

Technical Assistance Closure Report Template

Objective of the technical assistance (TA) Closure Report:

- To communicate publicly in one document, a summary of progress made and lessons learned during the TA towards the anticipated impact (sections 1-4).
- To document qualitative and quantitative data collected during TA, for use in donor and UN reporting (Annexe 1).

Steps for completing the TA closure report:

1. The lead TA implementer submits the closure report at the end of the technical assistance as a final deliverable. The TA closure report will capture outputs, outcomes and impacts of all activities conducted under the TA. Please copy and summarise relevant material from previous TA outputs/deliverables and the Response Plan, as relevant.
2. A CTCN Manager will review and revise the closure report before final approval by the CTCN Deputy Director.

Important note on public and internal use of the closure report:

Once approved by the CTCN Deputy Director, the TA closure report will be a public document available on the CTCN website www.ctc-n.org. Selected content will be used for targeted communication activities. Annexe 2 is for internal use only and will not be publicly available.

Closure Report for CTCN Technical Assistance

1. Basic information

Title of response plan	EMPOWERING COMMUNITIES WITH SUSTAINABLE AGRICULTURAL SYSTEMS: Piloting a Solar-Powered Hydroponic System in Kubau (EMSAS-Hydroponics)
Technical assistance reference number	2024000015
Country/countries	Nigeria
NDE organisation	National Council on Climate Change
NDE focal point	Mr. Chukwuemeka Okebugwu
NDE contact information	chuksokebugwu@yahoo.com , +2348064426144
Proponent focal point and organisation	<i>Yusuf Makama, Kubau Local Government Area, yusufmakama@gmail.com</i>
Designer of the response plan	<i>Sadiq Abubakar Gulma, Green Habitat Initiative, sadiq@greenhabitat.ng</i>
Implementer(s) of technical assistance	<i>Instruction: Implementers and other partner organisations are defined as the people and institutions engaged in the implementation of the TA</i> <ol style="list-style-type: none"> 1. Green Habitat Initiative (GHI) 2. National Council on Climate Change 3. Kaduna State Agricultural Development Agency 4. Kubau Local Government Area
Beneficiaries	<i>Instruction: Beneficiaries are defined as people and institutions benefiting from the TA</i> <i>Inhabitants of the Kubau Local Government Area.</i>

Sector(s) addressed	<i>Water, agriculture, and renewable energy</i>
Technologies supported	<p><i>Water, agriculture, and renewable energy</i></p> <p><i>Instruction: Select relevant sector(s) from the CTCN Water, Renewable agriculture, renewable energy taxonomy https://www.ctcn.org/resources/ctcn-taxonomy</i></p> <ol style="list-style-type: none"> <i>1. Solar water pumps</i> <i>2. Soil Management</i> <i>3. Precision Agriculture</i> <i>4. Soilless Agriculture</i> <i>5. Improved cultivation technique</i> <i>6. Greenhouse crop management</i>
Implementation start date	<i>02/05/2024</i>
Implementation end date	<i>30/04/2025</i>
Total budget for implementation	<p><i>Instruction: In addition to the financial value of the technical assistance, please also include if any pro bono or in-kind support has been provided by either the implementer/or the national counterparts.</i></p> <ol style="list-style-type: none"> <i>1. Budget from CTCN: USD 194,526.45</i> <i>2. An average of 720 working hours from five (5) Extension workers from the Kaduna Agricultural Development Agency (KADA) and Kubau LGA.</i> <i>3. Approximately USD 1,500 in support from Kubau LGA for the use of its hall for the training of beneficiaries.</i>
Description of delivered outputs and products, as well as the activities undertaken to achieve them. In doing so, review the log frame of the original response plan and refer to it as appropriate	<p>Description of Delivered Outputs and Products as well as the Activities Undertaken to Achieve Them</p> <p>The EMSAS Hydroponic Technical Assistance was implemented in alignment with the response plan, delivering on mandatory outputs and key components through a sequence of strategic activities. The outputs and activities are summarised below in reference to the original log frame:</p> <p>Output 1: Mandatory Deliverables to Support Implementation and Accountability</p> <p>Activity 1.1: Detailed Implementation Plan and Budget A complete implementation roadmap was developed, including clearly defined deliverables, responsibilities, timelines, and budget breakdowns.</p> <p>Key Deliverable:</p> <ul style="list-style-type: none"> • A detailed Implementation Plan and budget Document (approved and used as an operational guide). <p>Activity 1.2: Monitoring and Evaluation Plan A robust M&E plan with SMART indicators and data collection tools was</p>

	<p>designed. It facilitated real-time tracking of progress and enabled adjustments throughout the project cycle.</p> <p>Key Deliverable:</p> <ul style="list-style-type: none"> • A detailed Monitoring and Evaluation Plan with defined indicators aligned with the EC log frame. <p>Activity 1.3: Impact Statement Preparation Initial and final impact statements were produced to define and evaluate the expected versus actual project outcomes and climate adaptation contributions.</p> <p>Key Deliverables:</p> <ul style="list-style-type: none"> • Initial and Updated Impact Statements detailing goals, anticipated impacts, and final results. <p>Activity 1.4: Result Tracker from the European Commission Baseline, mid-term, and final log frameworks were submitted, documenting performance against set indicators.</p> <p>Key Deliverable:</p> <ul style="list-style-type: none"> • Completed EC Log Frame (including baseline, midline, and final values). <p>Activity 1.5: Technical Assistance Closure Report A document outlining a comprehensive summary of all project milestones, results, challenges, and recommendations was developed using the appropriate template</p> <p>Key Deliverable:</p> <ul style="list-style-type: none"> • This Technical Assistance Closure Report. <p>Output 2: Baseline Assessment and Gender Action</p> <p>Activity 2.1: Conduct Baseline Assessment A field-based survey using Kobo Toolbox was deployed across 4 council wards of Kubau LGA. Data on yield, land access, water resources, socio-economic conditions, and farming practices were collected.</p> <p>Key Deliverable:</p> <ul style="list-style-type: none"> • Baseline Assessment Report with disaggregated findings and infographics. <p>Activity 2.2: Gender Analysis and Action Plan Gender-inclusive tools and interviews were used to assess constraints and roles of women, youths and marginalised groups in agriculture.</p>
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	<p>Key Deliverable:</p> <ul style="list-style-type: none"> • Baseline Gender Assessment Report and Gender Action Plan, embedded into project design. <p>Activity 2.3: Risk Analysis and Mitigation Plan Technical, environmental, operational, and social risks were identified. A live risk register was maintained and utilised throughout the project implementation.</p> <p>Key Deliverable:</p> <ul style="list-style-type: none"> • Risk Analysis and Mitigation Plan, updated quarterly. <p>Output 3: Stakeholder Engagement and Working Group Establishment</p> <p>Activity 3.1: Stakeholder Mapping A multi-sectoral stakeholder mapping exercise was conducted, capturing over 40 key actors across government, private sector, academia, and civil society.</p> <p>Key Deliverable:</p> <ul style="list-style-type: none"> • List of Mapped Stakeholders by influence, sector, and role. <p>Activity 3.2: Establish Stakeholder Working Group (SWG) An 8-member SWG was formed, ensuring gender balance and representation from local, state and federal government, academia, and non-governmental organisations. A technical meeting with the SWG members was conducted monthly throughout the project implementation.</p> <p>Key Deliverable:</p> <ul style="list-style-type: none"> • Gender-disaggregated List of SWG Members. <p>Activity 3.3: Inception Meeting Held in Kaduna with 25 participants (19 males and 6 females), the meeting introduced project goals, timelines, roles, and the M&E framework.</p> <p>Key Deliverable:</p> <ul style="list-style-type: none"> • Inception Meeting Report and Attendance Records. <p>Activity 3.4: Conflict Analysis A conflict analysis tool was applied to assess community risks and causes of unrest and identify peace actors, especially those related to climate change.</p> <p>Key Deliverable:</p>
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- Conflict Analysis Report integrated into Risk Mitigation Plan.

