integrate nature-based solutions with geospatial technologies and community science to enhance local resilience in Dominica, Grenada and Jamaica. National programs in Barbados and Jamaica have begun to integrate renewable energy research and development, education in science, technology, engineering and mathematics (STEM), and regulatory innovation to facilitate energy transitions. Regional organizations, including the ECLAC Conference on Science, Innovation and Information and Communications Technologies, the University of the West Indies and the Caribbean Centre for Renewable Energy and Energy Efficiency, continue to play crucial roles in convening high-level officials to identify and set directives, including capacity-building. However, these vital efforts remain insufficiently scaled, inadequately resourced, and fail to provide the required human and technical continuity, often being project-based rather than institutionally embedded, and not systemically aligned with long-term national sustainable development planning.

This policy brief advocates for repositioning STI as on the central pillar of Caribbean SIDS sustainable development. It calls for stronger integration of STI into financing systems and governance arrangements. Key barriers and persistent gaps include chronic underinvestment, weak institutional coordination, fragmented data and digital systems, and the systemic exclusion of grassroots, local and indigenous knowledge.

To unlock the full potential of STI, the brief outlines a suite of actionable reforms. These include formalizing interministerial vertical and horizontal coordination, establishing robust national policies, legislation and regulatory requirements, creating dedicated STI financing mechanisms, strengthening data infrastructure, investing in human capital, and promoting inclusive, participatory innovation governance. Achieving resilient, equitable and sustainable development for Caribbean SIDS requires elevating STI from a peripheral concern to a strategic driver of transformation, necessitating the dismantling of entrenched structural and policy barriers. The following section examines the policy and institutional context that must be reshaped to achieve this.

1. Policy context and rationale

Despite broad recognition of its potential, STI remains structurally marginalized within Caribbean development planning. While countries such as Grenada, Jamaica and Trinidad and Tobago have adopted policies towards supporting STI in development, these frameworks often lack legal mandates, dedicated institutional arrangements, financing mechanisms or integration into development strategies and public investment planning. STI councils, where they exist, generally serve in advisory roles without binding authority to shape national planning or budgeting decisions (Walker and de Paula, 2022).

This marginalization is compounded by weak institutional coordination. STI is typically housed in ministries of education or planning and there are no formal arrangements to require coordination with those ministries responsible for the environment, terrestrial and marine based-natural resources, agriculture, tourism, the economy or climate resilience. Without structured interministerial links, STI remains siloed and disconnected from sectors that rely on innovation to meet pressing sustainability and resilience goals (Walker and de Paula, 2022).

At the regional level, institutions such as the ECLAC STI ICT Committee, the University of the West Indies (UWI) and the Caribbean Centre for Renewable Energy and Energy Efficiency (CCREEE) offer critical support for building regional consensus, capacity building and knowledge generation. CCREEE, for example, is embedded within CARICOM frameworks and operates through National Focal Institutions to promote national policy development on renewable energy and energy efficiency. Its 2019–2023 Strategic Plan focuses on energy planning, business support, and regulatory frameworks for the adoption of clean energy (CCREEE, 2023). However, these institutions are functionally constrained. Most are sector-specific, donor-(project) dependent, and only loosely connected to broader sustainable development and environmental governance systems (Walker and de Paula, 2022).

Disconnection from climate change, natural resources management, disaster management and environmental frameworks further weaken the enabling environment. Most Nationally Determined Contributions (NDCs), National Adaptation Plans (NAPs) and environmental impact assessment regulations across Caribbean SIDS do not refer to STI policies, priorities, data or research needs (Walker and de Paula, 2022). Similarly, tools such as remote sensing, geospatial data and community-based monitoring are not systematically mandated or integrated into policy instruments, despite their relevance and availability (UNESCO and CARICOM, 2005).

