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ADAPT FOR ENVIRONMENT AND CLIMATE RESILIENCE IN SUDAN (ADAPT!)

INTEGRATED WATER RESOURCES MANAGEMENT GOOD PRACTICES IN SUDAN

First published in February 2020 by the United Nations Environment Programme

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The cover picture illustrates community participation in the construction of water harvesting infrastructure for agricultural production as part of the Wadi El Ku Catchment Management Project in North Darfur State.

Design and layout: Ahmad Reza Amiri

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INTEGRATED WATER RESOURCES MANAGEMENT GOOD PRACTICES IN SUDAN

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OCTOBER 2019

KHARTOUM, SUDAN

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ACRONYMS

ARC	Agriculture Research Centre
CBOs	Community-Based Organizations
DFID	Department for International Development
DWSU	Drinking Water and Sanitation Unit
FAO	Food and Agriculture Organization
GDP	Growth Domestic Product
GWP	Global Water Partnership
GWWD	Groundwater and Wadis Directorate
IDPs	Internally Displaced Persons
IOM	International Organization for Migration
IWRM	Integrated Water Resources Management
JICA	Japan International Cooperation Agency
LDC	Least Developed Countries
NAPA	National Adaptation Programme for Action
ND	North Darfur
NK	North Kordofan
NRM	Natural Resources Management
SWC	State Water Corporation
UNEP	United Nations Environment Programme
UNICEF	United Nations International Children's Emergency Fund
WEK	Wadi El Ku Catchment Management Project
ZOA	Dutch Non-Governmental Organisation

EXECUTIVE SUMMARY

The ADAPT! project aims to integrate environmental management, governance and climate-resilience best practices into a humanitarian and development programme to help the people of Sudan cope with environmental stress and climate change. IWRM is "a process that promotes coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." The overall objective of the integrated water resources management (IWRM) theme in ADAPT! is to enhance management, control and use of water resources in a sustainable manner.

Six case studies have been selected and documented as good practices in IWRM to create a baseline that can be used to advocate upscaling of IWRM implementation and provide lessons for others to map out their own IWRM strategy. The case studies are based on the diagnostic criteria of: environmental, economic and social sustainability; gender sensitivity; technical feasibility; participation; scaling up; vertical and horizontal coordination; integration; replicability and adaptability; and reduction of disaster/crisis risks. There is no commonly agreed understanding on good practices. However, the keys to success are influenced by the local political, social, economic and cultural contexts of each country or community; there is no universal approach that can be replicated. Good practices in IWRM can be considered as activities and tools designed to minimize negative effects on the environment and water resources, promote efficient use of resources, improve safety for consumers and foster economic viability.

The selected case studies cover wide geographical locations, various ecological zones and a range of water uses:

1. The Wadi El Ku Catchment Management Project (North Darfur State) demonstrates an IWRM good practice, integrating water science, water planning and natural resources development.
2. The National Adaptation Programme for Action: Climate Change Adaptation Project aims at building the community adaptive capacity to climate change in four pilot areas in Sudan.
3. The Butana Integrated Rural Development Project (Gedaref State) aims to improve the livelihoods and resilience to drought of poor rural households. It particularly demonstrates IWRM good practices in empowering women.
4. The Khewei Water Supply Project (West Kordofan State) demonstrates good IWRM practices in providing safe water supply for domestic uses, reducing overgrazing and maintaining natural resources management. It also reflects the socioeconomic value of water.
5. The Hawata Wad-Elageili Water Supply Improvement Project (Gedaref State) demonstrates an IWRM good practice as it provides an example of a community-based system for sustainable water supply management.
6. The Rural Water for Sudan Project aimed at improved access to safe water, improved livelihood, sanitation and hygiene through establishment of catchment-level water resources management committees that represent key stakeholders and facilitate development of catchment-level water resources management plans through participatory planning processes.