Output 4: Hydroponic System Design and Demonstration

Activity 4.1: Study Tour

A study tour to hydroponic farms in Nigeria and Kenya was conducted, leading to the documentation of best practices and lessons on scalability.

Key Deliverable:

- Study Tour Report with Recommendations for Adoption.

Activity 4.2: Technology Benchmarking and Prioritisation

Comparative analysis of four hydroponic systems (NFT, DWC, trough, and Aeroponics) was conducted, with NFT and trough selected based on cost, simplicity, adaptability and water efficiency.

Key Deliverable:

- Technology Selection and Prioritisation (Benchmarking) Report.

Activity 4.3: Architectural & Engineering Design

An Architectural and Engineering firm was contracted to design a modular, replicable solar-powered hydroponic system, integrating local materials and automation-ready features.

Key Deliverable:

- Detailed A&E Design Blueprints for a solar-powered Hydroponics system.

Activity 4.4: Demonstration Workshop

A one-day design review and adoption workshop was held with stakeholders to validate the selected system.

Key Deliverable:

- Workshop Proceedings Report.

Activity 4.5: Cost Estimation

A detailed cost analysis of setting up the designed hydroponic system, including the solar systems, was completed.

Key Deliverable:

- Bill of quantity/ Cost Analysis Report of the selected hydroponics system set-up.

Component 5: Hydroponics System Set-up and Demonstration

**Activity 5.1: Identification and Grouping of Participants and Trainers
Community**

Community engagement was initiated by mapping and selecting 78 beneficiaries (40% female, 60% male), grouped into training cohorts. Criteria such as local knowledge, gender inclusivity, youth engagement, and geographic spread informed selection. The beneficiaries were selected across the four council wards in Kubau LGA to ensure a fair spread of knowledge and impact.

Deliverable:

- Gender-disaggregated List of Participants/ beneficiaries and community representation.

Activity 5.2: Development of Training Resources

Comprehensive training manuals were developed, incorporating visual aids, local language translations, and simplified instructions. The manuals covered hydroponics theory, construction, system operation, and crop management across local vegetable varieties.

Deliverable:

- Training Manual on Hydroponics System Design, Assembly, and Crop Management (print and digital versions).

Activity 5.3: MoU Signing between Key Project Stakeholders

To ensure clarity of roles and long-term commitment, two MoUs were signed between GHI (implementer) and Kubau LGA (project proponent), as well as between GHI (project implementer) and the Kaduna State Planning and Budget Commission (Kaduna State Government). The MoU outlined responsibilities for system sustainability, training continuation, and local ownership.

Deliverable:

- Countersigned Memorandum of Understanding (MoU).

Activity 5.4: Assembly and Piloting of Hydroponics System

The hydroponics demonstration unit was constructed at a central site using the A&E blueprint. Components included irrigation lines, grow beds, lighting, solar-powered water pumps, and overhead/underground nutrient tanks. This hands-on build was a critical step in introducing climate-resilient farming systems to the community.

Deliverable:

- Installed Hydroponics System with Technical Specifications.

	<p>Activity 5.5: Training of Trainers (ToT) An 8-day ToT was conducted for 10 trainers (8 males and 2 females), including artisans, lead farmers, and extension officers. The session covered hydroponics theory, construction, troubleshooting, and gender-sensitive teaching strategies. It culminated in a demonstration day with all stakeholders.</p> <p>Deliverable:</p> <ul style="list-style-type: none"> ToT Report and Attendance Register (disaggregated by gender, role, and location). <p>Component 6: Community Training on Hydroponics</p> <p>Activity 6.1: Community Training Sessions Three cohorts, each comprising 30 participants in cohort one, 22 in cohort 2, and 15 in cohort 3 (total of 68, with 49 males and 19 females), received one-week training sessions. The hands-on format emphasised assembly using local materials, nutrient preparation, seedling transfer, water management, and recordkeeping.</p> <p>Deliverable:</p> <ul style="list-style-type: none"> Community Training Report and Cohort-wise Attendance Records. <p>Activity 6.2: Sensitisation Workshops on Conflict Prevention Sensitisation sessions were held alongside technical training to foster peaceful coexistence. Using insights from the conflict analysis, workshops also highlighted how shared resources could be a source of collaboration rather than tension.</p> <p>Deliverable:</p> <ul style="list-style-type: none"> Workshop Report on Conflict Prevention and Peaceful Coexistence, including participant feedback and peacebuilding action points. <p>Component 7: Project Sustainability Strategy and Closure</p> <p>Activity 7.1: Roadmap for Scaling and Replication A strategic roadmap was drafted outlining steps, timelines, stakeholder roles, and funding pathways to replicate and scale the EMSAS hydroponic model across Kaduna and other northern states. The roadmap emphasises modular design, community-driven models, and public-private partnerships. The roadmap for the scale-up was developed with input from various stakeholders, especially the Kaduna State Agricultural Development Agency (KADA).</p>
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	<p>Deliverable:</p> <ul style="list-style-type: none"> Roadmap of Scaling Hydroponics Farming Beyond the Pilot Location. <p>Activity 7.2: Final Demonstration Workshop A multi-stakeholder demonstration event was held to showcase the pilot site and present the scale-up roadmap. Attendees included federal and state officials, donor agencies, private investors, and Civil Society Organisations. Sessions included live demonstrations, testimonials, and matchmaking for expansion.</p> <p>Deliverable:</p> <ul style="list-style-type: none"> Workshop Report and Stakeholder Engagement Register. <p>Activity 7.3: End-of-Project Assessment Using the same survey tools and methods from the baseline, the endline assessment evaluated knowledge gains, system uptake, socio-economic impact, and perceptions of the TA. The report presents a clear before-and-after picture of the intervention’s effectiveness.</p> <p>Deliverable:</p> <ul style="list-style-type: none"> Endline Assessment Report (includes comparative data analysis with baseline). <p>Activity 7.4: Final Impact Statement Based on the endline results, the final impact statement highlights how the TA improved food security, empowered youth and women, and enhanced adaptive capacity in climate-vulnerable communities.</p> <p>Deliverable:</p> <ul style="list-style-type: none"> Impact Statement (Final Version). <p>Activity 7.5: Technical Assistance Closure Report This report synthesises all activities, outputs, lessons learned, and future recommendations. It serves as a key reference for replication and reporting.</p> <p>Deliverable:</p> <ul style="list-style-type: none"> This Technical Assistance Closure Report (inclusive of all required annexes).
<p>Methodologies applied to produce outputs and products</p>	<p>Methodologies Applied to Produce Outputs and Products <i>(Components 1–7: System Set-up, Community Training, and Sustainability)</i></p>

