CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

Technical Assistance Response Plan - Terms of Reference

Country	**Indonesia**
Request ID#	**2020000036**
Title	**Identification of technical practices for climate-smart agriculture (CSA) in Indonesia**
NDE	Ir. Laksmi Dhewanthi, MA Director General of Climate Change Ministry of Environment and Forestry Indonesia ndectcn.idn@menlhk.go.id Manggala Wanabakti Building, Block VII 12th Floor, Jalan Gatot Subroto - Senayan, Jakarta 10270, Indonesia
Proponent	Dr. Ir. Dudi Iskandar M. For. Sc., IPU Director of Centre for Agricultural Production Technology Agency for the Assessment and Application of Technology dudi.iskandar@bppt.go.id LAPTIAB Building, Kawasan PUSPIPTEK, Tangerang Selatan, Banten 15343, Indonesia

Summary of the CTCN technical assistance

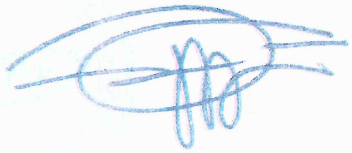
The objective of this technical assistance (TA) is to identify and design climate-smart agriculture (CSA) technologies and associated system for enhancing climate change adaptation in agriculture sector in Indonesia. In this TA, two of the indicative technical interventions in agriculture sector included in the National Adaptation Plan (① The use of sensors that are able to identify water content and soil chemistry on agricultural land and ② Automation of watering and fertilizing tools according to land requirements) will be selected, and the associated technologies for such interventions will be identified and prioritised to design an integrated system for CSA practice in the selected area of Indonesia. Market potential and cost-benefit analyses for the deployment of the integrated system will be carried out, and a workshop for national and local governmental officials will be organized to share CSA practices and associated business models investigated in this TA as well as to introduce the integrated system designed through this TA. Outputs from this TA are expected to facilitate implementation and replication of CSA technologies in Indonesia, supporting to achieve the goal and strategies of its National Adaptation Plan.

Agreement:

(If possible, please use electronic signatures in Microsoft Word file format)

National Designated Entity to the UNFCCC Technology Mechanism
Name: Laksmi Dhewanthi
Title: Director General of Climate Change
Date:
Signature:

Proponent (signature of the Proponent is optional)
Name: Dudi Iskandar
Title: Director
Date: June, 03, 2021
Signature:



UNFCCC Climate Technology Centre and Network (CTCN)

Name: Rose Mwebaza
Title: CTCN Director
Date: 07/06/2021
Signature:

1. Background and context

Agricultural production accounts for 12.9 % of Indonesia's gross domestic product and 43.3 % of total employment (BPS-Statistics Indonesia, 2008). However, Indonesia's agriculture has faced some challenges such as reduction of arable land and climate change on the one hand, and the fast-growing population on the other hand. As an archipelagic country, Indonesia has a high risk resulting from the impacts of climate change. Climate change poses one of the most serious risks to food and nutrition security in Indonesia, especially for subsistence farming, and by year 2050, total rainfall in Indonesia is expected to increase on average by nearly 10% from April through June but decrease by 10% to 25% from July through September. Climate change will have impacts on food security, environmental degradation and increase of poverty. Furthermore, results from a number of studies have indicated that climate change could result in a 9% to 25% reduction in farm level net revenue in Indonesia in the future. The incidence of food deficit is already reported in South Sumatera, Lampung, East Kalimantan, and Papua, whereas the incidence of lack of water availability occurred in Bali and West Nusa Tenggara.

According to the report by the Ministry of Foreign Affair (2018), climate change will affect water availability and food security through sea water intrusion, reduction of river flow, reduction of rainfall and increase of temperature which triggers more crop pests and disease, higher risk of crop failure, reduction of food production due to severe flood and drought, reduction of rice production due to reduced number of cold night during planting season, harder crops and seeds preservation during unpredicted and sometimes intense rainfall, frequent fluvial flooding, and increasing number of tropical cyclones (in certain areas). Centre for Agricultural Data and Information System, Secretariat General, Ministry of Agriculture Indonesia (2015) have reported that 141.044,53 ha of paddy, 3.300,04 ha of maize, 2.031,00ha of soybean planting area were damaged by flood in 2012-2014, while 35.423,45 ha of paddy, 2.306,32 ha of maize, and 394,50 ha of soybean area were damaged by drought. Some researchers have published that the decrease in food production due to rainfall change in 2050 compared to current condition is predicted to be as follows: rice (-4.6%), maize (-20%), soybean (- 65.2%), sugar (-17.1%) and palm oil (-21.4%).