INTRODUCTION

The ADAPT! project aims to increase understanding and ensure integration of environmental management, governance and climate-resilience best practices into humanitarian and development programme delivery. This document is designed to collate information around Integrated Water Resources Management (IWRM) best practices and Sudanese case studies (see Annex 1). It will form a baseline that can be used to inform project design and advocate for the upscaling of IWRM implementation in humanitarian and development programme delivery in Sudan. Although the IWRM concept has been used globally for several years and is accepted as a good practice, its implementation could be further improved, especially in developing countries such as Sudan.

Clarification of IWRM within the context of Sudan will be provided below and its practical implementation described. These will contribute towards changing perceptions from the traditional sectoral approach to the multisectoral integrated approach. Many traditional water projects have elements of an IWRM approach. Therefore, there is no single "best approach". Components of good practices are identified in the following, which also highlights missing management aspects that could enhance water plans, practice and policies.

IWRM good practices cannot simply be copied. Modification according to the local context is needed, as is focusing on IWRM as a process that involves learning, innovating and adapting. It is therefore necessary to document good practices and identify the tools that brought about these practices and disseminate them for possible use.

The perception of IWRM good practices differs greatly, as there is no commonly agreed understanding. The keys to success in IWRM processes are influenced by the political, social, economic and cultural conditions of communities.

Identification of good practices can involve judgment, which requires prior analysis using a set of criteria. This entails deep evaluation or assessment using an agreed set of indicators to avoid confrontation with practitioners. Therefore, in this study, IWRM diagnostics are used instead, and project assessment or evaluation are not considered.

This report focuses on Non-Nile Water. Due to the nature of the study and its limited duration, primary investigation with extensive fieldwork was not possible. Scattered information and data on water resources make it difficult to produce an exhaustive inventory of all good IWRM practices in Sudan. To cover as much variety in terms of water use, geographic spread and elements of IWRM principles, a list of intended filters or diagnostics has been used. Some of the case studies described have been identified based on participation in the IWRM conference "Integrated and Sustainable Management of Non-Nile Water Resources in Sudan, Corinthia Hotel, Khartoum" held in November 2017 and some ongoing projects such as Rural Water for Sudan implemented by a consortium led by ZOA .

The report of the IWRM collated good practices was represented in a national consultative workshop on 28th March 2018 at Paradise Hotel Khartoum and attended by 37 IWRM practitioners and the report further peer reviewed by nine organizations and government institutions (see Annex 2).

IMPORTANCE OF NON-NILE WATER RESOURCES

Non-Nile water resources are vital for Sudan. They are the main source of water for much of the economy. It is estimated about 70 per cent of the population in Sudan depends on Non-Nile Water for domestic uses. They comprise rainfall, seasonal streams, wadis and groundwater.

Sudan receives about 420 billion m^3 of rainfall every year (Salih, 2017). Decline and/or variability in annual rainfall were detected as early as the 1990s, leading to high sediment deposits in irrigation canals and reservoirs and crops failure (Awimbo et al., 2004).

Approximately 300 seasonal streams and wadis yield 2-8 billion m^3 of water per year, influenced by the variable rainfall. These sources are unreliable and their use for irrigation purposes is very limited. However, they are harvested for domestic and livestock uses in rural areas.

Water-bearing geological formations are common and include the Nubian Sandstone and Umrwaba Formations as well as alluvium basins. Information on the extent of groundwater is limited, but some studies (Salih, 1982; Salih and Kheir, 1994; Ali, 1998) estimate total annual recharge at 4 billion m^3. Groundwater is tapped for domestic use and rarely utilized for irrigation because reservoirs and associated aquifers in most parts of the country occur at very great depths (exceeding 100 m). The reserved groundwater is estimated to be about 16 billion m^3. Groundwater covers about 70 per cent of rural areas and 60 per cent of urban areas water supply.

Forest and woodland cover used to be approximately 25 per cent of the total area of the country before the separation of South Sudan and yielded 16 million m^3 of wood and timber for fuel, construction and various industrial purposes. There is great demand for these products, and their exploitation is associated with many detrimental effects on the environment.

Gum arabic is a valuable non-timber forest product harvested by rural communities. It contributes significantly to the gross domestic product (GDP) increase within the agriculture sector. Sudan provides more than 8 per cent of the total global production of gum arabic. All the forest areas depend on rainwater and rainfall in the rain-fed sector, and gum arabic contributes 3.3 per cent of GDP based on the value of its exports.