The implementation of Components 5 to 7 of the EMSAS Hydroponic Project employed a blend of participatory, technical, and evidence-driven methodologies to ensure inclusive engagement, sustainable capacity building, and long-term impact. The methods used are outlined below:

1. Community-Centric Participatory Selection

- A community-based selection approach was used to identify training participants and local trainers, guided by transparent eligibility criteria (gender, age, experience, and commitment).
- Engagement methods included community sensitisation meetings, local leadership consultations, and registration through structured screening tools.

2. Strategic Stakeholder Engagement and Consultation.

- A comprehensive stakeholder mapping was conducted very early in the implementation of the TA to identify relevant stakeholders.
- A total of 26 organisations were identified at the beginning of the project, and 8 organisations were strategically selected to form the Stakeholder Working Group (SWG) of the TA.
- The SWG included national and sub-national government organisations, agricultural institutions, non-governmental organisations, farmer groups, international development partners, and the organised private sector.
- The SWG was fully consulted throughout the TA's implementation via a monthly meeting and need-based consultation, which steered the TA to a successful close-out.

3. Gender-Responsive and Youth-Inclusive Grouping

- The training cohort model ensured diverse, gender-balanced groups to facilitate peer learning and equitable access.
- Demographic data was disaggregated and tracked, allowing for real-time gender and youth participation.

4. Experiential and Practical Training Techniques

- A Training of Trainers (ToT) model was adopted to build local capacity and ensure sustainability beyond the project lifecycle.
- Learning-by-doing approaches were central in our approach; participants actively assembled, operated, and troubleshooted the hydroponic systems during field demonstrations.

5. Visual and Contextualised Learning Materials

- Graphic-rich manuals and flipbooks were developed using human-centred design principles to accommodate low-literacy users.
- Materials incorporated local crops, languages, and culturally relevant examples to enhance usability and retention.

6. Consensus-Based MoU Development

- A multi-stakeholder negotiation process was employed to develop and ratify the MoU among implementing and local partners.
- The methodology emphasised clarity of roles, sustainability commitments, and ownership using a shared-value partnership model.

7. Demonstration and Validation Workshops

- The hydroponics system design was presented to stakeholders through live demonstration workshops for review and contextual adoption.
- Feedback loops during these workshops helped refine implementation tools and validate community readiness.

8. Conflict Sensitivity Integration

- Insights from the conflict analysis report were integrated into training and sensitisation workshops to ensure that hydroponic system access and management reduced, rather than triggered, communal tension.
- Peacebuilding techniques, such as dialogue facilitation and early warning mapping, were included in community sessions.

9. Comparative Endline Assessment

- The **end-of-project assessment** mirrored the baseline in structure and metrics to ensure comparability.
- Quantitative surveys and qualitative tools (e.g., questionnaires, FGDs and key informant interviews) were used to track knowledge gains, adoption rates, and livelihood impacts.

10. Strategic Scaling Roadmap Co-Design

	<ul style="list-style-type: none"> • A co-creation process involving stakeholders from the public, private, and academic sectors was used to develop the scale-up roadmap. • The roadmap employed systems thinking and value chain analysis to identify opportunities, gaps, and action points for national expansion.
Reference to knowledge resources	<p>TEC Brief on South-South Cooperation for Climate Technology Development and Transfer</p> <ul style="list-style-type: none"> • Use: This brief informed the EMSAS approach to leveraging local and regional expertise (e.g., study tours within Nigeria and Sub-Saharan Africa) and promoting peer learning during the hydroponic system adaptation phase.
Deviations	<p><i>Instruction: Please describe any deviations from the response plan against the actual implemented activities, outputs and products</i></p> <p>Nil</p>
Anticipated follow-up activities and next steps	<p>Anticipated Follow-Up Activities and Next Steps</p> <p>Following the successful completion of the EMSAS Hydroponic Technical Assistance, several strategic follow-up actions have been planned to ensure the sustainability, scale-up, and institutionalisation of project outcomes. These next steps will be implemented in collaboration with key stakeholders and aligned with state and national development priorities.</p> <p>1. Scaling and Replication of Hydroponics Systems in Nigeria.</p> <ul style="list-style-type: none"> • Lead Stakeholders: European Union Delegation in Nigeria, Gesellschaft fur Internationale Zusammenarbeit (GIZ). • Activities: <ul style="list-style-type: none"> ○ Key into the EU-funded Value Chain Development Facility (EU-VACE) towards the scaling-up of the hydroponics system to other parts of Nigeria. ○ Explore partnership opportunities with GIZ with their current Agricultural Value chain projects implemented across Nigeria. • Expected Outcomes: Secure additional funding to scale up hydroponics farming to other parts of Nigeria and integrate hydroponics systems into ongoing agricultural projects. <p>2. Scaling and Replication of Hydroponic Systems in Kaduna State (Q3 2025 – Q4 2026)</p>

	<ul style="list-style-type: none"> ● Lead Stakeholders: GHI, Kaduna State Ministry of Agriculture, Kubau LGA, Federal Ministry of Agriculture and Food Security. ● Activities: <ul style="list-style-type: none"> ○ Roll-out of hydroponic demonstration sites across 10 additional LGAs using the implementation model developed under the TA. ○ Mobilisation of cooperatives and youth/women groups for capacity building and adoption. ● Expected Outcome: Expanded access to sustainable agriculture tools for climate-vulnerable communities across Kaduna State and Northern Nigeria. <p>2. Submission of Funding Proposals to Donor Agencies and Climate Finance Mechanisms (Q2–Q3 2025)</p> <ul style="list-style-type: none"> ● Lead Stakeholders: NDE, Kaduna State Ministry of Budget and Planning, GHI. ● Activities: <ul style="list-style-type: none"> ○ Finalisation and submission of project proposals (informed by the TA design) to funding agencies such as CTCN, Green Climate Fund (GCF), African Development Bank, and IFAD. ○ Integration of TA outputs (A&E designs, baseline, and impact assessment data) into investment case documents. ● Expected Outcome: Secured multi-year funding to scale hydroponics across Kaduna and neighbouring states.
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2. Lessons learned

