TECHNOLOGY TRANSFER

STRATEGY AND ACTION PLAN

GAMBIA NBSAP 2025–2035



Biodiversity Conservation | **Climate Resilience** | **Sustainable Livelihods** | **Innovation & Partnerships**

Advancing Gambia's Biodiversity and Climate Goals

THE GAMBIA

TECHNOLOGY TRANSFER STRATEGY AND ACTION PLAN (TTSAP)

FOR THE IMPLEMENTATION OF THE NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN (NBSAP II) 2025–2035

Strengthening Biodiversity Conservation, Climate Resilience, and Sustainable Development through Technology Transfer

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Abbreviations and Acronyms

ABS	Access and Benefit-Sharing
AE	Accredited Entity
AF	Adaptation Fund
ANR	Assisted Natural Regeneration
CBD	Convention on Biological Diversity
CSOs	Civil Society Organizations
DoA	Department of Agriculture
DoFisheries	Department of Fisheries
DPWM	Department of Parks and Wildlife Management
EbA	Ecosystem-based Adaptation
eDNA	Environmental DNA
GBF	Global Biodiversity Framework
GBFF	Global Biodiversity Framework Fund
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gases
GIS	Geographic Information System
GoTG	Government of The Gambia
GPS	Global Positioning System
ICT	Information Communication Technology
LDN	Land Degradation Neutrality
LGA	Local Government Area
LTS 2050	Long-Term Strategy 2050
MEA	Multilateral Environmental Agreements
MECCNAR	Ministry of Environment, Climate Change and Natural Resources
MEL	Monitoring, Evaluation, and Learning
MoFEA	Ministry of Finance and Economic Affairs
MoPE	Ministry of Petroleum
MRV	Monitoring Reporting and Verification
MSMEs	Micro, Small, and Medium Enterprises
NAP	National Adaptation Plans
NBIS	National Biodiversity Information System
NBSAP	National Biodiversity Strategy and Action Plan
NCCP	National Climate Change Policy
NDA	National Designated Authority
NDC	Nationally Determined Contribution
NEA	National Environment Agency
NGOs	Non-Governmental Organization
NTAF	National Technology Access Facility
NTFP	Non-Timber Forest Product
O&M	Operation and Maintenance
OECM	Other effective area-based conservation measures

PA	Protected Area
PES	Payment for ecosystem services
PPP	Public Private Partnership
RF-NDP	Recovery-Focused National Development Plan
SMART-based	Specific, Measurable, Achievable, Relevant, and Time-bound,
SOC	Soil Organic Carbon
TAP	Technology Action Plan
TAPanel	Technical Advisory Panel
TNA	Technology Needs Assessment
TTSAP	Technology Transfer Strategy and Action Plan
TTSC	Technology Transfer Steering Committee
TVET	Technical Vocational Education and Training
TWGs	Technology Working Groups
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UTG	University of the Gambia

Executive Summary

The Technology Transfer Strategy and Action Plan (TTSAP) 2025–2035 provides The Gambia with a structured, investment-ready framework to identify, access, adapt, and scale biodiversity-related technologies required to implement the National Biodiversity Strategy and Action Plan (NBSAP II) and to deliver on commitments under the Kunming–Montreal Global Biodiversity Framework (GBF). The Strategy responds to a central implementation gap: while national policies and targets are well defined, progress has been constrained by limited access to appropriate technologies, weak institutional capacity for deployment and maintenance, fragmented financing, and insufficient systems for scaling innovation.

The TTSAP shifts technology transfer from ad-hoc, project-based procurement toward a coherent national system that integrates technology needs assessment, institutional strengthening, financing, deployment, and monitoring. It applies internationally recognized Technology Needs Assessment (TNA) and Technology Action Plan (TAP) methodologies, aligning biodiversity implementation with approaches used by major climate and biodiversity finance mechanisms, including the Global Environment Facility (GEF), the Green Climate Fund (GCF), and the Global Biodiversity Framework Fund (GBFF).

Strategic Focus and Results

The Strategy prioritizes six interlinked technology domains critical to The Gambia's ecological resilience and livelihoods:

(1) Coastal and mangrove restoration technologies;
(2) Sustainable fisheries and aquatic resource management technologies;
(3) Agroecological and climate-smart production technologies;
(4) Protected area management and biodiversity monitoring technologies;
(5) Environmental monitoring, data, and decision-support systems; and
(6) Community-based adaptation and green livelihood technologies.

By 2035, implementation of the TTSAP is expected to deliver four headline results:

- Strengthened ecosystem resilience through large-scale deployment of restoration, monitoring, and climate-smart technologies across mangroves, wetlands, forests, agricultural landscapes, and protected areas, contributing directly to GBF Targets 2, 3, and 8.
- Improved biodiversity governance and data systems, including an operational national biodiversity information system, enhanced remote sensing and monitoring capacity, and strengthened reporting to CBD, UNFCCC, and UNCCD processes (GBF Target 21).
- Inclusive, technology-enabled livelihoods, particularly for women and youth, through nature-based enterprises, reduced post-harvest losses, and climate-resilient value chains that reduce pressure on natural ecosystems (GBF Targets 10, 11, and 23).

- Sustained national capacity for technology transfer, with strengthened institutions able to evaluate, procure, adapt, maintain, and scale biodiversity-relevant technologies beyond individual project cycles (GBF Target 19).

Institutional and Governance Arrangements

Implementation is anchored in a clear governance architecture led by a Technology Transfer Steering Committee (TTSC) under the Ministry of Environment, Climate Change and Natural Resources, with strong participation from finance, sector ministries, academia, civil society, and the private sector. A multidisciplinary Technical Advisory Panel ensures scientific rigor, safeguards compliance, and alignment with Access and Benefit-Sharing obligations. Decentralized regional and local technology focal points embed delivery at landscape and community levels, ensuring local ownership and sustainability.

Cost and Financing Framework

The indicative total financing envelope for the TTSAP (2025–2035) is estimated at USD 2.536 million, implemented through a phased approach:

- Phase 1 – Readiness and Technology Needs Assessment (2025–2026): USD 0.5 million. This phase covers national TNA implementation, institutional set-up, governance systems, safeguards screening, and preparation of investment-ready project pipelines.
- Phase 2 – Pilots and Systems Development (2026–2029): USD 0.9 million. Resources support pilot deployment of priority technologies across ecosystems and sectors, establishment of national data and monitoring platforms, capacity-building programs, and initial private-sector engagement.
- Phase 3 – Scale-up and Institutionalization (2029–2035): USD 1. 136 million (indicative). This phase finances national scaling of proven technologies, long-term operation and maintenance systems, replication across regions, and integration into national and sub-national planning and budgeting frameworks.

Financing Sources

Financing will be mobilized through a blended approach:

- International biodiversity and climate finance (approximately 60–65%), including GEF (including GBFF), GCF, Adaptation Fund, and bilateral partners (EU, Germany, UK, World Bank, AfDB).
- National public co-financing (20–25%) through government budget allocations, in-kind institutional support, and integration into sector programs under the RF-NDP and NBSAP II.

- Private sector and innovative finance (10–15%) via public–private partnerships, impact investment in nature-based enterprises, and service-based technology delivery models.

1. Purpose & scope

The Technology Transfer Strategy and Action Plan (TTSAP) provide an implementable, nationally coordinated framework to identify, access, adapt, transfer, and scale biodiversity-related technologies essential for achieving the Gambia's national biodiversity priorities under the NBSAP 2015–2020 and its international commitments under the Kunming–Montreal Global Biodiversity Framework (GBF 2030). It operationalizes the country's obligations under the Convention on Biological Diversity (CBD), particularly provisions relating to technology cooperation, capacity-building, and fair and equitable benefit-sharing—by offering a practical roadmap for strengthening technological readiness across biodiversity, ecosystems, climate resilience, and community livelihood systems.

The Strategy aims to ensure that The Gambia possesses the technical, institutional, and financial capabilities required to utilize modern, locally appropriate, and environmentally sound technologies that enable:

i. Ecosystem protection and restoration, including forests, mangroves, wetlands, rangelands, and freshwater systems
ii. Sustainable use of biodiversity, including fisheries, agroecological production systems, and non-timber forest products
iii. Monitoring and reporting, consistent with CBD, UNCCD, and UNFCCC requirements, including GBF Target 21
iv. Strengthened access and benefit-sharing (ABS) for genetic resources, digital sequence information, and related knowledge; and
v. Inclusive, community-driven livelihoods, supported by climate-resilient, nature-positive technologies.

Through the TTSAP, The Gambia seeks to transition from fragmented, project-driven technology investments to a coherent national system that embeds technology transfer within long-term governance structures, regional and global partnerships, and sustainable financing arrangements.

1.2. Scope of the Strategy

The scope of the Technology Transfer Strategy and Action Plan spans the entire biodiversity–ecosystem–livelihood continuum and is intentionally designed to support integrated, cross-sectoral implementation of the Gambia's NBSAP II 2025–2035. It incorporates the full range of ecological systems—coastal, marine, forest, savanna, wetland, freshwater, and agricultural landscapes—as well as the socio-economic systems that depend on them. This broad scope ensures that technology transfer is not approached as a narrow, sector-specific intervention but as a comprehensive, national mechanism that strengthens resilience, productivity, and sustainability across interconnected ecological and livelihood domains.

The Strategy focuses on six priority domains derived from national needs assessments, the updated NBSAP, and the implementation requirements of the Kunming–Montreal Global Biodiversity Framework (GBF): (1) coastal and mangrove restoration technologies; (2) sustainable fisheries and aquatic resource technologies; (3) agroecological and climate-smart production technologies; (4) protected area management and biodiversity conservation technologies; (5) environmental monitoring, data, and decision-support systems; and (6) community-based adaptation and green livelihood technologies.

These domains provide a holistic framework for technology transfer—ensuring that ecosystem protection, sustainable use, restoration, ABS obligations, community resilience, and national reporting requirements are addressed in a coherent, well-coordinated, and scalable manner.

1.3 Theory of Change

The Technology Transfer Strategy and Action Plan (TTSAP) is based on the premise that biodiversity loss in The Gambia is not primarily due to lack of policy ambition, but to gaps in access to appropriate technologies, institutional capacity, financing, and coordinated deployment systems.

If biodiversity technology gaps across ecosystems (mangroves, wetlands, forests, fisheries, agriculture, protected areas, and data systems) are systematically identified through a national Technology Needs Assessment, and if institutions are strengthened to evaluate, adapt, finance, and manage these technologies through robust governance, skills development, and Access and Benefit-Sharing frameworks, then technologies can be effectively deployed and maintained at scale.

When locally adapted, environmentally sound technologies are deployed through participatory, gender-responsive, and decentralized mechanisms—supported by finance, monitoring systems, and private sector engagement—then ecosystem management and restoration outcomes improve, institutional performance strengthens, and data-driven decision-making becomes routine.

These improvements lead to healthier and more resilient ecosystems, including restored mangroves and wetlands, sustainably managed fisheries and agricultural landscapes, better protected areas, and integrated biodiversity monitoring systems. As a result, communities—especially women and youth—benefit from diversified, climate-resilient, nature-positive livelihoods, while pressure on natural resources is reduced.

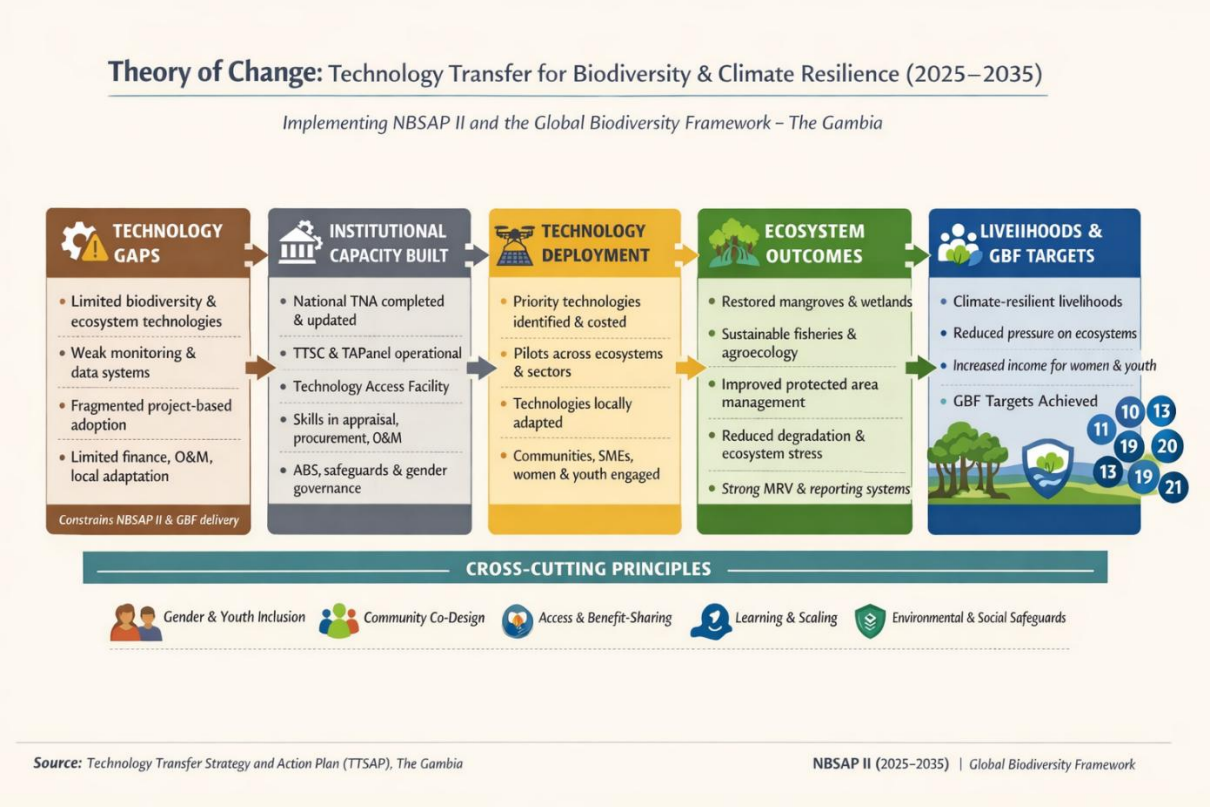


Figure 1. Theory of Change for the Technology Transfer Strategy and Action Plan (TTSAP) 2025–2035.

The diagram illustrates how addressing technology gaps through strengthened institutional capacity enables effective deployment of biodiversity technologies, leading to improved ecosystem outcomes, resilient livelihoods, and achievement of Global Biodiversity Framework targets.

Over the long term, this pathway enables systemic achievement of national biodiversity priorities and Global Biodiversity Framework targets, strengthens national ownership of technology transfer, and embeds biodiversity conservation and ecosystem-based adaptation within The Gambia's development trajectory beyond project cycles.

1.4 Strategic Priority Domains

1.4.1 Coastal and Mangrove Restoration Technologies

Coastal and mangrove restoration technologies are central to safeguarding The Gambia's estuarine ecosystems, which are increasingly threatened by salinization, erosion, hydrological disruption, and land degradation. The LDN Technical Report identifies wetland and riverine zones as some of the most vulnerable ecosystems in the country, noting widespread productivity decline, altered hydrology, and salinity intrusion in coastal and lowland agricultural areas. In

response, the TTSAP prioritizes technologies such as hydrological restoration tools, tidal-flow regulators, sediment and salinity monitoring sensors, and water-level loggers to rehabilitate mangrove systems in the Tanbi wetlands, Bao Bolong National Park, and the Central River Region.

Complementary technologies such as mangrove nursery systems, propagule propagation units, and remote-sensing monitoring platforms, support large-scale replanting, survival tracking, and blue-carbon accounting. These interventions align with the RF-NDP 2023–2027 objective of building environmentally sustainable, climate-resilient communities through ecosystem restoration and nature-based solutions. Together, they strengthen shoreline protection, enhance fisheries nurseries, and reinforce the country's blue-carbon restoration potential.

1.4.2 Sustainable Fisheries and Aquatic Resource Management

Sustainable fisheries technologies are critical for addressing pressures on The Gambia's riverine and coastal ecosystems, where declining productivity, habitat degradation, and climate stress threaten food security and livelihoods. The LDN Technical Report highlights significant degradation in riparian and estuarine ecosystems—areas essential for fish breeding and nursery functions—driven by poor land management, salinization, and hydrological disruption. To strengthen resilience and improve fisheries governance, TTSAP prioritizes fish stock assessment tools, digital landing-site data platforms, GPS and vessel monitoring systems, and water quality sensors capable of detecting salinity, turbidity, and pollution trends.

Additionally, improved post-harvest technologies, including fuel-efficient fish smoking kilns, solar and hybrid cold-chain systems, and hygienic fish handling equipment—address the high post-harvest losses documented in national development assessments. The Results Framework of the National Development Plan underscores the need for green, climate-resilient livelihood technologies to support coastal and riverine communities. Together, these technologies promote sustainable harvest practices, strengthen aquatic resource management, and enhance incomes and food security for fishing-dependent households.

1.4.3 Agroecological and Climate-Smart Production Technologies

Agroecological and climate-smart production technologies are essential for reversing declining soil fertility, reducing pressure on forests and wetlands, and strengthening agricultural resilience in The Gambia. The LDN Technical Report highlights widespread land degradation driven by overcultivation, nutrient mining, and poor soil management, underscoring the need for improved soil diagnostics, climate-resilient cropping systems, and sustainable land use practices. Priority technologies include drought-tolerant and early maturing seed varieties, conservation agriculture tools, soil fertility testing kits, and precision irrigation systems such as drip and solar-powered micro-irrigation.

Lowland and upland agricultural zones—particularly those affected by salinization and erosion—require ecosystem-based farm monitoring tools, including remote sensing platforms and digital farm record systems. This aligns with the Digital Readiness Assessment Report, which emphasizes the need for interoperable data systems and improved agricultural information flows to support

climate adaptation and productivity gains (GoTG 2023). Collectively, these technologies enable sustainable intensification, reduce reliance on forest resources, and promote resilient food systems across The Gambia's agro-ecological zones.

1.4.4 Protected Area Management and Biodiversity Conservation Technologies

Strengthening protected area (PA) management in The Gambia requires modern biodiversity monitoring and enforcement technologies, especially as forest parks, community forests, and national parks face pressures from illegal logging, wildlife decline, bushfires, and habitat degradation. The LDN Technical Report highlights declining vegetation productivity and forest degradation across several regions, underscoring the need for enhanced surveillance and monitoring capacity within protected landscapes. At the institutional level, the Environmental Statistics NAP identifies severe gaps in biodiversity data collection, limited monitoring tools, and fragmented information systems, which impede effective PA management and national reporting obligations (MECCNAR 2018).

To address these challenges, the TTSAP prioritizes GPS-enabled ranger systems, camera traps, acoustic sensors, drone-based surveillance, invasive species detection tools, eDNA sampling kits, and fire-risk modelling technologies, alongside digital permit and reporting platforms. These technologies align with the RF-NDP's emphasis on enhancing environmental governance and resilient ecosystems through improved monitoring and enforcement systems. Together, they strengthen conservation effectiveness across national parks, forest parks, community-managed forests, and Key Biodiversity Areas.

1.4.5 Environmental Monitoring, Data, and Decision-Support Systems

Effective environmental monitoring and decision-support systems are fundamental to implementing the NBSAP II, meeting GBF Target 21, and fulfilling reporting obligations under the UNCCD, UNFCCC, and SDGs. National assessments reveal substantial gaps in data availability, quality, and institutional coordination. The Environmental Statistics NAP highlights that most agencies lack systematic environmental data collection, resulting in fragmented and incompatible datasets that impede evidence-based planning and Multilateral Environmental Agreements MEA reporting. Similarly, the LDN Technical Report underscores the need for improved land productivity assessments, SOC monitoring, and spatial mapping capacities to track degradation and restoration progress effectively.

To address these deficiencies, the TTSAP prioritizes remote sensing platforms, integrated national biodiversity databases, land-use modelling software, and interoperable environmental data architectures. Complementary systems include hydrometeorological stations, GHG inventory and transparency Monitoring Reporting and Verification (MRV) systems, and digital environmental statistics platforms. These investments align with the Second NDC's call for strengthened MRV, climate data systems, and hydrometeorology infrastructure to enhance adaptation tracking and Paris Agreement transparency. Collectively, these technologies create a coordinated national

monitoring framework capable of supporting timely decision-making, ecosystem management, and international reporting.