The agriculture sector accounts for almost 40 per cent of GDP and supports approximately 80 per cent of the population. Almost 97 per cent of exports from Sudan comprise primary agricultural commodities. There are three distinct subsectors of agriculture in Sudan: modern irrigated farming, mechanized rain-fed farming and traditional rain-fed farming. Rain-fed agriculture covers 90 per cent of the cultivated area in Sudan and about 70 per cent of the population depends on it (Awimbo et al., 2004; Ali, 2017). However, productivity in the agricultural sector is declining. This is attributed to land degradation due to inappropriate agricultural expansion, inappropriate policies and planning, overgrazing and the continuous removal of vegetation cover.

Livestock rearing ranks second to crop cultivation as a key economic activity in Sudan. The country possesses diverse livestock herds that contribute approximately 20-22 per cent of GDP and 53-56 per cent of the agriculture sector.

According to Ali (2017), the productive non-Nile sector (rain-fed agriculture, livestock and forest) contributes substantially to the national income of Sudan by more than 17 per cent of GDP. Its other contributions can be summarized as:

1. Provide food for the population.
2. Provide job opportunities for more than 70 per cent of the population.
3. Provide a source of hard currency from export returns of more than 2.5 billion U. S. dollars annually.
4. Alleviate poverty.
5. Provide raw materials for basic industrial outputs.

6. Provide self-sufficiency in terms of animal products.
7. Provide improvements in personal income of the population if the sector is developed.
8. Provide support for considerable gum arabic production.

INTEGRATED WATER RESOURCES MANAGEMENT

Integrated management of water resources is becoming an increasingly needed approach. This is due to the fast-growing population, urbanization, food security policies and expansion of development and economic activities, in addition to climate change and other environmental factors exerting pressure on available water resources. The fast rise in water demand associated with the rapidly changing patterns of water use and climate change indicate that availability of water can no longer be taken for granted. Water use in the immediate future will be governed by increasing scarcity. Pollution further exacerbates water scarcity by reducing water usability downstream. IWRM is considered an effective approach for contributing to solving water problems.

According to the Global Water Partnership (GWP, 2000), IWRM is "a process that promotes coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems."

The main goals of IWRM are to:

1. Promote equitable access to water resources and the benefits that are derived from water to address poverty.
2. Ensure that scarce water resources are used efficiently and for the greatest benefit of the greatest number of people.
3. Coordinate the planning of projects and activities that affect water resources.
4. Achieve more sustainable utilization of water, including for a better environment.
5. Bring new approaches in a new vision for water managers as "advocates" of sustainable use of the resource and encourage changes in consumption behaviour and modes of water supply that account for social, economic and environmental costs in assessing and planning water development options. The challenge remains in defining sustainable management of water resources and what IWRM entails in policy options.

IWRM is a framework designed to improve the management of water resources based on four key principles (Dublin Principles) adopted at the 1992 International Conference on Water and the Environment, in Dublin, and the 2012 United Nations Conference on Sustainable Development, in Rio de Janeiro. These principles state that:

1. Fresh water is a finite and vulnerable resource essential to sustain life, development and the environment.
2. Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.
3. Women play a central part in the provision, management and safeguarding of water; andAchieve more sustainable utilization of water, including for a better environment.
4. Water has an economic value in all its competing uses and should be recognized as an economic good (ICWE, 1992).

"Integrated" water resources management can and must consider integration along at least four axes: space, objectives, institutions and time. The use of IWRM means a shift from a development focus to a management focus. It also means recognizing that there are many competing interests in how water is used and allocated among various stakeholders, who should be active participants in water management.

IWRM is a process with many dimensions concerning different water-related public agencies and also all sectors of the society, including private water users. It is strongly interdisciplinary and multisectoral and assumes a high level of horizontal communication and coordination among all stakeholders. IWRM addresses a wide range of issues involving management of the resource, relations with and participation of water users, and organization of the service in spatial terms and within the wider context of socioeconomic development. These issues include efficient and equitable water allocation, public health and environmental sustainability, institutional arrangements and international water rights (FAO, 1995).