In response to the impacts of climate change, agricultural production and food systems need to undergo adaptation and mitigation measures. Food producers will have to adapt their farming system techniques in the context of new climate conditions, and increasingly limited natural resources, while at the same time reducing GHG emissions. Indonesian Agricultural Environment Research Institute claims that climate-smart agriculture (CSA) is a prospective technology. This technology promotes a realistic adaptation and mitigation efforts to be applied in a potential area for agricultural production. Climate-smart agriculture methods and technologies will offer solutions for mitigation and adaptation in response to climate change while achieving more sustainable productivity. Climate-smart agriculture technology investments improve productivity and profits for agribusinesses and their value chains while decreasing greenhouse gas emissions from land use, improving management of ecosystem services and increasing the resilience of productive systems. They are based on increasing agricultural output while maintaining the same or even lower amounts of inputs per unit, enhancing the environmental impact and building resilience to climate change and other production threats.

One of the CSA implementation technology is smart farming system. The use of smart farming technology in agricultural production will offer great potential for improving efficiency, effectiveness and productivity. This means enabling economically viable and environmentally- friendly decision-making. The application of precision agriculture or smart farming method would be a potential solution for various problems impacted by climate change in agriculture. Application of smart farming system would give more precise treatment towards every part of land, so that it can increase the productivity level by increasing the yield, decreasing production cost and reducing environmental effect.

Through this CTCN Technical Assistance (TA), it is expected that basic information on current status, supply and demand of climate smart agriculture system for the adaptation of climate change effect on agricultural production in Indonesia can be gained. Besides, information on the implementation or new

innovation technology of ICTs application in agriculture among stakeholders in research, education, innovation, industry and farming will also be collected.

2. Problem statement

Smart farming technology offer more opportunities for more precise treatment toward every part of land, so that it can increase the productivity level by increasing product, decreasing production cost and reducing environmental effect. However, smart farming technology in Indonesia is still in an early-stage development. The implementation and dissemination of this technology are facing some obstacles. Important barriers in implementing the smart farming technologies in Indonesia are insufficient of information, knowledge and skill, public awareness, financial support, policy and market. The lack of knowledge and skill in implementing smart farming technology mainly consisted of facility instalment, preparation, application and postproduction maintenance. Furthermore, its application requires a concerted effort of government, investors, and innovative agricultural technologies because farms and agricultural operations will have to be run very differently, primarily due to advancements in technology including sensors, devices, machines, and information technology.

Another important barrier is social awareness. Community awareness of climate change and the implementation of smart farming technology as one of the alternative technologies to overcome climate change effect on agriculture in Indonesia is still limited. Therefore, promotion of climate smart agriculture should be enhanced which is expected to be adopted by the society widely. The adoption of this technology will support food sufficiency and will be able to solve the problem through the application of smart farming technology that can be controlled automatically and monitored in a real time.

Investment in Smart farming technology is another important barrier. Investment in smart farming technology is long-term and require additional working capital, which is often unable to be fulfilled by farmer and agricultural companies. Project revenue for such investments will be achieved over years and requires longer loan tenors than usual. Specific governmental support and regulation on smart farming implementation, one of them in supporting investment of this technology practices will be beneficial for enhancing the increase of agricultural production even when the effects of climate change still occur.

3. Logical Framework for the CTCN Technical Assistance:

Objective: Identification and design of CSA technologies and associated system for enhancing climate change adaptation in agriculture sector in Indonesia												
Outcome: Findings from the CTCN TA could facilitate implementation and replication of CSA technologies in Indonesia, supporting to achieve the goal and strategies of its National Adaptation Plan (NAP).												
Activities	**Months**											
	1	2	3	4	5	6	7	8	9	10	11	12
Mandatory output: All implementers must undertake the following activities at the beginning and at the end of the CTCN technical assistance. **Activity i**: A detailed implementation plan for all activities, deliverables, outputs, deadlines and responsible persons/organizations, including a gender study and an itemized budget for implementing the Response Plan. The detailed implementation plan and budget must be based directly on this Response Plan. **Activity ii**: Based on the work plan, a monitoring and evaluation plan with specific, measurable, achievable, relevant, and time-bound indicators should be developed to evaluate the timeliness and appropriateness of implementation (a template will be provided). The indicators selected in the monitoring and evaluation plan should be aligned with the technical assistance closure report template. This will enable the implementer to complete the technical assistance closure report at the end of the CTCN technical assistance (please refer to Activity iv and Section 14 of the Response Plan). **Activity iii**: Impact statement of the CTCN technical assistance prepared at the start of the CTCN technical assistance and updated at the end of the CTCN technical assistance (a template will be provided). **Activity iv**: A technical assistance closure report completed at the end of the CTCN technical assistance (a template will be provided).												
Mandatory Deliverables:												
i) Implementation plan	X											
ii) Monitoring and evaluation plan	X											
iii) Impact statement (initial and final version)	X											X
iv) Technical assistance closure report												X
Output 1: Map stakeholders and organize an inception meeting												