1.4.6 Community-Based Adaptation and Green Livelihood Technologies

Community-based adaptation and green livelihood technologies are essential for strengthening resilience among women, youth, and natural-resource–dependent households. The LDN Technical Report notes that land degradation, declining productivity, and salinization disproportionately affect rural communities, heightening vulnerability and reducing livelihood options. To address these pressures, the TTSAP prioritizes a suite of inclusive, low-cost, and locally maintainable technologies—such as solar dryers, NTFP processing equipment, biogas digesters, briquette-making machines, and nature-based enterprise tools for honey, oysters, nut grass ("goweh" / "Kuntomang") and agroforestry value chains.

Complementing these are community environmental monitoring apps and mobile reporting tools, which help fill major data gaps identified in the Environmental Statistics NAP and strengthen community participation in biodiversity monitoring and early warning systems. The RF-NDP emphasizes that green livelihood technologies are central to building climate-resilient, environmentally sustainable communities and to empowering women and youth through improved income opportunities and reduced reliance on degraded natural resources. Together, these technologies enhance adaptation, support biodiversity stewardship, and enable inclusive economic development.

1.5. Implementation Focus

The Technology Transfer Strategy and Action Plan (TTSAP) is designed as an implementable national framework that prioritizes practical, scalable, and low-maintenance technologies suited to The Gambia's ecological zones and institutional capacities. It translates national and global biodiversity commitments into deliverable actions that can be implemented through existing sector systems, local government structures, and community institutions.

To ensure a structured pathway from needs identification to on-the-ground deployment, the TTSAP includes five core components:

1. Technology Needs Assessment (TNA): A transparent and evidence-based assessment that identifies and prioritizes biodiversity technology gaps across ecosystems and productive sectors, using criteria such as feasibility, affordability, impact, scalability, and institutional readiness.
2. Technology Action Plan (TAP): A costed and sequenced action plan that converts the TNA priorities into implementable interventions over the implementation period. The TAP defines timelines, key performance indicators (KPIs), institutional roles, and budgets to enable effective planning and accountability.
3. Governance and institutional architecture: A coordination and oversight framework that clarifies leadership, inter-agency collaboration, technical advisory functions, and

decentralized implementation. This ensures coherent delivery across sectors and prevents duplication of efforts.

4. Financing strategy: A blended financing approach that combines national resources with international biodiversity and climate finance instruments—such as GEF, GCF, and the Global Biodiversity Framework Fund—as well as public–private partnership (PPP) models to support technology deployment, operation, and scaling.
5. Monitoring, evaluation, and learning (MEL): A results-based framework aligned with CBD/GBF monitoring expectations to track technology deployment, ecological outcomes, capacity gains, and social inclusion impacts. Lessons learned are systematically documented to guide adaptive management and scaling.

Importantly, the TTSAP treats technology transfer as more than procurement. It includes capacity-building, co-development with local actors, technology adaptation to Gambian conditions, maintenance and after-sales systems, knowledge exchange, and equitable benefit-sharing, consistent with CBD principles. The Strategy therefore provides a nationally owned platform to identify, access, adapt, transfer, and scale biodiversity-related technologies required to achieve The Gambia's NBSAP II priorities and the GBF 2030 targets—with implementation focus areas including coastal and mangrove restoration, sustainable fisheries, agroecological practices, protected area management, monitoring and data systems, and community-based adaptation and green livelihoods.

2. Policy and Strategy alignment

The Technology Transfer Strategy and Action Plan (TTSAP) is grounded in national and international policy frameworks that advance biodiversity conservation, sustainable development, and climate resilience in The Gambia. It aligns with the Convention on Biological Diversity (CBD), the Kunming–Montreal Global Biodiversity Framework (GBF), and national priorities under the NBSAP II 2025–2035, as well as sectoral policies on forestry, fisheries, wetlands, and community livelihoods. The Strategy incorporates CBD provisions on technology transfer and benefit-sharing and applies globally recognized methodologies such as Technology Needs Assessment (TNA) and Technology Action Plan (TAP), commonly used in climate finance and Green Climate Fund (GCF) programming, to ensure systematic adoption, scaling, and institutionalization of biodiversity technologies.

By supporting climate mainstreaming, risk-informed planning, and evidence-based decision-making, the TTSAP promotes resilient food systems, low-emission production, and inclusive economic growth. These policy foundations guarantee compliance with international obligations while tailoring implementation to The Gambia's socio-ecological context and institutional capacity.

2.1 Rationale for the Technology Transfer Plan Under International Frameworks and Agreements

The Technology Transfer Plan is developed to operationalize The Gambia's commitments under the National Biodiversity Strategy and Action Plan (NBSAP) 2025–2035 and to ensure continuity and alignment with the Kunming–Montreal Global Biodiversity Framework (GBF, 2022). It addresses persistent capacity, technology, and financing gaps identified during NBSAP implementation while positioning the country to meet the enhanced ambition and implementation requirements of the GBF. [1]

2.1.1 Rationale under the NBSAP (2015–2020)

The NBSAP (2015–2020) explicitly identifies technology transfer, knowledge management, and capacity building as core enablers of biodiversity conservation and sustainable use under Strategic Goal E. NBSAP Target 19 calls for improving, widely sharing, transferring, and applying knowledge, science, and technologies relating to biodiversity, its values, functioning, status, and trends.[2]

The NBSAP further emphasizes:

- Effective implementation of an updated and participatory NBSAP through strengthened institutional systems (Target 17);[3]
- Technologies to support ecosystem restoration, climate resilience, and ecosystem services, including forests, wetlands, and mangroves (Targets 2, 8, and 15); [4]
- Tools to promote sustainable use of biodiversity and wildlife resources (Targets 5, 10, and 12);[5]
- Operationalization of Access and Benefit-Sharing (ABS) (Target 16) and the protection of traditional knowledge of indigenous and local communities (Target 18);[6]

[1] Convention on Biological Diversity (CBD). National Biodiversity Strategies and Action Plans (NBSAPs). https://www.cbd.int/nbsap

[2] CBD (2011). Strategic Plan for Biodiversity 2011–2020 – Aichi Target 19. https://www.cbd.int/sp/targets

[3] CBD (2011). Aichi Target 17: Updated and participatory NBSAPs. https://www.cbd.int/sp/targets/rationale/target-17

[4] CBD (2011). Aichi Targets 2, 8 and 15. https://www.cbd.int/sp/targets

[5] CBD (2011). Aichi Targets 5, 10 and 12. https://www.cbd.int/sp/targets

[6] CBD (2011). Nagoya Protocol on Access and Benefit-Sharing & Aichi Target 18. https://www.cbd.int/abs

- Strengthened resource mobilization and financing mechanisms to support implementation (Target 20).[7]

While the NBSAP includes a Technology Transfer Annex, implementation experience demonstrated that the lack of a prioritized and financed technology framework constrained national scaling and sustainability. The Technology Transfer Plan therefore translates Targets 17, 19, and 20 into coordinated, implementable actions.

2.1.2 Rationale under the Kunming–Montreal Global Biodiversity Framework (2022)

The Kunming–Montreal Global Biodiversity Framework (GBF) significantly elevates global expectations for technology development, transfer, and scientific cooperation as core enablers of biodiversity implementation. Under GBF Goal D, Parties are called upon to strengthen the means of implementation through enhanced capacity-building, technology transfer, access to innovation, and mainstreaming of biodiversity across sectors. GBF Target 19 explicitly requires countries to improve national systems for capacity development, technology cooperation, and access to environmentally sound technologies to support achievement of all GBF goals (CBD, 2022).

The GBF establishes the global roadmap for halting and reversing biodiversity loss by 2030, backed by four overarching goals and 23 action-oriented targets. The TTSAP directly supports the implementation of key GBF targets by prioritizing technologies that address ecosystem restoration, species monitoring, sustainable use, equitable benefit-sharing, and capacity development.

Beyond Target 19, several additional GBF targets reinforce the necessity of establishing a coherent national Technology Transfer Strategy and Action Plan. Target 1 emphasizes biodiversity-inclusive spatial planning and land-use management, which depends on access to geospatial technologies, decision-support tools, and integrated data systems. Target 2 calls for large-scale restoration of degraded ecosystems, requiring restoration-support technologies, monitoring tools, and scalable implementation methods. Target 3 focuses on effective and equitable management of protected areas and other effective area-based conservation measures (OECMs), which rely on modern monitoring, enforcement, and community engagement technologies.

Similarly, Target 10 on sustainable management of agriculture, forestry, and fisheries highlights the need for climate-smart and biodiversity-friendly production technologies. Target 13 reinforces the importance of fair and equitable Access and Benefit-Sharing (ABS), including mechanisms related to genetic resources, traditional knowledge, and digital sequence information, all of which require appropriate institutional and technological systems. Target 14 mandates the mainstreaming of biodiversity across policies and development plans, necessitating integrated planning and monitoring tools. Target 20 underscores the need for resource mobilization, which in turn requires investment-ready technology pipelines. Finally, Targets 21–23 stress knowledge

[7] CBD (2011). Aichi Target 20: Resource Mobilization. https://www.cbd.int/sp/targets/rationale/target-20

sharing, inclusive participation of Indigenous peoples and local communities, gender equality, and intergenerational equity, all of which depend on accessible, participatory, and inclusive technology platforms.

Collectively, these targets demonstrate that achieving the GBF requires a shift from fragmented and project-based technology adoption toward systematic, nationally coordinated technology transfer systems that integrate policy, finance, capacity-building, and implementation (CBD, 2022).

2.1.3 Bridging NBSAP Targets and GBF Ambition

The Technology Transfer Plan provides a strategic bridge between the legacy priorities of the NBSAP (2015–2020) and the forward-looking ambition of the GBF. It ensures continuity while upgrading national implementation systems to meet GBF Targets 1–3, 10, 13, 19, and 20, directly supporting compliance with GBF Goal D and strengthening long-term biodiversity outcomes in The Gambia.

GBF Target 2: Restoration of Ecosystems

The TTSAP directly advances GBF Target 2, which calls for the restoration of degraded ecosystems to enhance biodiversity, ecosystem services, and resilience. In line with national restoration commitments, the TTSAP promotes a suite of practical and scalable technologies tailored to The Gambia's ecological conditions. These include mangrove and wetland hydrological restoration technologies that restore natural water flows and improve ecosystem functioning, as well as soil rehabilitation tools that rebuild soil fertility and structure in degraded agricultural and forest landscapes. Assisted Natural Regeneration (ANR) techniques are emphasized as cost-effective restoration approaches that protect and accelerate natural regrowth while strengthening community stewardship. In addition, erosion control technologies, such as contouring and vegetative barriers, reduce land degradation and sediment loss. Remote sensing–based land degradation monitoring systems support evidence-based planning, progress tracking, and national reporting, ensuring restoration efforts are targeted, adaptive, and scalable.

GBF Target 3: Effective Conservation and Area-Based Management

The TTSAP directly supports GBF Target 3, which calls for the effective and equitable conservation and management of protected areas and other effective area-based conservation measures. To enhance management effectiveness, the Strategy prioritizes a range of modern, cost-effective monitoring and enforcement technologies. Camera traps and acoustic sensors enable continuous, non-invasive monitoring of wildlife presence, population trends, and human pressures, improving ecological understanding and early detection of threats. SMART-based patrol tools strengthen ranger planning, data collection, and performance tracking, enhancing accountability and adaptive management. Drones for anti-poaching and surveillance expand coverage of remote and difficult-to-access areas, increasing deterrence and response capacity. In addition, emerging tools such as environmental DNA (eDNA) and bio-acoustic monitoring provide rapid and scientifically robust assessments of species diversity and ecosystem health. Together, these technologies improve conservation effectiveness, strengthen ecological connectivity, and support national

reporting against GBF requirements on representation, management performance, and long-term biodiversity outcomes.

GBF Target 10 & 11: Sustainable Resource Use

The TTSAP advances GBF Targets 10 and 11, which focus on the sustainable use of biodiversity and the reduction of negative impacts from food production systems, including fisheries and agriculture. In the fisheries sector, the TTSAP promotes low-impact fishing gear, fish stock monitoring sensors, and GPS-enabled vessel tracking, which improve selectivity, reduce bycatch, and support science-based management. Cold-chain and post-harvest technologies, such as solar-powered ice makers and insulated storage systems, reduce losses and increase value without intensifying fishing pressure. In agriculture, the Strategy supports agroecological technologies including precision and water-efficient irrigation, conservation agriculture tools, and soil fertility enhancement systems that reduce land degradation, chemical inputs, and ecosystem stress. Together, these technologies promote sustainable production, strengthen food security, and protect ecosystem functions, ensuring that resource use contributes to livelihoods and economic development while maintaining biodiversity integrity in line with GBF guidance.

GBF Target 20: Capacity Building and Technology Transfer

GBF Target 20 calls for enhanced capacity building, resource mobilization, and cooperation on access to and transfer of environmentally sound technologies as essential means of implementation of the Global Biodiversity Framework. The TTSAP is explicitly designed as The Gambia's national response to this requirement. It establishes a coordinated governance framework that brings together relevant ministries, technical institutions, local authorities, and non-state actors to guide technology identification, adaptation, and deployment.

The TTSAP also strengthens institutional and human capacities through training, technical assistance, and knowledge exchange, ensuring that transferred technologies can be effectively operated, maintained, and scaled. In addition, the Strategy sets out resource mobilization mechanisms that align national priorities with international biodiversity and climate finance instruments, including GEF, GCF, and the Global Biodiversity Framework Fund. By embedding technology cooperation within national planning and financing systems, the TTSAP enables sustained access to environmentally sound technologies and supports long-term implementation of biodiversity commitments.

GBF Target 21: Knowledge, Data, and Monitoring

The TTSAP supports national compliance with GBF Target 21 by strengthening integrated systems for biodiversity data, monitoring, and reporting. Central to this effort is the development of a National Biodiversity Information System (NBIS) that consolidates data from multiple sectors and scales, improving accessibility and interoperability. The Strategy also supports enhanced environmental statistics systems to strengthen evidence-based decision-making and national reporting. Expansion of the hydrometeorological monitoring network improves tracking of

climate and ecosystem variables, while remote sensing capabilities enable consistent monitoring of land cover change, habitat condition, and degradation trends. In addition, monitoring, reporting, and verification (MRV) systems integrate biodiversity, climate, and land-use data, ensuring transparency, consistency, and credibility in reporting to the CBD on biodiversity trends, ecosystem services, and progress toward national and global targets.

2.1.4 Alignment with The Gambia's National Biodiversity Strategy and Action Plan (NBSAP) II

The TTSAP is designed to operationalize the technology-related dimensions of the NBSAP II 2025–2035, which identifies priority sectors—including forestry, fisheries, wetlands, agricultural landscapes, and protected areas—as central to national biodiversity outcomes.

Forestry and terrestrial ecosystems

Forestry and terrestrial ecosystems are fundamental to The Gambia's biodiversity, climate resilience, and rural livelihoods. The National Biodiversity Strategy and Action Plan (NBSAP) II identify deforestation, recurrent bushfires, land degradation, and declining forest cover as major threats to ecosystem integrity and the sustainable provision of ecosystem services (CBD, 2015). These pressures are largely driven by agricultural expansion, fuelwood extraction, uncontrolled burning, and limited monitoring and enforcement capacity at local levels. Addressing these challenges requires the deployment of appropriate, cost-effective, and locally adaptable technologies.

The TTSAP directly supports NBSAP priorities by promoting a coordinated suite of forestry and land management technologies. Fire management technologies, including early-warning systems, firebreak planning tools, and community-based fire response equipment, help reduce the frequency and intensity of bushfires while improving preparedness and rapid response. Community forest monitoring applications empower local forest committees and rangers to report illegal activities, fire outbreaks, and forest condition in real time, strengthening co-management arrangements and compliance with forest regulations.

In addition, soil and vegetation mapping tools and remote sensing platforms provide accurate and timely data on forest cover change, degradation hotspots, and restoration potential. These technologies support evidence-based land-use planning, improve targeting of restoration interventions, and strengthen national monitoring, reporting, and verification (MRV) systems. Finally, Assisted Natural Regeneration (ANR) and other restoration-support technologies offer low-cost and scalable solutions for forest recovery by protecting natural regrowth, enhancing seedling survival, and integrating community stewardship (FAO, 2018). Together, these technological pathways contribute to ecosystem restoration, climate mitigation and adaptation, and the long-term sustainability of terrestrial landscapes in line with national and global biodiversity goals (CBD, 2022).

Fisheries and aquatic biodiversity

The National Biodiversity Strategy and Action Plan (NBSAP) II emphasize the need to strengthen the sustainable use of aquatic resources, rehabilitate degraded wetlands, and improve monitoring and management of fish stocks to safeguard food security, livelihoods, and ecosystem health. Overexploitation of fisheries, declining water quality, habitat degradation, and limited monitoring capacity have increased pressure on coastal and inland aquatic systems, particularly estuaries and mangrove-associated fisheries.

In response, the TTSAP prioritizes a targeted package of aquatic and fisheries-related technologies that address these challenges in an integrated manner. Fish stock assessment technologies, including digital catch reporting tools and acoustic monitoring systems, support evidence-based fisheries management and adaptive decision-making. Water quality sensors enable regular monitoring of key parameters such as salinity, turbidity, and dissolved oxygen, providing early warning of ecosystem stress in rivers, wetlands, and coastal waters. Improved fish processing and cold-chain systems reduce post-harvest losses, enhance product quality, and increase income without intensifying fishing pressure. GPS-enabled vessel monitoring technologies strengthen compliance, safety at sea, and spatial management of fisheries. In parallel, mangrove restoration technologies, including nursery systems and hydrological restoration tools, rehabilitate critical nursery habitats and enhance long-term productivity of aquatic ecosystems.

Wetlands and coastal systems

Wetlands are identified in the NBSAP as critical ecosystems for biodiversity conservation, fisheries productivity, water regulation, and climate adaptation. Coastal and inland wetlands, particularly mangrove systems, provide essential nursery habitats, protect shorelines from erosion and storm surges, and enhance resilience to sea-level rise and flooding. However, altered hydrology, increasing salinity, sedimentation, and human pressures have led to widespread wetland degradation.

The TTSAP responds to these challenges by promoting a suite of targeted wetland management and restoration technologies. Hydrological restoration tools, such as tidal channel re-opening and culvert installation, help restore natural water flows and ecological functioning. Salinity and sediment sensors provide real-time data to track environmental changes and identify early signs of ecosystem stress. Tidal flow adjustment systems support adaptive management by regulating water exchange in degraded wetlands and reclaimed areas. In addition, mangrove nursery technologies, including improved propagation techniques and climate-resilient seedling selection, support large-scale restoration and community-led rehabilitation efforts. Together, these technologies strengthen wetland resilience, sustain fisheries, and enhance climate adaptation benefits.

Community livelihoods and equitable benefit-sharing

Aligned with NBSAP targets on mainstreaming biodiversity into sustainable livelihoods, the TTSAP promotes technologies that link conservation outcomes with income generation, energy access,

and resilience at community level. Many rural and coastal households depend directly on natural resources for food, fuel, and income, yet unsustainable practices often undermine ecosystem health and long-term livelihoods. Addressing this challenge requires practical technologies that reduce pressure on biodiversity while enhancing economic opportunities.

The TTSAP supports solar dryers and other low-energy processing technologies to reduce post-harvest losses and improve product quality for fisheries, horticulture, and non-timber forest products (NTFPs). NTFP value-addition tools, such as honey processing equipment and small-scale fruit and medicinal plant processing units, increase incomes without increasing extraction rates. Agroecological technologies, including composting systems, water-efficient irrigation, and soil improvement tools, promote biodiversity-friendly farming. In addition, biogas and briquette systems reduce reliance on fuelwood, lowering deforestation pressures. Priority is given to women- and youth-friendly green enterprise technologies, supporting inclusive economic participation and translating NBSAP policy commitments into concrete, implementable livelihood pathways.

