

Country	Sudan
Request ID#	2024000016
Title	Improving the efficiency and sustainability of water harvesting technologies in Sudan by providing technical assistance in terms of enhancing; technology transfer, capacity building, and research collaboration
NDE	<p>Organization; Higher Council for Environment and Natural Resources Name: Huyam Ahmed Abdalla Ahmed Position: Environmental Officer Email: hoyamahmed66@gmail.com</p>
Proponent	<p>Organization: Water Research Center- University of Khartoum Name: Ahmed Elshaikh Position: Assistant Professor Email: ahmedhayaty@live.com</p>
Proponent	<p>Organization: Agriculture Research Corporation- Dry Land and Water Harvest Research Centre Name: Sahar Babiker Ahmed Abdalla Position: Assistant Professor Email: saharbabiker2015@gmail.com</p>

Summary of the CTCN technical assistance

Sudan has faced decades of conflicts and recently the War which trigger in April 2023 that have created massive displacements internally, while conflicts in neighboring countries have resulted in an influx of refugees. This request aims to address the needs of host communities and Internally Displaced People (IDPs) in the construction and design of water supply to mitigate potential conflict.

The CTCN's technical assistance is expected to provide the following support:

- Conduct assessments of existing water harvesting technologies and practices in Sudan.
- Assess capacity needs and identify gaps in knowledge and skills related to water harvesting. (Survey
- Diagnose the effectiveness and suitability of different water harvesting techniques in Sudan's diverse climatic conditions.
- Identify appropriate and innovative water harvesting technologies suitable for the Sudanese context and summarize this information into a catalogue or database.
- Facilitating the transfer of these technologies to local stakeholders through training programs, workshops, and demonstrations.
- Provide technical support for the installation, operation, and maintenance of one innovative water harvesting systems. (optional and dependent of Sudanese war context and possibility to export goods into the country).

1 Agreement:

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

2 National Designated Entity to the UNFCCC Technology Mechanism

Name: Huyam Ahmed Abdalla Ahmed

Title: Environmental Officer

Date: 23/5/2024

4

Signature:



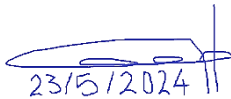
3 Project Proponent

Name: Ahmed Elsheikh

Title: Assistant Professor - Water Research Center

Date:

23/5/2024


23/5/2024

Signature:

4 UNFCCC Climate Technology Centre and Network (CTCN)

Name: Rajiv Garg

Title: CTCN Director

Date

Signature:



24 May 2024

1. Background and context

In light of observed and projected climate change over Sudan and according to the World bank (2021) climate knowledge portal rainfall is highly variable when compared to temperature. Forecast results of precipitation show varying trends of both weather and drier conditions. It is possible that average monthly rainfall decreases during the rainy season. Model projections for northern Sudan are inconsistent in changes in rainfall, while there is higher confidence in southern Sudan of an increase in intense precipitation. However, forecasts more consistently indicate increased variability and unpredictability in seasonal rainfall and increased incidences and intensity of drought.

Average annual temperatures in Sudan are expected to rise significantly, relative to baseline expectations. By 2050, average temperatures are forecast to increase by between 0.5°C to 3°C nationally, with more extreme increases in northern regions. Greater warming is forecast to occur during summer (1.5°C to 3.1°C in August by 2060) than winter (1.1°C to 2.1°C in January by 2060). Temperature increases are forecast to intensify the impacts of drought through increased evapotranspiration and reduced available soil moisture.

Extreme climatic variability with cyclical episodes of prolonged droughts and extreme floods, coupled with increasingly erratic distribution and intensity of rainfall, has a negative impact on the amount of surface and groundwater available for human and livestock consumption and productive purposes. These climatic phenomena complicate the design and operation of water supply facilities that contribute to competition and conflict between farmers and pastoralists for scarce water resources.

Half of Sudan's population lives on about 15% of the land, mostly near the River Nile. Sudan's National Adaptation Plan (NAP) of 2016 identified actions to protect water resources and reduce vulnerability to climate change in all 18 states of Sudan. The major proposed adaptation measures included water harvesting, efficiency irrigation technology, and improving water management practices.

The problem is related to climate change in Sudan and have a negative impact on water availability, agriculture production and the overall goal of food security. Implementation of a sustainable and efficient modern water harvesting technologies will benefit to overcome the impacts of climate change. Most rain fed areas in Sudan are not in close proximity to rivers, and depend solely on rainfall for crops and domestic uses. With frequent drought and high evaporation rates - conditions that are expected to worsen with climate - change - water harvesting technologies are increasingly viewed as essential to sustain rural livelihoods in Sudan. High rain variability during the rainy season and between years. This affects the distribution of soil moisture storage especially in rain fed agriculture, and the availability of drinking water for both human and animal. The consequent dry spells during the crop season could resulted in stunted growth diseases infestation and insect breakout which has direct effects on final yield. On the other hand, the rainfall variability affects the rainwater harvested for drinking purposes, as people are dependent on runoff water harvesting brought about by the ephemeral water courses -known as Wadis- especially in the Western (Darfur States) and Southeastern (Kordofan) of the country. The recurrent intense rainfall events in a short period of time serves the loss of water as well as the failure of the water harvesting structures being water pond (Hafir) or earth dam. The obstacles facing these structures is attributed to technical and management factors.