STI governance also lacks meaningful inclusion of indigenous and local knowledge systems. Community-driven innovations, traditional ecological practices, and citizen science remain peripheral to official STI policies. The Earth Negotiations Bulletin and the Caribbean Natural Resources Institute (CANARI) have both highlighted this issue in recent international fora, noting that Caribbean delegates and observers have called for stronger recognition of participatory and rights-based approaches in science-policy platforms (CANARI, 2023; OEWG, 2025).

Collectively, these systemic gaps help explain why STI remains a peripheral force in shaping economic growth, environmental, natural resources and climate policy across Caribbean SIDS. Realizing the transformative potential of STI will require more than technical upgrades. It will require legislative and instructional reforms, appropriate capacity, formal coordination mechanisms, strategic financing and inclusive governance structures that encompass a broader range of knowledge systems.

2. STI landscape in the Caribbean

The Caribbean STI ecosystem is evolving, marked by localized strengths and persistent regional constraints. Although STI is increasingly referenced in national developmental plans, the region continues to underinvest in research, lacks policy integration, and struggles to scale innovation for sustainability and climate resilience.

Investment in research and development across Caribbean SIDS remains chronically low. While some countries have begun to recognize the importance of science and innovation, sustained financial commitments are rare (UNESCO and CARICOM, 2005). Jamaica made its first direct public investment in STI in 2019, allocating J\$ 200 million in competitive research grants, a promising step (Walker and de Paula, 2022). However, comparable efforts remain limited across the region. Most national research systems continue to rely heavily on external funding and thematic donor-driven projects, making them vulnerable to shifts in development priorities, geopolitics and reducing their ability to pursue long-term, locally relevant innovation agendas.

National research capacity is concentrated in a few institutions. UWI operates as the Caribbean's principal public sector research institution, supported by national polytechnics and science faculties such as the University of Technology, Jamaica, which houses the country's longest-standing engineering programs. These institutions play a central role in producing STI talent, but face financial pressures, infrastructure constraints and difficulties linking research outputs to policy or commercial use.

Some countries have taken steps to embed STI into long-term development strategies. The Vision 2030 plan for Jamaica includes the integration of STI across the energy, environment and economic competitiveness pillars. Barbados, through its National Strategic Plan and clean tech cluster known as BLOOM, has emphasized the blue economy and marine innovation. Trinidad and Tobago references STI within its national development framework and continues to advance a formal National STI Policy (Walker and de Paula, 2022). While these initiatives signal progress, implementation and coordination remain uneven across ministries and planning cycles.

At the regional level, specialized agencies support STI-related collaboration but face similar fragmentation. CCREEE, under the auspices of CARICOM, coordinates with National Focal Institutions to advance clean energy innovation, business support and regulatory planning. Yet its activities remain concentrated in the energy sector and lack cross-sectoral policy influence. Broader STI governance mechanisms across industries, such as the environment, health or marine science, are still absent.

Digital transformation is one of the region's most dynamic STI fronts. Countries such as Grenada, Saint Kitts and Nevis and Saint Lucia are implementing the Caribbean Digital Transformation Project, which expands broadband access and modernizes public service delivery. Regionally, the Caribbean Network Operators Group (CaribNOG)¹ has led the development of Internet exchange points (IXPs) and training for digital resilience, contributing to foundational infrastructure for STI and emergency communication (CANARI, 2023).

Human capital remains both a strength and a constraint. Caribbean universities produce a steady stream of STEM graduates, but many migrate due to limited domestic research funding and a lack of

¹ Caribbean Network Operator's Group, (CaribNOG), see link at: Caribbean Network Operators Group, cited August 3, 2025.

opportunities in innovation-related employment. Diaspora initiatives, such as the Caribbean Diaspora for Science, Technology and Innovation, offer potential to link regional challenges with global expertise, but remain largely informal and under-supported.

Notably, emerging STI sectors are gaining traction. renewable energy, agri-tech, marine innovation and digital services are increasingly recognized as strategic areas for investment. Barbados has launched initiatives under its Blue Economy Innovation Framework, while Guyana and Trinidad and Tobago have identified priority research themes related to climate-smart development. These sectors present opportunities to build scalable, localized innovation platforms, especially if linked to participatory planning, regional cooperation and stable funding mechanisms (CANARI, 2023; Walker and de Paula, 2022). The following section provides examples of STI applications in the Caribbean.