2.1.5 CBD Technology Transfer Obligations and Biodiversity Technology Initiative Principles

The Convention on Biological Diversity (CBD) establishes clear and binding obligations for Parties to promote access to, and transfer of, environmentally sound technologies as a core means of implementing biodiversity objectives. Article 16 (Access to and Transfer of Technology) and Article 18 (Scientific and Technical Cooperation) call on Parties to develop national frameworks that facilitate technology cooperation, strengthen national capacities, and ensure that technology transfer is undertaken on fair and equitable terms. These obligations are reinforced under the Kunming–Montreal Global Biodiversity Framework (GBF) and its accompanying Capacity-Building and Technology Transfer Plan, which emphasize the role of technology in achieving the Framework's 2030 targets (CBD, 2011; CBD, 2022).

The Technology Transfer Strategy and Action Plan (TTSAP) operationalize these CBD obligations by embedding internationally agreed principles of biodiversity technology transfer into a nationally owned and implementable framework. First, the Strategy ensures that technology transfer is demand-driven, drawing directly on priorities identified through the Technology Needs Assessment (TNA). This approach aligns technology investments with national biodiversity challenges and avoids supply-driven or inappropriate solutions (UNEP, 2021).

Second, the TTSAP places strong emphasis on strengthening endogenous capacities. Technology transfer is treated not merely as equipment delivery, but as a process of institutional development, skills enhancement, and sustained knowledge exchange. Training, operational support, and local maintenance systems are integral components of all technology interventions, consistent with CBD guidance on capacity-building (CBD, 2022).

Third, the Strategy promotes equitable access to technology, with deliberate attention to women, youth, Indigenous peoples, and local communities. This reflects GBF commitments to inclusive participation and social equity. Fourth, the TTSAP prioritizes local co-development and

adaptation, ensuring that technologies are tailored to local ecological and socio-economic contexts rather than transferred in standardized form.

Fifth, the Strategy embeds fair and equitable benefit-sharing, particularly where genetic resources, digital sequence information (DSI), or traditional knowledge are involved, in line with the CBD and Nagoya Protocol. Finally, the TTSAP encourages South–South and triangular cooperation, fostering scientific and technical collaboration among developing countries. By embedding these CBD principles, the TTSAP ensures compliance with global commitments while strengthening national readiness to attract technical and financial support.

2.1.6 Alignment with TNA/TAP Approaches Used in Climate Finance (GCF, GEF)

The Technology Transfer Strategy and Action Plan (TTSAP) adopted the Technology Needs Assessment (TNA) and Technology Action Plan (TAP) methodology that is internationally recognized under climate technology transfer frameworks. This approach, promoted by the United Nations Framework Convention on Climate Change (UNFCCC) and widely applied by major financing mechanisms such as the Green Climate Fund (GCF) and the Global Environment Facility (GEF), ensures that technology interventions are systematic, investment-ready, and scalable over time (UNFCCC, 2013; GEF, 2020).

The TNA/TAP framework is essential because it introduces a structured and transparent technology prioritization process. Technologies are assessed using standardized criteria, including cost-effectiveness, technical feasibility, potential climate and biodiversity impacts, scalability, and institutional readiness. This methodology reduces fragmented or ad hoc technology selection and ensures that investments are aligned with national priorities and implementation capacity. As a result, the TTSAP establishes a robust evidence base for policy decisions and resource allocation, consistent with international best practice (UNEP, 2021).

Another key advantage of the TNA/TAP approach is its ability to support the development of bankable funding proposals. GCF and GEF project appraisal frameworks require clearly articulated technology rationales, implementation pathways, budgets, risk mitigation measures, and measurable results. By embedding these elements within the TTSAP, the Strategy significantly enhances The Gambia's readiness to access climate and biodiversity finance (GCF, 2023).

Operationally, the TTSAP applies to the TNA to identify biodiversity-relevant technology gaps across ecosystems and productive sectors. These gaps are then translated through the TAP into costed, sequenced, and monitored interventions covering the 2025–2035 period. The Strategy integrates monitoring, reporting, and verification (MRV) systems, as well as risk assessment and mitigation logic commonly used in climate finance, further strengthening investment credibility (GEF, 2020).

Implementation under the TTSAP follows a phased structure that mirrors GCF project design: readiness and foundational systems, scaling of field-level technologies, and long-term sustainability and institutionalization. Through this alignment, the TTSAP serves as a strong national platform for mobilizing climate and biodiversity financing.

2.2 Rationale Under National Policies and Strategies

The Technology Transfer Strategy and Action Plan (TTSAP) is a critical implementation instrument that translates The Gambia's climate, biodiversity, and development commitments into practical, scalable, and nationally owned solutions. Its rationale is firmly grounded in the priorities and implementation requirements of the National Climate Change Policy (NCCP), the Long-Term Strategy 2050 (LTS 2050), and the Revised Framework for the National Development Plan (RF-NDP 2023–2027), all of which identify technology access, capacity development, and institutional coordination as central enablers of resilience and sustainable development.

2.2.1. Rationale under the National Climate Change Policy (NCCP)

The NCCP recognizes that The Gambia's vulnerability to climate change—particularly in coastal zones, wetlands, agriculture, and fisheries—is exacerbated by limited access to appropriate technologies and weak institutional capacity to deploy them at scale. While the policy promotes climate adaptation, ecosystem-based adaptation (EbA), and low-emission development, it also acknowledges that fragmented and project-based technology adoption has constrained effectiveness and sustainability.

The TTSAP provides a structured national response to this challenge by establishing a coordinated system to identify, assess, adapt, and scale climate-relevant biodiversity technologies. By focusing on nature-based solutions, climate-smart production systems, early-warning tools, and monitoring technologies, the TTSAP operationalizes NCCP priorities in a way that strengthens adaptive capacity, reduces climate risks, and delivers co-benefits for livelihoods and ecosystems. Importantly, the TTSAP also strengthens access to climate finance by adopting technology prioritization, MRV, and investment-readiness approaches consistent with NCCP financing objectives.

2.2.2. Rationale under the Long-Term Strategy 2050 (LTS 2050)

The LTS 2050 articulates a national vision for a climate-resilient, low-emission, and sustainable development pathway over the long term. Central to this vision is the protection and restoration of natural systems as foundations for resilience, economic stability, and social well-being. However, achieving this transformation requires more than policy intent; it demands sustained deployment of appropriate technologies and the institutional capacity to maintain them over decades.

The TTSAP directly supports the LTS 2050 by embedding biodiversity technology transfer within a long-term transformation framework. It prioritizes technologies that restore ecosystem integrity, enhance carbon sinks, reduce vulnerability of climate-sensitive livelihoods, and prevent future losses rather than reacting to crises. By adopting phased implementation—from readiness and piloting to scaling and institutionalization—the TTSAP mirrors the LTS's transition logic and ensures that short-term investments contribute to enduring structural change. In this way, the TTSAP functions as a delivery mechanism for the LTS 2050's resilience and sustainability objectives.

2.2.3. Rationale under the RF-NDP 2023–2027

The Recovery-Focused National Development Plan, RF-NDP 2023–2027 emphasizes results-based planning, institutional reform, decentralization, digitalization, and resource mobilization as key drivers of development in the medium term. It also prioritizes climate resilience, natural resource management, job creation, and inclusive growth. Despite these priorities, implementation experience shows that sectoral initiatives often lack coordinated technology frameworks, leading to inefficiencies and limited impact.

The TTSAP addresses this gap by providing a cross-sectoral technology delivery framework that aligns biodiversity and climate technologies with national development priorities. It supports RF-NDP objectives by strengthening institutional coordination, enabling decentralized implementation through local technology focal points, and promoting green enterprises and value chains that generate employment and income. The TTSAP's emphasis on digital platforms, monitoring systems, and performance indicators also reinforces RF-NDP commitments to accountability, evidence-based decision-making, and public-sector performance.

The NCCP, LTS 2050, and RF-NDP share a common priority: deploying technologies effectively, in a coordinated and scalable manner to drive resilience and sustainable development. The TTSAP serves as the operational link between these frameworks, ensuring that climate and biodiversity technologies are systematically prioritized, financed, implemented, and maintained. By institutionalizing technology transfer, strengthening national and local capacities, and integrating financing and monitoring systems, the TTSAP translates The Gambia's climate, biodiversity, and development goals into measurable, enduring outcomes.

2.2.4. Rationale under The Gambia's NDC

The TTSAP serves as a key implementation mechanism for The Gambia's Nationally Determined Contribution (NDC) by operationalizing its technology, adaptation, mitigation, and capacity-building commitments. The Updated NDC (2021–2030) explicitly recognizes that achieving climate resilience and low-emission development requires access to appropriate, affordable, and locally adapted technologies, supported by strong institutions, finance, and knowledge systems. The TTSAP responds to this requirement by providing a structured national framework to identify, prioritize, adapt, deploy, and scale climate- and biodiversity-relevant technologies.

From an adaptation perspective, the NDC prioritizes ecosystem-based adaptation (EbA) across coastal zones, mangroves, wetlands, agriculture, forestry, and fisheries. The TTSAP directly supports these priorities by promoting technologies for mangrove and wetland restoration, sustainable land and water management, climate-resilient agriculture, fisheries monitoring, and early warning systems. By embedding these technologies within national and local institutions, the TTSAP strengthens adaptive capacity, particularly for climate-vulnerable communities in coastal and rural areas.

From a mitigation perspective, the NDC highlights land use, forestry, and renewable energy as key sectors for emissions reduction and carbon sequestration. Technologies promoted under the

TTSAP—such as forest and mangrove monitoring systems, renewable energy solutions for protected areas and rural enterprises, and sustainable production technologies—contribute to enhanced carbon sinks while delivering biodiversity and livelihood co-benefits. Improved data, monitoring, and reporting systems under the TTSAP also reinforce the NDC's transparency and MRV requirements.

The TTSAP further advances NDC enabling conditions by strengthening national capacity for technology transfer, innovation, and access to climate finance. Its alignment with internationally recognized TNA/TAP approaches enhances The Gambia's readiness to mobilize support from mechanisms such as the GCF and GEF. By emphasizing equity, gender responsiveness, and locally driven adaptation, the TTSAP ensures that NDC implementation delivers inclusive and sustainable outcomes.

Overall, the TTSAP translates the NDC's climate ambitions into coordinated, technology-enabled actions that simultaneously advance climate resilience, emissions reduction, biodiversity conservation, and sustainable development in The Gambia.

Table 1. TTAP Alignment with Major Frameworks, Policies and Strategies

NBSAP Strategic Goal & Priority Sector	Relevant GBF Goal(s) & Targets	TTAP Strategic Focus / Technology Areas	Alignment with NCCP (Climate Policy)	Alignment with LTS 2050	Alignment with RF-NDP 2023–2027	Alignment with NDC
Goal A – Mainstream biodiversity into development planning (land use, governance)	**Goal D**; Targets **1, 14, 19**	• Biodiversity-inclusive spatial planning tools (GIS, RS) • Decision-support & compliance tools	Supports climate-mainstreaming and risk-informed planning across sectors	Enables evidence-based, climate-resilient long-term development pathways	Aligns with results-based planning, spatial planning, and policy coherence reforms	Operationalizes NDC through ecosystem-based technologies, capacity, finance, and inclusive implementation.
Goal B – Reduce direct pressures on biodiversity (forests, wetlands, agriculture, fisheries)	**Goal B**; Targets **5, 7, 10**	• Climate-smart agriculture & agroecology • Sustainable fisheries technologies • Fire & invasive species management	Advances climate-resilient food systems and ecosystem-based adaptation	Supports low-emission, resilient production systems	Contributes to food security, rural livelihoods, and inclusive economic growth	Apply ecosystem technologies to reduce biodiversity pressures and strengthen climate adaptation across NDC priority sectors.
Goal C – Safeguard ecosystems, species & genetic diversity (PAs, ICCAs, coasts)	**Goal A**; Targets **2, 3, 8**	• Ecosystem restoration & NbS technologies • Protected area management (SMART, drones, camera traps)	Operationalizes ecosystem-based adaptation and disaster risk reduction	Strengthens ecosystem integrity, carbon sinks, and long-term resilience	Supports natural resource protection, eco-tourism, and climate resilience	Strengthens protected areas and coastal ecosystems using monitoring technologies to deliver climate resilience and mitigation benefits.
Goal D – Enhance benefits from biodiversity &	**Goals A & B**; Targets	• Nature-based enterprise technologies	Links biodiversity conservation with	Enables green growth and	Aligns with jobs, MSMEs, green growth, and	Supports climate-resilient livelihoods through nature-based

ecosystem services (livelihoods, resilience)	**2, 8, 10, 11**	• NTFP processing, eco-tourism tech, renewables	adaptive livelihoods	sustainable value chains	poverty reduction priorities	enterprises, renewable energy, and sustainable value chains.
Goal E – Knowledge management, capacity & participation	**Goal D**; Targets **19, 21, 22, 23**	• Biodiversity databases & CHM • E-learning, technology transfer platforms	Supports climate information services, MRV, and capacity building	Builds long-term institutional and human capital	Strengthens digitalization, statistics, and public-sector performance	Builds national capacity through training, partnerships, and knowledge systems enabling sustainable NDC implementation.
ABS, Genetic Resources & Traditional Knowledge (cross-cutting)	**Goal C**; Targets **13, 14, 21**	• Digital ABS registries • Traditional knowledge documentation • Traceability systems	Ensures equitable benefit-sharing in climate-related bio-innovation	Supports just transition and inclusive development	Aligns with governance reforms and social inclusion commitments	Embeds access and benefit-sharing ensuring equitable, rights-based technology transfer for climate action.
Resource Mobilization & Institutional Sustainability	**Goal D**; Target **20**	• Biodiversity finance tracking tools • Project pipeline & investment readiness systems	Strengthens access to climate finance (GCF, AF, carbon finance)	Enables sustained, blended financing for long-term transition	Supports RF-NDP financing strategy, PPPs, and donor alignment	Enhances climate finance access through bankable pipelines, blended finance, and partnerships.
Monitoring, Data & Early Warning Systems	**Goal D**; Targets **19, 21**	• Integrated biodiversity-climate data platforms • Remote sensing & early warning dashboards	Enhances climate risk monitoring and early warning	Supports long-term modelling, MRV, and adaptive management	Aligns with national data systems, digital governance, and accountability	Strengthens monitoring and early warning systems enabling transparent MRV and adaptive NDC implementation.

3. Strategic Objectives

The strategic objectives outlined below provide the operational backbone of the Technology Transfer Strategy and Action Plan (TTSAP), translating national biodiversity commitments into coordinated, results-oriented action. Together, they address the full technology lifecycle—from identification and prioritization, through institutional strengthening and financing, to equitable deployment, learning, and scaling. The objectives are mutually reinforcing and designed to ensure that biodiversity-related technologies are fit for purpose, locally adapted, financially sustainable, and socially inclusive. By integrating evidence-based planning, capacity development, investment mobilization, participatory approaches, and robust monitoring, these objectives enable The Gambia to systematically deploy technologies needed to achieve NBSAP II priorities and the GBF 2030 targets, while strengthening long-term national resilience and implementation capacity.

Strategic Objective 1: Identify and Prioritize Biodiversity and Ecosystem Management Technologies Needed to Achieve National Targets

This objective focuses on systematically identifying, assessing, and prioritizing technologies that directly support the achievement of national biodiversity targets under the NBSAP II. Priority technologies will be mapped against ecosystem types (forests, wetlands, mangroves, marine and coastal systems, agricultural landscapes) and thematic needs such as conservation planning, ecosystem restoration, invasive species management, climate resilience, and biodiversity monitoring. The process will be evidence-based, drawing on national assessments, research institutions, traditional knowledge holders, and lessons from ongoing projects. A transparent prioritization framework will be applied, considering ecological effectiveness, cost-efficiency, scalability, gender and social inclusion, and alignment with national development and climate strategies. The outcome will be a nationally endorsed portfolio of priority biodiversity technologies, serving as the foundation for investment, capacity building, and partnership development.

Strategic Objective 2: Strengthen Institutional Capacities for Technology Evaluation, Procurement, Adaptation, and Local Manufacturing or Maintenance

This objective aims to build the technical, organizational, and regulatory capacities of national and local institutions to effectively manage the full technology lifecycle. Key actions include strengthening skills in technology needs assessment, technical appraisal, procurement planning, and quality assurance within lead institutions and decentralized authorities. Emphasis will be placed on adapting imported technologies to local ecological, climatic, and socio-economic conditions, as well as promoting opportunities for local assembly, fabrication, repair, and maintenance. Partnerships with universities, vocational training centers, and the private sector

will support skills development and technology learning. Strengthened institutional capacity will reduce dependency on external expertise, lower long-term costs, and ensure the sustainability of biodiversity-related technologies.

Strategic Objective 3: Enable Access to Finance and Investment Mechanisms for Prioritized Biodiversity Technologies

This objective seeks to unlock sustainable financing for biodiversity technology transfer through a diversified mix of public, private, and blended finance instruments. It will support the development of bankable project pipelines aligned with national priorities and donor requirements, including grants, concessional loans, guarantees, and results-based financing. Public–private partnerships will be promoted to attract private sector investment in areas such as ecosystem restoration, waste management, renewable energy for protected areas, and biodiversity-friendly value chains. National mechanisms, including biodiversity and climate finance windows, will be leveraged to reduce financial risks and improve affordability. Clear financial frameworks will ensure that investments are transparent, equitable, and aligned with long-term biodiversity outcomes rather than short-term project cycles.

Strategic Objective 4: Support Equitable Technology Transfer and Locally Driven Adaptation Processes

This objective ensures that technology transfer processes are inclusive, rights-based, and responsive to local needs. Technologies will be co-designed and adapted with communities, local governments, women's groups, youth, and indigenous knowledge holders to ensure relevance and ownership. Capacity building will focus on practical skills development, knowledge exchange, and peer learning rather than one-off training events. Intellectual property and knowledge-sharing arrangements will respect Access and Benefit-Sharing principles, ensuring fair recognition and compensation for traditional knowledge and local innovation. By embedding equity, participation, and benefit-sharing into technology transfer, this objective strengthens social legitimacy and enhances the long-term effectiveness of biodiversity interventions.

Strategic Objective 5: Monitor, Evaluate, Learn, and Scale Biodiversity Technology Deployment

This objective establishes a robust system for tracking performance, impacts, and lessons of biodiversity technology deployment. Clear indicators will be developed to measure ecological outcomes, institutional performance, cost-effectiveness, social inclusion, and contribution to national and global targets. Monitoring and evaluation systems will be integrated with existing NBSAP reporting frameworks and national data platforms to avoid duplication and improve coherence. Knowledge generated through implementation will be systematically documented and shared through national clearing-house mechanisms, learning networks, and regional

platforms. Successful technologies and delivery models will be scaled up through policy integration, replication in new landscapes, and sustained financing, ensuring that innovation contributes to long-term biodiversity conservation and resilience.

4. Priority technology areas for The Gambia

The identification of priority technology areas for The Gambia under the Technology Transfer Strategy and Action Plan (TTAP) is informed by the sectoral priorities and implementation gaps identified in the National Biodiversity Strategy and Action Plan (NBSAP 2015–2020), as well as the enhanced ambition and implementation requirements of the Kunming–Montreal Global Biodiversity Framework (GBF, 2022). These priority areas reflect the country's ecological context, vulnerability to climate change, dependence on natural resources, and need for scalable, locally adapted, and inclusive technological solutions. Together, they provide a strategic focus for technology transfer interventions that support ecosystem integrity, sustainable livelihoods, and national development objectives.

4.1. Coastal and Mangrove Restoration Technologies

Coastal and mangrove ecosystems are among The Gambia's most valuable and vulnerable natural assets, providing critical ecosystem services including shoreline stabilization, fisheries nursery habitat, carbon sequestration, and protection against storm surges and sea-level rise. The NBSAP II identifies mangrove degradation, coastal erosion, and salinization as major threats, while the GBF emphasizes large-scale ecosystem restoration and climate resilience (GBF Targets 2 and 8).

Priority technologies in this area include restoration seedling nurseries, hydrological restoration techniques, and remote-sensing–based monitoring systems. Improved mangrove nurseries—using climate-resilient species selection, optimized propagation techniques, and community-managed production models—are essential for scaling restoration efforts and ensuring survival rates. Hydrological restoration technologies, such as tidal channel re-opening, culvert installation, and salinity control structures, address the underlying drivers of mangrove dieback and wetland degradation rather than relying solely on planting.