Rise in average annual temperature as a result of the global warming phenomenon will increase soil temperature which will accelerate the water loss via evaporation in particularly from the open surface water catchments. High soil temperature is rapidly accelerating soil micro-organism activity which decreases soil organic matter and soil fertility.

Rainfall variability and increased temperature due to climate change in Sudan has a direct impacts on crop productivity and water availability, It is evident that the water shortage and unsustainable water harvesting affect the dependent communities and was the reason behind the migration of youth and families to urban settings due to the instability and conflicts brought by the competition on this limited resource. This situation is exacerbated by the devastating civil war erupted in Sudan in April 2023. It serves as an extra threat for the agriculture activity, mainly the rainfed agriculture.

For instance, rainfall rate in the last year 2023 was below the average annual rate and some areas received even less than the minimum. The devastating civil war exploded in Sudan in April 2023 has been an extra threat for agriculture activity. The vulnerable economic situation in Sudan along with the increased price of agricultural inputs and limited accessibility for both inputs and water sources were hinder many to starvation.

The First (2003), Second (2012) and Third (2022) National Communication Reports (SNC1) (SNC) recognized water as one of the top priority sectors for the country to confront the escalating impacts of climate change.

Based on wide consultations at the federal and state level the NAPA process recognized 32 urgent adaptation interventions mainly in the water and agriculture sectors to reduce the increasing vulnerability of rural communities to current and future climatic risks (HCENR, 2007).

According to HCENR, (2016), the NAP extended existing efforts to identify and prioritize potential adaptation interventions at the state level, as primarily assessed during the NAPA process. The emphasis on the water sector was confirmed by GCF Country Program 2020.

The relation of Sudan's water policy to climate resilience is clearly expressed in the major policy objectives e.g. advocacy for integrated watershed management and protection of the environment.

The country conducted its Technology Needs Assessment (TNA) for adaption and mitigation in 2013. Two priority sectors have been covered about technology for adaptation, namely agriculture and water sectors. The TNAs resulted in a Technology Action Plan (TAP). The proposed project contributes to achieving Sudan's INDCs (2015) and Sudan's first NDC (2022) in the adoption of IWRM, water harvesting and introduction of revolving funds to support the implementation of small water harvesting projects.

2. Problem statement

Founded on the national and sectoral context as detailed in the section above, please include a brief problem statement clarifying the main problems and barriers for climate change mitigation and/or adaptation in terms of climate technologies that the CTCN Response Plan will address and overcome. (maximum 1250 characters including spaces).

Lack of knowledge, experience, and human resources remain major capacity barriers to Sudan's water resource adaptation technologies. Although a few governmental agencies and research institutes in Sudan have experience in design, implementation and operation, of hafirs technologies, the majority of institutes lack these capacities. As a result, most of the sectors may not have enough skills and experience to implement this technology confidently and effectively. Therefore, regular consultation and exchanges of knowledge and experience are required. In addition, the amount of trained experts capable of regular maintenance is very limited and may lead to structural collapse and decreased water storages also limited and missed opportunities in the use and application of appropriate technology, research, and development and engagement of the private sector: The country's isolation and limited engagement with international good practices have limited the introduction and adoption of new technologies and approaches to improve water supply service delivery. Adoption of technologies like renewable energy, such as solar and wind, have been limited.

So especial attention should be given to ground water-related research where, in surface water scarcity area, groundwater reserve can represent an alternative option to reduce vulnerability to drought and give the country a better position to cope with the harsh climatic conditions. Groundwater development offers major opportunities for communities to withstand the major cause of their vulnerability and less resilient and adaptive capacity through crop, vegetable and animal production for food and income generation and improved livelihoods of increased water supply for domestic and health hygiene

In the context of the war in Sudan, there are several technology barriers that hinder national efforts for the water harvesting project. These barriers include:

- 1- Lack of security in certain of Sudan cities.
- 2- Weak infrastructures
3. Limited access to advanced water harvesting technologies: The ongoing war has disrupted infrastructure development and limited access to modern technologies for water harvesting. This hampers the implementation of efficient and effective water storage systems such as earth embankments, dams, and hafirs.
4. Human Resource Development and Capacity Building Lack of technical expertise: There is an acute shortage of staff with adequate skills, including technical and administration qualifications, to design, implement, and manage water supply services in the country. The water supply sector has experienced a significant brain drain. Conflict has resulted in a brain drain, with many skilled professionals leaving the country. This lack of technical expertise in water harvesting techniques and systems further hinders national efforts to implement and maintain these projects.
5. Inadequate research and development: The war has diverted resources away from research and development activities related to water harvesting technologies. As a result, there is a lack of locally adapted solutions that can address specific challenges faced in Sudan's context.