Activity 1.1: Map stakeholders that are likely to be involved in CSA deployment in Indonesia With the support of the national expert (agriculture engineer), the NDE, the focal points to financial mechanism (e.g., GCF, GEF, Adaptation Fund, etc.), and the proponent (Agency for the Assessment and Application of Technology), the implementer will map the main stakeholders which would be involved in CSA practices in Indonesia. These stakeholders should include relevant Ministries and public institutions, private sectors, NGOs, academia, youth and gender associations, and any entities working in similar or complementary initiatives.												
Activity 1.2 Establish a stakeholder working group Of the stakeholders identified in Activity 1.1, a restrictive working group (up to 10 persons) will be created. The stakeholder working group shall maintain a gender balance and an adequate representation of vulnerable groups. It will provide a technical overview and a high-level guidance at every stage of the implementation of this TA. For this purpose, the members of the stakeholder working group should have the capacity to take key decisions with regards to the design of the climate technologies and ensure that these decisions are aligned with the strategic priorities of the country.												
Activity 1.3: Organize an inception meeting for the stakeholder working group to select one geographical area to contextualize the technology choice Once the stakeholder working group is created, an inception meeting will be held in presence of the stakeholder working group and of the team leader. It is expected that this meeting will be held presential in Indonesia. The objective of this inception meeting is to introduce the team of experts, the goals, milestones, anticipated deliverables and the role of the stakeholder working group. It is also fundamental that a consensus on the selection of the area for the context of this project be obtained. In order to prepare this meeting, and increase the chances of reaching the expected consensus, the team leader will take advantage of its presence in Indonesia to meet individually the 10 members of the stakeholder working groups. Short reports of these meetings should be provided. During these meetings, the governmental bodies will share with the implementer the existing and relevant documents such as strategies, policies, maps or else that could be relevant to this TA. Results of the inception meeting will be fed into the implementation plan elaborated under Activity i of the Mandatory Output.												
Deliverables:												
1.1 Report on stakeholder mapping	X											

1.2 Detailed description of the stakeholder working group, with name and contact details of the members, respective institutions, gender, etc.	X											
1.3 Minute of the inception meeting including a list of participants disaggregated by gender, the material used for the presentation (in English and Indonesian), **selection of the area for the context of the project.**	X											
Output 2: Identify technologies for the use of sensors that are able to identify water content and soil chemistry on agricultural land *Indonesia´s NAP[1] define the agriculture sector as a priority for the country. For the agriculture sector, the NAP states that the strategy should consist in delivering CSA to maintain the food production. A list of technologies has been identified and approved at country level. This TA will focus on two of the indicative technical interventions in agriculture sector included in the NAP (① The use of sensors that are able to identify water content and soil chemistry on agricultural land and ② Automation of watering and fertilizing tools according to land requirements).*												
Activity 2.1 Identify existing technologies that provide data on water content, soil chemistry and other parameters on agricultural land (vidiometry/drone/cctv, etc.) Agriculture depends entirely on soil for obtaining the highest quality and quantity of food. Soil is a big ecosystem formed by a high number of microorganisms, such as bacteria and fungi, which takes part in 90% of the decomposition of organic material (OM)[2]. In this context, to increase production, farmers are using fertilizers. These compounds are necessary to provide the required nutrients to the soil so that the plants can have all the nutrients they need. One of the best forms to control the necessities of the crops is the monitoring of irrigation water quality. The standard form to monitor the water quality is the extraction of an irrigation water sample and measuring in the laboratory. The use of a conductivity meter in agriculture is another method for controlling the quality of water. Nevertheless, this type of analyses is not useful since it is not possible to measure the water in situ and obtain continuous measurements. Nowadays, the use of sensors for monitoring agriculture parameters is another option. The implementer will make a catalogue of existing technologies that are able to identify water content and soil chemistry on agricultural land. The following technologies/systems (but not limited to it) would be considered: - Sensors implanted in the fields												

[1] https://lcdi-indonesia.id/wp-content/uploads/2020/05/Executive-Summary-NAP.pdf
[2] New Sensor Based on Magnetic Fields for Monitoring the Concentration of Organic Fertilisers in Fertigation Systems, MDPI, 2020.