Remote sensing and drone-based monitoring tools enable regular assessment of mangrove cover, canopy health, and erosion dynamics, supporting adaptive management and national reporting. When combined with participatory ground-truthing by local communities, these technologies strengthen accountability, enhance local ownership, and provide cost-effective data for decision-making. Technology transfer in this area directly contributes to GBF Goals A and D by restoring ecosystem integrity while strengthening national capacity for implementation.

4.2. Sustainable Fisheries and Aquaculture Technologies

Fisheries and aquatic resources are central to food security, employment, and livelihoods in The Gambia, yet they face increasing pressure from overfishing, habitat degradation, and climate

variability. The NBSAP II prioritizes sustainable use of aquatic biodiversity, while the GBF highlights sustainable fisheries and food systems (GBF Targets 5 and 10).

Priority technologies include fish stock monitoring sensors, low-impact fishing gear, and cold-chain micro-infrastructure to reduce post-harvest losses and increase value retention. Affordable acoustic sensors, mobile catch reporting tools, and community-based monitoring systems improve data availability on fish stocks and fishing effort, enabling more responsive and equitable management. Low-impact fishing gear technologies—such as selective nets and bycatch-reduction devices—help minimize ecosystem damage while maintaining livelihoods.

Cold-chain micro-infrastructure, including solar-powered ice makers, insulated storage boxes, and small-scale cold rooms, addresses one of the most significant constraints in the fisheries value chain. By reducing spoilage and improving product quality, these technologies enhance income without increasing fishing pressure, aligning conservation objectives with economic incentives. Technology transfer in this sector supports GBF Goals B and D by promoting sustainable use, resilience, and equitable benefit-sharing.

4.3. Agroecological and Sustainable Land Management Technologies

Agricultural landscapes cover a large portion of The Gambia and are closely linked to biodiversity loss, land degradation, and climate vulnerability. The NBSAP emphasizes sustainable land management, restoration of degraded areas, and integration of biodiversity into agricultural systems. These priorities are reinforced by GBF Targets 2, 7, and 10.

Key technologies include water-harvesting systems, soil conservation tools, climate-resilient crop varieties, and low-cost irrigation technologies. Rainwater harvesting structures, contour bunds, zai pits, and small-scale reservoirs enhance water availability while reducing runoff and erosion. Soil conservation technologies such as mulching tools, composting systems, and minimum-tillage equipment improve soil fertility and carbon stocks.

Climate-resilient crop varieties and diversified agroecological systems—integrating trees, crops, and livestock—reduce vulnerability to climate shocks while supporting agrobiodiversity. Low-cost, solar-powered irrigation systems enable efficient water use and year-round production without increasing pressure on natural ecosystems. Technology transfer in this area directly links biodiversity conservation with food security, livelihoods, and climate adaptation, supporting integrated landscape management approaches.

4.4. Protected Area Management and Biodiversity Monitoring Technologies

Protected areas, community conserved areas (ICCAs), and key biodiversity sites are central to national conservation efforts, yet they face challenges related to enforcement, monitoring, and limited resources. The NBSAP highlights the need for improved protected area management, while the GBF sets ambitious targets for effective and equitable conservation (GBF Target 3).

Priority technologies include GIS and spatial mapping tools, camera traps, environmental DNA (eDNA) sampling, and community-based reporting applications. GIS and remote sensing technologies support boundary demarcation, zoning, and threat analysis, enabling more strategic deployment of limited resources. Camera traps and acoustic sensors provide cost-effective wildlife monitoring, improving understanding of species presence and trends.

Emerging tools such as eDNA sampling allow for rapid, non-invasive biodiversity assessments in aquatic and terrestrial systems, reducing costs and technical barriers. Community reporting applications empower local stakeholders to contribute to monitoring and enforcement, strengthening co-management and trust. Together, these technologies enhance ecological effectiveness, transparency, and participation, advancing GBF Goals A and D.

4.5. Restoration and Nature-Based Enterprise Support Technologies

To ensure long-term sustainability, biodiversity conservation must generate tangible socio-economic benefits. The NBSAP emphasizes livelihood diversification and benefit-sharing, while the GBF promotes nature-based enterprises and sustainable value chains (GBF Targets 10, 11, and 13).

Priority technologies include small-scale processing equipment for non-timber forest products (NTFPs), eco-tourism facility technologies, and renewable energy systems for rural and conservation sites. Improved processing technologies for products such as honey, fruits, medicinal plants, and mangrove-associated resources increase value addition, reduce waste, and improve market access.

Eco-tourism technologies—such as low-impact accommodation systems, digital booking platforms, and interpretive tools—enhance visitor experiences while minimizing ecological footprints. Renewable energy solutions, including solar mini-grids and efficient appliances, reduce operational costs and environmental impacts in remote areas. Technology transfer in this area strengthens incentives for conservation, supports local entrepreneurship, and aligns biodiversity objectives with economic development.

4.6. Data, Modelling, and Early Warning Technologies

Reliable data and predictive capacity underpin effective biodiversity governance. The NBSAP identifies gaps in data availability and information sharing, while the GBF places strong emphasis on knowledge, monitoring, and reporting (GBF Targets 19 and 21).

Priority technologies include a national biodiversity data platform, interoperable databases, and open-source dashboards and modelling tools. A centralized, interoperable data platform—linked to the national Clearing-House Mechanism—enables integration of data from multiple sectors, scales, and sources. Open-source dashboards support transparency and evidence-based decision-making, while modelling tools enhance early warning for ecosystem degradation and climate impacts.

By investing in these digital technologies, The Gambia can improve national reporting, support adaptive management, and strengthen regional and global cooperation. This technology area underpins all others, ensuring coherence, accountability, and learning across the TTAP.

5. Institutional and Governance Arrangements

Effective implementation of the Technology Transfer Strategy and Action Plan (TTAP) requires a clear, coordinated, and accountable institutional and governance framework that builds on existing national systems while strengthening capacities for technology identification, adaptation, deployment, and scaling. The proposed arrangements are designed to ensure policy coherence with the NBSAP II, compliance with obligations under the Convention on Biological Diversity (CBD), and alignment with national climate and development frameworks. The governance structure emphasizes national ownership, inter-sectoral coordination, transparency, and meaningful participation of local actors and knowledge holders.

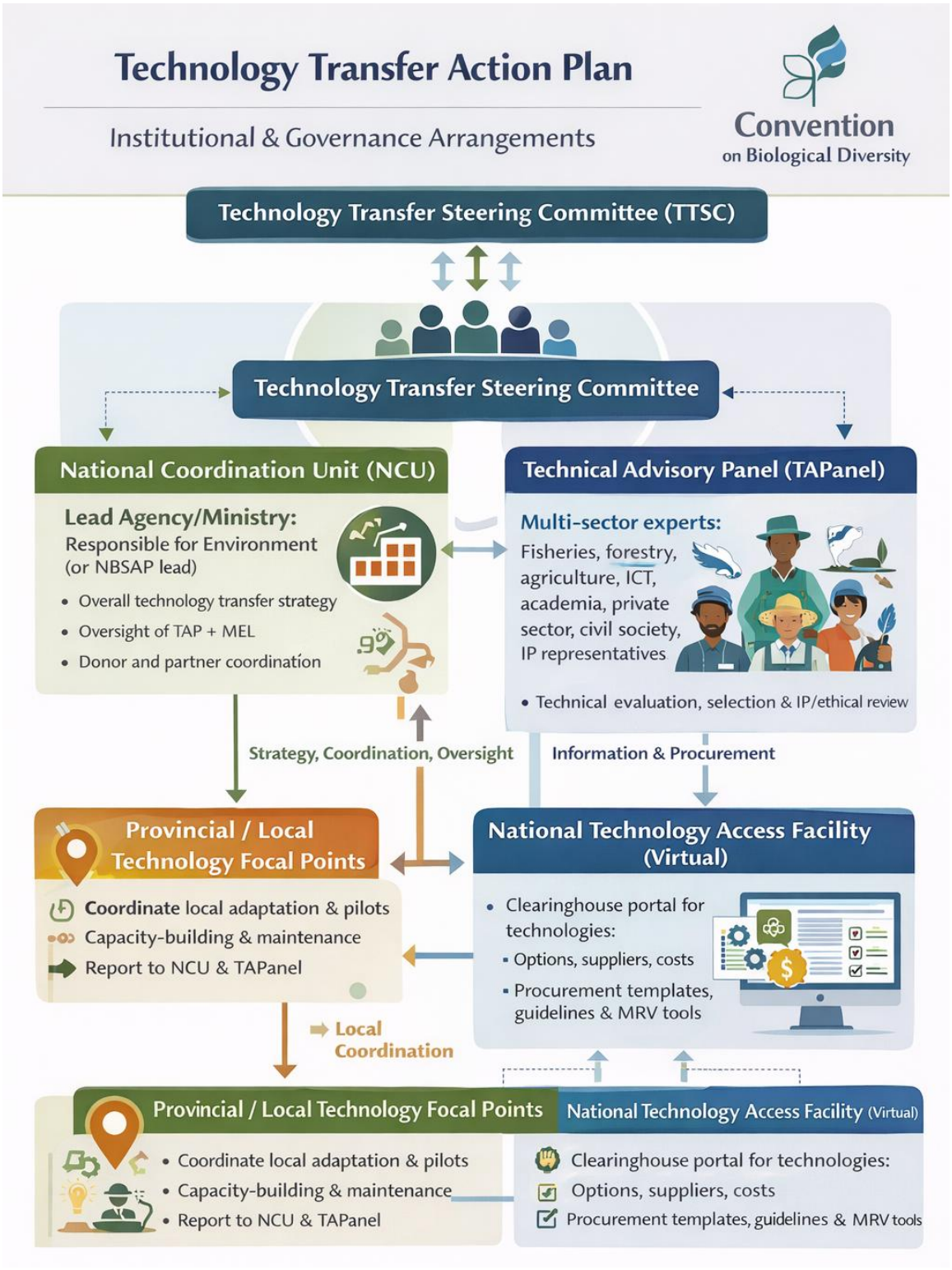


Figure 2. TTAP Institutional and Governance Framework

5.1 Technology Transfer Steering Committee (TTSC)

The Technology Transfer Steering Committee (TTSC) serves as the highest strategic and oversight body for the implementation of the Technology Transfer Strategy and Action Plan (TTSAP). It provides policy direction, ensures institutional coordination, and guarantees alignment of technology transfer interventions with national biodiversity, climate, and development priorities. The TTSC will operate within the framework of the NBSAP II (2025–2035) and its successor processes, while also ensuring coherence with the Kunming–Montreal Global Biodiversity Framework (GBF), the Gambia Climate Change Policy (GCCP/NCCP), the Long-Term Strategy 2050 (LTS 2050), and the Revised Framework for the National Development Plan (RF-NDP 2023–2027).

5.1.1 Strategic Leadership and Policy Alignment

The TTSC is responsible for setting the overall strategic direction of the TTSAP. It ensures that priority technologies selected under the Plan directly contribute to national biodiversity targets, climate resilience objectives, and sustainable development outcomes. In this role, the TTSC safeguards policy coherence across sectors and prevents fragmentation or duplication of technology initiatives. The Committee is typically chaired by the Ministry responsible for environment and biodiversity, with technical leadership from the Department of Parks and Wildlife Management and co-leadership from the Directorate for Climate Finance, Ministry of Finance and Economic Affairs (MoFEA), ensuring strong linkage between policy ambition and resource allocation.

5.1.2 Oversight, Accountability, and Decision-Making

A core function of the TTSC is to provide oversight and accountability for TTSAP implementation. The Committee reviews and approves annual TTSAP workplans, budgets, and priority technology portfolios, and endorses major implementation milestones. It also reviews consolidated monitoring, evaluation, and learning (MEL) reports prepared by the TTSAP Secretariat, using these to guide corrective actions, scaling decisions, and policy adjustments. Through this function, the TTSC ensures that technology transfer investments deliver measurable biodiversity, climate, and socio-economic benefits.

5.1.3 Inter-sectoral Coordination and Risk Management

The TTSC provides a formal platform for high-level inter-ministerial coordination. By bringing together senior representatives from environment, finance, agriculture, forestry, fisheries, water resources, local government, academia, civil society, and the private sector, the Committee helps resolve cross-sectoral bottlenecks and manage institutional risks. It ensures that technology transfer initiatives respect national safeguards, Access and Benefit-Sharing (ABS) obligations, and social inclusion principles, including gender equality and community participation.

5.1.4 Resource Mobilization and External Engagement

The TTSC plays a strategic role in resource mobilization and external engagement. It provides guidance on aligning TTSAP priorities with donor funding windows, climate and biodiversity finance mechanisms, and public–private partnership opportunities. The Committee also serves as a high-level interface with development partners and regional or international initiatives under the Convention on Biological Diversity, reinforcing national ownership while facilitating technical cooperation and investment.

5.2. Technical Advisory Panel (TAPanel)

To ensure that technology decisions are evidence-based, context-appropriate, and ethically sound, the TTSAP is supported by a Technical Advisory Panel (TAPanel). The TAPanel is a multi-disciplinary, multi-sector body comprising experts drawn from fisheries, forestry, agriculture, water resources, ICT and digital systems, academia and research institutions, the private sector, civil society organizations, and representatives of indigenous peoples and local communities.

The TAPanel's core mandate is to provide independent technical advice to the TTSC on the identification, evaluation, prioritization, and selection of biodiversity-relevant technologies. This includes assessing technological options against agreed criteria such as ecological effectiveness, cost-efficiency, scalability, gender and social inclusion, climate resilience, and alignment with national biodiversity targets. The Panel also reviews proposed technologies for potential environmental and social risks and ensures consistency with national safeguards.

A key function of the TAPanel is to provide guidance on intellectual property (IP), data governance, and ethical considerations, including Access and Benefit-Sharing (ABS) obligations under the CBD and the Nagoya Protocol. By incorporating local knowledge holders and community representatives, the TAPanel helps ensure that technology transfer processes respect customary rights, recognize traditional knowledge, and promote equitable benefit-sharing. The Panel operates in an advisory capacity, with recommendations formally documented and submitted to the TTSC for decision-making.

5.3. Provincial and Local Technology Focal Points

Recognizing that effective technology transfer must be locally grounded, the governance framework establishes Provincial and Local Technology Focal Points at decentralized levels of government. These focal points are embedded within regional administrations, local government authorities, or sectoral extension services, depending on national administrative arrangements.

Local Technology Focal Points play a critical role in coordinating the adaptation and deployment of technologies at the landscape and community levels. Their responsibilities include facilitating stakeholder engagement, supporting capacity-building and training activities, coordinating local pilots and demonstrations, and ensuring that technologies are adapted to local ecological, socio-

economic, and cultural conditions. They also serve as the first line of support for operation and maintenance, helping to identify technical issues, skills gaps, and supply-chain constraints.

Importantly, Local Focal Points act as two-way communication channels between national institutions and communities. They feed local lessons, challenges, and innovations back to the TTSC and TAPanel, ensuring that national decision-making is informed by on-the-ground realities. This decentralized function strengthens local ownership, improves sustainability of technology investments, and supports equitable and inclusive implementation consistent with CBD principles.

5.4. National Technology Access Facility (NTAF)

To address information asymmetries and reduce transaction costs associated with technology transfer, the TTSAP establishes a National Technology Access Facility (NTAF) as a virtual platform. The Facility functions as a centralized clearinghouse for biodiversity-related technologies and is embedded within, or linked to, the TTSC's digital portal and the national Clearing-House Mechanism.

The NTAF provides up-to-date information on priority technology options, technical specifications, suppliers, indicative costs, maintenance requirements, and performance records. It also hosts standardized procurement templates, model contracts, safeguard checklists, and guidance notes to support transparent and efficient technology acquisition. By consolidating this information in one accessible platform, the Facility supports informed decision-making by national agencies, local governments, communities, and private sector actors.

In line with CBD guidance, the NTAF also serves as a knowledge-sharing and learning hub, documenting case studies, lessons learned, and best practices from TTSAP implementation. Over time, it can support South–South cooperation and regional exchange by showcasing nationally adapted technologies and local innovations. As a virtual facility, it minimizes administrative overheads while maximizing access and transparency.

5.5. Governance Principles and Accountability

Together, the TTSC, TAPanel, Local Technology Focal Points, and the National Technology Access Facility form an integrated governance system that balances strategic oversight with technical rigor and local relevance. Clear roles and responsibilities, supported by transparent reporting and feedback mechanisms, ensure accountability across all levels. This institutional arrangement operationalizes CBD guidance on technology transfer by embedding cooperation, inclusiveness, and sustainability into national implementation, thereby enabling the TTSAP to deliver measurable biodiversity, climate, and development outcomes over the long term.

Table 2. TTSAP Governance – RACI Matrix (Roles & Responsibilities)

TTSAP Function / Activity	TTSC (MECCNAR/ DPWM/ MoFEA)	IM TTSAP Coordination Committee	TTSAP Secretariat (DPWM/ MECCNAR)	Technology Working Groups (TWGs)	Regional TTSAP Focal Points / LGAs	Communities / Private Sector / CSOs
Policy direction & strategic alignment (NBSAP, GCCP, LTS, RF-NDP)	**A**	C	R	I	I	I
Approval of annual TTSAP workplans & budgets	**A**	C	R	I	I	I
Identification & prioritization of biodiversity technologies	A	C	**R**	**R**	C	C
Inter-ministerial coordination & mainstreaming	A	**R**	C	I	I	I
Technical appraisal & adaptation of technologies	I	C	**R**	**R**	C	C
Procurement coordination & quality assurance	A	C	**R**	C	I	I
Capacity building & skills development	I	C	**R**	**R**	**R**	C
Piloting & field-level implementation	I	I	C	R	**R**	**R**
Community co-design & benefit-sharing (ABS)	I	I	C	R	**R**	**R**
Monitoring, evaluation & learning (MEL)	A	C	**R**	C	C	I
Knowledge management & CHM updates	I	I	**R**	C	C	I
Resource mobilization & investment pipeline	**A**	C	**R**	C	I	C
Reporting (NBSAP, NDC/LTS, RF-NDP)	**A**	C	**R**	I	I	I

Key: R = Responsible (leads implementation) | **A = Accountable** (final decision authority) **= Consulted** (provides input) | **I = Informed** (kept updated)

6. Technology Action Plan (TAP)

The Technology Transfer Strategy and Action Plan (TTSAP) provide The Gambia with a coherent, long-term framework to identify, access, adapt, deploy, and scale biodiversity-related technologies required to meet national biodiversity, climate, and development targets. Structured around five strategic objectives, the TTSAP translates the ambitions of NBSAP II (2025–2035) and the Kunming–Montreal Global Biodiversity Framework (GBF) into implementable actions supported by clear governance arrangements, financing pathways, and monitoring systems.

Strategic Objective 1: Identify and Prioritize Biodiversity and Ecosystem Management Technologies focus on establishing a strong evidence base through a national Technology Needs Assessment (TNA). Implemented primarily during 2025–2026, these objective maps technology needs across ecosystems—forests, wetlands, mangroves, marine and coastal systems, agricultural landscapes, and protected areas—and aligns them with national frameworks including the NCCP, LTS 2050, and RF-NDP. Inclusive consultations, spatial analysis, and transparent prioritization criteria are used to develop a nationally endorsed portfolio of priority technologies. The indicative budget for this objective is USD 1.61 million (2025–2035), with the bulk of costs incurred during the initial assessment and prioritization phase and smaller allocations for periodic updates.

Strategic Objective 2: Strengthen Institutional Capacity for Evaluation, Adaptation, and Maintenance address a critical constraint to effective technology transfer: limited institutional and technical capacity. Implemented progressively from 2025 to 2035, this objective establishes national standards for technology appraisal, strengthens procurement and quality assurance systems, and builds long-term operation and maintenance (O&M) capacity. Emphasis is placed on hands-on training, train-the-trainer cascades, decentralization to local government levels, and partnerships with universities, vocational institutes, and SMEs to support local adaptation, assembly, and servicing. The indicative budget for this objective is USD 2.41 million, reflecting sustained investment over the full NBSAP II period.

