Eswatini Technical Assistance Closure Report

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 (Annex 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. Annex 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	Strengthening the National Disaster Management Agency's (NDMA) capacity in application of UAV and remote sensing technology for vulnerability assessments and response planning to enhance national food security and climate resilience
Technical assistance reference number	2020000001
Country / countries	**Eswatini**
NDE organisation	Department of Meteorology, Ministry of Tourism and Environmental Affairs
NDE focal point	Mr. Bafana Simelane Instrument Engineer
NDE contact information	bafanasim@gmail.com
Proponent focal point and organisation	*Name, organization, email*
Designer of the response plan	*Shanar Tabrizi, consultant*
Implementer(s) of technical assistance	The Regional Centre for Mapping of Resources for Development (RCMRD) and the Kenya Red Cross Society
Beneficiaries	The National Disaster Management Agency, Ministry of Agriculture, Department of Meteorological Services,

Sector(s) addressed	Agriculture and Forestry, Early Warning and Environmental Assessment
Technologies supported	Disaster risk assessment tools, Hazard mapping solutions, Ecosystem monitoring, Improved cultivation techniques, Improved climate data and tools
Implementation start date	*01/02/2021*
Implementation end date	*10/10/2022*
Total budget for implementation	*USD 154,614*
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	*The TA delivered several outputs and products, all generated through a co-development approach with the national partners. Two formal consultation meetings were held, one at the inception and the other during the fieldwork implementation stage. Two training workshops were also held, remotely with four experts from the Dept of Meteorological Services and physically in Eswatini with NDMA and participation from other co-implementing institutions. A framework document that provides a reference for implementation of UAVs and Remote Sensing technologies use was delivered to the NDMA. This framework is a guiding document, and it describes considerations for selecting the type of equipment (UAVs), data and data collection procedures, consultations and stakeholder engagements, gender analysis when implementing these technologies for agricultural monitoring and climate resilience. It provides a detailed descrpition of the pilot study that was conducted to demonstrate how these technologies could be applied in Eswatini, and a gender analysis guide for mainstreaming gender considerations in such technology implementation. The TA also provided data analysis tools that were used during the implementation of the case study, which are open source, and through which training was also provided. Raw and processed data were also provided to the CTCN and the local partners for future reference. A GCF Readiness Proposal was submitted to the NDE to scale up the piloted technologies across the country.*
Methodologies applied to produce outputs and products	*This TA combined stakeholder consultations with technical methods. At the beginning of the implementation, stakeholder consultations were carried out to align the TA with priorities and needs of the local partners, and allocate roles for data collection, authorizations and co-implementation. Technical methods included the use of drones/UAVs to collect field data, the use of satellite data from Sentinel-2 to complement drone data, and use of GIS and Remote Sensing tools to analyze drone and satellite data. Several open source tools were utilized during the implementation including PiX4D, WebODM, QGIS and R. Detailed methods are included in the framework document provided as part of the deliverables from the TA implementation.*
Reference to knowledge resources	*NA*
Deviations	*None*
Anticipated follow-up activities and next steps	*The GCF Readiness Proposal submitted as part of the deliverables requires formal submission. If this proposal is funded, the NDMA and other partners will use the*

	lessons, materials, and tools delivered during the pilot phase to scale up the interventions across the country. The implementing institution, RCMRD, has Eswatini as one of the Member States, and as such has committed to continue to assist Eswatini to implement future activities. It is also noted that toward the end of the pilot project, NDMA purchased a fixed wing drone as a result of the recommendations from this TA.

2. Lessons learned

	Lessons learned	**Recommendations**
Lessons learned from the CTCN TA process	*The pilot approach is an innovative pathway to a gradually accelerated operationalization of innovations. This approach enabled identification of appropriate technologies, possible challenges and solutions before operationalization. Another important lesson is that the preparation of the TA response plan was consultative, which made the implementation easier to accomplish than if possibly this approach was not used. The CTCN TA response plan consultant had meetings and further follow up conversations with the implementing institution, RCMRD, which was useful in understanding the requirements of the TA.*	• *The major recommendation from these lessons is the need to have more coordination between the CTCN, the national implementing institutions (NDE, NDA) and the institution implementing the TA. Communication across this nexus was sometimes challenging and having an active involvement of the CTCN is likely going to improve the implementation.*
Lessons learned related to climate technology transfer	*Climate technology transfer in Eswatini was supported by a generally enthusiastic and engaged partner, NDMA. However, the agency was short of technical capacity, even where some tools like UAVs were present. This was indeed the intention of the pilot TA but such TAs cannot fully realize the benefits if not backed up by a well prepared partner institution. This is not to discredit the capacity at NDMA but an indication of level of capacity before the development a response plan is important.*	*Several recommendations are provided: A comprehensive technological, individual and institutional capacity assessment is required at the TA development stage. Such assessment would be helpful when developing the activities and eventually the log frame. This was done in the TA but an evaluation of the activities revealed that the depth of such an assessment may not have been considered critical.* *The regulatory environment for the use of UAVs is relatively new in Eswatini which is encouraging given that many countries do not yet have these regulations in place. However, along with these regulations, it is important to build awareness at different levels of*