- Drones - Satellite Imagery - Combination of drone and satellite imagery - Any other identified For each of these existing technologies, the implementer will generate a fact sheet that should include at least (but not limited to) the following information: - Name, photo and title of the technology - Characteristics of the sensors - Characteristics of the drones or satellites - Characteristics of the combined systems (drones + sensors) - Data frequency - Characteristics of the architecture of communication (how are information stored, transmitted and accessible to the users) - Characteristics of the transmission - Does the technology require power backup - Geographic Operation-ability/ Performance standard (energy use, safety, reliability, waterproof) - Additional Infrastructure requirement - Etc. The implementer will present these results under fact sheet format.												
Activity 2.2 Produce a feasibility analysis for the technologies Based on the results of Activity 2.1, the implementer will analyse the feasibility of the technologies in the context of identified geographic area/region in Indonesia (results of the consensus obtained under Activity 1.3). In this activity, the implementer will analyse all the possible barriers, challenges, bottlenecks that could difficult the use of the technologies catalogued in activity 2, in Indonesia, for the selected area. These barriers, challenges, bottlenecks will be defined by type such as institutional barriers, capacity barriers, technological barriers, legislative barriers, gender barriers, financial barriers or else. This exercise will enable to identify which of these technologies may potentially be implemented faster and have better efficiency while used in the selected area, and which ones might not be deployable immediately in Indonesia or might not provide the best efficiency.												

The results of this gap analysis will be presented in a matrix. Based on this matrix, the implementer will propose a methodology to prioritize the technologies. This methodology will be explained and detailed in a report. Then, the implementer will apply this methodology to the current matrix and obtain a preliminary prioritization list of technologies. These results will be presented in a report, using clear and easily understandable figures, tables and colours to ease the decision process.												
Activity 2.3 Organize a half day meeting with the stakeholder working group The results of Activity 2.1 and 2.2 will be presented to the stakeholder working group during a virtual meeting. The implementer will briefly present the technologies, and the feasibility analysis. The objective of this meeting will be to validate, in coordination with the stakeholder working group, the technology(ies) that should be considered for the design of the system. At least one technology will be selected, and a maximum of 3 technologies should be selected at this stage.												
Activity 2.4 Design the macro system framework for the selected technology The implementer will design the system taking into account that the objective of this TA is to analyse 2 technologies that are interconnected. The sensor technology will drive the automatic watering and fertilizing. Thus, systems should be compatible. The design will include a description of: - all the components of the technology (type of sensors, type of drones, type of batteries, characteristics of the communication systems, performance standards etc). - the end-to-end system architecture of the technology including communication interface and decision support required, and communication to local farmers - technology system specifications - Operating conditions The results of this activity will be summarized in a report that will describe the full architecture, as will provide information about any spare parts. The use of images and schemes to explain the way the system will work will be requested. Technical language should not be avoided. However, some part of the reports should be made so that governmental bodies could understand the system easily.												
Activity 2.5 Organize a half day meeting with the stakeholder working group												

During this meeting, the design of the system will be presented and explained to the stakeholder working group.												
Deliverables:												
2.1 A catalogue of existing technologies and their fact sheet		X										
2.2 Report on the feasibility analysis for the technologies			X									
2.3 Report on the design of the macro system framework for the selected technology					X							
2.4 Minutes of the meeting with the stakeholder working group (Activity 2.3 and 2.5) with a list of participants disaggregated by gender, material used, and summary of the discussions held.			X		X							
Output 3: Identify technologies for automatic irrigation and fertilizer application and design fully integrated system for the suitable conditions as per the geographic location selected												
Activity 3.1 Identify existing technologies to enable automatic irrigation and fertilizer application The growing scarcity and competition for water resources require the urgent implementation of measures to ensure their rational use. Farmers need affordable irrigation tools that allow them to take advantage of scientific know-how to improve water use efficiency in their common irrigation practices. Crop water needs vary spatially and temporally depending on meteorological conditions, crop type and crop growth stage. Irrigation management efficiency depends to a large extent on the ability to adapt water inputs to the variable needs of the plants. The implementer will make a catalogue of 3 existing technologies that enable the automation of watering and fertilizing according to land requirements. For each of these existing technologies, the implementer will generate a fact sheet that should include at least (but not limited to) the following information: - Name, photo and title of the technology - Characteristics of the technologies - Characteristics of the architecture of communication - Performance standard (energy use, safety, reliability) - Etc. The results of this activity will be presented into Fact Sheets, similar to the one designed for Activity 2.1.												
Activity 3.2 Produce a feasibility analysis for the integration of the two systems This activity is fundamental as it will analyse which of the combination of technologies, i.e. in Activity 2.4 and 3.1, will be more suited for Indonesia.												

