The Republic of Sudan

Project Ideas for Climate Change Adaptation
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This document is an output of the Technology Needs Assessment project, funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP) and the UNEP Risoe Centre (URC) in collaboration with the Regional Centre, Environmental Development Action in the Third World **(ENDA)**), for the benefit of the participating countries. The present report is the output of a fully country-led process and the views and information contained herein are products of the National TNA team, led by the Higher Council for the Environment and Natural resources, Ministry of Environment, Forestry and Physical Development.

Foreword

Technology Needs Assessment for Climate Change (TNA) is a project implemented by the Higher Council for Environment and Natural Resources (HCENR) in collaboration with the United Nations Environmental Program (UNEP) Risoe Centre (URC), Denmark, and supported by the Global Environmental Facility (GEF) grant financing. Project execution is assisted by a national team composed of eleven experts representing different government institutions, research centres and universities.

TNA is considered as a prospect for Sudan to prioritize technologies suitable for Sudan conditions and contribute to reducing Greenhouse Gases (GHGs) emissions and to moderate vulnerability to negative impacts of climate change; these technologies will go in line with the national development priorities of the country.

TNA also allows Sudan to come up with ideas for sound projects on appropriate technologies for both adaptation and mitigation. Hence, Sudan is considered as one of the many vulnerable developing countries around the world due to its fragile ecosystem and its livelihood which is directly affected by the impact of climate change. TNA will also contribute to the success of implementation of the United Nations Framework Convention on Climate Change (UNFCCC) as long as the developed countries take a leading role in providing financial assistance and facilitating technology transfer for developing countries.

TNA is a participatory process; it requires consultation of wide range of stakeholders during different steps of the process. Stakeholders participated in the groundwork of these studies will eventually add more to the preparation and success of the TNA as they have different views, background and experiences in climate change. Identified sectors and sub sectors for the TNA would build upon preceding studies conducted earlier such as the National Adaptation Program of Actions and National Communications.

Sudan has set many goals in its Millennium Development Goals (MDGs). Amongst the most important goals identified are eradication of extreme poverty and hunger, combating HIV/AIDS, Malaria and other diseases and ensure environmental sustainability. Conducting TNA will give Sudan a great opportunity in achieving those goals. Technologies identified through the TNA will assist remarkably in overcoming many challenges that face the country in the context of poverty, hunger, human health and environment in general.

Environment and poverty alleviation have also been recognized as the cross-cutting issues in the Five-Years Strategic Plan of the country (2007 – 2011). Sound, environmentally benign technologies are needed to be incorporated in the improvement of the environment and alleviation of poverty. The government exerts great emphasis on the improvement and development of international relations with environmental development partners, and augmenting mechanisms for benefiting from the latest research, expertise and technologies to enable the country for achieving these goals.TNA in Sudan can go beyond prioritizing technologies to practical approach to spread the use of the technologies identified, as Sudan faces many barriers in the technology transfer such as limited resources, lack of training, poor dissemination tools. In conclusion, TNA will help overcome these barriers.

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List of Abbreviations

MDGs	Millennium Development Goals
MOA	Ministry of Agriculture
NAPA	National Adaptation Program of Action
NGOs	Non-Governmental Organizations
PRSP	Poverty Reduction Strategy Program
RWH	Rain Water Harvesting
TAP	Technology Action Plan
TNA	Technology Needs Assessment
USD	United States Dollar

Executive Summary

Projects ideas are a short snapshot of the projects proposed to the funding agencies and considered a first step in the development of a project (a detailed Project Proposal). The project idea aims to support the realization of some of the targets formulated in the Technology Action Plans (TAPs). The TAP focused on two sectors, namely agriculture and water resources, and for each sector two technologies have been selected for adaption. The selected project ideas for the agriculture sector are 'Production of improved crop seeds and seedlings in six states and Zero Tillage' in one state. For the water sector *Haffirs* are to be established in 15 states and *Automatic Water Level* along the River Nile and its tributaries in six states.