APPLYING INTEGRATED WATER RESOURCES MANAGEMENT

Applying the basic principles underlying IWRM can be accomplished independently of context and stage of economic or social development. However, there is no universal blueprint for the implementation of such principles. The differences among countries and regions pertain to the condition of water resources (e.g. nature, character and intensity of water problems), the enabling environment (e.g. human resources, institutional capacities, relative strengths and characteristics of the public and private sectors), the cultural setting, natural conditions and many other factors. Practical implementation of approaches derived from common principles must reflect variations in local conditions and thus should necessarily take a variety of forms.

GWP has published a paper on the framework for WRM (GWP, 2000), and in 2001 it launched the IWRM Toolbox. This is a compendium of over 50 policies, actions and tools for putting IWRM into practice. There is also a growing collection of case studies illustrating practical real-world use of IWRM tools. The three complementary main components or elements of IWRM implementation revolve around the following categories/pillars:

1. The enabling environment, that is, the general framework of national policies, legislation, regulations and information for water resources management stakeholders.
2. Institutional roles and functions of the various administrative levels and stakeholders.
3. Management instruments and tools including operational instruments for effective regulation, monitoring and enforcement that enable decision makers to make informed choices among alternative actions.

Thus, implementation of an IWRM process is a question of getting the three pillars right.

There are also three fundamental and interrelated principles, known as the three "E pillars (Objectives)" of IWRM underlying the policy instruments presented in the Toolbox (GWP, 2001). The three E pillars (Objectives) that support the framework are:

1. Social equity: the basic right for all people to have access to water of adequate quantity and quality for the sustenance of human well-being.
2. Sustainable environment: the present use of water resources should be managed in such a way that does not undermine the life support system, thereby compromising use of the same resource by future generations.
3. Economic efficiency: because of the increasing scarcity of water and financial resources, the finite and vulnerable nature of water as a resource and the demands on it, water must be used with a maximum possible efficiency.

Figure 1 shows the three objectives (E pillars) and three elements of IWRM.