	Lessons learned	Recommendations
Lessons learned from the CTCN TA process	<p>Importance of Structured Guidance and CTCN Tools</p> <ul style="list-style-type: none"> ● Lesson: The structured templates, response plan log frame, and monitoring frameworks provided by the CTCN were instrumental in 	Based on insights gathered during the EMSAS Hydroponic Technical Assistance implementation, the following recommendations are proposed to strengthen future CTCN-supported TA projects and enhance the success of similar climate technology transfer efforts:

	<p>maintaining focus, clarity, and accountability throughout implementation.</p> <ul style="list-style-type: none"> ● Challenge: The technical nature of some templates required additional orientation and hands-on guidance early in the process. <p>Timely and Responsive Support from the CTCN Secretariat</p> <ul style="list-style-type: none"> ● Lesson: Regular communication with the CTCN Secretariat was critical in addressing implementation bottlenecks and validating deliverables. <p>Early Engagement with National Counterparts is Key</p> <ul style="list-style-type: none"> ● Lesson: Proactive collaboration by GHI with the NDE and Kaduna State ministries significantly enhanced project ownership and facilitated smoother access to data and community networks. ● Challenge: Alignment of schedules between implementing partners and government counterparts required flexibility and advanced coordination. 	<p>1. Recommendations for Improving the CTCN TA Process</p> <ul style="list-style-type: none"> ● Enhance Orientation for First-Time Implementers: Provide an initial onboarding session or toolkit for new TA implementers, focusing on reporting templates, timeline expectations, and communication protocols to enhance the quality of deliverables. <p>2. Recommendations for Increasing the Success of Similar Efforts</p> <ul style="list-style-type: none"> ● Policy and Institutional Embedding from Day One: Engage policy actors early—not only for validation but to co-lead design processes—ensuring long-term adoption and potential mainstreaming of TA outcomes into national or sub-national frameworks. ● Strengthen Legal and Regulatory Enablers: Encourage TA projects to include a legal and regulatory review component, especially when introducing innovative technologies (e.g., hydroponics), to assess compliance, safety, and importation standards. ● Incentivise Private Sector Participation: Integrate business modelling, financing mechanisms, and investor dialogue forums into the TA process to unlock private sector interest and support sustainability beyond donor funding. ● Institutionalise Knowledge Retention: Promote partnerships with universities, vocational
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		<p>institutions, and extension agencies to sustain technical knowledge through formal curricula and long-term capacity-building arrangements.</p>
<p>Lessons learned related to climate technology transfer</p>	<p>1. Lessons Learned</p> <ul style="list-style-type: none"> ● Localised Adaptation Improves Usability: Adapting hydroponic systems to local resource availability (e.g., using local materials for grow trays and piping) improved affordability, reduced procurement delays, and enhanced community ownership. ● Demonstration and Co-Creation Build Trust: When community members participated in assembling the hydroponic units, their trust in the technology increased significantly. Seeing the system's function in real time helped dispel myths about “unnatural farming.” ● Capacity is the Foundation of Transfer: Skills transfer through Training of Trainers (ToT) and hands-on community learning was a critical success factor. Local trainers became advocates and troubleshooters, enhancing system sustainability. ● Gender-Inclusive Strategies Drive Adoption: 	<p>1. Risk Mitigation Measures</p> <ul style="list-style-type: none"> ● Climate and Infrastructure Risks: Introduce solar-powered backups and automated sensor alerts for critical hydroponic system components to mitigate risks from power outages and climate-induced heat waves. ● Water Quality Issues: Incorporate basic water testing kits and filtration units into hydroponic packages to ensure nutrient uptake is not compromised by poor water sources. ● Security and Community Tensions: Embed hydroponics projects within existing community structures (e.g. cooperatives, women’s groups) and conduct regular conflict sensitivity assessments in volatile areas. ● Maintenance and System Failure Risks: Establish local maintenance task teams and mobile support technicians trained during the ToT sessions to provide ongoing system servicing and troubleshooting. <p>2. Identified Opportunities for Overcoming Barriers</p> <ul style="list-style-type: none"> ● Reducing High Start-Up Costs: Promote micro-leasing models and pay-as-you-grow schemes in partnership with microfinance

	<p>Targeted recruitment of women and youth not only fulfilled social equity goals but also increased system use rates. Women especially appreciated the system’s water efficiency and minimal land requirements.</p> <p>2. Opportunities for Wider Use and Scale-Up</p> <ul style="list-style-type: none"> ● Market Linkages and Branding Potential: The pilot branded produce (“Kubau Fresh Hydroponics”) will be well received, creating an opportunity to build local and regional market recognition of hydroponically grown vegetables. ● Alignment with Climate and Youth Policies: The technology aligns well with Kaduna State’s agricultural transformation and youth empowerment agenda, creating a policy window for institutional support and budgetary integration. ● Private Sector Engagement and Financing Models: Opportunities exist to involve agritech companies, microfinance institutions, and green entrepreneurs in scaling access through lease-to-own, pay-as-you-grow, and 	<p>institutions and agritech startups to ease access for smallholders and youth.</p> <ul style="list-style-type: none"> ● Strengthening Input Supply Chains: Facilitate partnerships with local agri-retailers and cooperatives to become last-mile distributors of hydroponic inputs (nutrients, trays, sensors), thereby stimulating local business ecosystems. ● Building Technical Knowledge Across Sectors: Engage universities and polytechnics in developing formal certification courses on hydroponics, and include training for local extension agents and agric officers to mainstream knowledge. ● Policy Leverage: Advocate for hydroponic systems to be included in the Kaduna State Agricultural Investment Plan and other national frameworks on climate-smart agriculture. <p>3. Long-Term Sustainability Strategies</p> <ul style="list-style-type: none"> ● Building Endogenous Capacities: Institutionalise hydroponics training into the curriculum of agricultural colleges and vocational centres, and continue community-led ToT programs to maintain a local talent pool. ● Creating Revenue Streams for Cooperatives: Link cooperatives managing hydroponic units to bulk buyers and value-added chains (e.g., packaged salads, restaurant supply), enabling them to
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	<p>insurance-backed financing models.</p> <ul style="list-style-type: none"> Expansion to Conflict-Affected and Climate-Stressed Areas: Hydroponic systems, being land-independent and resource-efficient, are ideal for IDP camps, urban slums, and arid zones with minimal arable land, offering a replicable model for food security interventions. <p>3. Barriers to Deployment</p> <ul style="list-style-type: none"> High Initial Setup Costs: Startup costs (especially for advanced systems with solar power and water pumps) remain a challenge for low-income farmers. Without external funding or subsidies, adoption rates may remain low. However, the use of locally available materials is promising, especially for women to practice small-scale home-based hydroponics systems. Limited Access to Technical Inputs and Spare Parts: Availability of hydroponic nutrients, sensors, and replacement parts is limited in local markets. This threatens system sustainability unless a local supply chain is established. 	<p>generate profits and reinvest in system expansion.</p> <ul style="list-style-type: none"> Leveraging Climate Finance and Green Investment: Develop and submit funding proposals to multilateral and bilateral donors such as the CTCN Green Climate Fund (GCF), African Development Bank, and IFAD using EMSAS outcomes as proof of concept. Technology Innovation and R&D Partnerships: Foster long-term collaboration with research institutions (e.g., Ahmadu Bello University, Zaria, Kaduna State) to support continuous system optimisation, local material innovation, and crop nutrient research.
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	<ul style="list-style-type: none"> ● Knowledge Gaps Among Key Stakeholders: Some policymakers and extension officers are still unfamiliar with hydroponic principles, requiring ongoing sensitisation to promote institutional buy-in. ● Climate and Infrastructure Risks: Inconsistent power supply and extreme weather in some areas require additional resilience measures (e.g., solar backup, filtration units) to ensure uninterrupted system function. 	
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3. Illustration of the TA and photos