3. Case studies

3.1 Case study: Resilient Islands Programme, Jamaica

The Resilient Islands Programme exemplifies the effective application of STI to enhance climate resilience and promote nature-based solutions in Caribbean coastal communities. Implemented in Jamaica between 2017 and 2022, the programme was coordinated by the International Federation of Red Cross and Red Crescent Societies (IFRC) and the Nature Conservancy, in collaboration with the Jamaican Red Cross, community groups, and government agencies. The initiative aimed to integrate ecosystem-based approaches into disaster risk reduction (DRR) while empowering communities to co-produce knowledge and participate in planning processes.

A defining feature of the programme was its use of participatory tools and geospatial technologies. In coastal areas such as Old Harbour Bay, community members were trained to conduct participatory risk mapping, field-based data collection and vulnerability assessments. These data were combined with scientific tools, including remote sensing, GIS mapping and ecosystem service modelling to inform decision-making at the local level. This hybrid approach bridged formal scientific analysis with traditional and local knowledge, producing more context-specific planning tools and strengthening community engagement in resilience efforts (IFRC and The Nature Conservancy, 2020).

The programme also contributed to institutional change. It supported revisions to the National Disaster Risk Management Plan for Jamaica to explicitly include nature-based solutions and developed technical guidance for mainstreaming these approaches at the parish level. It piloted a toolkit on ecosystem-based DRR that allowed local governments and civil society actors to integrate environmental data into hazard mitigation planning. This process was not externally imposed but rather co-developed with local actors through workshops and iterative feedback loops, thereby reinforcing the legitimacy and usability of STI tools in community settings (IFRC, 2022).

Capacity-building was a central component. More than one hundred community leaders, Red Cross volunteers, and public officials were trained in ecosystem-based approaches to disaster risk management. Trainings emphasized equity and gender sensitivity while also building familiarity with data systems and planning frameworks. These investments helped improve not only technical capacity but also local ownership and cross-sector trust.

The Resilient Islands Programme as a best practice demonstrates that STI can be most effective when deployed through inclusive, community-centred models. By integrating geospatial tools, environmental data and participatory science, the programme strengthened local governance and positioned nature-based solutions as viable components of national resilience strategies. It offers a compelling model for scaling STI in support of sustainability goals across other small island developing States.

3.2 Case study: Barbados BLOOM Cleantech Cluster and Blue Economy Innovation

As a leading SIDS, Barbados has advanced STI policies focused on digital transformation, climate resilience and inclusive innovation to advance blue economy development and clean technology entrepreneurship. Through initiatives such as the Barbados Clean Tech Cluster (Bloom)² and the Blue Economy Innovation Action Plan,³ the government has demonstrated how targeted investments in marine innovation and policy reform can align STI with climate resilience and economic diversification.

The BLOOM Clean Tech Cluster, launched in 2020 with support from the United Nations Development Programme and other partners, serves as an incubator and accelerator for start-ups focused on ocean sustainability and low-carbon innovation. The cluster provides early-stage companies with technical training, market access and research support, particularly in areas such as marine pollution monitoring, ocean energy and coastal data applications. It also promotes linkages between scientific institutions, private entrepreneurs and public agencies to strengthen the innovation ecosystem in Barbados (CANARI, 2023).

In parallel, Barbados has adopted a Blue Economy Roadmap that frames the ocean space not only as a resource base but also as a domain for STI application. The government has supported the development of digital tools for ocean governance, including open-data platforms for fisheries management and marine spatial planning. These tools enable real-time environmental monitoring, enhanced enforcement of protected areas and evidence-based policymaking. The University of the West Indies Cave Hill Campus has also contributed through research on coral reef restoration, coastal erosion modelling and climate-smart aquaculture (Walker and de Paula, 2022).