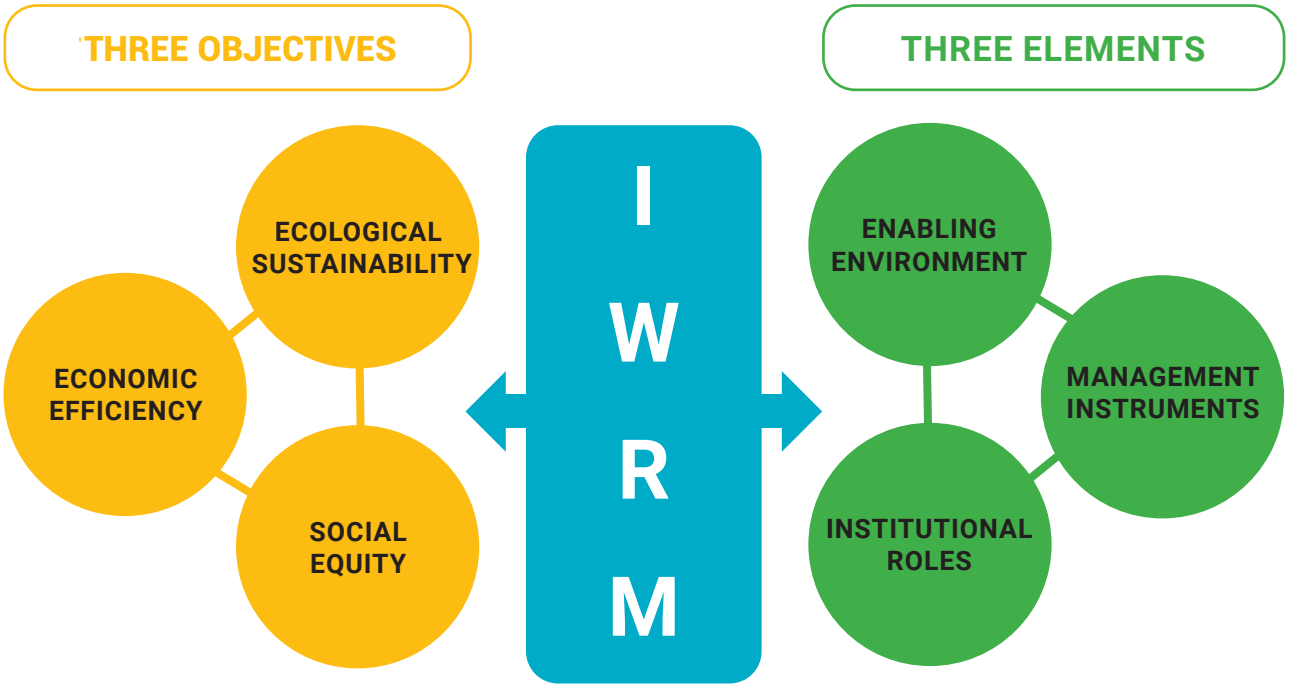


Figure 1. Three objectives and three elements of IWRM (Source: ESCWA (2005))

IWRM is not a scientific theory to be proved or disproved by scholars, but is a set of practices and suggestions that makes up important management aspects. Due to the flexibility in the IWRM approach to water management, it can be adapted to diverse local and national contexts. It requires judgments about which set of suggestions, reform measures, management tools and institutional arrangements are most appropriate in a cultural, social, political, economic or environmental context (Hassing et al., 2009). IWRM concepts give the water community a common language that is applicable over a wide range of levels, from local through to national and regional. This allows knowledge and lessons learned to be exchanged across borders, across regions and at a local level. It also makes it possible for decision makers and managers to agree on and monitor policies and targets for the improvement of water resources management.

GOOD PRACTICES IN INTEGRATED WATER RESOURCES MANAGEMENT

In the broadest sense, good practices are a set of guidelines, ethics or ideas that represent the most efficient or prudent course of action to achieve some goals. In the IWRM context, good practices are a set of activities, practices and tools designed to minimize negative effects upon the environment and water resources, promote efficient use of resources, improve safety for consumers and foster economic viability. The definition of what is good varies according to context and sector (IFSA, 2005).

Thus, good IWRM practices are recommended methods, structures and practices designed to prevent or reduce water pollution, reduce resource wastage, promote efficient resource use, combat environment deterioration, and enhance sustainability and social equity, while maintaining economic efficiency and well-being (Botkosal, 2011).

DIAGNOSTIC PROCEDURE FOR IDENTIFYING GOOD PRACTICES

The IWRM diagnostics procedure used in this study is adapted from the procedure of the Food and Agriculture Organization of the United Nations[1], which includes the following.

Environmentally, economically and socially sustainable: a "good practice" meets current needs, in particular the essential needs of the world's poorest, without compromising the ability to address future needs. In a situation of competition for scarce water resources, not recognizing the value of water can lead to water being allocated to low-value uses and does not provide incentives to treat water as a limited resource. That is, water users should pay for water services for domestic drinking water, agricultural water use and all other uses as seen in the case studies of Khewei and Hawata (see Annex 1).

Gender-sensitive: a description of the practice showing how actors (men and women) involved in the process were able to improve their livelihoods. Good practices should consider women's participation and empowerment.

Technically feasible: the ability to learn and implement good practices with good scientific backing. Good IWRM practices will base management decisions on scientific findings.

Inherently participatory: addresses inclusiveness and gender dimensions, bridging the gap in decision-making between decision makers and water users/community members, through efforts to raise community awareness in schools, youth, etc., and capacity development for water management. Participatory approaches are essential as they support a joint sense of ownership of decisions and actions. The lowest appropriate management level needs to be as close to the action as possible. Good IWRM practices consider management at the community level through community organizations.

Scale: the scale at which the management happens defines the boundary conditions, which could range from a whole river basin/catchment or micro-catchment at village or locality levels. Good IWRM practices consider hydrological boundaries as the scale for management interventions.