		regulatory space to ensure that the regulations are consistent with strengthening climate resilience in the country. For example, agricultural technologies that could benefit from the use of these UAVs may benefit from exceptions that may be required to operate such equipment such as payment for permits.

3. Illustration of the TA and photos

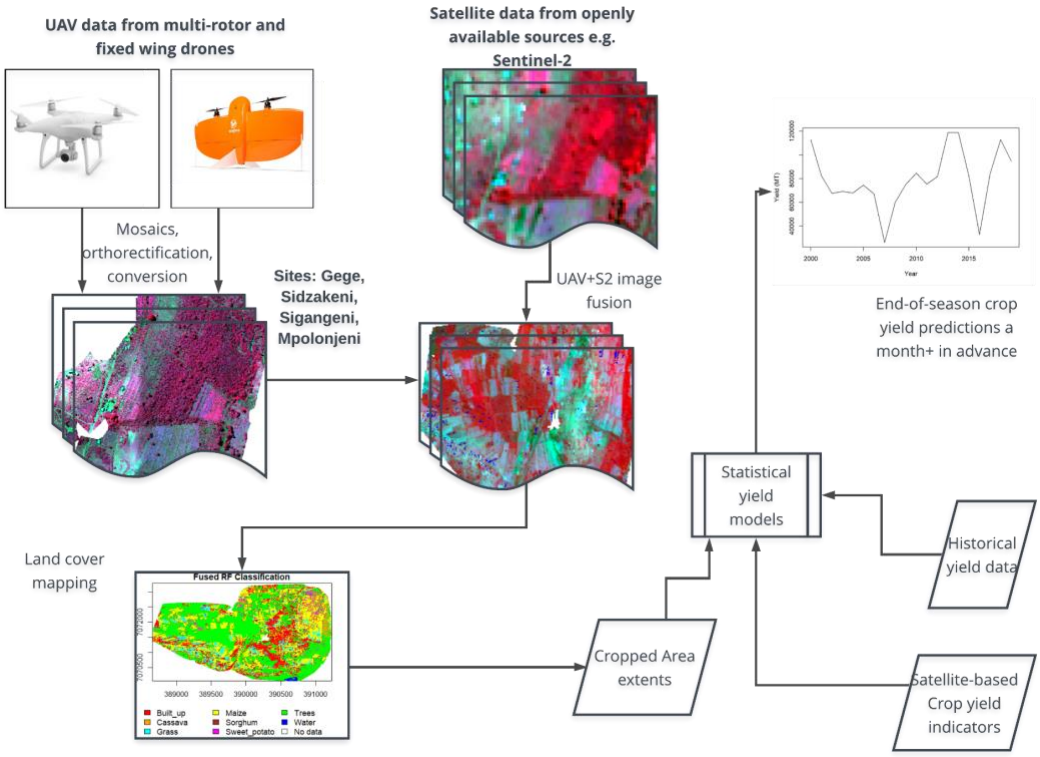


Figure 1: An illustration of the UAV and Satellite remote sensing data integration for land cover mapping, cropped area estimation and yield forecasting implemented as the key services of the TA.


wingtra
1690

10 National News

NDMA ENGAGES IN DRONE USE TRAINING

...exercise meant for vulnerability assessment accross the country

BY SIFISO NHLABATSI
Mbabane

THE National Disaster Management Agency has hosted experts to capacitate the agency on drones and remote sensing technology for vulnerability assessment and response planning processes.

According to a statement released by NDMA Communications Manager Wandile Mavuso the agency through assistance from the Climate Technology Centre and Network (CTCN, hosted technical experts from the Regional Centre for Mapping and Resource Development (RCMRD) and Kenya Red Cross Society to strengthen the NDMA's capacity in the application of Unmanned Aerial Vehicle (drones) and remote sensing technology for vulnerability assessments and response planning to enhance national food security and climate resilience.