Strategic Objective 3: Enable Access to Finance and Investment for Biodiversity Technologies ensures that prioritized technologies move from planning to implementation at scale. Spanning 2025–2035, this objective establishes a national biodiversity technology financing framework, develops a pipeline of bankable projects, and mobilizes resources from international funds such as the GEF, GCF, and GBF Fund, alongside public–private partnerships and blended finance instruments. Risk-sharing mechanisms, revolving funds, and inclusive finance windows are designed to reduce barriers for communities, SMEs, women, and youth. The indicative catalytic budget for this objective is USD 2.55 million, excluding leveraged external finance, which is expected to significantly exceed national investments.

Strategic Objective 4: Support Equitable and Locally Driven Technology Transfer embeds equity, participation, and benefit-sharing at the core of technology deployment. Implemented throughout 2025–2035, this objective promotes participatory co-design of technologies with communities, applies Access and Benefit-Sharing (ABS) principles consistent with the Nagoya Protocol, and strengthens community institutions through localized training, simplified manuals, and peer-learning networks. South–South and triangular cooperation are promoted to facilitate learning and innovation adapted to The Gambia's socio-ecological context. The indicative budget for this objective is USD 2.05 million, reflecting the sustained engagement required to institutionalize inclusive approaches.

Strategic Objective 5: Monitor, Evaluate, Learn, and Scale Technology Deployment establishes a national Monitoring, Evaluation, Learning, and Scaling (MEL) system to ensure accountability, adaptive management, and long-term impact. Implemented from 2025–2035, this objective defines core indicators, establishes baselines during the TNA phase, integrates MEL into the National Biodiversity Information System (NBIS), and supports annual learning reviews and scaling decisions. Proven technologies are mainstreamed into sector plans and national budgets to ensure sustainability beyond project cycles. The indicative budget for this objective is USD 2.55 million.

Across all objectives, the TTSAP follows a phased implementation approach:

- 2025–2026: Readiness, assessments, institutional setup, and baseline establishment.
- 2026–2030: Pilot deployment, applied learning, and initial scaling aligned with GBF 2030 milestones.
- 2030–2035: National scaling, institutionalization, and long-term sustainability.

In total, the indicative national investment envelope for the TTSAP core actions is approximately USD 11.2 million (2025–2035), designed to catalyze significantly larger flows of international climate and biodiversity finance. Together, the five strategic objectives provide The Gambia with a practical, inclusive, and fundable pathway to transform biodiversity technology transfer from fragmented interventions into a coordinated national system delivering measurable ecological, social, and economic benefits.

Table 3. Strategic Objective, targets, actions, implementing agencies and period of implementation

Strategic Objective 1: Identify & Prioritize Biodiversity and Ecosystem Management Technologies					
Targets (by Goals)	**Indicators**	**Key Actions**	**Implementing Agency / Partners**	**Implementation Period**	**Indicative Budget (USD)**
GBF Goal D / Target 19: Establish a National Biodiversity Technology Needs Assessment (TNA)	• TNA completed and officially endorsed (Yes/No) • # sectors and ecosystems covered by TNA	• Design and conduct a national TNA covering forests, wetlands, mangroves, marine, agriculture, and PAs • Review existing NBSAP, sector plans, and projects	MECCNAR (TTSC), NEA, Line Departments, Consultants	2025–2026	122,500
GBF Goal A / Target 14: Mainstream biodiversity technology needs into development planning	• # sector strategies informed by TNA • Evidence of TNA referenced in national plans	• Map technology needs against NBSAP II, NCCP, LTS 2050, RF-NDP • Prepare cross-sector technology mainstreaming notes	MECCNAR, MoPE, Line Ministries	2025–2026	42,000
GBF Goal D / Target 21: Ensure evidence-based technology prioritization	• Prioritization framework approved (Yes/No) • # technologies scored and ranked	• Develop transparent prioritization criteria (impact, cost, scalability, gender, readiness) • Apply multi-criteria analysis	TTSC, TAPanel, Academia	2025–2026	63,000

GBF Goal D / Target 22: Ensure inclusive and participatory prioritization	• % women/youth represented in consultations • # community consultations conducted	• Conduct regional consultations and FGDs • Integrate traditional knowledge and local innovation	TTSC, Local Governments, CSOs	2025–2026	52,500
GBF Goal A / Target 1: Link priority technologies to spatial and ecosystem planning	• Priority technologies mapped by ecosystem/region • GIS layers produced	• Spatial mapping of technology needs by ecosystem and hotspot • Overlay climate and biodiversity risk maps	NEA, DPWM, GIS Units	2026	70,000
GBF Goal D / Target 19: Establish a national portfolio of priority technologies	• National priority technology list endorsed (Yes/No) • # technologies included in TTSAP portfolio	• Consolidate TNA results into a national TTSAP portfolio • Secure inter-ministerial validation	MECCNAR, Cabinet Secretariat	2026	31,000
GBF Goal D / Target 21: Prepare technologies for financing and scaling	• # technologies with concept notes • # technologies aligned to donor windows	• Prepare technology briefs and pre-feasibility notes • Match technologies to GEF/GCF/GBFF pipelines	TTSC, MoPE, Development Partners	2026–2027	75,000
GBF Goal D: Institutionalize technology prioritization processes	• TNA/prioritization integrated into NBSAP II (Yes/No) • Update cycle defined	• Establish periodic TNA update mechanism (every 5 years)	MECCNAR, MoPE	2027–2035	45,000

		• Integrate into national planning systems			
Strategic Objective 2: Strengthen Institutional Capacity for Evaluation, Adaptation & Maintenance					
GBF Goal D / Target 19: Establish national capacity for technology evaluation & appraisal	• National technology evaluation guidelines adopted (Yes/No) • # institutions applying standardized appraisal tools	• Develop national guidelines for biodiversity technology evaluation (technical, environmental, social, cost criteria) • Train core staff in evaluation methodologies	MECCNAR (TTSC), NEA, TAPanel, Universities	2025–2026	60,000
GBF Goal D / Target 21: Strengthen skills for technology adaptation to local conditions	• # technologies locally adapted or modified • # staff trained in technology adaptation	• Conduct applied adaptation trials in pilot landscapes • Establish learning partnerships with universities and research institutes	TTSC, DPWM, DoFisheries, DoA, UTG	2026–2030	35,000
GBF Goal D / Target 19 & 20: Improve institutional procurement & quality assurance systems	• Procurement manuals updated (Yes/No) • % technology procurements meeting quality standards	• Update procurement templates to include technology transfer clauses (training, manuals, after-sales service) • Train procurement officers	MoFEA, Gambia Public Procurement Authority, MECCNAR	2025–2027	60,000
GBF Goal D / Target 21: Build national capacity for operation & maintenance (O&M)	• Functionality rate of deployed technologies after 12 months (%)	• Train national and regional technicians in O&M (sensors, GIS, eDNA, renewable	TTSC, Line Ministries, TVET Institutes	2026–2035	125,000

	• # technicians certified	energy) • Develop O&M manuals and toolkits			
GBF Goal D / Target 22: Promote inclusive and decentralized capacity development	• % women/youth among trained technicians • # local government units with trained focal points	• Implement train-the-trainer cascades • Establish regional technology focal points	TTSC, LGAs, CSOs	2026–2035	75,000
GBF Goal D / Target 19: Encourage local fabrication, assembly & maintenance	• # technologies with local servicing arrangements • # SMEs engaged in maintenance/assembly	• Identify opportunities for local assembly and fabrication • Support partnerships with SMEs and vocational centers	MoTI, GIEPA, Private Sector	2027–2035	85,000
GBF Goal D / Target 21: Institutionalize capacity development systems	• Capacity development embedded in NBSAP II (Yes/No) • Budget lines secured for O&M	• Integrate capacity and O&M requirements into sector plans • Secure recurrent financing for maintenance	MECCNAR, MoPE, Line Ministries	2030–2035	60,000
Strategic Objective 3: Enable Access to Finance & Investment for Biodiversity Technologies					
GBF Goal D / Target 20: Establish a national financing framework for biodiversity technologies	• National biodiversity technology financing strategy adopted (Yes/No) • # financing instruments identified and mapped	• Design a national financing framework covering grants, concessional finance, PPPs, and blended finance • Map funding windows (GEF, GCF, GBFF, AF, bilateral)	MECCNAR (TTSC), MoFEA, MoPE, Development Partners	2025–2026	45,000

GBF Goal D / Target 19: Develop a bankable pipeline of priority biodiversity technologies	• # priority technologies with costed investment profiles • # project concept notes developed	• Prepare pre-feasibility studies and investment briefs for priority technologies • Package technologies into programmatic proposals	TTSC, TAPanel, Consultants	2025–2027	35,000
GBF Goal D / Target 20: Improve access to international biodiversity & climate finance	• Amount of external finance mobilized (USD) • # proposals submitted/approved	• Develop and submit funding proposals to GEF, GCF, GBFF, AF • Strengthen coordination with national designated authorities	MECCNAR, MoFEA, NDAs, AEs	2026–2035	75,000
GBF Goal D / Target 20: Promote private sector engagement and PPPs	• # PPP arrangements established • Volume of private capital leveraged (USD)	• Design PPP models for restoration, cold-chain, eco-tourism, renewables • Engage banks, MFIs, impact investors	MoTI, GIEPA, Private Sector	2026–2035	65,000
GBF Goal D / Target 20: Reduce financial risks for technology adopters	• # risk-sharing instruments operational • % reduction in upfront costs for adopters	• Establish guarantees, revolving funds, and results-based incentives • Pilot blended finance instruments	MoFEA, Central Bank, Donors	2026–2035	450,000
GBF Goal D / Target 22: Ensure inclusive access to finance	• % women/youth-led enterprises accessing finance • # community groups financed	• Design gender-responsive and community-accessible finance windows • Provide financial	TTSC, Women's Bureau, NGOs, MFIs	2026–2035	45,000

		literacy and proposal support			
GBF Goal D / Target 20: Institutionalize biodiversity technology financing	• Biodiversity finance embedded in national budgets (Yes/No) • Dedicated financing window established	• Integrate biodiversity technology financing into NDP • Establish long-term national financing mechanisms	MECCNAR, MoFEA, National Assembly	2028–2035	35,000
Strategic Objective 4: Support Equitable & Locally Driven Technology Transfer					
GBF Goal D / Target 22 & 23: Ensure inclusive and participatory technology transfer	• % women, youth, and IPLCs participating in technology design & deployment • # community co-design processes conducted	• Conduct participatory technology co-design workshops • Integrate gender, youth, and social inclusion criteria into all technology pilots	MECCNAR (TTSC), Local Governments, CSOs, MoWCSW	2025–2035	75,000
GBF Goal C / Target 13: Ensure fair and equitable Access & Benefit-Sharing (ABS)	• # technology initiatives applying ABS principles • # benefit-sharing agreements documented	• Integrate ABS clauses into technology transfer agreements • Strengthen linkages with Nagoya Protocol implementation	NEA (ABS Focal Point), TTSC, DPWM	2025–2030	30,000
GBF Goal D / Target 21: Strengthen community and local institutional capacity	• # community institutions trained • Retention of skills after 12 months (%)	• Deliver practical, hands-on training at community level • Develop simplified manuals in local languages	TTSC, Line Ministries, NGOs, TVET Centers	2026–2035	60,000
GBF Goal D / Target 19: Promote local	• # technologies locally adapted or modified	• Support pilot adaptation of technologies to local	Universities, Research Institutes, TTSC	2026–2035	115,000

adaptation and innovation	• # local innovations integrated into TTSAP	ecological & socio-economic conditions • Document and validate local innovations			
GBF Goal D / Target 22: Institutionalize train-the-trainer and peer learning	• # master trainers certified • # secondary trainings delivered at local level	• Establish national and regional train-the-trainer programs • Support peer-to-peer learning networks	TTSC, Civil Service Training Institute, CSOs	2026–2035	65,000
GBF Goal D / Target 21: Strengthen South–South & triangular cooperation	• # exchange programs implemented • # technologies adapted through exchanges	• Facilitate regional exchange visits and twinning with centers of excellence • Promote joint pilots and applied research	MECCNAR, Universities, Regional Bodies	2026–2035	125,000
GBF Goal A & D: Embed equity in governance and decision-making	• Equity safeguards included in TTSAP governance (Yes/No) • # grievance or feedback mechanisms operational	• Integrate social safeguards and grievance mechanisms into TTSAP governance • Ensure community representation in steering structures	MECCNAR, NEA, Local Authorities	2025–2035	35,000
Strategic Objective 5: Monitor, Evaluate, Learn & Scale Technology Deployment					
Goal D / GBF Target 21: Establish a national MEL system for biodiversity technology deployment	• National TTSAP MEL framework approved (Yes/No) • % priority technologies with defined indicators and baselines	• Design and adopt TTSAP MEL framework aligned with NBSAP & GBF • Define core indicators, baselines, and reporting protocols	MECCNAR (TTSC), NEA, DPWM, DoFisheries, DoA	2025–2026	35,000

Goal D / Target 19 & 21: Ensure evidence-based tracking of technology performance	• % technologies with annual performance data • Functionality rate of deployed technologies after 12 months (%)	• Establish technology performance tracking tools • Integrate MEL into project implementation manuals	TTSC, Line Departments, Universities	2026–2035	35,000
Goal D / Target 21: Integrate biodiversity data into national reporting systems	• MEL data integrated into NBIS (Yes/No) • # GBF/CBD reports supported by MEL data	• Link MEL indicators to NBIS and CHM • Automate data flows from pilots and sectors	NEA, TTSC, ICT Agency	2026–2030	25,000
Goal A & D: Promote learning and adaptive management	• # annual learning reviews conducted • # technologies adapted based on MEL findings	• Conduct annual learning and reflection workshops • Produce policy briefs and technical learning notes	TTSC, TAPanel, Research Institutions	2026–2035	45,000
Goal D / Target 20: Scale successful technologies nationally	• # technologies scaled beyond pilot sites • Area/communities covered through scaling	• Develop scaling criteria and decision tools • Mainstream proven technologies into sector plans	MECCNAR, MoPE, Line Ministries, LGAs	2027–2035	55,000
Goal D / Target 19 & 20: Strengthen institutional capacity for MEL	• # staff trained in MEL (% women/youth) • % institutions applying MEL tools	• Train national and regional MEL focal points • Develop practical MEL toolkits and dashboards	TTSC, Civil Service Training Institute, Universities	2025–2030	35,000
Goal D / Target 21 & 22: Ensure transparency and knowledge sharing	• # MEL reports publicly available • # stakeholders	• Publish annual TTSAP MEL reports • Develop open-access dashboards and briefs	NEA, TTSC, CSOs	2027–2035	40,000

	accessing MEL dashboards				
Goal D: Institutionalize MEL beyond project cycles	• MEL embedded in NBSAP II implementation (Yes/No) • Budget line for MEL secured	• Integrate MEL into national planning & budgeting • Secure long-term financing arrangements	MECCNAR, MoPE, National Assembly	2030–2035	50,000

7. Capacity Development & Knowledge Sharing

Capacity development and knowledge sharing are central to the effective implementation of the Technology Transfer Strategy and Action Plan (TTSAP). The Convention on Biological Diversity (CBD) explicitly recognizes that access to and transfer of environmentally sound technologies must be accompanied by sustained capacity-building, scientific and technical cooperation, and knowledge exchange to ensure long-term impact (CBD 2011; CBD 2022). In this context, the TTSAP adopts a comprehensive approach that strengthens human skills, institutional systems, and learning platforms across national and local levels.



Figure 3. Capacity development and Knowledge Sharing pillars

7.1 Strengthening Technical Skills for Technology Deployment and Maintenance

A core pillar of the TTSAP is the training of national and local technicians in the installation, operation, and maintenance of biodiversity-relevant technologies. These include environmental sensors for water quality and climate variables, GIS and remote sensing tools for land-use and habitat monitoring, camera traps and acoustic sensors for wildlife assessment, and environmental DNA (eDNA) kits for rapid biodiversity surveys. Training programs will prioritize practical, hands-on learning and troubleshooting, ensuring that staff can independently manage routine operations and minor repairs.

By embedding training within technology deployment activities, the TTSAP reduces reliance on external consultants, lowers long-term operational costs, and enhances institutional resilience. This approach aligns with CBD guidance emphasizing endogenous capacity development as a prerequisite for effective technology transfer (CBD 2022).

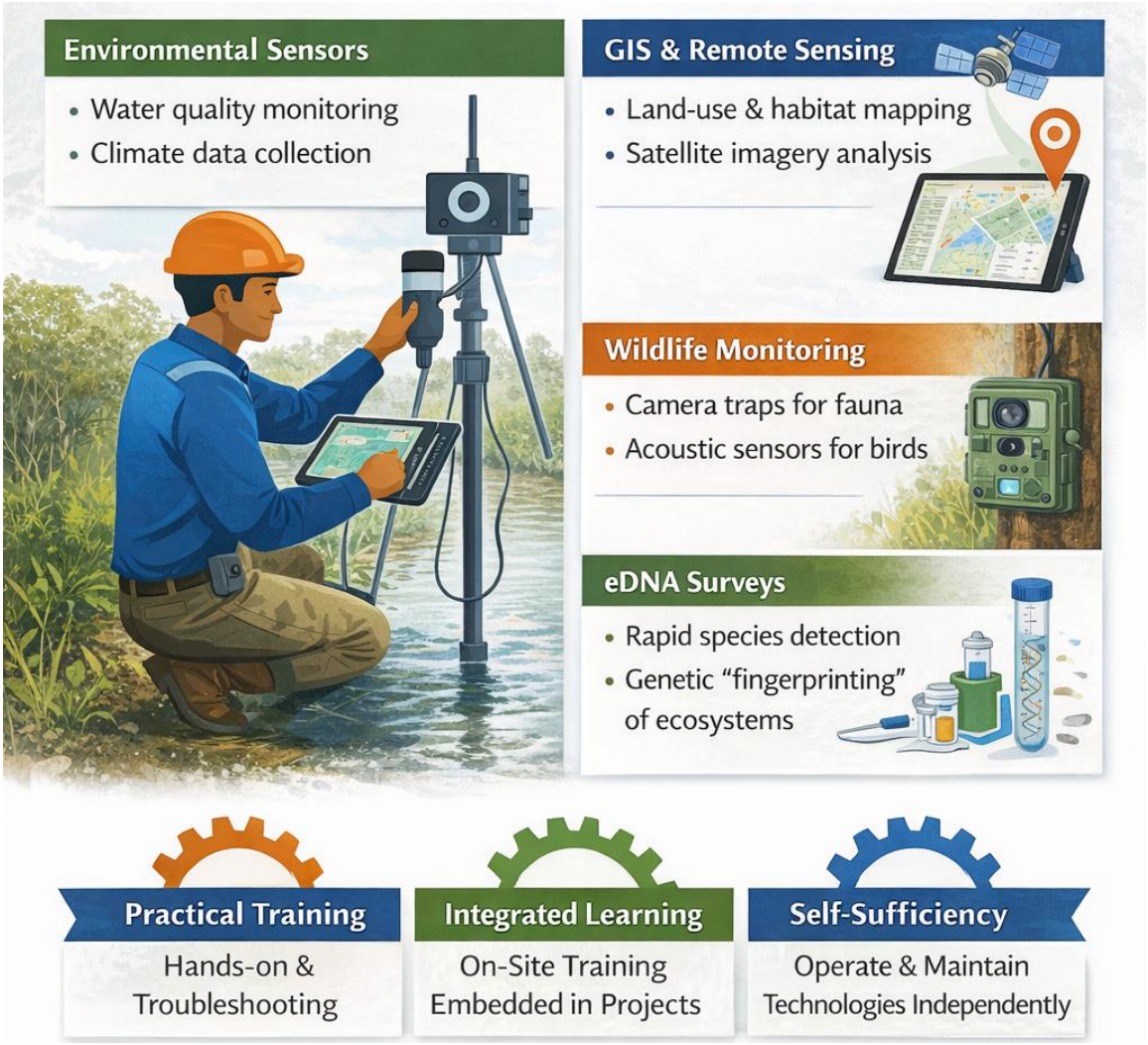


Figure 4. Strengthening Technical Skills for Technology Deployment and Maintenance as a core pillar of TTSAP

7.2 Knowledge Exchange and Institutional Partnerships

To complement in-country training, the TTSAP promotes exchange programs and institutional partnerships with regional centers of excellence, universities, research institutes, and specialized NGOs. Twinning arrangements with academic institutions and conservation organizations will enable joint research, staff exchanges, and exposure to emerging biodiversity technologies and methodologies. These partnerships support advanced learning, innovation, and adaptation of technologies to The Gambia's ecological and socio-economic contexts.