The first technology that was explored in Output 2, and the automatic irrigation and fertilizer application should generate appropriate actions based on the information provided by the sensors. The two technologies need to be compatible, and the two technologies need to be suitable to the selected area in Indonesia. The implementer will make a full feasibility analysis of the integration of the two technologies for the selected area and provide a report explaining the methodology that was used, the results with the conclusions and recommendations of the analysis obtained.												
Activity 3.3 Organize a half day meeting with the stakeholder working group The results of Activity 3.1 and 3.2 will be presented to the stakeholder working group during a virtual meeting. The implementer will briefly present the two systems, and the feasibility analysis. The objective of this meeting will be to validate, in coordination with the stakeholder working group, the two system that should be considered for their integration.												
Activity 3.4 Define and design the fully integrated system On the basis of the results of Activity 3.2, the implementer will design the architecture, system specifications and operating conditions of the fully integrated technologies. The results of this activity will be summarized in a report that will describe the full architecture, the operating system as well as maintenance procedures, as well as a detailed description of any component of spare parts necessary to the use of the system. The use of images and schemes to explain the way the system will work will be requested. Technical language should not be avoided. However, some part of the reports should be made so that governmental bodies could understand the system easily.												
Activity 3.5 Organize a half day meeting with the stakeholder working group During this meeting, the design of the fully integrated technologies will be presented and explained to the stakeholder working group.												
Deliverables:												
3.1 A catalogue of existing technologies and their fact sheet		X										
3.2 Report on the feasibility analysis for the integration of the two systems			X									
3.3 Report on the design of the fully integrated system					X							

3.4 Minutes of the meeting with the stakeholder working group (Activity 3.3 and 3.5) with a list of participants disaggregated by gender, materials, and summary of the discussions held.			X		X							
Output 4: Analyse market potential and cost-benefit of the fully integrated system												
Activity 4.1 Analyse the market potential for the deployment of the fully integrated system The implementer will make recommendations on the barriers that should be leveraged to create the enabling environment for the deployment of the fully integrated technologies in Indonesia. This market potential analysis should consider at least, but not be limited to: - Institutional reforms - Legislative needs - Access to finance - Needs for capacity building and increase awareness - Needs to increase research and data on the nexus of climate, CSA, food security, water and energy - Else. The results of this activity will be summarized in a report.												
Activity 4.2 Analyse cost-benefit and financing for the deployment of the fully integrated system The cost-benefit analysis will be carried out, and Cost-Benefit Ratio (CBR), Net Present Value (NPV) and Internal Rate of Return (IRR) will be estimated for the fully integrated technologies, based on Business as Usual (BAU) scenario. Additionally, a list of financing mechanisms or instruments that could be used to finance the deployment of the fully integrated technologies in Indonesia will be identified and assessed.												
Activity 4.3 Organize a meeting with the stakeholder working group A meeting will be organized to present the results of Activity 4.1 and 4.2 to the stakeholder working group. It is expected that this meeting will be presential, in presence of the Team Leader.												
Deliverables:												
4.1 Report on the market potential analysis for the deployment of the fully integrated system							X					
4.2 Report on cost-benefit and financing analyses for the deployment of the fully integrated system								X				
4.3 Minute of the meeting with the stakeholder working group with list of participants disaggregated by gender, material used, summary of the discussion held.								X				

Output 5: Train governmental bodies in the CSA practices and the fully integrated system												
Activity 5.1 Selection of best CSA practices and associated business models The implementer will investigate CSA practices and associated business models of the technologies studied in this TA. The results of this activity will be used in developing presentation materials in the workshop (Activity 5.2).												
Activity 5.2 Organize a 2-day workshop with participation of at least 10 contextual technology suppliers and the stakeholders - with case presentations and different applications; business models and solutions The implementer will organise and facilitate a 2-day workshop for national and local government officials in Indonesia. Presentations on case studies with different CSA practices and associated business models as well as presentations on the fully integrated technologies designed through this TA will be provided to participants in the workshop. It is expected that 10 technology suppliers will be travelling to Indonesia to present their technologies to the Government of Indonesia. After the workshop, satisfaction survey from participants will be conducted to identify the level of their understanding regarding CSA practices and the fully integrated technologies.												
Deliverables:												
5.1 Workshop materials										X		
5.2 Report on the 2-day workshop (including results of the satisfaction survey) with list of participants disaggregated by gender, material used, summary of the discussion held.											X	