This training according to NDMA started on 31 March and will end tomorrow.

Mavuso explained that the overall objective was to strengthen Eswatini's climate resilience, disaster risk reduction and vulnerability assessments in the agricultural sector by building capacity on access to an application of meteorological data, UAV technology and remotely sensed imagery for crop monitoring and early warning systems.

"The technical assistance aims to enhance the capacity of national stakeholders, including the NDMA, on the application of meteorological data, UAV technology and remotely sensed imagery for crop monitoring and provision of timely early warning data to farmers through various training workshops, make available a set of baseline data for agricultural indicators in support of vulnerability assessments and decision-making" Mavuso stated.

Officers from NDMA posing for a group photo.

An officer manning a drone.

Officers inspecting one of the drones

Another objective of the training according to NDMA is to improve the country's readiness to seek GCF funding for up-scaling of technologies.

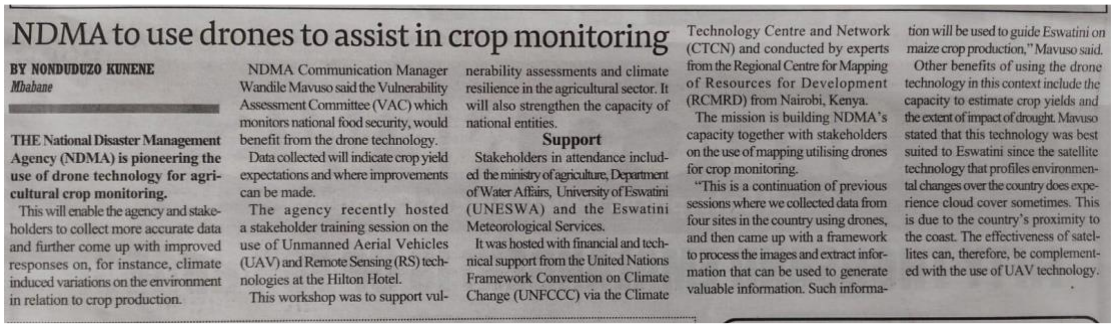
The technical assistance according to NDMA is expected to strengthen the country's capacity to identify, plan for and respond to climate-induced vulnerabilities and food insecurity situation in the country.

"The exercise of drone use is being carried out in all four regions of the country and is expected to last for two weeks" part of the statement from Mavuso reads.

Mavuso said the technical assistance is expected to strengthen the country's capacity to identify, plan for and respond to climate-induced vulnerabilities and food insecurity situation in the country.

He said the total project cost approximately E2 million for more effective data management and decision making around vulnerability assessment, food security and response, and enhance the use of climate information to increase resilience to broader climate change impacts and shocks for the 200 000 persons experiencing acute food insecurity in the country.

Mavuso said the drones may provide regular field overviews and crop assessment for faster response such as exact planning of pests and disease treatments, and yield higher outcomes compared to conventional methods of assessment related to time, accuracy, safety, costs and yield maximisation.



NDMA to use drones to assist in crop monitoring

BY NONDUDUZO KUNENE
Mbabane

THE National Disaster Management Agency (NDMA) is pioneering the use of drone technology for agricultural crop monitoring.

This will enable the agency and stakeholders to collect more accurate data and further come up with improved responses on, for instance, climate induced variations on the environment in relation to crop production.

NDMA Communication Manager Wandile Mavuso said the Vulnerability Assessment Committee (VAC) which monitors national food security, would benefit from the drone technology.

Data collected will indicate crop yield expectations and where improvements can be made.

The agency recently hosted a stakeholder training session on the use of Unmanned Aerial Vehicles (UAV) and Remote Sensing (RS) technologies at the Hilton Hotel.

This workshop was to support vulnerability assessments and climate resilience in the agricultural sector. It will also strengthen the capacity of national entities.

Support

Stakeholders in attendance included the ministry of agriculture, Department of Water Affairs, University of Eswatini (UNESWA) and the Eswatini Meteorological Services.

It was hosted with financial and technical support from the United Nations Framework Convention on Climate Change (UNFCCC) via the Climate Technology Centre and Network (CTCN) and conducted by experts from the Regional Centre for Mapping of Resources for Development (RCMRD) from Nairobi, Kenya.