<p>Activity 2: Assess capacity needs and identify gaps in knowledge and skills related to water harvesting</p> <p>This needs to be addressed at the individual technologies since there is not one statement to be made about water harvesting. For instance, there has been a lot of attention for Hafir and dams from engineers with several manuals developed and improved. On the other hand, nearly nothing is known about the implementation of water spreading weirs. In this section the consultant will need to look at the contextual analysis of capacity needs and gaps for the following groups of stakeholders: governmental, NGOs / CSOs, universities, research institutes / think tanks, and consulting / contracting firms.</p> <p>The capacity needs of different stakeholders will need to be assessed. In general, government agencies tend to go for the known solution (Hafir) and larger NGOs experiment a bit more with different technologies. It would be good to do capacity needs assessment at organizational and at individual levels (complementing each other). One main capacity gap is the lack of understanding / taking into account of the wider context in which water infrastructure is implemented, sometimes leading to negative downstream impact or depletion of groundwater.</p>											
<p>Sub-activities:</p> <p>2.1. Survey of knowledge, skills and capacities of stakeholders</p>											
<p>Deliverables:</p> <p>2.1. Report, describing knowledge, skills and capacities and identified gaps</p>											

<p>Activity 3. Diagnose the effectiveness and suitability of different water harvesting techniques in Sudan's diverse climatic conditions</p> <p>With this assignment, the discussion on IWRM that UNEP started (https://www.unep.org/sudan/integrated-water-resources-management) will be reignited. Water harvesting in Sudan can only be effective if it is done considering the catchment in which this takes place. Too many innovations have led to reduced downstream water for communities and only negligible increased uptake in the area itself.</p> <p>As much as possible, the research should be done locally and where needed remotely, using historical satellite data to study the effectiveness and suitability. Temporal trends in soil moisture and vegetation need to be investigated, from for example: NDVI, NDMI and SMOP, but also true color images, that would need to be linked to the known implementation of water harvesting techniques. First a quick study of the most appropriate datasets should be performed. After that, these products should be analyzed in e.g. R or GEE at locations where water harvesting has been implemented. Together with local knowledge, this will give indications of the effectiveness of the different water harvesting techniques. It is however important to note that satellite products often have a too large spatial resolution, and in many cases, it is difficult to attribute changes to implementation of harvesting techniques as for example annual differences in rainfall are also important. Such factors should therefore be included in the analysis. Besides the effectiveness and suitability, an analysis of implemented structures that are currently abandoned or dilapidated, should be included, to learn from innovations that did not deliver.</p> <p>Linked to the identified capacity needs, the prospects of improving existing design manuals, operation guidelines and common practices will be analyzed. To illustrate that, it is suggested to do 2-3 case studies on representative technologies, the available knowledge and manuals, guidelines, and practices.</p>									
<p>Sub-activities:</p> <p>3.1. A detailed analysis into the prospects of improving existing design manuals, operation guidelines and common practices.</p> <p>3.2. 6 cases studies to undergo a critical technical review. both functional and non-functional</p>									
<p>Deliverables:</p> <p>3.1. Report, describing analysis results</p> <p>3.2. Report, describing case studies</p>									
<p>Activity 4: Identify appropriate and innovative water harvesting technologies suitable for the Sudanese context and summarize this information into a catalogue or database</p> <p>After activity 2.4, it is suggested to prepare a list of appropriate and innovative water harvesting technologies existing in Sudan, and from similar climatic conditions in Africa (e.g. subsurface dams, gabion dams, rock catchments, 'recharge hafirs') to assess if these might be appropriate for Sudan. The option to use a global database would be welcomed.</p>									
<p>Sub-activities:</p> <p>4.1. Analysis of collected data</p>									
<p>Deliverables:</p> <p>4.2. Report, describing analysis results</p>									
<p>Activity 5: Facilitate the transfer of these technologies to local stakeholders through training programs, workshops, and demonstrations.</p>									