4. Resources required and itemized budget:

Activities and Outputs	**Input: Human resources** *(Title, role, estimated number of days)*	**Input: Travel** *(Purpose, national vs. international, number of days)*	**Inputs: Meetings and events** *(Meeting title, number of participants, number of days)*	**Input: Equipment and resources** *(Item, purpose, buy/rent, quantity)*	**Estimated cost (US $)** *Please indicate the cumulative cost of the activities and outputs and provide an estimated cost range for each activity and the entire Response Plan.*	
					Minimum	**Maximum**
Mandatory Output: Development of the work plan and related communication documents	I1: 12 N1 : 2 N2: 5	None	None	None	5,000	7,000
Output 1: Map stakeholders and organize an inception meeting	I1: 13 I2: 1 I3:1 N1: 5 N2: 19	Travel for inception meeting (Activity 1.3) USD 2,200 international travel + USD 2,400 local travel	Stakeholder Working Group (WG) meeting (Activity 1.3): USD 1,500 logistics and participation of 10 members of the WG at 200 USD/person.	None	15,000	20,000
Output 2: Identify technologies for the use of sensors that are able to identify water content and soil chemistry on agricultural land	I1: 35 I2: 52 I3:2 N1: 9 N2: 40		Stakeholder Working Group (WG) meeting held online and participation of 10 members of the WG at 200 USD/person.	None	65,000	70,000
Output 3: Identify technologies for automatic irrigation and fertilizer application and design	I1:30 I2: 41 I3: 2		Stakeholder Working Group (WG) meeting held	None	45,000	50,000

fully integrated system for the suitable conditions as per the geographic location selected	N1: 4 N2: 30		online and participation of 10 members of the WG at 200 USD/person.			
Output 4: Analyse market potential and cost-benefit of the fully integrated system	I1: 20 I2: 12 I3: 25 N1: 2 N2: 20	Travel for Stakeholder working group meeting (Activity 4.3): 2 international experts thus a total of USD 4,400 international travel + USD 2,800 local travel	Stakeholder Working Group (WG) meeting (Activity 4.3): USD 1,500 logistics and participation of 10 members of the WG and the 2 international experts at 200 USD/person	None	30,000	35,000
Output 5: Train governmental bodies in the CSA practices and the fully integrated system	I1: 20 I2: 10 I3: 15 N1: 5 N2: 10			None	40,000	43,000
Estimated cost range for the entire Response Plan (US$)					**200,000**	**225,000**

5. Profile and experience of experts

Experts required	Brief description of required profile
Project Manager (I1) (International expert)	The project manager shall have the following expertise and experience: • Master's degree or above (or equivalent experience) in agricultural technology and/or management, climate technology, climate change response or an affiliated major such as agriculture engineer, IoT for agriculture purposes or affiliate • Experience in leading and managing a project and a team of experts from different cultural background and fields of expertise • At least 10 years of experience in identifying, evaluating, and/or deploying climate technologies in agriculture sector, sector, including irrigation and remote-control technologies. • At least 5 references demonstrating experience in either the implementation of climate smart irrigation and remote-control technologies, climate smart technologies or the development of strategies for climate change response in agriculture sector in developing countries • Experience in organising workshops and/or capacity building trainings • Previous experience in Indonesia will be valued. • Excellent written and communication skills in English are required.
Expert in climate smart agriculture design (I2) (International expert)	The expert in climate smart agriculture design shall have the following expertise and experience: • Master's degree or engineering degree in agriculture, drone, climate smart technologies, remote-control irrigation systems or affiliate. • At least 8 years of experience in identifying, evaluating, designing deploying remotely controlled irrigation climate technologies for the agriculture sector. • At least 3 references demonstrating experience in the analysis, design, testing and implementation of climate smart technologies for the agriculture sector in developing countries • Experience in organising workshops and/or capacity building trainings • Previous experience in Indonesia will be valued • Excellent written and communication skills in English are required
Agriculture finance expert (I3) (International expert)	The expert in agriculture finance shall have the following expertise and experience: • Master's degree or above (or equivalent experience) in agriculture, economics and management or an affiliated major • At least 8 years of experience in agriculture finance, agriculture economic analysis, including cost-benefit analysis for the agriculture sector

	• At least 3 references demonstrating experience in estimating the cost benefit of climate smart technologies systems, including cost-benefit analysis, in agriculture sector in developing countries • Experience in organising workshops and/or capacity building trainings • Excellent written and communication skills in English are required
Gender expert (N1) (National expert)	The gender expert shall have the following expertise and experience: • Bachelor's degree or above (or equivalent experience) in social science or an affiliated major • At least 8 years of experience in gender studies and/or management of equality policies • At least 2 references demonstrating experience in gender studies in agriculture sector in developing countries • Excellent written and communication skills in Indonesian and English are required • It is expected that the gender expert will be based in Indonesia or with the availability to travel frequently and for long periods of time in Indonesia
Agriculture engineer (N2) (National expert)	The agriculture engineer shall have the following expertise and experience: • Master's degree or above (or equivalent experience) in agriculture engineering, agricultural technology and/or management or an affiliated major • At least 8 years of experience in the field of agriculture and irrigation in Indonesia • Excellent written and communication skills in Indonesian and English are required • It is expected that the gender expert will be based in Indonesia or with the availability to travel frequently and for long periods of time in Indonesia

6. Intended contribution to the expected impact of the technical assistance

Indonesia will be involved at all the stages of the processes through the Stakeholder Working group.