The mission is building NDMA's capacity together with stakeholders on the use of mapping utilising drones for crop monitoring.

"This is a continuation of previous sessions where we collected data from four sites in the country using drones, and then came up with a framework to process the images and extract information that can be used to generate valuable information. Such information will be used to guide Eswatini on maize crop production," Mavuso said.

Other benefits of using the drone technology in this context include the capacity to estimate crop yields and the extent of impact of drought. Mavuso stated that this technology was best suited to Eswatini since the satellite technology that profiles environmental changes over the country does experience cloud cover sometimes. This is due to the country's proximity to the coast. The effectiveness of satellites can, therefore, be complemented with the use of UAV technology.

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 impact statement developed in the M&E Plan and update as relevant.

Impact Statement	
Challenge	*Agriculture is the most important sector for the majority of Eswatini's population, as well as national food security and economic development contributing about 9.5% of the country's GDP. Smallholder agriculture is the primary source of rural livelihoods, with over 70% of the country's total population relying on subsistence farming and women accounting for 60% of that group. Crop production among smallholder farmers is mainly rain-fed and it is thus the most vulnerable to climate change. Climate change impacts have negatively affected the most climate-vulnerable communities particularly smallholder farmers, increasing poverty levels and food insecurity, as well as limiting access to basic services. The vulnerability profile in the country indicates that 60% of the population experiences medium to high vulnerability to climate-driven hazards exacerbated by underlying*

	socio-economic conditions, including poverty. The country's agricultural vulnerability assessment information relies on pre-planting and post-harvest assessments, and oftentimes the annual National Agricultural Survey which aims to provide information on cropped areas through questionnaires and field surveys not consistently conducted due to resource and technology constraints. As a result, the country lacks continuous crop growth monitoring and assessment tools and technologies for quick and early detection of undesirable threats and occurrence of risks and hazards to food security. With Unmanned Aerial Vehicles (UAV) technology and satellite earth observations, it is expected that such assessments can be done with minimal human resources and during any phase of crop growth in order to deliver timely interventions.
CTCN assistance	*CTCN provided funding (USD 154,614) as well as overall coordination of the TA pilot project implementation. It also acted as the linkage between the implementing institution (RCMRD) and national partners (NDA and NDE).*
Anticipated impact	*UAV's provide regular field overviews and crop assessment for faster response such as precise planning of pests and disease treatments, and yield better outcomes compared to conventional methods of assessment.* *This TA is anticipated to build the capacity of the Kingdom of Eswatini to use modern technologies such as remote sensing and UAV for better analysis of agricultural vulnerabilities. Training provided remotely and physically during the implementation of the TA provide a foundation upon which more capacity strengthening, and building can be built. This training was complemented with agricultural and climate technology tools that will further improve the readiness of the country to enhance climate adaptation and mitigation in the country.* *The development of a GCF readiness proposal will facilitate access to large-scale climate funding that will in turn accelerate wide-spread application of modern technologies of vulnerability assessment in the agricultural sector in the country*
Anticipated co-benefits from the TA	*NDMA staff capacity enhanced on use of UAV and Remote Sensing technology for DRR and Vulnerability assessments including agricultural data collection, analysis and interpretation for crop monitoring, yield predictions and integration of information derived from this case study into early warning alerts* *This TA harnessed the power of drone technology with machine learning to generate detailed, up-to-date information on potential and existing agricultural land conditions and the development of Eswatini baseline datasets for vulnerability assessments indicators using high resolution imagery.* *Upscaling of technologies piloted will have far reaching benefits beyond the pilot areas and participating instititutions.*
Gender aspects of the TA	*The services of a gender expert were utilized to carry out a gender analysis of the technical assistance during implementation, with a particular focus on women's climate vulnerabilities and their role as active agents and farmers in strengthening climate resilience through their contribution to disaster risk reduction, vulnerability assessments and crop monitoring.* *The activities will support provision of data and knowledge to better understand women farmers, their strengths and climate vulnerabilities in the agriculture sector.*