<p>Transfer of technology is best facilitated through horizontal learning of experts with experts at real project sites. The current political situation does not allow this to happen in Sudan. Therefore, online training is the best option, which could then be the first step for field-based training to be developed after the current program is delivered. An online workshop is required to present project results and findings, and plan to present those to the wider sector during lectures, webinars and/or in an article.</p>												
<p>Sub-activities: 5.1. Organize workshop to present project results and findings. 5.2. Side events: lesson learned and knowledge exchange lectures/webinars/article (joining local and international expertise)</p>												
<p>Deliverables: 5.1. Workshop (report or recording) 5.2. Lecture, webinar, article (to be defined)</p>												
<p>Activity 6: Provide technical support for the installation, operation, and maintenance of one innovative water harvesting system (optional and dependent of Sudanese war context and possibility to export goods into the country) Currently there is no opportunity for construction of physical infrastructure within the project framework. For now, a design for an innovative water harvesting system at a certain location could be developed. This activity is strongly supported by the team to adopt proposed innovative water harvesting techniques. The selected site better be on one of the stats which are indirectly affected by war in the eastern part (to be identified latter).</p>												
<p>Sub-activities: 6.1. Pilot (optional)</p>												
<p>Deliverables: 6.1. Pilot (optional)</p>												

	A	B	D	E	F	G	H	O	P	Q	R	S
1	Budget											
2	Support / main activity											
3	Support / main activity											
4												
5	1	Conduct assessments of existing water harvesting systems and develop implementation planning		1a1	Detailed work plan	1a1	Plan the project	0	2	\$ 500		\$ 500
6				1a2	M&E plan with SMART indicators	1a2	Checking existing database info against current situation	0	5	\$ 1,250		\$ 1,250
7				1a3	Impact statement	1a3	statement on functionality and sustainability	0	1	\$ 250		\$ 250
8				1a4	Gender assessment report, Gender Action Plan	1a4	Detailed gender assessment and Gender Action Plan	0	10	\$ 2,500		\$ 2,500
9				1a5	Result tracker	1a5	Result tracker, linked to M&E plan	0	1	\$ 250		\$ 250
10				1a6	Closure report	1a6	Reporting, documentation	0	10	\$ 2,500		\$ 2,500
11		Use the existing harvesting systems (including rainwater harvesting)		1b1	Report, describing representative structures and technologies	1b1	Assessment of representative water harvesting systems	30	10	\$ 13,000	\$ 12,000	\$ 25,000
12				1b2	Report, describing market availability and demand	1b2	Report on financial sustainability	2	1	\$ 950	\$ 1,000	\$ 1,950
13				1b3	Report existing policies and regulations, and their impact	1b3	Mapping of policies and regulations	1	2	\$ 850	\$ 500	\$ 1,350
14				1b4	Stakeholder map / diagram	1b4	Mapping of stakeholders	1	2	\$ 850		\$ 850
15	2	Assess capacity needs and identify gaps in knowledge and skills related to water harvesting		2.1	Report, describing knowledge, skills and capacities	2.1	Survey of knowledge, skills and capacities	7	3	\$ 3,200	\$ 4,500	\$ 7,700
16	3	Diagnose the effectiveness and suitability of water harvesting techniques in Sudan		3.1	Report, describing analysis results	3.1	A detailed analysis into the prospects of irrigation	6	5	\$ 3,350	\$ 4,500	\$ 7,850
17				3.2	Report, describing case studies	3.2	6 cases studies to undergo a critical technical review	6	5	\$ 3,350		\$ 3,350
18	4	Identify appropriate and innovative water technologies suitable for the Sudanese context		4	Report, describing analysis results	4	Analysis of collected data	2	10	\$ 3,200		\$ 3,200
19	5	Facilitating the transfer of these technologies to stakeholders through training programs		5.1	Workshop (report or recording)	5.1	Organize workshop to present project results	5	5	\$ 3,000	\$ 2,500	\$ 5,500
20				5.2	Lecture, webinar, article (to be defined)	5.2	Side events: lesson learned and knowledge sharing	0	5	\$ 1,250	\$ 5,000	\$ 6,250
21	6	Provide technical support for the installation, and maintenance of one innovative water harvesting system		6	Pilot (optional)	6	Pilot (optional)	20	5	\$ 8,250	\$ 10,000	\$ 18,250
22	Total (\$)		exchange rate (d.d.26/4/2024):	0.93295		Budgeted days		80	82	\$ 48,500	\$ 40,000	\$ 88,500
23	Total incl. unforeseen (\$)		unforeseen percentage:	10%				Operational as part of total:			20%	\$ 97,350
24	Total incl. unforeseen (€)											€ 90,823
25												