7. Relevance to NDCs and other national priorities

Indonesia has identified that smart farming technology could be applied as one part of the CSA practices and aligned with national adaptation and mitigation action plan, as follow:

- Indonesia Mid-Term National Plan 2020-2024 (Indonesia's National Development Planning Agency - BAPPENAS).
- National Action Plan for Climate Change Adaptation (RAN-API) 2014 as part of Indonesia Mid-Term National Plan 2015-2019 {Indonesia's National Development Planning Agency - BAPPENAS).
- Indonesian Ministry of Agriculture (MoA) Strategic Plan 2015-2019 (Ministry of Agriculture).
- Policy Recommendations on Agriculture Development and Investment in Indonesia for 2020- 2045 (Ministry of Agriculture)
- National Research Priorities 2020-2024 (Ministry of Research and Technology /National Agency for Research and Innovation)
- 'Making Indonesia 4.0', as an integrated roadmap to implement a number of strategies to enter the Industrial Revolution 4.0 (Ministry of Industry).
- National Action Plan for Green House Gas 2011 ((Indonesia's National Development Planning Agency - BAPPENAS). Nationally Determined
- Contribution (NOC)
- National Adaptation Plans for Climate Change Adaptation **(RAN-API)** (2012)
- Climate change adaptation strategies for Indonesia

8. Links to relevant parallel activities:

Some projects have been implemented to reduce the impacts of climate change in Indonesia. The previous projects were held in the form of training, education program and study of public awareness with regards mitigation and adaptation action, development of renewable energy, development of best practices in agriculture and natural resources sectors and assessment of mitigation technology in reducing greenhouse gas emissions from agricultural production. However, application of smart fanning technology is not fully explored as one of the solutions to overcome climate change effect to agricultural production.

Due to climate change issue, achievement of climate resilience through the implementation of National Plan for Climate Change Adaptability will be conducted through the use of geospatial data, information and automation as a part of smart farming practices. This is in accordance with the Ministry of lndustry's program " Making Indonesia 4.0" as an integrated roadmap to be implemented for the Industrial Revolution 4.0. The roadmap requires collaborative actions among multiple stakeholders consisting of governmental institutions, associations, industry and academic components.

In the National Mid-Term National Plan 2020-2024, the National Planning Agency (BAPPENAS) stated that one of the objectives of economic resources management strategies is to increase the availability, access and quality of food consumption, maintain the productivity and sustainability of adaptive agricultural resources with regards to climate change, agricultural digitalization, land management and irrigation. It is also mentioned the application of advanced technology especially in relation to industry 4.0 in some sectors; one of them is for increasing the efficiency, productivity and

competitiveness of agriculture sector. The agriculture 4.0 can play a key part in solving the food scarcity issue. The Indonesian government introduced the "Smart farming 4.0" in September 2018. The initiative was led by the Indonesian Ministry of Rural Development, with a pilot project in Situbondo, East Java.

Agricultural production varies widely across places and climate change affected each area specifically. Therefore, identification and dissemination of a climate-smart agricultural technology approaches are urgently needed. Indonesian government through The Ministry of Agriculture has published general guidelines of climate change adaptation in the agricultural sector (Pertanian 2011). However, the policy still lacked the details and will be difficult to implement.

The concept of CSA in Indonesia is still in the formulation process, conducted by the Ministry of Agriculture and CTAT (International Center for Tropical Agriculture), funded by the World Bank. The concept will cover the whole agricultural condition in Indonesia, starting from value chain, agriculture system, sensitive geographical areas which are affected by climate factors. Adaptation strategy should also be assessed by revealing program intervention and institution capacity effect on adaptation option that should be able to reduce agricultural risk and climate vulnerability (flood, drought, storm).

Some CSA technologies practices that could be conducted in addressing adaptation and mitigation of climate change in agriculture sector are the application of smart farming technologies in agriculture production, development of integrated crop-livestock system improvement of food security through crop diversification, development and introduction of drought, flood and saline tolerant crops, improvement of water regime , application of matured animal manure to improve soil fertility and soil C sequestration, introduction of rice and other crops variety with low CH4 emission potential, and avoidance of biomass burning for manure. Furthermore, the use of ICTs in agriculture offers great potential for improving efficiency, effectiveness and productivity under climate change adaptation. The application of ICTs in agriculture such as precision agriculture or smart farming method would be potential as an alternative solution for various problems in the Indonesian agricultural sector due to the impact of climate change.

9. Anticipated follow-up activities after this technical assistance is completed:

Following the closure of this TA, it is expected that the country will continue the discussion with the suppliers of the technology (some of them will be met during the workshop of activity 5.2). The country should also look for financing and implement a small-scale pilot project in the selected area.