South–South and triangular cooperation are emphasized, consistent with CBD Article 18 on scientific and technical cooperation. Through regional exchanges, national institutions can benefit from shared experiences in ecosystem restoration, fisheries monitoring, and biodiversity

data management, while contributing local innovations to regional knowledge networks (CBD 2011).



Figure 5. Knowledge Exchange and Institutional Partnerships

7.3 Localized Learning and Train-the-Trainer Approaches

Recognizing the importance of accessibility and inclusiveness, the TTSAP will develop simple maintenance manuals and operational guides tailored to local users. Where appropriate, these materials will be translated into local languages and adapted for varying literacy levels, ensuring that community institutions, local government staff, and frontline practitioners can effectively use and maintain technologies.

A structured train-the-trainer cascade will be implemented to multiply impact. National technicians and extension officers trained under the TTSAP will, in turn, train community forest committees, fisheries co-management groups, protected area co-managers, and local youth groups. This approach strengthens decentralized implementation, supports gender and youth inclusion, and institutionalizes knowledge within local governance structures, in line with CBD commitments to participation and equity (CBD 2022).

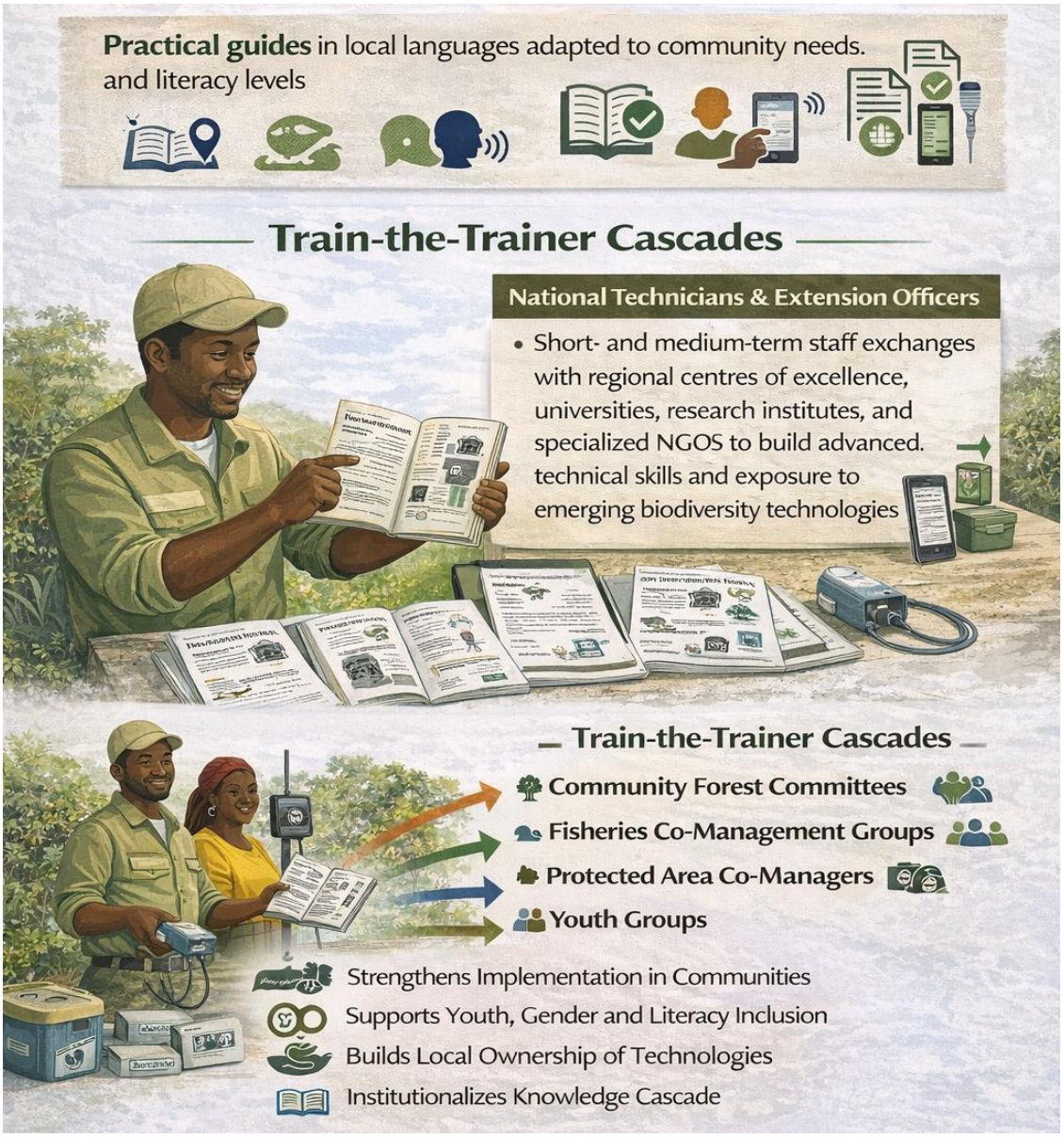


Figure 6. Localized Learning and Train-the-Trainer Approaches

7.4 National Platforms for Knowledge Sharing and Innovation

To institutionalize learning and promote innovation, the TTSAP will establish an annual Biodiversity Technology Forum. This national platform will bring together government agencies, research institutions, communities, civil society organizations, private sector actors, and development partners to showcase pilot projects, share lessons learned, and discuss emerging biodiversity technologies.

The Forum will also function as a partnership and investment platform, creating opportunities for dialogue with technology providers, service companies, and investors interested in

biodiversity-related solutions. By increasing visibility of successful pilots and locally adapted technologies, the Forum will help attract private sector engagement, stimulate innovation, and support scaling of proven approaches, consistent with CBD guidance on technology cooperation and resource mobilization.



Figure 7. National Platform for Knowledge Sharing and Innovation

7.5 Knowledge Management and Long-Term Impact

All capacity development and knowledge-sharing activities under the TTSAP will be systematically documented and integrated into national knowledge platforms, including the NBSAP Clearing-House Mechanism. Training materials, case studies, technical guidelines, and lessons learned will be made accessible to support continuous learning, replication, and adaptive management.

Through this integrated approach, the TTSAP ensures that capacity development and knowledge sharing are not peripheral activities but core enablers of sustainable technology transfer. By investing in people, institutions, and learning systems, the Strategy strengthens national ownership of biodiversity technologies and enhances The Gambia's ability to meet its biodiversity, climate, and development commitments under the CBD and the Kunming–Montreal Global Biodiversity Framework.

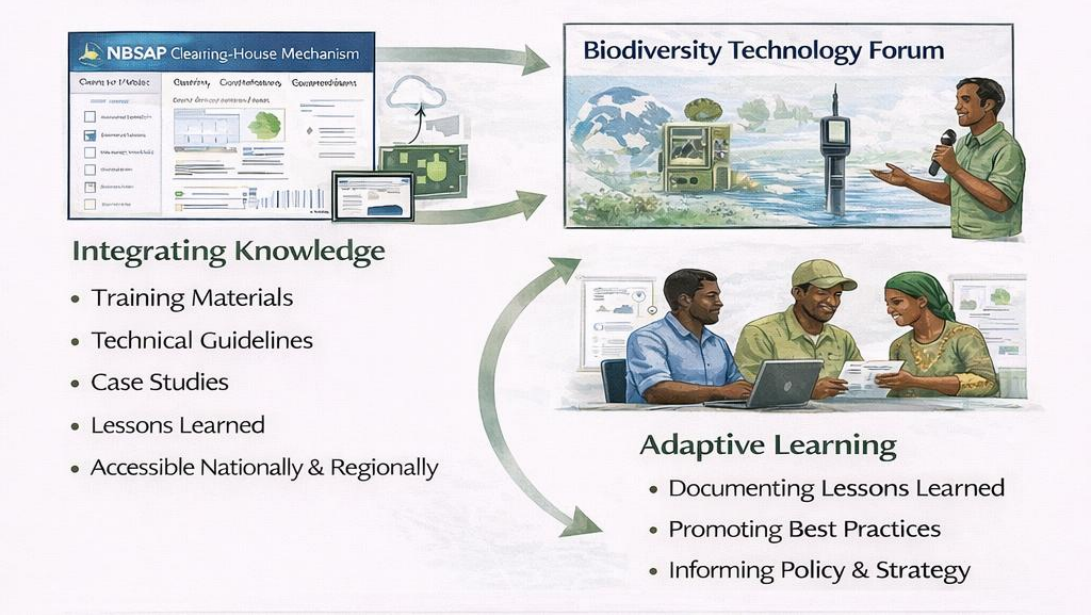


Figure 8. Knowledge Management and Long-term Impact

8. Financing and Partnerships

The successful implementation of the Technology Transfer Strategy and Action Plan (TTSAP) depends on a diversified and well-coordinated financing and partnership approach that blends international, national, public, and private resources. Given the scale and long-term nature of biodiversity and ecosystem investments, the TTSAP is designed to function as a financing platform, rather than a stand-alone project.

8.1 Multilateral and Climate Funds

Multilateral and climate funds will play a central role in financing the Technology Transfer Strategy and Action Plan (TTSAP), reflecting both the scale of investment required and the strong alignment between biodiversity technology transfer and global climate and biodiversity commitments. The TTSAP is explicitly designed to function as a financing-ready framework, enabling The Gambia to systematically access international resources by translating national priorities into bankable, standards-compliant proposals.

A core focus of the TTSAP is the preparation of Technology Needs Assessment (TNA) and Technology Action Plan (TAP)–aligned funding proposals to major multilateral mechanisms, including the Green Climate Fund, the Adaptation Fund, the Global EbA Fund, and financing windows under the Kunming–Montreal Global Biodiversity Framework. These funds increasingly prioritize integrated, programmatic approaches that link technology transfer, capacity building, and long-term institutional sustainability—areas directly addressed by the TTSAP.

Guidance and methodologies developed by the Green Climate Fund for TNAs and TAPs will be used as a reference framework to ensure that proposals emerging from the TTSAP meet international best practice. This includes the application of transparent technology prioritization criteria, robust cost–benefit analysis, gender and social inclusion measures, climate and biodiversity impact assessment, and results-based monitoring frameworks. By aligning with these requirements, the TTSAP reduces transaction costs, shortens proposal preparation timelines, and improves approval success rates.

The TTSAP also supports programmatic and phased financing approaches, which are increasingly favored by multilateral funds. Rather than fragmented, stand-alone projects, priority technologies can be packaged into multi-phase programs—beginning with readiness and pilot deployment, followed by large-scale implementation and institutionalization. This approach is particularly well suited to ecosystem-based adaptation, biodiversity monitoring systems, and national data platforms.

By embedding international financing requirements into national planning processes, the TTSAP strengthens The Gambia's institutional readiness to absorb and manage large-scale funding. It also ensures consistency with obligations and guidance under the Convention on Biological Diversity, including the Global Biodiversity Framework's emphasis on resource mobilization, capacity building, and technology cooperation. Overall, multilateral and climate funds are positioned as strategic partners in translating the TTSAP from policy into sustained, nationally owned impact.

8.2 Bilateral Donors and Development Banks

Bilateral donors and development banks will be key partners in supporting capital-intensive components of the Technology Transfer Strategy and Action Plan (TTSAP) that exceed national budget capacity and require long-term, large-scale investment. Many of the priority technologies identified under the TTSAP—such as cold-chain infrastructure for fisheries, national-scale biodiversity and ecosystem monitoring platforms, and advanced digital data systems—entail high upfront costs but generate substantial and sustained economic, environmental, and resilience benefits. Bilateral partners and development finance institutions are particularly well suited to financing these types of investments.

Within the fisheries sector, for example, solar-powered cold-chain systems, landing-site infrastructure, and storage facilities are essential for reducing post-harvest losses, improving product quality, and increasing incomes without intensifying fishing pressure. Development banks and bilateral agencies can provide concessional loans, blended finance, or grant–loan combinations to support such infrastructure, while aligning investments with sustainable fisheries management and climate adaptation objectives. Similar approaches are applicable to large-scale monitoring platforms, including national biodiversity data systems, remote sensing infrastructure,

and early warning systems, which require sustained capital investment and technical support over multiple years.

Bilateral donors and development banks also bring strong comparative advantages in system strengthening, including policy reform, institutional development, and long-term technical assistance. Their engagement under the TTSAP will therefore extend beyond hardware procurement to include support for governance frameworks, procurement systems, operation and maintenance arrangements, and integration of new technologies into national institutions. This is critical for ensuring that capital investments deliver lasting impact and do not become underutilized or unsustainable.

The TTSAP provides a coherent framework through which bilateral partners and development banks can align their investments with national priorities articulated in the NBSAP II, the Nationally Determined Contribution, and long-term development strategies. By anchoring capital-intensive investments within this national strategy, the TTSAP enhances coordination among partners, reduces duplication, and ensures that infrastructure and technology deployments contribute to biodiversity conservation, climate resilience, and inclusive economic development in The Gambia.

8.3 Private sector and social enterprises

Private sector actors and social enterprises are essential partners for the long-term sustainability and scaling of the Technology Transfer Strategy and Action Plan (TTSAP). While public institutions play a central role in policy, coordination, and oversight, many biodiversity-related technologies require ongoing service provision, maintenance, innovation, and market linkages that are best delivered through private and community-based enterprise models.

The TTSAP promotes public–private partnerships (PPPs) as a practical mechanism for engaging the private sector in areas such as technology supply, installation, operation, and maintenance. PPPs will be encouraged for services including cold-chain management in fisheries, renewable energy systems for protected areas and rural enterprises, digital monitoring platforms, and eco-tourism infrastructure. These partnerships help reduce long-term costs to government while improving efficiency, responsiveness, and technical performance.

Special emphasis is placed on small and medium-sized enterprises (SMEs), cooperatives, and social enterprises, which are well positioned to operate in rural and peri-urban contexts. By supporting local manufacturing, assembly, repair, and servicing of selected technologies, the TTSAP contributes to job creation, skills development, and local value retention. In sectors such as fisheries, agroecology, eco-tourism, and non-timber forest product (NTFP) value chains, private engagement enables conservation objectives to be translated into viable, income-generating business models.

The TTSAP also creates space for engagement with impact investors and blended finance instruments, particularly where biodiversity outcomes can be linked to measurable social and

climate benefits. All private sector engagement under the TTSAP will be guided by safeguards, transparency, and equity principles consistent with the Convention on Biological Diversity, ensuring that partnerships support conservation outcomes while delivering inclusive and sustainable economic benefits for communities in The Gambia.

8.4 National Co-financing

National co-financing is a critical pillar of the Technology Transfer Strategy and Action Plan (TTSAP), demonstrating national ownership, political commitment, and long-term sustainability. By committing domestic resources alongside external financing, The Gambia strengthens the credibility of the TTSAP and significantly improves its attractiveness to international partners and funds.

National co-financing will be provided through a combination of in-kind and financial contributions. In-kind contributions will include dedicated staff time from line ministries and agencies, use of government facilities and laboratories, access to protected areas and pilot landscapes, and integration of TTSAP activities into existing data systems and monitoring programs. These contributions reduce overall project costs while embedding technology transfer activities within existing institutional structures, enhancing continuity beyond donor-funded project cycles.

In addition, targeted national budget allocations will be mobilized from environment, agriculture, fisheries, forestry, water, and climate change budget lines. These allocations may support co-financing of pilot deployments, operation and maintenance of technologies, training activities, and recurrent costs associated with monitoring and data management. Even modest capital contributions play a strategic role by strengthening leverage ratios for external finance from mechanisms such as the Green Climate Fund, Global Environment Facility, and Global Biodiversity Framework funding windows.

Beyond traditional public finance, the TTSAP allows for the selective exploration of innovative financing mechanisms, including payment for ecosystem services (PES), biodiversity offsets, and other incentive-based approaches. Such mechanisms will only be pursued where they are environmentally credible, socially equitable, and institutionally feasible. All innovative finance instruments will be designed and applied in strict accordance with safeguards, Access and Benefit-Sharing principles, and equity requirements under the Convention on Biological Diversity and the Kunming–Montreal Global Biodiversity Framework.

By combining public investment, in-kind contributions, and carefully designed innovative finance, national co-financing under the TTSAP ensures that technology transfer is nationally anchored, financially sustainable, and aligned with long-term biodiversity and development objectives.

8.5 Phased Financing Logic

The implementation of the Technology Transfer Strategy and Action Plan (TTSAP) is structured around a phased financing logic that reflects the progressive nature of technology transfer—from readiness and institutional strengthening, through piloting and systems development, to large-scale deployment and mainstreaming. This approach reduces risk, strengthens national ownership, and allows for adaptive learning while leveraging both national resources and international climate and biodiversity finance.

Phase 1: Readiness and Technology Needs Assessment (USD 900,000)

Phase 1 focuses on establishing the foundational conditions required for effective and sustainable technology transfer. Core activities include the conduct of a comprehensive national Technology Needs Assessment (TNA) across priority ecosystems and sectors; establishment and operationalization of governance structures such as the Technology Transfer Steering Committee and Technical Advisory Panel; development of technology prioritization and appraisal tools; and initial capacity building for national institutions in technology evaluation, safeguards, Access and Benefit-Sharing (ABS), and monitoring frameworks.

This phase is primarily donor-funded, reflecting its public-good nature and its role as an enabling investment for subsequent phases. International financing (e.g. GEF, GBFF, or readiness windows of climate funds) will cover technical assistance, assessments, stakeholder consultations, and systems design. National co-financing will be provided in the form of staff time, office space, coordination costs, and integration of TNA outputs into national planning processes.

Phase 2: Pilots and Systems Development (USD 6.5 million)

Phase 2 translates readiness into action by financing **demonstration pilots and national systems** that validate priority technologies under real ecological and socio-economic conditions. Investments will support pilot deployment of biodiversity-relevant technologies across mangroves, wetlands, agriculture, fisheries, protected areas, and biodiversity data systems; establishment of a National Technology Access Facility; development of national monitoring, reporting and verification (MRV) and data platforms; and targeted capacity building for local governments, communities, SMEs, women and youth groups.

This phase is predominantly donor-financed, as it carries higher upfront costs and learning risks. Donor funding will support capital investments, technical assistance, and systems development. National contributions will include co-financing for operations and maintenance, policy and regulatory support, partial infrastructure costs where feasible, and integration of pilots into sectoral programmes and budgets. The emphasis in this phase is on learning, adaptation, and proof of concept.

Phase 3: Scale-Up and Mainstreaming (Indicative USD X million)

Phase 3 focuses on scaling proven technologies and institutional arrangements nationwide and embedding them into long-term development and financing frameworks. Activities include expansion of successful pilots, replication across regions and sectors, private-sector engagement, blended finance mechanisms, and integration of biodiversity technologies into national budgets, public investment programmes, and development partner pipelines.

Financing in this phase is expected to shift toward a blended model, combining large-scale donor investments (e.g. GCF, multilateral development banks), increased national budget allocations, and private-sector capital. National funding will progressively cover recurrent costs, maintenance, and co-investment, while donor resources will support scaling, innovation, and transformational investments.

Rationale for the Phased Approach

This phased financing logic ensures that early donor investments de-risk later large-scale financing, strengthen national capacity, and build a credible pipeline of bankable biodiversity and climate technologies. Over time, the balance shifts from donor dependence to national ownership and sustainable financing, ensuring that technology transfer continues beyond individual projects and funding cycles.

9. Intellectual Property, Access and Benefit Sharing

The Technology Transfer Strategy and Action Plan (TTSAP) adopt a balanced, practical, and rights-based approach to intellectual property (IP), access, and benefit-sharing (ABS) that reflects both CBD guidance and The Gambia's local realities, where biodiversity management is strongly community-based and traditional knowledge plays a critical role. The objective is to enable affordable and timely access to biodiversity-related technologies while ensuring that benefits are shared equitably with communities, institutions, and national stakeholders.