Barriers and Opportunities

Barriers:

- Difficulties in sourcing hydroponic nutrients, substrates, and system components locally may be a temporary challenge before full market linkages.
- Limited technical know-how as it requires specialised knowledge and skills in system design, crop management, and nutrient balancing.
- Limited access to financing, as farmers and youth-led agribusinesses often struggle to access credit or tailored loan products.

Opportunities:

- Hydroponics aligns with climate empowerment policies, promoting food security and economic resilience.
- Zero reliance on erratic weather.



- Improves water efficiency as it uses up to 90% less water than traditional agriculture, ideal for arid and drought-prone regions.
- Safer growing locations within communities to tackle food and physical insecurity.
- Less labour-intensive farming activities.
- Round-the-year crop production enhances food security.
- Gender-inclusive strategies drive adoption, empowering women and youth in agriculture.
- Potential expansion to conflict-affected and climate-stressed areas.
- Acts as a platform for agricultural innovation, school feeding programs, and vocational training.

Methodology and Activities

Methodology:

- Community-based participatory selection ensures inclusivity.
- Practical Training of Trainers (ToT) model for capacity building.
- Gender-responsive grouping and visual, culturally relevant learning materials.
- Conflict sensitivity integration to mitigate communal tensions.

Activities:

- Field-based assessments and stakeholder mapping.
- Community training sessions on hydroponics.
- Sensitisation workshops for conflict prevention.
- Demonstration workshops showcasing hydroponics systems.

Outputs and Achieved Results

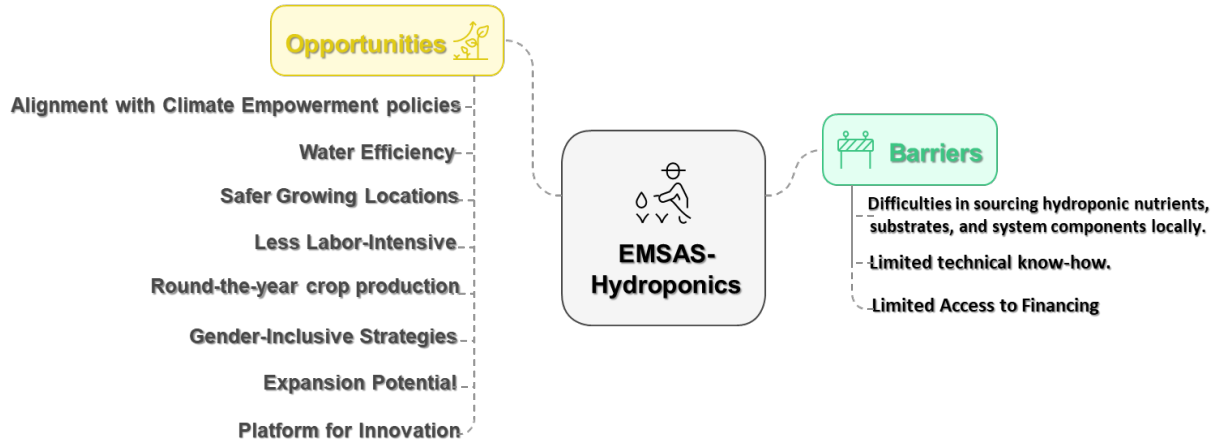
Outputs:

- An 8x40 meter solar-powered hydroponics screenhouse and system.
- Trained artisans (such as welders, plumbers, carpenters, extension agents, etc.) and community beneficiaries.
- Conflict prevention training for community beneficiaries and a hydroponics scaling-up roadmap.

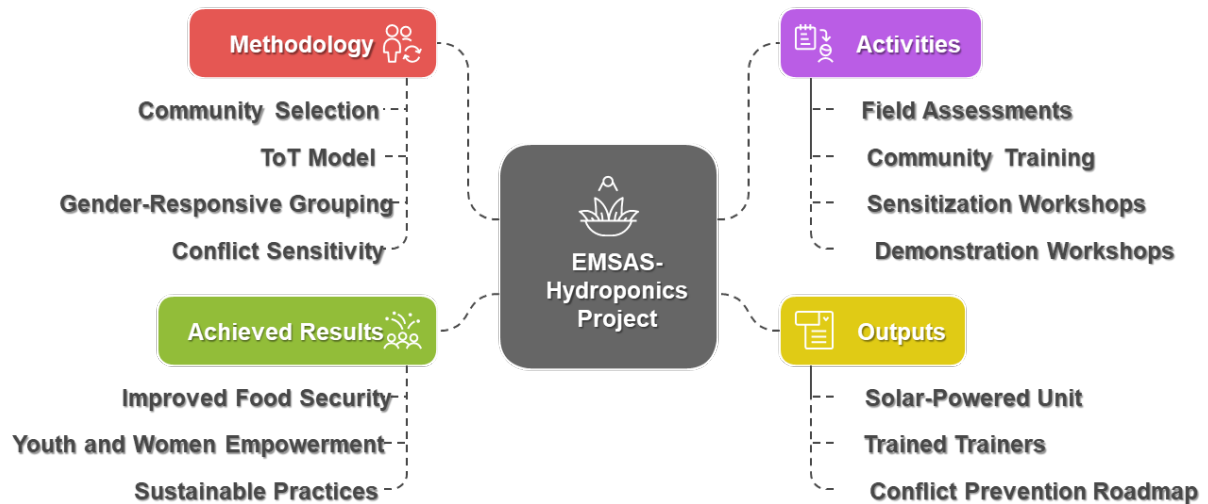
Achieved Results:

- Improved food security and nutrition through year-round vegetable farming.
- Empowerment of youth and women, reducing vulnerabilities.
- Sustainable, climate-resilient agricultural practices have been adopted in the region.