What distinguishes the Barbadian approach is its integration of STI into a broader vision for inclusive, sustainable growth. The government's Ministry of Maritime Affairs and the Blue Economy has championed the use of innovation to create green jobs, reduce dependence on fossil fuels and expand ocean literacy among citizens. Through partnerships with international donors, academic institutions and regional bodies, Barbados has positioned itself as a testing ground for scalable blue economy models that combine ecological resilience with digital transformation.

While the BLOOM initiative and associated platforms are still in the early stages, they represent a proactive, state-led effort to institutionalize STI within a national development strategy. By treating the ocean as a living lab for climate resilience and technological experimentation, Barbados is aligning STI with global sustainability targets and regional adaptation needs.

² Barbados Cleantech Cluster (Bloom) Ecosystems for cleantech entrepreneurs and startups; link <https://bloomcluster.com/>, cited August 3, 2025.

³ Barbados, Action Plan/Roadmap: implementation of an Integrated Blue Economic Policy Framework and Strategic Action Plan for Barbados, see link at <https://coastal.gov.bb/wp-content/uploads/2024/07/Barbados-BE-Roadmap-Final.pdf>, cited August 3, 2025.

3.3 Case study: Caribbean Network Operators Group and Caribbean digital infrastructure

Robust digital infrastructure is a foundational enabler of STI, particularly in regions vulnerable to natural hazards and climate impacts. The CaribNOG has emerged as a key regional actor in strengthening the digital backbone of Caribbean SIDS. Its work supports STI not only through Internet expansion and cybersecurity training but also by improving digital resilience for governments, communities and research institutions.

CaribNOG, in partnership with the Internet Society and regional telecommunications regulators, has played a leading role in establishing IXPs in countries such as Belize, Grenada, Jamaica and Saint Kitts and Nevis. IXPs enable local Internet traffic to be routed domestically rather than through international servers, improving connectivity speeds, reducing costs and enhancing data sovereignty. These improvements are critical for STI, as they support more reliable cloud computing, remote research collaboration, e-government services, and data-intensive applications such as GIS and climate modelling (CaribNOG, 2021).

In addition to infrastructure development, CaribNOG has spearheaded training and capacity-building efforts focused on network engineering, cybersecurity and digital governance. These activities help equip local technical personnel with the skills to maintain resilient digital systems. Importantly, CaribNOG collaborates closely with universities, civil society and disaster management agencies to ensure that digital tools are not only technically sound but also socially responsive and integrated into broader resilience strategies (SKNIS, 2023).

The organization's work became especially relevant during the COVID-19 pandemic, when reliable digital access was essential for maintaining education, health services and emergency communications. By providing a regional platform for knowledge exchange and infrastructure coordination, CaribNOG contributes to the enabling environment that STI requires to function across sectors.

Although CaribNOG is a technical network rather than a traditional development agency, its efforts illustrate the importance of regional digital governance for STI. Its decentralized, collaborative model aligns well with the needs of small island States, offering a replicable approach to building STI readiness and climate resilience through infrastructure, skills and policy innovation.

These case studies effectively illustrate the successful application of STI in addressing environmental challenges within Caribbean SIDS. However, these examples also highlight systemic gaps and critical policy drivers that must be addressed to scale such initiatives effectively across the subregion. The following section delves into these enabling conditions, beginning with the fundamental importance of robust institutional coordination and governance.

4. Policy drivers and enabling conditions

4.1 Institutional coordination and governance

Effective STI governance requires more than policy declarations. It demands robust institutional structures that link STI to core sustainable development and climate planning systems. In the Caribbean, the lack of formalized coordination mechanisms remains one of the principal barriers to operationalising STI for environmental sustainability.

Most Caribbean SIDS maintain STI functions within ministries of education, planning or economic development. However, these mandates are typically confined to education or research policy and lack formal authority to engage other critical sectors, such as the environment, energy, agriculture and disaster risk management (Walker and de Paula, 2022). This siloed structure undermines efforts to apply STI across the policy domains where it is most urgently needed.