The project ideas for the agriculture sector aim at increasing crop productivity and increasing people's income with a view to poverty alleviation and food security strengthening. It is expected that the Ministry of Agriculture and Animal Resources in close coordination with the Sudanese Farmers General Union will leading roles in the prioritized pursuits. Additionally, the Federal and State governments are expected to enhance the adoption of the technology interventions because the projects relate to the country's sustainable development priorities. The expected costs for the project for production of improved seeds and seedlings amount to an estimated 18,290,000 USD in addition to 388,000 USD for the Zero Tillage. It is expected that rain-fed small scale farmers will benefit from these projects which will start as pioneer models to be replicated in the other selected states. The time framework for the production of improved seeds and seedlings is three years; and five years for Zero Tillage. The main non-financial and economic challenges confronting adoption of improved seeds and seedlings production are social reluctance, problems of coordination between actors, ecological barriers, pests and outbreak of diseases. Zero Tillage faces similar problems while the two proposed projects constitute a tremendous financial challenge for Sudan.

As water is crucial for life inevitably the proposed projects aim towards provision of drinking water security for both humans and animals. The selection criteria for areas where Haffirs are to be constructed are (1) sufficient potential water surface run-off (2)suitability of the physical condition of the soil to avoid high infiltration rates (3) areas distant from natural resource-based conflicts and (4) sites remote from River Nile and its tributaries, as well as seasonal water courses. The expected unit costs for the Haffirs is around 105,000 USD (15 Haffirs in all 15 states of Sudan), while for the Automatic Water Level unit costs are about 186,000 USD (14 Stations). The time framework for launching both the *Haffirs* project and the automatic water level is expected to be one year. The two proposed projects for the water sector will be under the responsibility of the Nile Water Directorate in coordination with national and international experts for training in the different activities of the proposed projects.

Chapter 1.

Project Ideas for the Agriculture Sector

1.1 Brief Summary of the Project Ideas for the Agriculture Sector

This report contains project ideas aimed at supporting the realization of some of the targets discussed in the TAP. After reviewing Sudan's development priorities, identified in the Comprehensive National Plan, and the national strategies of the country which aim towards poverty alleviation and guaranteeing sustainable livelihood, these project ideas have been elaborated. The selection of these projects reflects the degree of their relevance and acceptability by the government and local communities. The selected project ideas for the agricultural sector are production of improved seeds and seedlings and Zero Tillage technology for reduction of vulnerability of food security and enhancement of farmers' resilience. Target groups are mainly the Ministry of Agriculture and Animal Wealth and farmers in six states cultivating crops vulnerable to climate change. As for Zero Tillage, the target groups are similar to that of improved crop varieties but focusing on one state instead of six states. The stakeholders, mainly from the Ministry of Agriculture, contributed significantly to the formulation of the project idea. Group discussion has been deployed to arrive at a general consensus for the selection of the projects. Some individual meetings have also been used for consensus on projects ideas. The stakeholders who have engaged in the different processes of Sudan – TNA includes Ministry of Agriculture, Ministry of Water Resources and Electricity, Forests National Corporation, Forests Research Centre and Agriculture Research Centre, besides some academics from different universities.

1.2 Specific Project Ideas

1.2.1 Project Idea for Improved Crop Varieties Technology

This project predominantly aims at improving seeds and increasing seedlings varieties. Under-nutrition, that is an inadequate calorie and protein intake, has been a major concern of medical specialists, nutritionists, agriculturists, and demographers, both at local and international levels in the Sudan. One way of attenuating the problem of under-nutrition is the development and distribution of high yielding and well adapted seeds to farmers. The identification of project ideas is based on the priority needs, developed by the national stakeholders and the national team of TNA, as explained in the previous reports.

Enhancing breeding of improved crop varieties (seeds and seedlings) is expected to take place in six states of the country; particularly in rain-fed areas targeting small scale farmers. Selection of the target groups and areas relied more on individual meetings with concerned parties, namely the Ministry of Agriculture and Farmers Unions in the different states.