	The TA built technical capacity of NDMA staff and other participating institutions to undertake crop monitoring and assessments, which will help support both male and female farmers. These trainings and engagements included women participation. *The expected outcomes include enhanced early warning, which will support farmers with increased crop yields and reduced losses, ultimately promoting food security to the benefit of both men, women and children in farming households.*
Anticipated contribution to NDC	*Enhanced capacity of national stakeholders, including the National Disaster Management Agency, on the application of UAV technology and remotely sensed imagery for crop monitoring and provision of timely early warning data to farmers.* *Availability of baseline dataset based on pilot application of UAV and remote sensing in the agricultural sector.* *Improved readiness to seek GCF funding for up-scaling of technologies*
The narrative story	*The landlocked Kingdom of Eswatini is increasingly vulnerable to the impacts of climate change due to an upward trend in mean annual temperature across the country, as well as extreme weather events such as droughts, bush fires, storms and floods becoming more severe and frequent. As a result of these recurrent shocks, the country's food security and water resources are under threat. Eswatini also faces numerous interlinked challenges such invasive plants and diseases, HIV/AIDS and poverty which erode the population's ability to recover and remain resilient towards climate change effects. The agricultural sector is a critical component of the economy and contributes approximately 9.5% of the country's GDP. In 2015/16 the country declared a national state of emergency due to drought, and experienced losses amounting to approximately 7% of GDP, and about 18% of the government's expenditure.* *As projections expect continued uncertain rainfall patterns and warmer climate, it is imperative that farming and agricultural communities adapt their practices to climate change and extreme weather events to decrease the vulnerability of rural livelihoods, where women head 48% of the households. As an example, maize production dropped by 67% in the 2015/16 El Niño-induced droughts, and it is predicted that the Highveld region will be unsuitable for growing maize by the year 2050. According to the 2019 Annual Vulnerability Assessment and Analysis Report, a recent 15% decline in cereal production coupled with increased food prices and unemployment has resulted in a 66% increase in food insecurity among the population.* *The Kingdom of Eswatini relies on pre-planting and postharvest assessments and oftentimes the annual National Agricultural Survey which aims to provide information on cropped area through questionnaires and field surveys is not consistently conducted due to resource and technology constraints. As a result, the country lacks continuous crop growth monitoring and assessment tools and technologies for quick and early detection of undesirable threats and occurrence of risks and hazards to food security. With Unmanned Aerial Vehicles (UAV) technology, it is expected that such assessments can be done with minimal human resources and during any phase of crop growth to deliver timely interventions.*

Contribution to SDGs	*This response plan will positively contribute to the following SDGs;* *SDG 2-The Technical Assistance will contribute to achieving food security through strengthened vulnerability assessments and response planning in the agricultural sector.* *SDG 8-Improved vulnerability assessment and early detection of undesirable threats and occurrence of risks and hazards to food security will contribute positively to a sustainable economic growth and sustainable livelihoods in the agricultural sector* *SDG13-The Technical Assistance will strengthen resilience and adaptive capacity to climate-related hazards and risks in the agricultural sector through national policies and strategies. As well as raise the capacity of national stakeholders to effectively plan for food security, including the perspectives of women and affected communities*

Annex 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 Please note indicators below highlighted as **anticipated**	**Quantitative value** *Numerals only; disaggregates must sum to the total*	**Qualitative description** *List the various elements corresponding to the quantitative value as well as timelines and responsible institutions*
Total number of events organized by proponents and implementing partners	*3*	*1 virtual inception workshop (March 2021), 1 virtual training workshop (30/9, 7/10, 14/10, 21/10 2021) and 1 physical training workshop (24-29th January 2022)- all events co-organized by RCMRD and NDMA*
Number of participants in events organized by proponents and implementing partners	*64*	
a) Number of men	*49*	
b) Number of women	*15*	
Number of climate technology RD&D related events	*3*	
Number of participants in climate technology RD&D events	*64*	
a) Number of men	*49*	
b) Number of women	*15*	
Number of training organized by proponents and implementing partners	*2*	1. *Earth observations and in-situ data integrations to improve climate data (30/9, 7/10, 14/10, 21/10 2021)* 2. *Use of Unmanned Aerial Vehicles (UAVs) and Remote Sensing for Crop Monitoring ((24-29th January 2022)- all events co-organized by RCMRD and NDMA)*
Number of participants in trainings organized by proponents and implementing partners	*21*	
a) Number of men	16	