1	Budget						
2	Support / main activity	Output	Deliverable	(Sub-)activity	Total costs		
3	Support / main activity						
4							
5	1	Conduct assessments of existing water harvesting systems	1a	Development of implementation planning	1a1 Detailed work plan	1a1 Plan the project	\$ 2,500
6					1a2 M&E plan with SMART indicators	1a2 Checking existing database info against current situation	\$ 4,150
7					1a3 Impact statement	1a3 statement on functionality and sustainability	\$ 800
8					1a4 Gender assessment report, Gender Action Plan	1a4 Detailed gender assessment and Gender Action Plan	\$ 9,750
9					1a5 Result tracker	1a5 Result tracker, linked to M&E plan	\$ 800
10					1a6 Closure report	1a6 Reporting, documentation	\$ 10,550
11			1b	Diagnose the existing harvesting systems	1b1 Report, describing representative structures	1b1 Assessment of representative water harvesting systems	\$ 46,500
12					1b2 Report, describing market availability and demand	1b2 Report on financial sustainability	\$ 4,850
13					1b3 Report existing policies and regulations, and their impact	1b3 Mapping of policies and regulations	\$ 4,250
14					1b4 Stakeholder map / diagram	1b4 Mapping of stakeholders	\$ 3,750
15	2	Assess capacity needs and identify gaps in knowledge and skills related to water harvesting	2.1	Report, describing knowledge, skills and capacities	2.1 Survey of knowledge, skills and capacities	2.1 Survey of knowledge, skills and capacities	\$ 14,400
16	3	Diagnose the effectiveness and suitability of different water harvesting techniques in Sudan	3.1	Report, describing analysis results	3.1 A detailed analysis into the prospects of irrigation	3.1 A detailed analysis into the prospects of irrigation	\$ 18,650
17			3.2	Report, describing case studies	3.2 6 cases studies to undergo a critical technical review	3.2 6 cases studies to undergo a critical technical review	\$ 7,650
18	4	Identify appropriate and innovative water harvesting technologies suitable for the Sudanese context	4	Report, describing analysis results	4 Analysis of collected data	4 Analysis of collected data	\$ 12,350
19	5	Facilitating the transfer of these technologies to local stakeholders through training programs	5.1	Workshop (report or recording)	5.1 Organize workshop to present project results	5.1 Organize workshop to present project results	\$ 8,400
20			5.2	Lecture, webinar, article (to be defined)	5.2 Side events: lesson learned and knowledge exchange	5.2 Side events: lesson learned and knowledge exchange	\$ 10,800
21	6	Provide technical support for the installation, operation, and maintenance of one innovative water harvesting technology	6	Pilot (optional)	6 Pilot (optional)	6 Pilot (optional)	\$ 21,600
22	Total (\$)		exchange rate (d.d.26/4/2024):	0.93295	Budgeted days		\$ 181,750
23	Total incl. unforeseen (\$)		unforeseen percentage:	10%			\$ 199,925
24	Total incl. unforeseen (€)						€ 186,520
25							

5. Profile and experience of experts

Based on the required Human Resources identified in section 4 (Resources required and itemized budget) please provide a description of the required profile of all involved experts for the implementation of the CTCN Response Plan.

Experts required	Brief description of required profile
<p>Please use the same titles for all experts as applied in section 4.</p>	<p>Please provide a short description of expertise and experience needed (education, sectors of expertise, years of experience, country experience, language requirements, etc.).</p>
<p>Project Manager (11) (International expert)</p>	<p>The project manager shall have the following expertise and experience:</p> <ul style="list-style-type: none"> • Master’s degree or above (or equivalent experience) in water engineering, technology and/or management, climate technology, climate change response, environmental planning and/or management, or an affiliated major • 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 developing plans and associated strategies and programmes/projects for climate technology development, transfer and deployment in adaptation sector • Experience with community engagement and participatory planning • Experience in developing climate-related action plans in developing countries • Experience in developing GCF/GEF concept notes • Experience in developing capacity building programmes and in organizing workshops and/or capacity building trainings • Previous experience in Sudan will be valued. • Excellent written and communication skills in English are required.
<p>Expert in rainwater harvesting system (12) (International expert)</p>	<p>The expert in rainwater harvesting system shall have the following expertise and experience:</p> <ul style="list-style-type: none"> • Master’s degree or above (or equivalent experience) in water engineering and/or technology or an affiliated major • At least 8 years of experience in designing, developing and deploying rainwater harvesting systems • At least 5 references demonstrating experience in the design, development and/or deployment of rainwater harvesting systems in developing countries • Experience in developing GCF/GEF concept notes • Experience in organizing workshops and/or capacity building trainings • Previous experience in Sudan will be valued.