EMSAS-Hydroponics: Barriers and Opportunities



EMSAS-Hydroponics Project Overview





Pictures showing beneficiaries of the EMSAS-Hydroponics in the solar-powered hydroponics system during training, highlighting crop planting, management, and harvest.



The exterior and interior view of the solar-powered hydroponics system shows the Nutrient Film Technique (NFT) and trough systems.

For communication purposes, please provide 2-4 PowerPoint slides, including illustrations or charts, describing barriers, opportunities, methodology, activities, outputs and achieved results. The illustrations must be copied into the TA Closure report, but must also be delivered as PowerPoint files. Also, please provide at least five high-resolution pictures in JPG format, capturing technical assistance. The pictures should illustrate how the TA has impacted the lives of the beneficiaries in particular and the communities in general.

4. Impact Statement

The information in the table below will be used to communicate results and anticipated impacts of this technical assistance publicly. Please copy information from the impact statement developed in the M&E Plan and update as relevant.

<p>Challenge</p>	<p>In the Northern part of Nigeria, particularly in states like Kaduna State, which is generally arid, the impacts of drought and desertification have been disproportionately pronounced, affecting communities predominantly reliant on rain-fed agriculture. These environmental crises have triggered inter-communal conflicts between traditional farmers and nomadic communities engaged in livestock herding as land and water resources become increasingly scarce¹². These have heightened violence perpetrated by armed groups, including the extremist organisation Boko Haram, bandits, and herdsmen.</p> <p>Evidencing the severity of the food security crisis due to these two factors, a recent report from the United Nations Food and Agriculture Organisation has signified that an alarming 25.3 million Nigerians stand on the precipice of acute food insecurity. Consequently, the Federal Government felt compelled to declare a state of emergency concerning the nation's food security on July 14, 2023³⁴.</p>
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¹ <https://sci-hub.se/downloads/2021-06-30/e7/oruma2021.pdf>

² https://saudijournals.com/media/articles/SJEF_64_118-125.p

³ <https://guardian.ng/opinion/as-northern-farmers-abandon-food-production/>

⁴ <https://www.fao.org/giews/reports/crop-prospects/en/>

<p>CTCN Assistance</p>	<ul style="list-style-type: none"> • Designed and piloted, solar-powered hydroponics system tailored for conflict-affected communities as a climate-resilient farming technique. • Built local capacity through Training of Trainers and community-based beneficiaries, prioritising youth and women. • Enhanced coordination of relevant stakeholders in the agricultural and environmental spectrum within Kaduna State and across Nigeria.
<p>Anticipated impact</p>	<p>The EMSAS-Hydroponics Technical Assistance is anticipated to deliver transformative outcomes that enhance climate resilience, food security, and economic stability in Kaduna State, Nigeria. By introducing controlled-environment (a screenhouse) agriculture, the project reduces dependency on erratic rainfall and degraded soils, enabling year-round crop production even in conflict-affected and climate-vulnerable regions. It will foster secure, in-community livelihoods for marginalised groups, particularly women and youth. The project promotes gender inclusion, economic empowerment, and resource-efficient farming practices that minimise water use and environmental degradation. Through strategic training, stakeholder engagement, and localised design, the initiative builds community capacity for innovation and resilience. Ultimately, this TA will contribute to Nigeria’s national climate commitments and food security agenda, while aligning with key Sustainable Development Goals, including, zero hunger (SDG 2), gender equality (SDG 5), decent work (SDG 8), responsible consumption and</p>

	<p>production (SDG 12), and climate action (SDG 13). Additionally, the government’s broader food security emergency response will be enhanced through the TA by offering an immediately scalable model that addresses both climate change adaptation and conflict sensitivity</p>
<p>Co-benefits: Achieved or anticipated co-benefits from the TA</p>	<ul style="list-style-type: none"> ● Youth and Women Empowerment: Over 50% of trainees were youth and women, increasing their access to income-generating opportunities in agri-tech. ● Conflict Mitigation: Engagement of diverse groups and delivery of conflict prevention workshops helped promote peaceful co-existence in high-risk communities. ● Water Efficiency: Hydroponic systems use up to 90% less water than traditional farming, contributing to sustainable water resource management. ● Health and Nutrition: Increased year-round availability of fresh vegetables has the potential to improve household nutrition and food diversity. ● Clean and Sustainable Energy: The use of solar power technology ensures access to sustainable, clean and reliable energy to farmers.
<p>Gender aspects of the TA</p>	<p>The technical assistance was supported by a gender analysis and gender action plan (GAP) conducted during the baseline assessment, which identified barriers such as limited land access, unpaid care burdens, and underrepresentation of women in agricultural decision-making. In response, gender mainstreaming was prioritised throughout the implementation of the GAP. This</p>

	<p>included: ensuring at least 30% female participation in all training cohorts; developing gender-responsive training materials; gathering and reporting gender-disaggregated data; and involving women in cooperative leadership and system management roles. The project also integrated conflict sensitivity with a gender lens to enhance inclusivity and reduce vulnerabilities in conflict-prone communities.</p>
<p>Anticipated contribution to NDC</p>	<ul style="list-style-type: none"> ● Supports climate-resilient agriculture through water-efficient hydroponic systems. ● Reduces post-harvest losses and enhances food security. ● The use of solar-powered systems promotes low-carbon livelihoods for youth and women. ● Aligns with adaptation priorities in Nigeria’s NDC.
<p>The narrative story</p>	<p>Northern Nigeria faces a complex mix of climate and conflict-related challenges. In Kaduna State, erratic rainfall, land degradation, and insecurity, caused by banditry, land disputes, and farmer-herder clashes, have disrupted traditional agriculture, worsened food insecurity, and displaced farming communities. Youth and women, who are often excluded from land ownership and decision-making, face limited livelihood options. Climate-resilient agricultural technologies remain largely inaccessible due to high costs, lack of technical knowledge, and weak infrastructure. The EMSAS Technical Assistance introduced hydroponics as an innovative, water-efficient solution that requires no soil and minimal land. I built local capacity, demonstrated</p>