Vertical and horizontal coordination: assumes effective communication among water users and related ministries and public agencies, etc., including upstream–downstream issues, domestic resources within the same State versus trans-State or transboundary management and federal- versus State-level dynamics.

Integration: an important constituent of the concept of IWRM and includes integration in all contexts (managerial, administrative, technological, behavioural and, above all, political). Therefore, in this study, integration among two or more sectors, integration of the resources and also in using the same water source (multipurpose dams), along with allocation and a licensing system, are considered good practices.

Replicable and adaptable: a good practice should have the potential for replication and should therefore be adaptable to similar objectives in varying situations.

Reducing disaster/crisis risks: a good practice contributes to disaster/crisis risk reduction/ adaptation for resilience.

In this report, projects are diagnosed against these nine diagnostic elements. Projects that satisfy six or more elements are considered good practices and are documented below.

1. http://www.fao.org/capacity-development/en/.

DOCUMENTING GOOD PRACTICES

Documenting a case study entails explaining the process pathway. A case study lays out the facts in a sequential manner and illustrates the pathway towards the keys to success. It includes several important aspects of the project reflecting the pathway to success and presents the following project aspects.

Background: a brief background and facts about the case study and information on the project.

Keys to success: the thought or implemented processes behind the keys to success to ensure relevance to users.

Title: the type of problem to solve, for example, legislation and regulation of activities.

Situation: a description of the situation.

Problems: a statement of the problems encountered.

How the problems were overcome: the measures taken to overcome the problems.

Wisdom of the keys to success: the wisdom behind the measures taken in a generalized term.

Conditions and limitations in applying the keys to success: the conditions, limitations and tools to enhance application of the keys to success.

Ideas for enhancing applicability of the key for success: ideas to further improve or upscale the keys to success.

Results: some of the successful results.

SELECTED CASE STUDIES

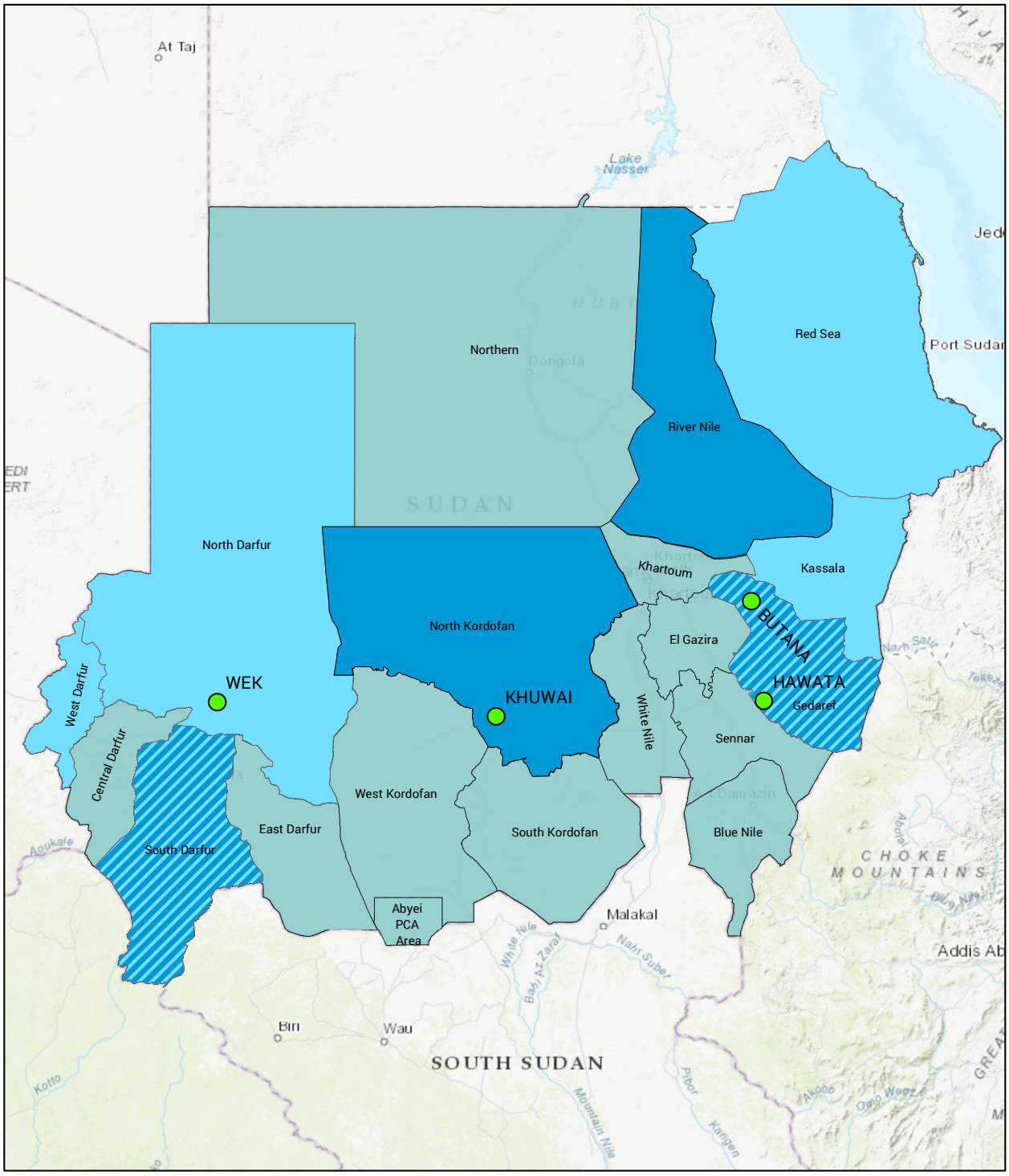
More than 30 case studies were collected and diagnosed, with about half being documented. In this report, six case studies from different parts of Sudan are selected for presentation. They cover wide geographical locations; various ecological zones and a range of water uses. They are not listed in any order. Locations of the selected case studies are shown in Figure 2. Brief descriptions of the projects are given below, with full details provided in Annex 1.