<p>Expert in water technology development, transfer and planning (I3) (International expert)</p>	<ul style="list-style-type: none"> • Excellent written and communication skills in English are required. <p>The expert in water technology development, transfer and planning shall have the following expertise and experience:</p> <ul style="list-style-type: none"> • Master’s degree or above (or equivalent experience) in water engineering, technology and/or management or an affiliated major • At least 8 years of experience in developing plans and associated strategies and programmes/projects for water technology development, transfer and deployment and for capacity building of stakeholders • At least 5 references demonstrating experience in the development of action plans for water technology implementation and diffusion at the local level in developing countries • Experience in developing GCF/GEF concept notes • Experience in organizing workshops and/or capacity building trainings • Previous experience in Sudan will be valued. • Excellent written and communication skills in English are required.
<p>Gender expert (N1) (National expert)</p>	<p>The gender expert shall have the following expertise and experience:</p> <ul style="list-style-type: none"> • 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 water sector in developing countries • Experience in community engagement processes • Excellent written and communication skills in Sudanese ’s language and English are required. • It is expected that the gender expert will be based in Sudan or with the availability to travel frequently and for long periods of time in Sudan
<p>Water expert (N2) (National expert)</p>	<p>The water expert shall have the following expertise and experience:</p> <ul style="list-style-type: none"> • Master’s degree or above (or equivalent experience) in water engineering, technology and/or management or an affiliated major • At least 8 years of experience in water management in Sudan • Excellent written and communication skills in Sudanese’s language and English are required. • It is expected that the water expert will be based in Sudan or with the availability to travel frequently and for long periods of time in Sudan.

6. Intended contribution to impact over time

Please provide a brief description of the intended contribution to impact over time of the outcome and outputs provided by this technical assistance on resilience to climate change and/or carbon abatement. To the extent possible, please quantify the intended impact contribution, for example by indicated estimated number of people potentially impacted over time, GDP contribution of the focus sector, carbon emissions by the focus sector, etc. This intended contribution to impact is what will happen if the objective (as articulated in section 3) is met. Please ensure relevant complementarity with text in sections 7 to 12. (maximum 1250 characters including spaces)

Adoption of the rainwater harvesting system could be one of the most appropriate approaches for sustainable water supply to local communities in Sudan. As to deployment of the rainwater harvesting in the country, possible technical, institutional, social and economic barriers could be identified. The catalogue of technologies and the trainings should contribute to facilitating the uptake of the rainwater harvesting technologies for surface runoff storage and for groundwater recharge, enhancing climate resilience in water sector in Sudan.

7. Relevance to NDCs and other national priorities

Alignment with national priorities (up to 2000 characters including spaces):

Please describe how the technical assistance is consistent with national climate priorities such as: Nationally Determined Contribution, national development plans, poverty reduction plans, technology needs assessments, Low Emission Development Strategies, Nationally Appropriate Mitigation Actions, Technology Action Plans, National Adaptation Plans, sectorial strategies and plans, etc.

Reference document (please include date of document)	Extract (please include chapter, page number, etc.).
Nationally Determined Contribution (NDC)	Direct alignment and contribution to NDC implementation is required for all CTCN technical assistances. Please include a direct reference to the INDC/NDC document (chapter, page number, etc.). Adaptation component of the updated NDC- Table 4-1: Sudan's adaptation priorities page No. 16- 18 and 4.5. Implementation of adaptation actions and plans page No. 22
Technology Needs Assessment	TNA- Adaptation 2013 Chapter 5 Technology Prioritization for Water Sector Page No. 44- 47 and 5.4.1 Rain water harvesting (haffir) Page No. 48-49. Annex I Technology Fact Sheets B.1. Technology: Rain Water Harvesting (Haffir) page 74- 76. B.3. Technology: Water Harvesting (Earth Dam) page 80-83. Part 2: Barrier Analysis And Enabling Framework Chapter2: 2.1 Preliminary Targets for Haffirs Technology and 2.2 Barrier Analysis and Possible Enabling Measures for Haffir page No. 137- 146. Part 3: Technology Action Plan- 2.2 Action Plan for Rain Water Harvesting (Haffirs) page No. 206- 217. Part4: give a summery idea for the some projects related the water harvesting technology like Haffir Page No. 243-244. 2.3 Project Overview 2.3.1 Construction of 15 rain water harvesting (haffir) in 15 states page No.245-247.
National Adaptation Plans	NAP 2015 <ul style="list-style-type: none">In page 54 – 57 Mentioned enhanced National Research for climate change adaptation- including Objective and key activities

	<p>and Approach and results in number of sectors including water sector</p> <ul style="list-style-type: none"> • As well as clarify the Adaptation investment and financial flows in page 64 -65. Specific activities for the Sudan adaptation investment • Page 72 – 80 define Priority adaptation measures in all states in Sudan including those cities effected by the war
<p>Nationally Appropriate Mitigation Actions</p>	<p>NDC 2021 Page 20-21 Table 4-1: Sudan’s adaptation priorities.</p>
<p>Add others here as relevant</p>	

8. Linkages to relevant parallel on-going activities:

Please identify relevant previous and ongoing public and private sector initiatives, projects or programmes that the CTCN assistance will specifically build on and contribute to. To the extent possible, please add practical and operational details on the linkages between existing activities and the CTCN assistance. (maximum 2500 characters including spaces)