In line with CBD Articles 15, 16, and 18 and the Nagoya Protocol, the TTSAP recognizes that technology transfer must go beyond equipment procurement. In The Gambia, where protected areas, community forests, mangroves, and fisheries are often co-managed with local institutions, technology agreements must explicitly support capacity building, local adaptation, and long-term usability. Accordingly, all procurement contracts and partnership agreements under the TTSAP will include clauses requiring technology providers to deliver hands-on training, provide user-friendly operation and maintenance manuals, and support knowledge transfer to national technicians and community users.

Where feasible, the TTSAP will promote local assembly, fabrication, repair, or servicing arrangements, particularly for monitoring equipment, restoration tools, and processing technologies used in rural and coastal areas. Licensing terms will be negotiated to ensure

affordable maintenance, access to spare parts, and software or data accessibility, avoiding technology lock-in that could undermine sustainability in resource-constrained settings.

Access and Benefit-Sharing is particularly relevant in The Gambia for technologies linked to genetic resources, mangrove ecosystems, fisheries, and traditional ecological knowledge. The TTSAP will ensure that the use of such resources is subject to prior informed consent, mutually agreed terms, and fair benefit-sharing arrangements. Benefits may include capacity development, technology access, co-development of solutions, livelihood opportunities, and recognition of community knowledge.

By embedding IP, access, and ABS provisions into national technology transfer processes, the TTSAP ensures compliance with CBD obligations while strengthening trust, equity, and national ownership. This approach supports sustainable biodiversity management and reinforces the role of communities as partners—not beneficiaries alone—in The Gambia's biodiversity and climate action agenda.

10. Monitoring, Evaluation & Learning (MEL)

The Monitoring, Evaluation, and Learning (MEL) framework of the Technology Transfer Strategy and Action Plan (TTSAP) is designed to ensure accountability, evidence-based decision-making, and continuous improvement throughout implementation. The MEL system aligns with CBD and GBF monitoring expectations, while remaining practical and proportionate to national institutional capacities in The Gambia. It emphasizes not only tracking outputs, but also understanding outcomes, sustainability, and learning for scale-up.

A set of core indicators will be used to measure progress and performance across the technology lifecycle. These include:

- the number of priority technologies assessed, adopted, and effectively maintained by institutions and communities.
- the area (hectares) of ecosystems restored or sustainably managed using transferred technologies, such as mangroves, wetlands, forests, or degraded agricultural lands.
- the number of community members, cooperatives, and small and medium enterprises (SMEs) trained and actively applying the technologies in livelihoods or management activities.
- the functionality rate (%) of installed equipment after 12 months, serving as a key indicator of sustainability, maintenance capacity, and value for money; and
- measurable improvements in biodiversity and ecosystem indicators, such as species abundance, mangrove cover, habitat condition, or fish biomass, assessed against established baselines.

Baseline data will be established during Activity 1 (Technology Needs Assessment – TNA), drawing on existing NBSAP data, field assessments, and community knowledge. Monitoring data will be collected annually and integrated into national reporting systems, including the NBSAP Clearing-House Mechanism where relevant.

Crucially, the MEL framework incorporates annual learning reviews, where results, challenges, and lessons learned are analyzed with stakeholders. Findings will directly inform adaptive management, allowing technologies, delivery models, and capacity-building approaches to be refined and scaled based on evidence. This learning-oriented approach ensures that technology transfer remains responsive, cost-effective, and impactful over time.

11. Risk Management and Safeguards

Risk management and safeguards are integral to the implementation of the Technology Transfer Strategy and Action Plan (TTSAP), ensuring that technology deployment delivers positive biodiversity and social outcomes while avoiding unintended negative impacts. The TTSAP adopts a precautionary and inclusive approach, consistent with CBD principles and national environmental and social safeguards.

All prioritized technologies will undergo environmental and social safeguard screening during the Technology Needs Assessment (TNA) and prior to deployment. This screening will assess potential risks such as habitat disturbance, pollution, inequitable access, or adverse livelihood impacts. Technologies with identified risks will be redesigned, adapted, or accompanied by mitigation measures, and where necessary, excluded from implementation. This ensures that technology transfer supports biodiversity conservation and ecosystem integrity rather than undermining them.

A dedicated gender and social inclusion plan will guide implementation to ensure that women, youth, and marginalized groups have equitable access to training, technology benefits, and decision-making processes. Targeted outreach, inclusive training schedules, and support for women- and youth-led enterprises will help address existing barriers and promote fair distribution of benefits across communities.

Given the increasing use of digital tools and data platforms, the TTSAP also addresses data privacy and sovereignty concerns. Biodiversity databases and monitoring systems will balance open-data principles with the secure handling of sensitive information, such as locations of endangered species or community-held traditional knowledge. Clear protocols will govern data access, storage, and sharing, ensuring transparency, national ownership, and compliance with ethical standards. These safeguards strengthen trust, reduce implementation risks, and enhance the long-term sustainability and legitimacy of technology transfer under the TTSAP.

12. Implementation Timeline (high-level)

The Technology Transfer Strategy and Action Plan (TTSAP) will be implemented through a phased and adaptive timeline that allows for learning, refinement, and scaling of biodiversity technologies. This high-level schedule provides clarity on sequencing while remaining flexible to funding availability and institutional readiness.

Months 0–6: Foundation and Readiness Phase

The initial phase focuses on establishing a strong enabling environment for the effective and coordinated implementation of the Technology Transfer Strategy and Action Plan (TTSAP). During this phase, a comprehensive Technology Needs Assessment (TNA) is conducted to systematically identify, assess, and prioritize biodiversity-related technologies across key ecosystems and productive sectors, using criteria such as feasibility, impact, scalability, and institutional readiness. In parallel, the Technical Advisory Panel (TAPanel) is established and operationalized, bringing together multidisciplinary expertise from government, academia, civil society, the private sector, and community representatives to guide technology selection and oversight. Baseline data are collected and validated to support the Monitoring, Evaluation, and Learning (MEL) framework, ensuring that progress and impacts can be measured over time. In addition, financing and fund-access mechanisms are designed to align national priorities with potential sources such as GEF, GCF, and the GBF Fund. Institutional roles, safeguard screening frameworks, and inter-agency coordination protocols are finalized to ensure clarity, accountability, and risk management from the outset.

Months 6–18: Pilot Deployment and Learning Phase

The second phase of implementation emphasizes pilot deployment and applied learning, serving as a critical bridge between planning and large-scale rollout of biodiversity technologies. During this phase, priority pilot interventions are implemented in selected landscapes and sectors that reflect The Gambia's ecological diversity and development priorities. These include pilots for mangrove and wetland restoration technologies, such as hydrological restoration tools and nursery systems; sustainable fisheries technologies, including stock assessment tools, vessel monitoring systems, and improved post-harvest handling; and national biodiversity data platform pilots that integrate field data, remote sensing, and institutional reporting systems.

Capacity-building and skills development are embedded within each pilot, ensuring that national technicians, local government staff, community institutions, and user groups gain hands-on experience in operating, maintaining, and adapting technologies. Training is delivered through practical, on-site sessions, mentoring, and peer learning rather than stand-alone workshops, strengthening local ownership and operational sustainability.

Throughout this phase, continuous monitoring and learning are integral to implementation. Data on performance, costs, functionality, and social inclusion are collected to assess effectiveness and identify challenges early. Regular learning reviews with stakeholders enable adaptive management, allowing technologies, delivery approaches, and institutional arrangements to be refined in real time. Based on emerging lessons, policy notes, technical guidelines, and operational standards are drafted to inform future scale-up and integration into national systems. This applied learning approach reduces risk, improves cost-effectiveness, and ensures that only proven, context-appropriate technologies are advanced to the scaling phase.

Months 18–36: Scaling and Institutionalization Phase

The Months 18–36 Scaling and Institutionalization Phase focuses on transforming proven pilot interventions into nationally embedded and financially sustainable systems. Technologies that demonstrate strong ecological impact, cost-effectiveness, institutional feasibility, and social inclusion during the pilot phase are scaled up across priority landscapes and sectors. This includes expanding successful mangrove and wetland restoration approaches, sustainable fisheries management tools, biodiversity monitoring systems, and community-based livelihood technologies to additional regions and user groups.

A key emphasis during this phase is SME incubation and private sector engagement. Local enterprises, cooperatives, and service providers are supported to deliver technology-related services such as equipment supply, maintenance, data collection, restoration services, and value-added processing. Business development support, access to finance, and partnership facilitation enable SMEs to participate in biodiversity technology value chains, reducing long-term dependence on externally funded delivery models.

Institutionalization is achieved by integrating proven technologies, guidelines, and operating procedures into national and sectoral policies, planning tools, and budgets, including NBSAP implementation mechanisms. Roles and responsibilities for technology operation, maintenance, and oversight are formally assigned to relevant agencies and local authorities. Long-term financing arrangements are finalized by linking national budget allocations with external financing sources such as GEF, GCF, and the GBF Fund, as well as public–private partnership models.

Finally, the Monitoring, Evaluation, and Learning (MEL) framework is fully operationalized, with regular reporting, learning cycles, and feedback mechanisms embedded in national systems. This ensures continuous improvement, accountability, and sustainability beyond the project cycle, enabling biodiversity technology transfer to remain an enduring component of national development and conservation efforts.

13. Conclusion

The Technology Transfer Strategy and Action Plan (TTSAP) provides The Gambia with a coherent, practical, and forward-looking framework for enabling the effective adoption, adaptation, and scaling of biodiversity-relevant technologies in support of national development priorities, the National Biodiversity Strategy and Action Plan II (2025–2035), and the Global Biodiversity Framework. It responds directly to long-standing systemic constraints—limited access to appropriate technologies, weak institutional coordination, insufficient financing, and fragmented deployment—and translates global commitments into nationally grounded, implementable actions.

At its core, the TTSAP recognizes that technology transfer is not a one-off activity or a collection of isolated pilots, but a continuous, systems-based process. Successful technology transfer requires strong governance, capable institutions, sustainable financing, inclusive participation, and robust learning mechanisms. The Strategy therefore moves beyond traditional project-based approaches and establishes

a national architecture that enables technologies to be identified, assessed, deployed, maintained, and scaled in ways that are environmentally sound, socially equitable, and economically viable.

The Theory of Change underpinning the TTSAP clearly articulates the pathway from addressing technology gaps, through institutional capacity strengthening and coordinated deployment, to improved ecosystem outcomes, resilient livelihoods, and achievement of Global Biodiversity Framework targets. By aligning institutional reforms, technical interventions, and financing mechanisms, the Strategy ensures that investments in biodiversity technologies generate durable results rather than short-lived gains. This approach is particularly critical in the context of climate change, where adaptive capacity, ecosystem resilience, and timely access to appropriate technologies will increasingly determine development outcomes.

A defining strength of the TTSAP is its emphasis on phased implementation and financing. The Strategy deliberately sequences readiness, piloting, and scale-up to reduce risk, maximize learning, and ensure efficient use of resources. Early investments in assessments, governance structures, and capacity building lay the foundation for effective deployment, while pilot interventions generate evidence and confidence for larger-scale investments. Over time, the Strategy envisages a gradual transition from donor-led financing to greater national ownership, private sector engagement, and blended finance, ensuring long-term sustainability beyond individual funding cycles.

Equity, inclusion, and rights are embedded throughout the Strategy. The TTSAP places particular emphasis on women, youth, and community-based actors as both users and innovators of biodiversity technologies. It integrates Access and Benefit-Sharing principles, safeguards traditional knowledge, and promotes participatory co-design to ensure that technology transfer contributes to social justice as well as ecological integrity. In doing so, the Strategy aligns biodiversity objectives with poverty reduction, food security, and climate-resilient livelihoods.

The institutional arrangements proposed under the TTSAP— including the Technology Transfer Steering Committee, Technical Advisory Panel, and National Technology Access Facility—provide a clear governance and coordination framework that links policy, finance, and implementation. These mechanisms are designed to strengthen inter-sectoral collaboration, improve accountability, and enable evidence-based decision-making. By embedding technology transfer within existing national institutions and planning processes, the Strategy avoids parallel systems and reinforces long-term institutional capacity.

Monitoring, evaluation, and learning are treated not as compliance exercises, but as strategic tools for adaptive management and scaling. The integration of technology performance tracking, biodiversity monitoring, and national reporting systems ensures that progress can be measured, lessons captured, and successful approaches replicated. This is essential for meeting national reporting obligations under the Convention on Biological Diversity and for demonstrating impact to development partners and investors.

Looking ahead, the successful implementation of the TTSAP will depend on strong political commitment, sustained institutional leadership, and coordinated support from development partners. Government ministries, local authorities, communities, civil society, academia, and the private sector all have critical roles to play. Development partners are invited to align their investments with the phased priorities outlined in the Strategy, while national institutions are encouraged to progressively integrate technology transfer into core budgets, policies, and programmes.

In conclusion, the Technology Transfer Strategy and Action Plan represents a strategic turning point in The Gambia's approach to biodiversity conservation and ecosystem-based development. By transforming how technologies are identified, financed, and deployed, the TTSAP lays the groundwork for resilient ecosystems, inclusive livelihoods, and sustained national capacity to meet both present and future challenges. Its successful implementation will not only advance national biodiversity goals, but also position The Gambia as a regional example of integrated, locally grounded, and globally aligned technology transfer for sustainable development.

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Annex 2: Detailed Technology Action Plan (TAP) — Technology-by-Technology Matrix

Technology	Package/Scale	CapEx	OpEx/year	Suppliers	O&M schedule	Skills required	IP/ABS notes	Lead	Timeline	KPIs
SMART Patrol Monitoring System (SMART Desktop/Cloud + SMART Mobile)	Deploy to 3–5 priority PAs; 30–60 ranger devices; central database + reporting	$15,000–$40,000 (devices, setup, training, hosting setup)	$3,000–$10,000 (hosting, connectivity, replacements, refresher training)	SMART Conservation Tools (software); Android rugged devices via local distributors; cloud hosting provider	Monthly data QA; quarterly device checks; annual refresher + system audit	Ranger data collection; GIS/M&E officer (SMART admin); basic ICT support	Open-source tools; data ownership retained by GoTG; role-based access and data-sharing agreements	MECCNAR/NEA; DPWM/DoF (PAs)	3–6 months (setup) + ongoing	PAs using SMART (#); patrol coverage km/quarter; incident reporting completeness %; quarterly SMART reports produced (#)
Wildlife Camera Traps	50–150 units across key habitats; standardized deployment protocol + data workflow	$18,000–$60,000 (cameras, accessories, lock boxes, spares)	$3,000–$12,000 (batteries/solar, SD cards, replacements, field servicing)	Conservation-grade camera brands (authorized distributors/retailers); local hardware vendors for mounts/locks	Bi-monthly checks; SD/battery rotation; annual inventory + replacement plan	Field deployment; basic maintenance; data labeling/QA; biodiversity monitoring	Images are GoTG assets; protocols for sensitive locations/species; evidence handling where applicable	NEA/DPWM; Research partners	2–4 months (procure+deploy) + 12–24 months monitoring	Camera trap-nights (#); species detections (#); % functioning cameras; monitoring reports (#)
Mapping Drone (UAV) for habitat monitoring (e.g., enterprise mapping drone)	2 UAV teams; mapping of mangrove/coastal/wetland hotspots; processing workstation	$20,000–$45,000 (2 drones, spares, training, basic processing setup)	$3,000–$10,000 (insurance, batteries, repairs, licensing)	Authorized enterprise UAV resellers; local ICT/geomatics vendors; processing software providers (if licensed)	Pre/post-flight checklists; battery lifecycle tracking; quarterly maintenance; annual recertification	Certified pilot; GIS/RS analyst; photogrammetry processing; safety compliance	Flight products owned by GoTG; comply with aviation rules; ensure exportable formats and no vendor lock-in	MECCNAR/NEA; GIS Units; Civil Aviation (compliance)	3–6 months (setup) + ongoing missions	Area mapped (ha/year); orthomosaics produced (#); enforcement alerts/assessments supported (#)
EO Monitoring Workflow (Sentinel/Landsat + GEE/QGIS)	National workflows for land cover, mangroves, wetlands; annual reporting + alerts	$25,000–$60,000 (workflow dev, training, baseline mapping, QA)	$8,000–$20,000 (support, retraining, hosting/dashboards if needed)	Open-source tools (QGIS); EO service providers/consultants; cloud/dashboard hosting provider	Annual model updates; quarterly QA/QC; backup/version control monthly	Remote sensing; GIS; scripting (GEE/Python); metadata management	Prefer open workflows; define data governance and public release rules (mask	MECCNAR/NEA; GIS Units	4–8 months (build+baseline) + annual updates	Annual national maps produced (#); accuracy assessment %; hotspot alerts issued (#); datasets

							sensitive layers)			uploaded to NBIS/CHM (#)
GPS/GNSS Field Kits for ground-truthing and boundary verification	20–50 standard GPS kits + 2–5 sub-meter GNSS units for technical teams	$15,000–$80,000 (depending on sub-meter units and quantity)	$2,000–$8,000 (repairs, replacements, batteries, calibration)	Garmin/Trimble/Emlid via distributors; tablets and accessories via local ICT suppliers	Quarterly device checks; annual calibration/servicing; inventory control ongoing	Field mapping; basic GIS; survey protocols; data QA	Apply consent protocols for community-sensitive points; central archival and access control	NEA/GIS Units; Sector Agencies	1–3 months (procure+train) + ongoing use	Ground-truth points collected (#); boundary checks completed (#); % datasets with metadata
eDNA Field-to-Lab Workflow (wetlands/coastal biodiversity)	1 national lab node + 2 field teams; sampling-to-analysis SOPs; partnerships for sequencing as needed	$30,000–$90,000 (sampling kits, filtration, cold chain, starter sequencing option, training)	$15,000–$60,000 (consumables, flow cells/kit reagents, QA, lab maintenance)	eDNA sampling/filter consumables via lab suppliers; sequencing platform/provider (in-country or partner labs)	Per campaign QA; monthly contamination controls; quarterly proficiency checks; consumable stock mgmt	Molecular lab skills; field sampling; biosafety; data analysis (bioinformatics)	High ABS sensitivity (genetic resources). Require PIC/FPIC where relevant, ABS clearances, data/sequence ownership rules	MECCNAR/NEA; Universities/Research Institutes; ABS Focal Point	6–12 months (setup+first pilots)	Sites sampled (#); taxa detected (#); turnaround time (days); ABS compliance (100%)
Water Quality & Salinity Monitoring Network (coastal/mangrove/wetlands)	10–20 manual stations + optional 5–10 telemetry stations in priority zones	$20,000–$100,000 (probes, loggers, telemetry kits, installation)	$5,000–$15,000 (calibration, sensor replacement, data costs)	Multiparameter probe suppliers via regional distributors; telecom operators (SIM/IoT); local installation services	Monthly/quarterly calibration; anti-fouling maintenance; quarterly data validation; annual overhaul	Field hydrology; sensor calibration; data management; basic electronics	Data-sharing agreement MECCNAR/NEA/DoWR; publish aggregated indicators while protecting sensitive sites	MECCNAR/NEA; DoWR; LGAs	3–6 months (install) + ongoing monitoring	Stations operational %; calibration compliance %; salinity trend reports (#); early warnings issued (#)
Mangrove Restoration Performance Toolkit (survival, sediment, hydrology)	1 toolkit per priority landscape; permanent plots + simple gauges + EO/drone integration	$15,000–$45,000 per landscape (tools, training, surveys)	$3,000–$12,000 (seasonal monitoring, field logistics, replacements)	Local fabrication (pins/gauges); GIS/drone services; community partners for monitoring	Seasonal monitoring (2–4x/year); plot upkeep quarterly; annual analysis + learning update	Restoration monitoring; basic hydrology; community facilitation; data QA	FPIC for community knowledge; ensure benefit-sharing recognition for local innovations and practices	MECCNAR/NEA; Forestry/Mangrove Units; Communities	3–6 months (setup) + 2–5 years monitoring	Survival rate %; area restored (ha); hydrology suitability index; lessons integrated into restoration design (#)

Invasive Species Early Detection & Rapid Response (EDRR) package	National reporting + 6 regional rapid response teams; SOPs and stockpiles	$20,000–$70,000 (systems, guides, starter equipment)	$5,000–$20,000 (response operations, refreshers, replenishment)	Kobo/ODK reporting tools; printing/publishing; local tool suppliers; specialized services as needed	Pre-season preparedness; quarterly drills; annual training + SOP updates	Species ID; response planning; data collection; safeguards/biosafety where relevant	If biocontrol considered, require biosafety approvals and clear IP/licensing; ensure safeguards and community engagement	NEA/Sector Agencies; LGAs; Research partners	3–6 months (setup) + ongoing	Reports validated (#); response time (days); infestations contained/eradicated (#); hectares treated (#)
Fire Risk & Restoration Planning Tools (EO + community reporting)	National fire risk mapping + regional planning templates; integrate with forest/community structures	$20,000–$55,000 (workflow, training, templates, baseline mapping)	$5,000–$15,000 (pre-season planning, updates, outreach)	GIS service providers; open-source tools; printing/training services	Annual pre-season plan; monthly incident updates in dry season; annual review after season	GIS/RS; community facilitation; incident database management	Open tools preferred; manage access to sensitive layers to prevent misuse	Forestry/DPWM; MECCNAR/NEA; LGAs	4–8 months (build) + annual cycle	Fire risk maps produced (#); firebreak plans (#); burned area reduced (%/ha); response coordination meetings (#)
National Biodiversity Geodatabase + NBIS/CHM Integration (PostGIS + dashboards)	Central geodatabase + ETL pipelines + user roles; integration with NBIS/CHM reporting	$35,000–$120,000 (system setup, integration, dashboards, training)	$10,000–$30,000 (hosting, cybersecurity, backups, support)	Open-source stack; local ICT integrators; cloud hosting provider	Daily/weekly backups; monthly security patching; quarterly audits; annual user training	Database admin; GIS; ETL/data engineering; cybersecurity basics; M&E reporting	Data governance is essential: access tiers, masking for sensitive species, data-sharing MoUs; GoTG ownership	NEA (custodian); MECCNAR; ICT Units	6–12 months (build+deploy)	Datasets integrated (#); data completeness %; automated reports generated (#); users active (#)
Community Co-design + Local Language Manuals (adoption enablers)	2 rollout waves; 12+ workshops; translated illustrated manuals; ToT network	$12,000–$50,000 per wave (workshops, prototyping, translation, printing)	$5,000–$15,000 (refreshers, updates, reprints)	Local training institutes; NGOs/CSOs; translators; printing houses	Annual refresher training; update manuals after learning cycles; quarterly feedback collection	Facilitation; adult learning; participatory methods; basic tech troubleshooting	Recognize local innovations; define licensing/benefit-sharing if innovations are commercialized; safeguard FPIC	MECCNAR/NEA; LGAs; Women's Bureau; CSOs	3–6 months per wave	Participants trained (#, % women/youth); manuals distributed (#); adoption rate %; grievance cases resolved (#)

Note: Costs are indicative and must be confirmed through market assessment and national procurement processes.