To address this, countries must establish interministerial STI coordination bodies with legal mandates, clear authority and budgetary alignment. These bodies should serve as platforms for aligning national development strategies with STI policy, harmonizing sectoral innovation needs and ensuring that research agendas support national sustainability goals. Coordination with ministries responsible for climate change, environmental protection and finance is especially critical, given the cross-cutting nature of STI.

Another institutional priority is the integration of STI into climate, natural resources and environmental planning instruments. NDCs, NAPs, biodiversity strategies and coastal management frameworks must go beyond referencing innovation. They should include STI-linked implementation pathways, research partnerships and technology deployment plans. Formal procedural links such as joint committees or mandatory STI inputs into environmental assessments can facilitate this alignment (Walker and de Paula, 2022; UNESCO and CARICOM, 2005).

Legal frameworks should also be updated to reflect STI as a core enabler of development. Most existing STI policies across the region are either outdated or lack enabling legislation. Countries should adopt modern STI laws and regulations clarify institutional roles, create mechanisms for interagency cooperation, and define how innovation contributes to national sustainability priorities. Such laws can also formalize the role of regional institutions, such as CREEE, UWI and the Caribbean Agricultural Research and Development Institute, in supporting national planning and policy coherence (Walker and de Paula, 2022).

Lastly, STI governance must be responsive and transparent. Regular reporting on STI outcomes, public participation in innovation strategy design and stakeholder engagement in priority-setting are essential for ensuring legitimacy and policy alignment. Without inclusive governance, STI risks becoming technocratic and disconnected from the lived realities of vulnerable communities.

Strengthening institutional coordination is therefore a foundational step toward unlocking the full potential of STI for resilience and sustainability in the Caribbean. It requires legal reform, political will and an explicit effort to align fragmented planning systems under a coherent innovation strategy.

4.2 Financing mechanisms

Mobilizing sustainable and dedicated financing for STI remains one of the most persistent challenges across Caribbean SIDS. Although governments widely acknowledge the importance of innovation for climate resilience, economic diversification and disaster preparedness, actual STI funding remains low, fragmented, and poorly aligned with development and environmental finance systems. In most countries, STI budgets are limited to academic research grants or donor-supported technical cooperation, with few allocations specifically earmarked for applied innovation, digital resilience or cross-sectoral technology solutions (Walker and de Paula, 2022).

A critical gap is the lack of dedicated, programmatic STI financing mechanisms. Even where STI strategies exist, they are not linked to medium-term expenditure frameworks or sectoral budgets. Without predictable, multiyear funding lines, STI projects tend to rely on short-term grants, scattered pilot programs, or externally driven projects with limited continuity. Countries need to establish national innovation funds with clearly defined eligibility criteria, effective oversight and alignment with environmental and climate goals. Such funds could be capitalized through public budgets, climate finance readiness facilities or regional development banks.

Another opportunity lies in mainstreaming STI into climate finance planning. NAPs, Green Climate Fund proposals and resilience investment frameworks should explicitly include STI as a key enabler. For example, funding proposals for renewable energy, ecosystem restoration, massive sargassum influx management or early warning systems should contain STI components such as geospatial modelling, innovation partnerships or data infrastructure. This would align innovation efforts with national priorities while unlocking new sources of international financing (UNESCO and CARICOM, 2005).

At the regional level, institutions such as the Caribbean Development Bank and CREEE have supported energy and digital innovation, but there is no dedicated regional STI fund. The creation of a Caribbean Research and Innovation Fund, jointly supported by CARICOM member States, regional institutions, and international donors, has been proposed multiple times but remains unrealized (Walker and de Paula, 2022). Establishing such a mechanism would enable pooled risk, resource sharing and coordinated regional investment in priority areas, such as climate-smart agriculture, blue economy technologies or sustainable transport.

Innovative financing approaches, including challenge funds, blended finance models and public-private co-investment, should also be considered. These tools can help attract private capital into STI sectors while ensuring that public funding is used strategically to de-risk innovation in high-need areas. Regional coordination will be crucial to prevent duplication and ensure alignment with Caribbean development objectives.