10. Benefits in terms of gender and co-benefits:

Imbedded into the design of the activities:	• Women can be powerful agents of change and leaders in promoting the smart farmingtechnology as men did. • Application of smart farming technology will significantly reduce the ecologicaldestruction and loss of biodiversity. • The use of smart farming technology in agricultural production offer great potential for improving efficiency, effectiveness and productivity which will be able to elevate bettereconomy, social and culture.
Gender and co-benefits of the activities:	Benefiting from climate smart agriculture technologies will help women in increasing the productivity of their harvest and will ensure food security.

11. Main national stakeholders in the implementation of the technical assistance activities:

National Stakeholder	Function in the implementation of the technical assistance
National Designated Entity (Directorate General of Climate Change, Ministry of Environment and Forestry)	Member of the stakeholder working group, supervise the implementation of the TA, ensure quality checks of the deliverables and implementation of the mission.
NDA	Member of the stakeholder working group, Member of the stakeholder working group, supervise the implementation of the TA, ensure quality checks of the deliverables and implementation of the mission.
National Planning Agency (BAPPENAS)	Stakeholder
Ministry of Rural Development,	Stakeholder
Ministry of Agriculture	Stakeholder
CTAT (International Center for Tropical Agriculture)	Stakeholder
World Bank	Stakeholder
Centre for Agricultural Data and Information System, Secretariat General, Ministry of Agriculture Indonesia	Stakeholder
Indonesian Agricultural Environment Research Institute	Member of the stakeholder working group as promoter of CSA practices
Request Applicant (Agency for The Assessment and Application of Technology)	Member of the stakeholder working group, supervise the implementation of the TA, ensure quality checks of the deliverables and implementation of the mission.
Bogor Agricultural University (IPB), LIPI, BATAN	Provide data and information related to CSA practices and development
Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture	Provide data and information related to CSA practices and development
Local governments, local farmers community	Provide data and information related to CSA practices and development
Youth and Gender associations	Stakeholders

12. Contribution to the SDGs:

Goal:	Sustainable Development Goal	Direct contribution from CTCN TA
1	End poverty in all its forms everywhere	yes, this TA will work on improving agricultural practices in Indonesia, and thus will have a direct impact on food security
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	yes, this TA will work on improving agricultural practices in Indonesia, and thus will have a direct impact on food security
3	Ensure healthy lives and promote well-being for all at all ages	
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	

5	Achieve gender equality and empower all women and girls	
6	Ensure availability and sustainable management of water and sanitation for all	Yes, the climate technologies include a smart irrigation system that will help improve the use of water in Indonesia.
7	Ensure access to affordable, reliable, sustainable, and modern energy for all (consider adding targets for 7)	
	7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services	
	7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix	The climate technologies usually work with solar panel energy.
	7.3 - By 2030, double the global rate of improvement in energy efficiency	
	7.a - By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	
	7.b - By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
10	Reduce inequality within and among countries	
11	Make cities and human settlements inclusive, safe, resilient and sustainable	
12	Ensure sustainable consumption and production patterns	
13	Take urgent action to combat climate change and its impacts	
	13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	Yes, this TA should help design better climate smart techniques, that, once implemented, will increase the resilience and adaptive capacities of the country.
	13.2 - Integrate climate change measures into national policies, strategies and planning	
	13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	This TA includes workshops and trainings to governmental bodies on CSA and climate technologies.

	13.a - Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	
	13.b - Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	

13. Classification of technical assistance:

Please tick the relevant boxes below	Primary	Secondary
☐ 1. Decision-making tools and/or information provision		
☐ 2. Sectoral road maps and strategies		
☐ 3. Recommendations for legal reforms, policies and regulations		
☐ 4. Financing facilitation		
☐ 5. Private sector engagement and market creation		
☐ 6. Research and development of new technologies		
☐ 7. Feasibility of technology options	X	
☐ 8. Piloting and deployment of technologies in local conditions		
☐ 9. Technology identification and prioritization		X

Please note that all CTCN technical assistance contributes to strengthening the capacity of in-country actors.

14. Monitoring and evaluation process

Upon contracting the implementing partners to implement this Response Plan, the lead implementer will produce a monitoring and evaluation plan for the technical assistance. This monitoring and evaluation

plan must include specific, measurable, achievable, relevant, and time-bound indicators that will be used to monitor and evaluate the timeliness and appropriateness of the implementation. The CTCN Technology Manager responsible for the technical assistance will monitor the timeliness and appropriateness of the Response Plan implementation. Upon completion of all activities and outputs, evaluation forms will be completed by the (i) THE COUNTRY on overall satisfaction level with the technical assistance service provided; (ii) the Lead Implementer on the experience and knowledge gained through the technical assistance; and (iii) the CTCN Director on the timeliness and appropriateness of the activities and outputs.