Annex 3. Six-year Strategic Objectives and Activity GANTT matrix

Year 1		Year 2		Year 3		Year 4		Year 5		Year 6	

	Year 1				Year 2				Year 3				Year 4				Year 5				Year 6			
Strategic Objective / Activity	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
SO1: National Biodiversity Technology Needs Assessment (TNA)																								
SO1: Policy & Project Review (NBSAP, sector plans)																								
SO1: Technology Mapping & Mainstreaming Notes																								
SO1: Prioritization Framework & MCA																								
SO1: Regional Consultations & Traditional Knowledge Integration																								
SO1: Spatial & Risk Mapping																								
SO1: National TTSAP Portfolio & Validation																								
SO1: Technology Briefs & Financing Alignment																								
SO1: Periodic TNA Update & Institutionalization																								
SO2: National Technology Evaluation Guidelines & Training																								
SO2: Applied Adaptation Trials & Research Partnerships																								
SO2: Procurement Reform & Officer Training																								
SO2: O&M Capacity Building & Manuals																								
SO2: Train-the-Trainer & Regional Focal Points																								
SO2: Local Fabrication & SME Partnerships																								
SO2: Institutionalization of O&M Financing																								
SO3: National Biodiversity Technology Financing Framework																								
SO3: Bankable Pipeline & Investment Briefs																								
SO3: International Funding Proposals (GEF/GCF/GBFF/AF)																								
SO3: PPPs & Private Sector Engagement																								
SO3: Risk-Sharing & Blended Finance Instruments																								

SO3: Gender & Community Finance Windows																								
SO3: Institutionalization of Biodiversity Finance																								
SO4: Participatory Technology Co-design & Inclusion																								
SO4: ABS Integration & Nagoya Compliance																								
SO4: Community Training & Local Manuals																								
SO4: Local Adaptation & Innovation Pilots																								
SO4: Train-the-Trainer & Peer Learning																								
SO4: South–South & Triangular Cooperation																								
SO4: Safeguards, Grievance & Governance Equity																								
SO5: TTSAP MEL Framework & Indicators																								
SO5: Technology Performance Tracking																								
SO5: NBIS/CHM Integration & Automation																								
SO5: Annual Learning & Policy Feedback																								
SO5: Scaling & Mainstreaming Technologies																								

Annex 4. Detailed budget table by activity

Strategic Objective	GBF Goal / Target	Activity	Implementing Agency	Period	Budget (USD)
SO1	Goal D / T19	National Biodiversity Technology Needs Assessment (TNA)	DPWM (MECCNAR), NEA	2025–2026	82,500
SO1	Goal A / T14	Technology mapping & mainstreaming	DPWM (MECCNAR), MoPE	2025–2026	42,000
SO1	Goal D / T21	Prioritization framework & MCA	TTSC, Academia	2025–2026	63,000
SO1	Goal D / T22	Regional consultations & traditional knowledge	LGAs, CSOs	2025–2026	52,500
SO1	Goal A / T1	Spatial & climate-biodiversity risk mapping	NEA, GIS Units	2026	70,000
SO1	Goal D / T19	TTSAP portfolio & inter-ministerial validation	DPWM (MECCNAR)	2026	31,000
SO1	Goal D / T21	Technology briefs & financing alignment	TTSC, MoPE	2026–2027	75,000
SO1	Goal D	TNA update mechanism & integration	DPWM (MECCNAR), MoPE	2027–2035	45,000
SO2	Goal D / T19	Technology evaluation guidelines & training	DPWM (MECCNAR), NEA	2025–2026	60,000
SO2	Goal D / T21	Adaptation trials & research partnerships	DPWM, UTG	2026–2030	35,000
SO2	Goal D / T19/20	Procurement reform & officer training	MoFEA, GPPA	2025–2027	60,000
SO2	Goal D / T21	O&M training & manuals	TTSC, TVET	2026–2035	125,000
SO2	Goal D / T22	Train-the-trainer & regional focal points	LGAs, CSOs	2026–2035	75,000
SO2	Goal D / T19	Local fabrication & SME partnerships	MoTI, GIEPA	2027–2035	85,000
SO2	Goal D / T21	Institutionalize O&M financing	DPWM (MECCNAR), MoPE	2030–2035	60,000
SO3	Goal D / T20	National biodiversity financing framework	DPWM (MECCNAR), MoFEA	2025–2026	45,000
SO3	Goal D / T19	Bankable pipeline & investment briefs	TTSC	2025–2027	35,000
SO3	Goal D / T20	Funding proposals & NDA coordination	DPWM (MECCNAR), NDA	2026–2035	75,000
SO3	Goal D / T20	PPPs & private sector engagement	MoTI, GIEPA	2026–2035	65,000
SO3	Goal D / T20	Risk-sharing & blended finance	MoFEA, Central Bank	2026–2035	450,000
SO3	Goal D / T22	Gender & community finance windows	Women’s Bureau, NGOs	2026–2035	45,000
SO3	Goal D / T20	Institutionalize biodiversity finance	DPWM (MECCNAR), NA	2028–2035	35,000
SO4	Goal D / T22/23	Participatory technology co-design	DPWM (MECCNAR), CSOs	2025–2035	75,000
SO4	Goal C / T13	ABS integration & Nagoya compliance	NEA, TTSC	2025–2030	30,000

SO4	Goal D / T21	Community training & local manuals	TTSC, NGOs	2026–2035	60,000
SO4	Goal D / T19	Local adaptation & innovation pilots	Universities	2026–2035	115,000
SO4	Goal D / T22	Train-the-trainer & peer learning	CSOs, CSTI	2026–2035	65,000
SO4	Goal D / T21	South–South cooperation & exchanges	DPWM (MECCNAR), Regional	2026–2035	125,000
SO4	Goal A/D	Safeguards, grievance & equity governance	DPWM (MECCNAR), NEA	2025–2035	35,000
SO5	Goal D / T21	TTSAP MEL framework & indicators	DPWM (MECCNAR), NEA	2025–2026	35,000
SO5	Goal D / T19/21	Technology performance tracking	TTSC, Universities	2026–2035	35,000
SO5	Goal D / T21	NBIS/CHM integration & automation	NEA, ICT	2026–2030	25,000
SO5	Goal A/D	Learning, reviews & policy feedback	TTSC, TAPanel	2026–2035	45,000
SO5	Goal D / T20	Scaling & mainstreaming technologies	DPWM (MECCNAR), LGAs	2027–2035	55,000
SO5	Goal D / T19/20	MEL capacity & dashboards	CSTI, Universities	2025–2030	35,000
SO5	Goal D / T21/22	Transparency, reporting & MEL financing	NEA, NA	2027–2035	40,000
				Grand Total	**2,536,000.00**

Annex 6. TTSAP Monitoring, Evaluation, Learning & Accountability (MELA) Framework

Strategic Objective 1. Evidence-Based Technology Prioritization & Planning

Level	Indicators (Core)	Baseline	Targets	Means of Verification	Frequency	Responsibility
Output	% of NBSAP/sector plans reviewed	0	100%	Review reports, matrices	Quarterly	NEA
Output	Policy–technology alignment matrix produced	No	Yes	Validated matrix	Once	MECCNAR
Outcome	Priority technologies ranked using MCA	0	≥20 technologies	MCA reports	Annual	MECCNAR/NEA
Outcome	% regional inputs integrated into TNA	0	≥80%	Consultation synthesis	Annual	LGAs/NEA
Impact	TTSAP endorsed & used for investment	No	Yes	Cabinet minutes, proposals	End of phase	MECCNAR
Strategic Objective 2. Institutional Capacity for Evaluation, Adaptation & Maintenance						
Output	National evaluation guidelines adopted	No	Yes	Approved guideline	Once	MECCNAR
Output	Staff trained (evaluation, O&M)	0	≥130 staff	Training records	Quarterly	NEA
Outcome	% pilots generating performance data	0	100%	Pilot M&E reports	Bi-annual	Sector Ministries
Outcome	O&M manuals used in programs	0	≥5 programs	Program reports	Annual	NEA
Impact	Reduced technology failure rate	TBD	≥30% reduction	Post-pilot reviews	Endline	MECCNAR
Strategic Objective 3. Access to Finance & Investment						
Output	Financing framework approved	No	Yes	Policy document	Once	MoFEA
Output	Pre-feasibility studies completed	0	≥10	Briefs, studies	Annual	MECCNAR
Outcome	Technologies matched to funds	0	≥5	Pipeline tracker	Annual	NDA
Outcome	Proposals submitted	0	≥3	Submission records	Annual	MECCNAR/AEs

Impact	Biodiversity finance mobilized (USD)	0	≥USD X million	Funding agreements	End of phase	MoFEA
Strategic Objective 4. Equitable & Locally Driven Technology Transfer						
Output	Financing framework approved	No	Yes	Policy document	Once	MoFEA
Output	Pre-feasibility studies completed	0	≥10	Briefs, studies	Annual	MECCNAR
Outcome	Technologies matched to funds	0	≥5	Pipeline tracker	Annual	NDA
Outcome	Proposals submitted	0	≥3	Submission records	Annual	MECCNAR/AEs
Impact	Biodiversity finance mobilized (USD)	0	≥USD X million	Funding agreements	End of phase	MoFEA
Strategic Objective 4. Equitable & Locally Driven Technology Transfer						
Output	Co-design workshops conducted	0	≥12	Workshop reports	Quarterly	LGAs
Output	Technologies with ABS clauses	0	100%	Contracts	Annual	NEA
Outcome	Women & youth participation	TBD	≥40%	Attendance data	Quarterly	Women's Bureau
Outcome	Local innovations documented	0	≥20	Innovation inventory	Annual	Research partners
Impact	Community satisfaction & ownership	TBD	≥75% positive	Surveys	Endline	MECCNAR
Strategic Objective 5. Monitoring, Learning, Scaling & Accountability						
Output	TTSAP MEL framework adopted	No	Yes	Approved MEL framework	Once	NEA
Output	Indicators linked to NBIS/CHM	No	Yes	System integration logs	Annual	ICT/NEA
Outcome	Annual learning events held	0	1/year	Workshop reports	Annual	MECCNAR
Outcome	Proven technologies scaled	0	≥5	Sector plans	Annual	Planning Authority
Impact	TTSAP evidence used in budgets	No	Yes	Budget references	Budget cycle	MoFEA

Table 4. Activity timeline with key roles for stakeholders

Technology Needs Assessment (TNA)	Month	National Coordination Unit (TTSC)	MECCNAR / NBSAP Lead	TAPanel, Universities, NGOs, Communities	Line Ministries, LGAs
TAPanel Setup & Governance	0–6	TTSC	MECCNAR	MoPE, NEA, DoF, DoFisheries, Academia	Development Partners
Baseline & MEL Framework	0–6	TTSC / Statistics Unit	MECCNAR	NEA, GBoS, Research Institutions	CBD Secretariat
Financing & Fund Mechanism Design	0–6	TTSC / MoPE	MoFEA	GEF/GCF NDA, Private Sector	LGAs, CSOs
Pilot Deployments (Mangroves, Fisheries, Data)	6–18	Sector Ministries & LGAs	MECCNAR	Communities, NGOs, TAPanel	TTSC, Donors
Capacity Building & Embedded Training	6–18	Sector Agencies	MECCNAR	Universities, TVETs, NGOs	Local Authorities
Policy Notes & Technical Guidelines	9–18	TTSC	MECCNAR	TAPanel, Legal Units	Cabinet, Parliament
Continuous Monitoring & Learning	6–36	TTSC / NEA	MECCNAR	GBoS, Academia	CBD, Donors
Scale-up of Successful Pilots	18–36	Sector Ministries	MECCNAR	LGAs, Private Sector	Communities
SME Incubation & Private Sector Engagement	18–36	MoTI / GIEPA	MoPE	Financial Institutions, NGOs	Youth/Women Groups
National Rollout of Proven Technologies	20–36	Sector Ministries & LGAs	MECCNAR	TTSC, TAPanel	National Stakeholders
Institutionalization & Policy Integration	24–36	MECCNAR / MoPE	Cabinet	TTSC, Line Ministries	Public
Long-term Financing Finalized	24–36	MoFEA / TTSC	Cabinet	GEF, GCF, GBF Fund	Implementing Agencies

Key: R = Responsible (leads execution) | A = Accountable (final decision/oversight) | C = Consulted (technical input) |I = Informed (kept updated

Annex 5. GEF ENVIRONMENTAL & SOCIAL SAFEGUARDS SCREENING FORM

Project Type: Enabling / Strategic Planning (Technology Transfer Strategy & Action Plan – TTSAP)
Focal Area: Biodiversity (with Climate Change & Land Degradation co-benefits)
Country: The Gambia
Executing Entity: [Lead Ministry / Agency]
GEF Agency: [UNDP / UNEP / FAO – to be confirmed]

PART I. PROJECT INFORMATION

Project Title:
Technology Transfer Strategy and Action Plan (TTSAP) for Biodiversity Conservation and Ecosystem-based Adaptation in The Gambia

Project Objective:
To identify, prioritize, deploy, and scale biodiversity-relevant and ecosystem-based adaptation technologies in a socially inclusive, environmentally sound, and institutionally sustainable manner aligned with the NBSAP and Kunming–Montreal Global Biodiversity Framework.

Project Components:

1. National Biodiversity Technology Needs Assessment (TNA)
2. Technology prioritization and roadmap development
3. Pilot deployment of priority biodiversity technologies
4. Capacity building, institutional strengthening, and governance
5. Monitoring, evaluation, learning, and safeguards integration

PART II. SAFEGUARDS SCREENING (CHECKLIST)

A. Environmental Safeguards

Safeguard Issue	Yes	No	Explanation / Mitigation
Adverse impacts on natural habitats or biodiversity	☐	☑	TTSAP promotes conservation-oriented, EbA-compatible technologies only
Risk of ecosystem degradation	☐	☑	Ecosystem screening applied before any pilot
Introduction of invasive alien species	☐	☑	Native species prioritized; ecological clearance required

Pollution, waste, or hazardous materials	☑	☐	Minor e-waste risk from digital/monitoring technologies
Climate maladaptation risks	☐	☑	Climate-resilience screening embedded

Mitigation Measures (if applicable):

- E-waste management plans
- Circular-economy principles
- Technology lifecycle assessments

Environmental Risk Level: LOW

B. Climate Change & Disaster Risk

Issue	Yes	No	Explanation
Increases vulnerability to climate hazards	☐	☑	TTSAP explicitly targets climate-resilient technologies
GHG emission increases	☐	☑	Technologies are low-carbon or neutral
Disaster risk exposure	☐	☑	Risk-informed siting and design

Risk Level: LOW

C. Social Safeguards

Safeguard Issue	Yes	No	Explanation / Mitigation
Land acquisition or resettlement	☐	☑	No land acquisition anticipated
Land tenure or access conflicts	☑	☐	Possible during pilots
Impact on Indigenous Peoples / Local Communities	☑	☐	Community-level engagement expected
Risk of elite capture	☑	☐	Technology benefits may be monopolized
Exclusion of vulnerable groups	☑	☐	Gender/youth exclusion risks

Mitigation Measures:

- FPIC procedures
- Transparent beneficiary selection
- Community oversight mechanisms

Social Risk Level: MODERATE

D. Gender Equality & Social Inclusion

Issue	Yes	No	Explanation
Risk of gender exclusion	☑	☐	Technology sectors traditionally male-dominated
Increased unpaid workload for women	☑	☐	Some technologies may add labor
Unequal access to skills and finance	☑	☐	Structural barriers exist

Mitigation Measures:

- Gender Action Plan integrated into TTSAP
- Minimum 40–50% women participation targets
- Women-only training and pilot sites

Gender Risk Level: MODERATE–HIGH (Mitigated)

E. Indigenous Peoples & Local Communities (IPLCs)

Issue	Yes	No	Explanation
Presence of IPLCs in project areas	☑	☐	Community forests, wetlands, mangroves
Use of traditional knowledge	☑	☐	Technology co-design includes local knowledge
Risk of misuse of genetic resources	☑	☐	Potential without safeguards

Mitigation Measures:

- ABS clauses
- Alignment with Nagoya Protocol
- Community consent and benefit-sharing

Risk Level: MODERATE

F. Governance, Ethics & Institutional Risks

Issue	Yes	No	Explanation
Weak institutional capacity	☑	☐	Capacity gaps exist
Coordination failures	☑	☐	Multi-sectoral complexity
Financial misuse risk	☑	☐	Procurement and asset risks
Data privacy & misuse	☑	☐	GIS, eDNA, community data

Mitigation Measures:

- TTSC governance framework
- Financial audits & procurement rules
- Data-sharing and consent protocols

Risk Level: MODERATE

PART III. OVERALL SAFEGUARD RISK CLASSIFICATION

Overall Environmental Risk: LOW
Overall Social Risk: MODERATE
Overall Gender Risk: MODERATE (Mitigated)

GEF Safeguards Category:
☑ **Category B – Moderate Risk (Mitigation Measures Required)**
☐ Category A – High Risk
☐ Category C – Minimal Risk

PART IV. REQUIRED SAFEGUARDS INSTRUMENTS

Instrument	Required	Status
Environmental & Social Management Framework (ESMF)	☐	Not required
Gender Action Plan (GAP)	☑	Integrated
Stakeholder Engagement Plan	☑	Integrated

Instrument	Required	Status
Indigenous Peoples Plan	☐	Embedded via FPIC
ABS Compliance Measures	☑	Integrated
Grievance Redress Mechanism (GRM)	☑	Integrated