Strengthening STI financing in the Caribbean will therefore require both domestic reforms and regional innovation diplomacy. Governments must embed STI into national budget systems, leverage climate finance platforms and collaborate to build shared resource pools that can support the long-term development of resilient, inclusive and transformative innovation systems.

4.3 Data and digital infrastructure

A well-functioning STI system depends on the availability of reliable data and the digital infrastructure to collect, store, analyse and share it. In the Caribbean, weak data ecosystems and uneven digital access continue to be significant barriers to STI-driven environmental and development decision-making.

Environmental data, including ecosystem baselines, hazard exposure, biodiversity inventories and emissions metrics, are often fragmented across ministries, academic institutions and project-specific platforms. National datasets are frequently outdated, incompatible across agencies or not publicly accessible (Walker and de Paula, 2022). This limits the ability of policymakers and researchers to conduct evidence-based planning and to evaluate the long-term effectiveness of STI interventions in areas such as climate adaptation, sustainable land use or fisheries management.

Many countries also lack national open data policies, geospatial data standards, or centralized scientific research portals. While some progress has been made, such as the GeoNode platform in Jamaica and the open data strategy in Saint Lucia, most national systems do not yet treat environmental data as a public good. This restricts opportunities for community science, private sector innovation and cross-border research collaboration.

Digital infrastructure presents a mixed picture. Broadband access and ICT adoption have improved across several countries, supported by projects such as the Caribbean Digital Transformation Programme. Nations such as Grenada, Saint Kitts and Nevis and Saint Lucia are making strides in building e-government platforms and expanding Internet access in schools and public institutions (CANARI, 2023). However, digital divides persist, particularly in rural and underserved communities, and many countries still rely on international servers to route domestic internet traffic.

Institutions such as CaribNOG and the Internet Society have supported the development of IXPs across the region, enhancing local Internet performance and digital sovereignty. These IXPs are essential for building the backbone of STI readiness, enabling the more secure and efficient transfer of scientific data, facilitating cloud computing for research and the deployment of digital environmental tools such as remote sensing and early warning systems (CANARI, 2023).

To realize the potential of STI, Caribbean SIDS must invest in data governance frameworks and digital public infrastructure. This includes standardizing environmental data formats, adopting open data policies, and supporting regional data-sharing agreements. Countries also need to train and retain data professionals who can manage environmental datasets, build decision-support systems, and support STI across sectors.

Regional collaboration is key. A Caribbean environmental data platform, co-managed by universities, government agencies, and regional bodies, could serve as a shared asset for long-term research, innovation, and planning. It would also strengthen the region's position in global data partnerships and international climate finance negotiations, where credible, high-resolution data is increasingly a prerequisite for funding access.

Building strong data and digital foundations is not just a technical issue. It is a core enabling condition for sustainable development, risk-informed decision-making, and inclusive STI governance in the Caribbean.

4.4 Human capital and talent retention

The strength of any STI system depends fundamentally on the people who generate, apply and manage knowledge. In the Caribbean, human capital is a significant asset, yet it is also one of the region's most persistent vulnerabilities. Despite producing highly educated graduates in science, engineering, ICT, and environmental fields, the region struggles to retain STI talent due to limited research funding, underdeveloped innovation ecosystems and constrained career opportunities (Walker and de Paula, 2022).

Universities such as UWI and the University of Technology in Jamaica, as well as regional polytechnic institutions, continue to provide foundational education in scientific disciplines. However, STI-oriented postgraduate research remains underfunded, and many graduates find few opportunities to apply their skills in domestic contexts. Weak job markets and limited entrepreneurial incentives contribute directly to emigration and underemployment among technically trained youth (Walker and de Paula, 2022).

This dynamic has long fuelled brain drain, with a substantial portion of STI talent relocating to North America or Europe. In some cases, this results in beneficial remittances and international networks. However, for most countries in the region, it represents a chronic loss of scientific capacity and a structural barrier to building sustained innovation systems. Reversing or mitigating this trend will require both domestic reforms and proactive diaspora engagement strategies.