	<p>scalable models, and promoted inclusive participation in climate-smart food systems. By addressing both environmental and socio-economic barriers, the TA laid the groundwork for sustainable adaptation and resilience in a conflict-prone, climate-stressed region.</p>
<p>Contribution to SDGs</p> <p>A complete list of SDGs and their targets is available here: https://sustainabledevelopment.un.org/partnership/register/</p>	<p>SDG 2 – Zero Hunger The EMSAS TA promoted sustainable food production through hydroponic technology, enabling year-round cultivation of vegetables in resource-constrained and conflict-affected communities. It improved food security, reduced post-harvest losses, and increased access to fresh produce for vulnerable households.</p> <p>SDG 5 – Gender Equality Through gender-sensitive design and implementation, the project empowered women and girls by ensuring at least 50% participation in all training activities, promoting leadership roles in cooperatives, and addressing barriers to land access and economic inclusion.</p> <p>SDG 6 – Clean Water and Sanitation Hydroponics systems use significantly less water than traditional agriculture, promoting efficient water management in arid and drought-prone areas.</p> <p>SDG 7 – Affordable and Clean Energy By powering the hydroponics system with solar energy, the project reduces reliance on fossil fuels and promotes access to renewable, clean, and affordable energy, especially in rural or off-grid areas. It demonstrates how clean energy solutions can be integrated into agriculture to drive</p>

	<p>sustainability and reduce carbon emissions.</p> <p>SDG 12 - Sustainable Consumption and Production</p> <p>The hydroponic system design includes elements of closed-loop resource use, where water and nutrients are recirculated, and minimal waste is generated. Communities are also trained to reuse locally available materials for construction and maintenance, fostering circular economy principles. The TA enables economic empowerment without compromising environmental sustainability.</p> <p>SDG 13 – Climate Action</p> <p>By introducing water-efficient, soil-less farming and solar-powered infrastructure, the TA directly supported local adaptation to climate change. It built community resilience to erratic rainfall and land degradation while reducing the carbon footprint of agricultural practices.</p>
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Annexe 1: Technical assistance data collection

Please add quantitative and qualitative values for the indicators selected in the M&E plan and monitored throughout the technical assistance in the tables below. Indicators which have been monitored in addition to the proposed indicators below may be added at the end of Table A. Non-relevant indicators should be left blank.

A. Output and outcome indicators

Indicator	Quantitative value	Qualitative description
Please note the indicators below highlighted as anticipated	<i>Numerals only; disaggregates</i>	<i>List the various elements corresponding to the quantitative value, as well</i>

	<i>must sum to the total</i>	<i>as timelines and responsible institutions</i>
Total number of events organised by proponents and implementing partners	10	<ol style="list-style-type: none"> 1. Project inception meeting (30-05-2024). 2. Demonstration workshop (24-04-2025). 3. 8 Stakeholder Working Group (SWG) monthly meetings. <p>Responsible institutions: Kubau LGA and Green Habitat Initiative</p>
Number of participants in events organised by proponents and implementing partners	<i>List the total number here</i> 90	
a) Number of men	60	<i>Disaggregate by country</i>
b) Number of women	30	
Number of climate technology RD&D-related events		
Number of participants in climate technology RD&D events	<i>List the total number here</i>	
a) Number of men		
b) Number of women		
Number of training sessions organised by proponents and implementing partners	<i>List the total number here</i> 7	<ol style="list-style-type: none"> 1. Training of beneficiaries on hydroponics farming (3 cohorts). 2. Training of beneficiaries on conflict management (3 cohorts). 3. Training of Trainers(ToT)
Number of participants in trainings organised by proponents and implementing partners	<i>List the total number here</i> 77	
a) Number of men	56	
b) Number of women	21	
Total number of institutions trained	2	
a) Governmental (national or subnational)	2	<ol style="list-style-type: none"> a) Kaduna Agricultural Development Agency (KADA) b) Department of Agriculture (Kubau LGA)
c) Private sector (bank, corporation, etc.)	0	
d) Nongovernmental (NGO, University, etc.)	0	<i>List the names of organisations trained here</i>

Percentage of participants reporting satisfaction with CTCN training (from CTCN training feedback form)		<i>Satisfied = 4+ on 5-point scale</i>
Percentage of participants reporting increased knowledge, capacity and/or understanding as a result of CTCN training (from CTCN training feedback form)		<i>Increased knowledge, capacity and/or understanding = 4+ on 5-point scale</i>
a) Percentage of men		
b) Percentage of women		
Total number of deliverables produced during the assistance (excluding mission, progress and internal reports)	<i>List the total number here</i> 5	
a) Number of communication materials, including news releases, newsletters, articles, presentations, social media postings, etc.	1	<i>Technical Assistance factsheet</i>
b) Number of tools and technical documents strengthened, revised or developed		<i>List the names of the documents</i>
c) Number of other information materials strengthened, revised or created (For example, training and workshop reports, PowerPoint Points, exercise docs, etc.)	4	<ol style="list-style-type: none"> 1. <i>Hydroponics training workshop report.</i> 2. <i>Conflict management training workshop report.</i> 3. <i>TA Demonstration workshop report.</i> 4. <i>Hydroponics training manual.</i>
Total number of policies, strategies, plans, laws, agreements or regulations supported by the assistance	<i>List the total number here</i>	
a) Adaptation related		<i>List the type and name of documents supported</i>
b) Mitigation related		<i>List the type and name of documents supported</i>
c) Both adaptation- and mitigation-related		<i>List the type and name of documents supported</i>
Anticipated number of policies, strategies, plans, laws, agreements or regulations proposed, adopted or implemented as a result of the TA	<i>List the total number here</i>	
a) Adaptation related		<i>List the type of documents anticipated to be proposed, adopted or implemented</i>
b) Mitigation related		<i>List the type of documents anticipated to be proposed, adopted or implemented</i>
c) Both adaptation- and mitigation-related	1	<ol style="list-style-type: none"> 1. <i>Roadmap to scaling up hydroponics in Kaduna State.</i>
Anticipated number of technologies transferred or deployed as a result of CTCN support	<i>List the total number here</i> 3	<i>Instruction: List the type of technologies supported by this assistance. Technologies must be identified from the CTCN taxonomy of climate</i>

		<p>sectors and technologies (download in PDF format and choose from column C): https://www.ctcn.org/resources/ctcn-taxonomy.</p> <ol style="list-style-type: none"> Solar water pumps. Soilless Agriculture. Greenhouse crop management.
Anticipated number of collaborations facilitated or enabled as a result of technical assistance	4	
a) Number of South-South collaborations		List the names of the organisations (excluding the CTCN or TA implementers)
b) Number of RD&D collaborations	2	<ol style="list-style-type: none"> Turkana Basin institute (TBI), Kenya. National Agricultural Extension Research and Liaison Services (NAERLS), Nigeria.
c) Number of private sector collaborations	2	<ol style="list-style-type: none"> Human Needs Project, Kibera, Kenya. The Ngong Hydroponics Farm, Nairobi, Kenya.
Number of countries with a strengthened National System of Innovation as a result of CTCN support		List the names of countries
Insert any additional indicators here		

B. Core impact indicators

Please fill in the tables for the anticipated impacts of the CTCN assistance. Every technical assistance should contribute to at least one of the indicators below. For guidance on how to report on core indicators, see the '[M&E Guidance Document for TA Implementers](#)'.