b) Number of women	5	
Total number of institutions trained	*5*	
a) Governmental (national or subnational)	4	National Disaster Management Agency, Forestry Department, Ministry of Agriculture, Eswatini Meteorological Services
b) Private sector (bank, corporation, etc.)		*NA*
c) Nongovernmental (NGO, University, etc.)	1	*University of Eswatini*
Percentage of participants reporting satisfaction with CTCN training (from CTCN training feedback form)	**100**	*Satisfied= 4+ on 5-pt scale*
Percentage of participants reporting increased knowledge, capacity and/or understanding as a result of CTCN training (from CTCN training feedback form)	**100**	*Increased knowledge, capacity and/or understanding= 4+ on 5-pt scale*
a) Percentage of men	**100**	
b) Percentage of women	**100**	
Total number of deliverables produced during the assistance (excluding mission, progress and internal reports)	*10*	Data, Framework and Technical specifications, case study report, data integration tools, GCF Readiness proposal, Communication materials, training manuals, presentations
a) Number of communication materials, including news releases, newsletters, articles, presentations, social media postings, etc.	3	*Media articles, presentations*
b) Number of tools and technical documents strengthened, revised or developed	4	*Data integration tools, R scripts, GeoCLIM, Framework and technical specifications document*
c) Number of other information materials strengthened, revised or created (For example training and workshop reports, Power Points, exercise docs etc.)	3	*Stakeholder consultation and training workshop reports*
Total number of policies, strategies, plans, laws, agreements or regulations supported by the assistance	*0*	
a) Adaptation related		
b) Mitigation related		
c) Both adaptation- and mitigation related		
Anticipated number of policies, strategies, plans, laws, agreements or regulations proposed, adopted or implemented as a result of the TA	*0*	
a) Adaptation related		
b) Mitigation related		
c) Both adaptation- and mitigation related		
Anticipated number of technologies transferred or deployed as a result of CTCN support	*3*	*Climate change monitoring, ecosystem monitoring, disaster risk assessment tools*
Anticipated number of collaborations facilitated or enabled as a result of technical assistance	*0*	
a) Number of South-South collaborations		
b) Number of RD&D collaborations		
c) Number of private sector collaborations		
Number of countries with strengthened National System of Innovation as a result of CTCN support		

Insert any additional indicators here		

B. Core impact indicators

Please fill in the tables for 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 CO_2 equivalent (CO_2e) emissions reduced or avoided as a result of CTCN TA** *Please add your calculations in word or excel format as an Annex to this Closure Report, where applicable.*	
	Anticipated metric tons of CO_2e reduced or avoided as a result of the TA **on annual basis**	Anticipated metric tons of CO_2e reduced or avoided as a result of the TA **in total**
Quantitative value *(emissions reductions)*	*Total number (numerals only, no rounding or abbreviations)*	*Total number (numerals only, no rounding or abbreviations)*
Unit	tCO_2e	tCO_2e
GHG assessment boundary (project emissions) Identify expected post-TA activities, associated effects and assess 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 data was gathered		
Assumptions Describe assumptions made during calculation and quantification of GHG reductions		

Core indicator 2	**Anticipated increased economic, health, well-being, infrastructure and built environment, and ecosystems resilience to climate change impacts as a result of technical assistance** *Please provide a **qualitative** description of the anticipated impacts on the categories below*
Infrastructure and built environment Anticipated increased infrastructure resilience (avoided/mitigated climate induced damages and strengthened physical assets)	
Ecosystems and biodiversity Anticipated increased ecosystem resilience (areas with increased resistance to climate-induced disturbances and with improved recovery rates)	
Economic Anticipated increased economic resilience (e.g. less reliance on vulnerable economic sectors or diversification of livelihood)	
Health and wellbeing Anticipated increased health and wellbeing of target group (e.g. improved basic health, water and food security)	

Core indicator 3	**Anticipated number of direct and indirect beneficiaries as a result of the TA**	
	Quantitative value	**Means of verification**
Total beneficiaries	*Total number*	
Number of adaptation beneficiaries		
Number of mitigation beneficiaries		
Number of adaptation-and mitigation beneficiaries	5000	*This was a pilot study TA and as such, it is difficult estimate the number of beneficiaries who are likely to be impacted by the pilot. However, assuming that the national co-implementing partners carry on with the technologies developed, improved or trained on, it is likely that this could benefit more than 5,000 farming households in the pilot study areas, calculated from the basis of an estimated total number of farmers within the study areas.*

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** *List the institutions, timelines, and description or title of the investment*	**Methods** *Describe methods used for quantification of funds leveraged*
Total funding	*Total number in USD (numerals only, no rounding or abbreviations)*	*Total number in USD (numerals only, no rounding or abbreviations)*		
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				

Annex 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;
- 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.