Several Caribbean diaspora networks, such as the Caribbean Diaspora for Science, Technology and Innovation have attempted to bridge this gap through mentoring programs, research exchanges and advisory roles. These platforms provide opportunities for knowledge transfer, collaboration, and virtual entrepreneurship. However, most remain informal and operate without policy support or long-term institutional infrastructure (Walker and de Paula, 2022).

Beyond retention, technical training and mid-career skills development are also essential. As STI systems evolve, professionals in sectors such as environmental management, health, agriculture and urban planning will require continuous upskilling in areas including digital tools, geospatial data, systems thinking, and transdisciplinary research. Regional institutions and national ministries should invest in modular, cross-sectoral training programs that strengthen the interface between science and public policy (Walker and de Paula, 2022).

Recent developments in Guyana offer a compelling example of the transformative power of values-based STI education. The St. George's School of Sciences, was praised by its President as a "sanctuary for transformation", exemplifies an emerging model of human capital development that pairs scientific instruction with a foundation of discipline, resilience and social responsibility. This model not only enhances academic outcomes but also positions science education as a vehicle for social mobility and empowerment, particularly for students from disadvantaged communities. Rooted in national priorities and a vision for inclusive development, it reflects how STI can be aligned with cultural values to achieve broader social transformation goals across the Caribbean (DPI, 2024).

Policy frameworks must also support youth engagement, gender equity and inclusivity in STI training and leadership. While women are increasingly represented in undergraduate science programs, gender disparities persist at senior levels and in high-growth fields, including engineering, artificial intelligence and digital entrepreneurship. National innovation strategies should incorporate targets and funding to address these gaps, particularly among young people, rural populations, and marginalized groups (UNESCO and CARICOM, 2005).

In summary, unlocking STI's full potential in the Caribbean requires sustained investment in human capital, from early education through postdoctoral training, and from diaspora engagement to public sector capacity-building. This is not only a matter of technical preparedness but also of equity, economic resilience, and long-term sustainability.

4.5 Equity, inclusion and knowledge pluralism

Building effective STI systems in the Caribbean requires more than investments in infrastructure and talent. It also requires deliberate efforts to ensure that STI policies and practices are equitable, inclusive, and reflective of the region's cultural and epistemological diversity. This includes recognizing and integrating indigenous and local knowledge systems, expanding participation in STI decision-making and addressing structural barriers related to gender, geography and socioeconomic status.

Historically, Caribbean STI policy has focused narrowly on formal tertiary-level scientific research institutions, often excluding the contributions of community-based innovation, traditional ecological knowledge and grassroots experimentation. However, these knowledge systems play a critical role in resource management, adaptation to environmental change and biodiversity stewardship, particularly among coastal, indigenous and rural populations (CANARI, 2023). Their exclusion from formal policy processes limits both the effectiveness and legitimacy of STI interventions.

Several regional voices, including civil society groups and negotiators at international fora, have called for the integration of diverse knowledge systems into STI governance. During the negotiations of the global science-policy panel on chemicals and pollution, Caribbean stakeholders emphasized the need for participatory approaches and rights-based science-policy interfaces that recognize non-academic knowledge contributions. These calls are consistent with the broader international shift toward knowledge pluralism as a pillar of just and inclusive sustainability transitions (OEWG, 2025).

Gender equity is another critical dimension. Although women in the Caribbean are increasingly represented in science education, they remain underrepresented in STI leadership, patenting, and entrepreneurial ventures. Innovation strategies often fail to address gendered barriers to participation, including limited access to funding, mentorship and decision-making roles⁴. National STI policies should adopt gender-responsive indicators, targets and institutional mechanisms to address these imbalances.

Inclusive STI systems also require participatory governance mechanisms. This means creating opportunities for marginalized groups, including youth, indigenous peoples, women and persons with disabilities, to engage in research priority-setting, innovation funding decisions and technology policy. Citizen science, co-design processes, and community-based innovation grants can help democratize STI, aligning it more closely with real-world needs and values (CANARI, 2023).