Production of improved seeds and seedlings will increase the productivity of major crops, thus contributing to the increase of farmers' incomes. The general result of this project will guarantee food security and diversification of nutrition through producing different crop types which leads to sustainable livelihood in the project areas.

The number of beneficiary states will be six: (1) Gadarif (2) Sennar (3) North Kordofan (4) North Darfur (5) White Nile and (6) Blue Nile. The selection criteria for the project included low level of development interventions (marginalized areas) by the national government and other donors; suitability to traditional rain fed farming; vulnerability to climate change and variability (acute poverty and lack of food security) of farmers in these areas. Similarly, six

localities (one from each state) will be targeted for project implementation. The project will focus on organized farmers groups at village level and a total of at least 50 farmers will benefit in each locality. The selection of the localities will be based on the following criteria:

- Relative size of rural households involved in traditional rain-fed agriculture;
- Locality free of natural resource-based conflict and with conducive work environment;
- Willingness of the community to accept development interventions of the project;
- Willingness and readiness of the community to form farmer groups and mobilize women;
- Potential for productivity increase; and availability of Ministry of Agriculture and Farmers Union staff to facilitate project interventions.

The strategy of the project will base on the establishment of a demonstration farm at each locality for sake of dissemination of information in the six states. This method is selected because it offers the chance for demonstration of methods of raising seedlings using nursery techniques. Sixteen nurseries are proposed to be established at the different localities relying on simple materials in order to guarantee the sustainability of the activity.

1.2.2 Project Idea for Zero Tillage Technology

Research results in the country showed that zero-tillage technology resulted in significant increase in sorghum production (from about 700 kg/ha to 1,650 kg/ha). Research findings also indicate that zero tillage is promising and recommended particularly in mechanized rain-fed agriculture, which is sensitive to climate change and constitutes 35% of the national cultivated land. With the current and future climate change vulnerabilities, the adoption of the technology is expected to increase resilience of vulnerable communities and consequently enhance their adaptation.

The Introduction of zero tillage technology in different parts of the country and its testing with different crop species remain one of the challenges that require careful consideration. However, the findings of the research showed that in spite of the challenges facing the technology, there are numerous opportunities that could be created by the adoption of zero tillage such as:

- Reducing the number of labourers, considering that since farmers are poor and reluctant to hire labour
- Stable yields and improved soil fertility
- Profitable crop production under zero tillage over time relative to conventional agriculture
- Conservation of soil and biodiversity
- Potential economic benefits
- Poverty reduction

At the global level, zero tillage sequesters carbon and consequently decreases CO_2 in the atmosphere. Gedarif State has been selected for this project due to the fact that this state encompasses the main rain fed mechanized agriculture schemes in the country, and the state is responsible for guaranteeing satisfactory crop production for the whole country and export of the surplus. Few years ago fluctuation of rainfall in terms of intensity and distribution led to sharp decline of productivity besides the changes in the physical and chemical properties of

the soil. As a remedy for these problems zero tillage has been suggested given its restoration of soil fertility and relatively high productivity. The entire stakeholders involved in Sudan – TNA, through general consensus, agreed on the project and the selection of the project site. It is worth mentioning that the majority of the stakeholders are from the Ministry of Agriculture. Moreover, one of the national team is from the Ministry of Agriculture.