Rainwater harvesting in most of the rural areas in Sudan is considered the main source for domestic water supply and cultivation. It is the key method for securing water for food security and settlement of rural population. Therefore, the government has given the priority to water harvesting projects, e.g. Zero Thirst initiative to combat thirst between the years 2010 – 2016, where a number of 427 Hafirs and 29 dams were constructed, mainly for water provision for the rural population by the Dam Implementation Unit (DIU) all over the States of the country. However, an evaluation and assessment study in the year 2016 has revealed that 64% and 69% of the Hafirs and dams, respectively, failed due to problems pertinent to the management of these structures. Since then, various studies took place in order to investigate the sustainability of the rainwater harvesting for agricultural and drinking purposes from technical and management perspectives:

(2022 - 2023): Technical Study, Analysis, Implementation and Coordination to Reduce the Impact of Flash Floods on Human Lives and Economic Assets in Um Zaifa Village - Ed Al Fursan Locality – South Darfur State

(2020 - 2022): Assessment and Evaluation of the Water Quality of the Water Harvesting Facilities in Rural Areas of Sudan

(2020 - 2022): Surface Water Resources Assessment – Coastal Area of the Red Sea State.

(2020 - 2022): Water Harvesting for Integrated Large Scale Agricultural Activities in Gadarif State.

(2019 - 2020): Development of a Community-based Management System for Sustainable Water Harvesting Facilities in the Rural Areas of Sudan

(2019): Training manual for surface water harvesting as part of the project ‘Strengthening local communities’ resilience to climate change in North Darfur State, Sudan

(2018 - 2019): Assessment of Hafirs’ Systems in Sudan, Technical, Socio- Economic and Environmental Aspects

(2016 - 2020): Localization and design of potential Water Harvesting projects in Wadi Nyala using advanced methodologies (RS and GIS) (Financed by the Ministry of Higher Education and Scientific Research)

(2014): Evaluation of Enhanced Hafir Project in South Darfur State – Water Harvesting Center – University of Nyala

Zero- Thirst initiative (2016-2020): governmental initiative to construct rainwater harvesting techniques (Hafir and earth dams) to combat thirst all over Sudan

in additions to:

- Sudan Water Sector Strategy 2021 - 2031 The Promise of the Ministry of Irrigation and Water Resources to Transform the Livelihoods of the People of Sudan.

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

Please describe the expected future use of the outputs and deliveries produced by this technical assistance, after the CTCN implementation is completed, towards contributing to the anticipated impacts over time articulated in section 6. For example, what organizations or stakeholders will use the outputs of the technical assistance after it is completed, for what purpose, at what scale and scope the outputs and deliveries will be applied, when and what will be the next steps undertaken, etc. (maximum 2500 characters including spaces)

Based on the achievements and deliverables of the TA described:

- the assessments of existing water harvesting technologies and practices in Sudan (including the gender assessment, the market availability and prices, the policies and regulations, and the stakeholder map / diagram,
- the capacity needs assessment (including gaps),
- the diagnosis of the effectiveness and suitability of different water harvesting techniques (including the analysis into the prospects of improving existing design manuals, operation guidelines and common practices, and case studies),
- the catalogue or database (with identified appropriate and innovative water harvesting technologies),
- the transfer to local stakeholders through training programs, workshops, and demonstrations, and
- (possibly) the pilot,

the local government, NDE and proponents could:

- Develop a plan for capacity building on water harvesting in selected areas, including the embedding of the application of water harvesting in a catchment / integrated water resources management approach; depending on the political / security situation, exchange visits (national / international) could be organized;
- Develop a plan for improving existing design manuals, operation guidelines and common practices;
- Develop a plan for the (lobby for the) update and review of policies and regulations;
- Use the identified and described water harvesting technologies and approaches, as described in the WOCAT database to populate the Water Harvesting Explorer tool, that makes this database more easily available and accessible;
- Develop a plan for the implementation of water harvesting technologies and approaches in selected areas, taking into account:
 - political and security situation;
 - available funds;
 - interest, knowledge and experience of stakeholders;
 - available knowledge of / experience in catchment / integrated water resources management approaches.