Core indicator 1	Anticipated metric tons of CO₂ equivalent (CO₂e) emissions reduced or avoided as a result of CTCN TA	
	<i>Please add your calculations in Word or Excel format as an Annexe to this Closure Report, where applicable.</i>	
	Anticipated metric tons of CO ₂ e reduced or avoided as a result of the TA on an annual basis	Anticipated metric tons of CO ₂ e reduced or avoided as a result of the TA in total
Quantitative value (emissions reductions)	<i>Total number (numerals only, no rounding or abbreviations)</i>	<i>Total number (numerals only, no rounding or abbreviations)</i>

Unit	tCO ₂ e	tCO ₂ e
GHG assessment boundary (project emissions) Identify expected post-TA activities, associated effects, and assess the boundary for quantification of GHG emission reductions		
Baseline emissions Describe baseline scenario, baseline candidates, emission factors and emissions calculated		
Methodology Explain the method or process of verifying the indicator and how the data was gathered		
Assumptions Describe assumptions made during the calculation and quantification of GHG reductions		

Core indicator 2	Anticipated increased economic, health, well-being, infrastructure and built environment, and ecosystem resilience to climate change impacts as a result of technical assistance <i>Please provide a qualitative description of the anticipated impacts on the categories below</i>
Infrastructure and built environment Anticipated increased infrastructure resilience (avoided/mitigated climate-induced damages and strengthened physical assets)	The established hydroponics system is anticipated to provide a viable alternative to the traditional system of farming that is exposed to drought, harsh climate changes, and insecurity. By adopting the hydroponics system, farmers are anticipated to build resilient agricultural infrastructures that will allow them to grow agricultural products devoid of vulnerability to harsh climate conditions that affect the traditional system of agriculture. Please see Table 1: Output 5: Activity 5.4.
Ecosystems and biodiversity Anticipated increased ecosystem resilience (areas with increased resistance to climate-induced disturbances and with improved recovery rates)	
Economic	Trained farmers on hydroponics systems are anticipated to have improved economic resilience through expected returns from year-round cultivation of crops and increased yield.

Anticipated increased economic resilience (e.g. less reliance on vulnerable economic sectors or diversification of livelihood)	Please see Table 5: Output 6: Activity 6.1
Health and wellbeing Anticipated increased health and well-being of the target group (e.g. improved basic health, water and food security)	With improved agricultural yield from the implementation of the hydroponics system, it is anticipated that the population of the target community will achieve increased food security, thereby increasing overall nutrition and health and well-being of the community.

Core indicator 3	Anticipated number of direct and indirect beneficiaries as a result of the TA	
	Quantitative value	Means of verification
Total beneficiaries	11, 333	
Number of adaptation beneficiaries	11, 333	<i>This represents 50% of the estimated number of active vegetable farmers (22,620) in Kubau LGA, where approximately 90% of the population are farmers and an estimated 70% indulge in vegetable farming⁵. The total estimated population of Kubau LGA is 414,700⁶. Focusing on the target 4 council wards engaged during the TA, with an estimated combined population of 32,314. Thus, 70% (22,620) represents the estimated number of vegetable farmers, and 50% (11,310) are anticipated to directly or indirectly benefit from the TA implementation, assuming the knowledge is disseminated across the population of the communities by the trained beneficiaries. This is in addition to 23 representatives of various stakeholders who actively participated in the TA implementation.</i>
Number of mitigation beneficiaries	0	<i>Describe calculation methods and assumptions made</i>
Number of adaptation and mitigation beneficiaries	11, 333	<i>This represents 50% of the estimated number of active vegetable farmers (22,667) in Kubau LGA, where approximately 90% of the population are farmers and an estimated 70% indulge in vegetable farming⁷. The total estimated population of Kubau LGA is 414,700⁸. Focusing on the target 4 council wards engaged during the TA, with an estimated combined population of 32,380. Thus, 70% (22,667) represents the estimated number of vegetable farmers, and 50% (11,333) are anticipated to directly or indirectly benefit from the TA implementation, assuming the knowledge is</i>

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<https://www.saspublishers.com/article/9864/download/#:~:text=Generally%2C%20Kubau%200is%20an%20agricultural,conductive%20atmosphere%20for%20such%20activities.>

6 https://citypopulation.de/en/nigeria/admin/kaduna/NGA019015_kubau/

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<https://www.saspublishers.com/article/9864/download/#:~:text=Generally%2C%20Kubau%200is%20an%20agricultural,conductive%20atmosphere%20for%20such%20activities.>

8 https://citypopulation.de/en/nigeria/admin/kaduna/NGA019015_kubau/

		<i>disseminated across the population of the communities by the trained beneficiaries. The TA is an adaptation strategy aimed at increasing the resilience of farmers against climate change.</i>
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Core indicator 4				
Anticipated amount of funding/investment leveraged (USD) as a result of TA (disaggregated by public, private, national, and international sources, as well as between anticipated/confirmed funding)				
	Quantitative value confirmed in USD	Quantitative value anticipated in USD	Qualitative description <i>List the institutions, timelines, and description or title of the investment</i>	Methods <i>Describe the methods used for the quantification of funds leveraged</i>
Total funding	<i>Total number in USD (numerals only, no rounding or abbreviations)</i>	<i>Total number in USD (numerals only, no rounding or abbreviations)</i>		
Anticipated amount of public funding mobilised from national/domestic sources				
Anticipated amount of public funding mobilised from international/ regional sources				
Anticipated amount of private funding mobilised from national/domestic sources				
Anticipated amount of private funds mobilised from international/regional sources				

Annexe 2 (for internal use – to be filled in by the CTCN)

CTCN evaluation

This section will be completed by the relevant CTCN Technology Manager.

- Evaluation of the timeliness of the TA implementation as measured against the timeline included in the response plan;
- Evaluation of TA quality as defined in the response plan;



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- Overall performance of the Implementers;
- Overall engagement of the NDE and Proponent.
- Lessons learned on the CTCN process and steps taken by the CTCN to improve.