1.3 Project overview

1.3.1 Production of Improved Seeds and Seedlings

Name of the Project	Production of improved seeds and seedlings
Introduction	The farmers in Sudan rely heavily on farm saved seeds and have little access to commercial improved seed. Improved crop varieties seed reach only 10 per cent of farmer producers in Sudan. The rain fed-sector is characterized by low productivity and horizontal expansion of the area in rain fed farming. This has negative consequences for forests and pasture as it creates an agro-ecological imbalance with severe environmental consequences. In addition, the production of improved seed variety on large-scale will strengthen the capacity of research, extension and the private sector in the development, dissemination and adoption of improved seed varieties. This can lead to improved food security and sustainable crop production intensity and livelihoods.
Objectives	This project aims to guarantee satisfactory crop production that leads to food security, improved and diversified nutritional status, and poverty reduction among marginal and small-scale farmers by upgrading agricultural production and improving income.
Outcome	- Establish the necessary infrastructure for plant multiplication, inspection, sanitation and certification - Increase the production of improved seeds and seedlings in six states
Relationship to the country's sustainable development priorities	The project is in line with the Country Agricultural Strategy and its commitment to the UNFCCC which focuses on the organization of seed and seedlings production as well as on the production of certified plant material for high yielding varieties. Moreover, it aims to increase the productivity vertically and induce reduction in cost of production. In addition, the project intends to reduce the need for more new land, a prospect that bodes well for the country's green covering of trees while decreasing GHG emissions.
Project Deliverables	Provision of improved seeds and seedlings of the different crops to all small farmers in the rain-fed areas, which will improve food security and diversify crops. The project will benefit from 16 local nurseries that will have a positive impact on yield of all crops (15 to 50 per cent increase, depending on crop and climatic conditions).
Project Scope	The project is designed for small-scale farmers in six states (South Gadarif, Sennar White Nile, North Kordofan, North Darfur and Blue Nile states) under rain-fed agriculture. The project will focus on farmers presently relying on saved local varieties with low yield, farmers with lack of know-how and skills in producing improved seeds and seedlings. The main crops to be covered are cereals and fruit trees.
Project activities	1. Identification of needs and gaps in the necessary infrastructure for improved seeds and seedlings propagation 2. Elaboration of coordination mechanism between the Ministries of Agriculture and Animal Resources in the states, federal seed administration, seed companies, Farmers Union and local actors 3. Elaboration of communication tools for extension purpose 4. Acquire the necessary inputs related to propagation and production 5. Capacity building of government institutions that provide technical services 6. Community organizations and farm families, using participatory approaches 7. Introduction of related improved technologies such as water harvesting, small-scale irrigation and general improvement in farm management 8. Enhancing the capacities of farmers through Farmer Training Schools and other group initiatives

	9. Facilitation of farmers' associations formation and support to them 10. Provision of credit facilities using existing traditional and financial mechanisms 11. Establishment of healthy plant mother plots within the nurseries of local varieties and rootstocks; and upgrading existing tissue-culture laboratories 12. Training of all stakeholders at different levels *13.* Training MOA staff in inspection and certification.
Timeline	3 years and once in operation, the lifetime is in excess of 30 years.
Budget	Budget for project management team (staff) =1.5 million USD i.e 200,000 USD for each state for the 3 years (66,667 USD) as salaries and consultancies One unit (nursery) = 4.5 million USD (the unit composed of 2 offices, meeting room, laboratory, rest house and toilets vehicles motor cycles offices supply and equipment) Laboratory equipment cost= 1.5 million USD (200000 USD for each state) Three units are needed in the targeted areas (13.5 million USD). Cost of capacity building and training for the six states = 500,000 USD Running cost for the six states = 750,000 USD Unforeseen cost for the six states= 540,000 Total cost=18,290,000 USD
Potential source of finance	- Farmers Union - State Government - Federal Government
Measurement/ evaluation	Increase the production of improved seeds and seedlings through the establishment of 16 nurseries which in turn will be reflected in increasing the subsistence and cash crops besides vegetables and fruits. Moreover, the farmers (50 per locality or 300 in the six states) can be used as a measure for the success of the project)
Possible complication/challenge	• Social reluctance from producing improved seeds and seedlings • Financial constraints • Problem of coordination between actors • Ecological barriers • Pest and diseases outbreak
Assumption	• Farmers are willing to produce improved seeds and seedlings • Good coordination between actors.
Responsibilities	Ministry of Agriculture, Department of Technology Transfer and Agriculture Extension.