In sum, embedding equity, inclusion, and knowledge pluralism into Caribbean STI systems is not only a matter of fairness, but it is also essential for relevance, resilience and legitimacy. By widening the scope of who participates in innovation and whose knowledge is valued, the region can build more adaptive and socially grounded STI ecosystems that support sustainable development for all.

⁴ Financial Flows to Promote Technology Transfers and Gender Inclusiveness for Small Island Developing States (SIDS), technology Facilitation Mechanism, United Nations Department of Economic Affairs, link: 5th UN Policy Brief on STI roadmaps - SIDS finance_rev.pdf, cited January 9th 2026.

POLICY RECOMMENDATIONS

- **Integrate STI into national and regional sustainable development action plans and priorities:** advancing a Caribbean STI ecosystem capable of supporting inclusive, climate-resilient and environmentally sustainable development requires a deliberate reorientation of current approaches. STI must be embedded not as a peripheral support but as a central pillar of national sustainable development. This entails integrating STI into national climate, natural resources and environmental frameworks with clear implementation pathways. Countries should establish formal mechanisms such as interministerial STI-environment committees or procedural requirements for STI inputs into development planning and environmental assessments. These institutional linkages will ensure that STI is positioned to support long-term transformation, rather than remaining a stand-alone policy area.
- **Strengthening STI ecosystems: institutions, human capital and inclusive collaboration:** to effectively bridge the gap between knowledge generation and practical and sustained applications, governments and regional partners must prioritize the establishment and expansion of formal STI institutions, fostering robust collaboration across academia, government, the private sector and civil society, including through South-South and triangular cooperation. These entities, such as innovation hubs and applied research centres, should be explicitly mandated to translate STI investments into actionable solutions for critical development challenges like food security, climate resilience, health systems and sustainable livelihoods. Concurrently, parallel investments in human capital are essential, necessitating a coordinated regional strategy to promote inclusive access to STEM and technical and vocational education and training, strengthen entrepreneurship and create opportunities for Caribbean researchers. Public sector incentive structures also require reform to offer meaningful career paths for science and technology professionals. Ultimately, these strengthened institutional frameworks, through inclusive governance mechanisms such as statutory STI councils with multi-stakeholder representation (including youth, indigenous and rural communities, women and girls and civil society), must actively integrate indigenous and local knowledge systems, ensuring STI decision-making is participatory, accountable, equitable and responsive to local realities, thereby preventing the reinforcement of existing inequalities and leaving no-one behind.
- **Mobilize dedicated financing:** given the scale of investment needed, dedicated and diversified financing mechanisms are essential. These should include innovation challenge funds, blended finance instruments and green/blue bonds designed to reach underserved actors, especially micro-, small and medium-sized enterprises and initiatives led by women, youth and grassroots groups. Regionally pooled resources or thematic accelerators, such as the Caribbean Climate-Smart Accelerator, should be expanded to include STI portfolios that align with sustainable development priorities. Public finance reform must also ensure that STI allocations are protected from fiscal volatility and aligned with long-term transformation goals.
- **Strengthen data infrastructure:** modern, interoperable data systems must underpin efforts to advance STI. Countries should accelerate the digitization of environmental, economic and research data, and commit to developing nationally relevant STI indicators aligned with national and

international benchmarks. A strengthened data infrastructure will support evidence-informed planning and enable the tracking of innovation performance, partnership activity and an all-of-society outcomes of STI interventions.

- **Effective communication and outreach strategies:** an effective communication strategy for STI policy implementation should prioritize tailored, clear and accessible messaging for diverse stakeholders, from policymakers to communities. It must foster multi-stakeholder dialogues and co-creation of knowledge, leveraging various channels to build trust, data transparency, access and ensure early and continuous engagement throughout the policy lifecycle. This approach ensures that STI insights are effectively translated into actionable and sustainable solutions.

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