10. Gender and co-benefits:

<p><i>Gender mainstreaming</i></p>	<p>In Sudan, focusing on gender-inclusive water harvesting initiatives can lead to a range of co-benefits including improved livelihoods, environmental sustainability, social equity, and cultural preservation.</p> <p>Technology Transfer: The transfer of water harvesting technologies can be tailored to benefit women in Sudan who are often responsible for water collection and management. This can include the introduction of simple and efficient water harvesting techniques such as rainwater harvesting systems, small-scale irrigation technologies, and water conservation methods that can be easily managed by women.</p> <p>Capacity Building: Capacity building programs can be designed to empower women in Sudan through training on water harvesting techniques, project management, and leadership skills. By involving women in decision-making processes and providing them with the necessary skills and knowledge, they can play a more active role in water management, leading to improved water access and sustainability.</p> <p>Research Collaboration: Research collaborations focusing on gender-responsive water harvesting solutions can lead to a better understanding of the specific challenges and opportunities faced by women in Sudan. This can result in the development of tailored approaches that address gender disparities in water access and management, ultimately benefiting both women and their communities.</p>
<p>Gender and co-benefits intended as result of the activities:</p>	<p><i>Please describe all gender aspects, women's equality and other co-benefits expected as a result of the CTCN technical assistance.</i></p> <p>Gender Linkages and Co-Benefits: By prioritizing gender-responsive approaches in water harvesting initiatives, women in Sudan can experience increased economic opportunities, improved health outcomes, and enhanced social empowerment. Additionally, integrating biodiversity conservation practices within water harvesting projects can lead to environmental co-benefits such as habitat restoration and improved ecosystem resilience. Furthermore, by involving local communities, including women, in the decision-making process, there is potential for the preservation and promotion of cultural practices related to water management.</p>

11 Main in-country stakeholders in implementation of the technical assistance activities:

Using the table below, please list and describe the role of in-country stakeholders, participants and beneficiaries who will be involved in or directly consulted during implementation of the assistance.

<p>Key stakeholders:</p> <p>Please list the stakeholders who will be involved in the implementation of the requested CTCN technical assistance and describe their role during the implementation (for example, government agencies and ministries, academic institutions and universities, private sector, community organizations, civil society, etc.).</p>	
Stakeholders	Role to support the implementation of the technical assistance
National Designated Entity	Support and facilitated to the implementation technical assistance in Sudan and coordinate. Coordination between the National entities and CTCN.
Request Applicant	Project coordination with different stakeholders for overseeing and managing all aspects of communication and implementation.

- Ministry of Irrigation and Water Resources
- Agriculture Research Corporation- Dry Land and Water Harvest Research Centre.
- Water Research Center- University of Khartoum

Institutional arrangements, policies and strategic planning, and technology adoption.

Conducting research studies aims to improve water harvesting techniques in Sudan. Providing technical assisting and supervising the implementation of the recommended water harvesting technics released from the previous research studies. Transfer knowledge to the beneficiaries such as: local community members, government officials, farmers andetc.

Supporting capacity building activities, conducting research, and implementing training program.

12. SDG Contributions:

Instructions: Please complete the grey section below for **a maximum of three SDGs** that will be advanced through this TA. A complete list of SDGs and their targets is available here:

<https://sustainabledevelopment.un.org/partnership/register/>.

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-3 SDGs)
1	End poverty in all its forms everywhere	
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	
3	Ensure healthy lives and promote well-being for all at all ages	
4	Ensure inclusive and equitable quality education and promote life-long 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	This TA will identify (1) the most appropriate best practices and associated technologies for rainwater harvesting in the selected area and (2) develop the locally led technology transfer action plan for deploying rainwater harvesting in the selected area, which will contribute to enhancing sustainable water supply and water quality to the selected area in Sudan.
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	
	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	This TA will contribute to enhancing climate-resilient water supply to the North and East region of Sudan by identifying the most appropriate best practices and

		associated technologies for rainwater harvesting in the selected area and by developing the locally led technology transfer action plan for deploying rainwater harvesting in the selected area.
	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 will (1) develop the capacity building and stakeholder engagement plan, (2) provide communications materials for sustainable water use in response to climate change and (3) organize the 1- day workshop for local government officials and communities in the selected area, supporting them to increase their knowledge on climate change impacts on water scarcity and their understanding of the locally led technology transfer action plan for deploying rainwater harvesting in the selected area.
	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 indicate primary type of technical assistance. Optional: If desired, indicate secondary type of technical assistance.

<i>Please tick off the relevant boxes below</i>	<i>Primary</i>	<i>Secondary</i>
<input type="checkbox"/> 1. Decision-making tools and/or information provision		<input type="checkbox"/>
<input type="checkbox"/> 2. Sectoral roadmaps and strategies		<input type="checkbox"/>
<input type="checkbox"/> 3. Recommendations for law, policy and regulations	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 4. Financing facilitation	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 5. Private sector engagement and market creation	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 6. Research and development of technologies	X	<input type="checkbox"/>
<input type="checkbox"/> 7. Feasibility of technology options	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 8. Piloting and deployment of technologies in local conditions	X	<input type="checkbox"/>
<input type="checkbox"/> 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 of the implementing partners to implement this Response Plan, the lead implementer will produce a monitoring and evaluation plan for the technical assistance. The 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) NDE about overall satisfaction level with the technical assistance service provided; (ii) the Lead Implementer about the knowledge and learning gained through delivery of technical assistance; and (iii) the CTCN Director about timeliness and appropriateness of the delivery of the activities and outputs