1.3.2 Zero Tillage Technology

Zero tillage technology for reduction of Vulnerability of food security and enhancement of farmers' resilience in Gadarif State

Name of Project	**Zero tillage technology for reduction of vulnerability to food insecurity and enhancement of farmers resilience in Gadarif State**
Introduction	Under the vulnerability of rain-fed mechanized agriculture in Sudan in general and in Gedarif State in particular, attempts have been made to reduce this vulnerability through adoption of Zero Tillage technology. The project is targeting farmers in the state for sake of increasing crop yield and sustainability of agricultural production
Objectives	-To select cover crops based on goals, - To select proper cropping rotation - To increase crop yields while decreasing input costs.
Outcome	- Increase crop production - Organize farmers into working groups - Increase income generation - Enhance farmers' awareness - Reduce farmers' expenditures
Relationship to the country's sustainable development priorities	The project is well linked to government policies and plans, being in line with the 25-year National Strategy and the Poverty Reduction Strategy Program (PRSP). It has also strong links with the Millennium Development Goals (MDGs).
Project Deliverables	The project will provide the rain-fed farmers in Gadarif State with the technical know-how by demonstration plots and mobilization and sensitization of farmers to adopt the intervention. The project will benefit from the active extension unit of the Ministry of Agriculture and Animal Resources at the state level besides the Higher Council for Environment and Natural Resources at Gadarif State.
Project Scope	In Gadarif State vast rain-fed areas exist that are suitable for the application of zero tillage. The total area under mechanized farming reached 71 400 km2. Most of these areas became degraded owing to various climatic and non-climatic factors. Land degradation has been found to cause decrease of agricultural production. Accordingly, many communities are extremely vulnerable as they do not guarantee food security.
Project activities	• Awareness raising • Organizing local people and establishing leadership committees/cooperatives to facilitate group work and overcome financial and non-financial barratries • Training and capacity building of zero-tillage farming and its management • Establishing physical infrastructures necessary for facilitating zero tillage farming • Purchasing agricultural machinery and equipment • Providing production inputs • Introduce pilot farms for research • Involvement of private sector and decision makers
Timeline	The estimated timeline for the project is 5 years
Budget	Budget for project management team: 330,000 USD (48,000 USD project manager/year + 18,000 USD assistant/year x 5 years of project) Budget for technical/extension consultants: 35,000 USD (350 USD/man-day x 100 days) Budget for elaborating a financial mechanism for subsidies and for sustaining extension activities: 4,000 USD Budget for communication tools development, including demonstration plots: 12,000 USD Budget for training of trainers: 2,000 USD (100 USD for 6 trainings/person x 20 persons)

	Budget for field visits and training: 5,000 USD Total budget: 388, 000 USD
Potential source of finance	• Federal Government • Farmers Union
Measurement/ Evaluation	• Increase in production per unit area • Increase in income • Status of poverty of the farmers • Increase in resilience of farmers • Change in perception of farmers towards land management and utilization of zero tillage
Possible complications/ challenges	• Social and cultural barriers (e.g. mistaken perception that soil plowing is essential for high crop production) • Insufficient extension services • Insufficient policies • others
Assumptions	The project will contribute to achieving food security, responding to climate variability and change as well as contributing to environmental conservation.
Responsibilities	Main stakeholders: Ministry of Agriculture at federal and state level, Farmers' Union, NGOs, relevant private sectors, etc. Financing to be provided by both national and international donors

Chapter 2 Project Ideas for Water Sector

2.1 Brief summary of the Project Ideas for the Water Sector

This report presents two project ideas that will contribute to the implementation of two Technology Action Plans (TAPs) in the water sector: Rainwater Harvesting (*Haffir*) and seasonal forecasting and early warning (automatic water level). The identification of project ideas is based on the priority needs of the national stakeholders, as explained within the previous reports. In parallel, the investigation of on-going projects and current enabling environment lead to the identification of two ideas: the construction of 15 rainwater harvesting (*haffir*) in 15 states, and the use of 14 automatic water level monitoring stations. The selection of the target groups and areas relied more on individual meetings with concerned parties.

2.2 Specific Project Ideas

2.2.1 Project idea for Technology of Haffir

Water harvesting techniques have been implemented in several states in Sudan and in different forms like earth embankment, dams and *haffirs*. Haffirs are manmade ground reservoirs to store water for drinking purposes/ or irrigation for both human and livestock. The concept is that during the rainy season water running in natural stream is diverted to these *haffirs* and stored. The size of the *haffir* ranges from 100,000 m^3 for large one to 30,000 m^3 for small ones. Guide bunds are required to divert the water into the *haffir*. If it is used for human drinking filters are needed for clean potable water. *Haffirs* can only be established in suitable locations with a reasonable amount of rainfall. This project aims to assist the most vulnerable areas that are prone to climate change and that are characteristic of reasonable amount of rainfall. The selection of the states depends on the following criteria;

- Areas of potential water surface run-off
- Suitability of the physical condition of the soil to avoid high infiltration rates
- Areas prone to natural resource-based conflicts
- Sites remote from River Nile and its tributaries and seasonal water courses

2.2.2 Project idea for Technology of Automatic Water Level

Seasonal forecasting and early warning systems related to the Nile flooding and its risks are not well developed in Sudan, mainly because of inefficient old technologies. Hence, the application of the automatic water level measurement technology is essential to accurately monitor the water levels in the River Nile and its tributaries at the key stations. This technology enables early warning report information in an appropriate time to protect about six millions people residing in the Sudan's floodplain. The installation of automatic loggers and management thereof require experts and institutional organization. This technology needs to be implemented in 14 key locations in Sudan along the River Nile and its tributaries.

Training and skills development of state staff and local communities for the operation and maintenance of the automatic loggers is very important for its success and sustainability.

2.3 Project Overview

2.3.1 Construction of 15 rain water harvesting (*haffir*) in 15 states

Name of the Project	Construction of 15 Rain water harvesting (haffir) in 15 state
Introduction	The project aims at assisting the community in water stress areas by implementing one haffir in each state. It focuses on the most vulnerable areas that are prone to climate change and receive a reasonable amount of rainfall.
Objectives	Construction of the *haffirs* can help a number of villages to supply hygienic potable water for humans and livestock. The objectives of the rain-water harvesting development are to enhance availability and access to water, improve living conditions of both pastoralists and farmers, promote peace and stability and strengthen the resilience of the local communities to climate change.
Outcome	Providing easy access to water for people and livestock during dry seasons and increased water availability per capita at a reasonable price.
Relationship to the country's sustainable development priorities	The main adaptation benefits of *haffirs* can be summarized as: projects of water harvesting in some parts of the country have increased community access to reliable water, increasing their capacity to cope with the impacts of reduced precipitation, all of which has been integrated into the NAPA consultation process. Accordingly, these benefits can be attained in new locations where the intervention has not been introduced.
Project Deliverables	15 Rain water harvesting (*haffirs*), one in each state, which has varying capacities of storing water (depending on the rainfall intensity) ranging from 30,000 m^3 to 100,000 m^3. For human water consumption, the water stored in *haffirs* needs to be treated with filtrations to remove all possible contamination. For this purpose, slow sand filtration techniques are usually adopted. However, filter costs (slow sand filter/rapid sand filter/ pressure sand filter) are not included in the costs estimations. Two separate outtakes should be constructed for people and animals. An elevated tank with a reasonable capacity is usually provided to withdraw clean water.
Project Scope	The project is applicable for all areas between latitude 10 – 14 North a distant a part from the River Nile and its tributaries.
Project activities	1. Identification of project target group beneficiaries in each state 2. Review of existing practices in water supply in the selected areas 3. Conducting environmental impact assessment studies 4. Selection of the best locations for the *haffirs* 5. Conducting soil analysis, infiltration rates, site specific requirements by field visits and design *haffirs*. 6. Awareness campaigns at stakeholder level and field visits to the existing RWH *haffir*. 7. Incorporation of water quality test and treatment for the rainwater before discharge for human consumption. 8. Construction of one *Haffir* in each state (total of 15 *Haffirs*). 9. Setup the scheduled maintenance and operation of the *Haffir* by the respective local government body 10. Training of the local staff/communities for regular cleaning of the intake channel
Timeline	1 year
Budget	Budget for construction of 15 haffir is 105,000 USD for two bulldozers (60,000 USD) and Caterpillar (45,000 USD)
Potential source of finance	- Federal Government (Ministry of Water and Electricity) - State Government - NGOs (IFAD, SOS, UNCEIF etc... - Local components in kind (voluntarly labor)

Name of the Project	**Construction of 15 Rain water harvesting (haffir) in 15 state**
Measurement/evaluation	- Quantity of water stored in *haffir* - Period of water availability Prevalence of peace
Possible complications/challenges	• Empty *haffir* before the dry season • Clogging of the intake channel (*haffir* not filled by water) • Water infiltrate to the groundwater storage
Assumptions	Stakeholders are willing to adopt the technology to reduce the cost of water supply from far places.
Responsibilities	- Ministry of Water Resource and Electricity should be responsible for scientific studies regarding the selection of suitable sites for the construction of *haffir*, beside the provision of experts. - Ministry of Water Resources and Electricity should train the local people about the different activities of maintenance of *haffir* and rational use of the stored water. - The traditional leader should allow the pastoralist to benefit from the stored water

2.3.2 Using automatic water level in monitoring station

Name of the project	Using Automatic Water Level in monitoring station
Introduction	Sudan has numbers of established stations for water level staff gauges across the river Nile and its tributaries, which have long time series records. This project is concerned about modernising these systems by adopting automatic water level technologies.
Objectives	Installing automatic water level in 14 key stations
Outputs	Improve monitoring system that will enhance the flood forecasting and early warning systems
Relationship to the country's sustainable development priorities	The development objective of seasonal forecasting and early warning is to reduce human suffering and damages, and capture the benefits of flooding. Through this technology it is possible to manage flood risks, including floodplain management and flood mitigation planning, flood forecasting and warning, and emergency response and preparedness at regional, national, local and community levels. This will contribute to the longer term goal of establishing a comprehensive approach to flood management that integrates watershed, river and floodplain management, and incorporates a suite of structural and non-structural flood mitigation measures within a broad multi-purpose framework.
Project Deliverables	Using automatic water level is a priority technology enabling adaptation to climate change through better dissemination of early warning messages to communities. This helps saving lives and capture flood benefits.
Project Scope	The project will cover all automatic water levels in 14 stations along the River Nile and its tributaries (White Nile, Blue Nile and Atbara River).
Project activities	1. Visiting the 14 stations and examine their different location needs 2. Selecting the best type of automatic water level 3. Use of compatible wireless system to send information to the headquarters 4. Programming the logger for the reading interval 5. Training the technician in the whole process (installation, operation, validation, and periodical maintenances) 6. Awareness of the local community about its benefits 7. Purchase the automatic water level, installing and testing by experts 8. Purchase of solar batteries/generator as alternative for electricity shortage 9. Training of Nile Water Directorate staff members on database management, monitoring, retrieving, archiving and maintenance with the assistance of experts
Timeline	1 year
Budget	• Budget for purchase of 14 automatic water levels: 56,000 USD (4,000 USD *14 = 56,000 USD) • Budget for training of technician: 10,000 USD • Budget for technical/ consultants and staff training: 60,000 USD • Budget for awareness campaign: 50,000 USD • Budget for maintenance: 10,000 USD • Total budget: 186,000 USD
Potential source of income	- Federal Government (Ministry of Water and Electricity) - NGOs (UNEP, GEF etc.....
Measurement/evaluation	Operating the new system during the flood seasons and validation of the data transfer and its accuracy compared to old procedures.
Possible complications/challenges	Disturbance of the new system due to fault in wireless system/electricity shortage/sedimentation or stolen of the automatic water level or one of its components.

Name of the project	**Using Automatic Water Level in monitoring station**
Assumptions	Decision makers are willing to adopt automatic water level.
Responsibilities	Nile Water Directorate can require the assistance of national experts in training and international experts in installation and operation of the new system.