1. Wadi El Ku Catchment Management Project. This project used a wadi sub-catchment in a non-hydrological boundary as the spatial scale for IWRM implementation in North Darfur. It aimed to strengthen livelihoods by increasing agricultural production and related value-chain activity through effective use and management of the local natural resource base. It linked hydrological/water assessment, water management, agricultural development/food security and conflict reduction. The project benefited from the political will and engagement of high-level politicians and coordination among different authorities at federal and State levels.

The project's approach was focused on: assessment and monitoring of water resources, water demands analysis, integration of groundwater and surface water for conjunctive use, innovated interventions for soil conservation, involvement of stakeholders, raising community awareness, capacity-building at all levels and empowering women in a transparent participation environment.

The project interventions and approaches resulted in strengthened community-based decisions, reduced conflicts based on natural resources, especially between farmers and pastoralists, established a functional catchment management council.

This project was diagnosed as an IWRM good practice because it linked water science, water planning and natural resources development in the same sub-catchment.



The boundaries and names shown and the designations used in this map do not imply official endorsement or acceptance by the United Nations.

0 250 500 1,000 km

Legend

- Project Locations
- NAPA Project States
- Rural Water for Sudan Project States

Projects

- Wadi El Ku Catchment Management Project (WEK).
- Khewei Water Supply Project (KHUWAI).
- Hawata Wad-Elageili Water Supply Improvement Project (HAWATA).
- Butana Integrated Rural Development Project (BUTANA).

Sources: UNEP Sudan, Esri ArcGIS Online Base Map.

Figure 2. Locations of the selected case studies

2. National Adaptation Programme for Action: Climate Change Adaptation Project. This project aimed to build the community adaptive capacity to vulnerability due to climate change in four pilot areas. The areas covered different geographic and climatic zones. The project based its interventions on stakeholder participation, awareness-raising, training through demonstration farms, empowerment of women, coordination, establishment of revolving funds and increase of crop productivity through field water harvesting (construction of terraces) to increase soil moisture. The project received international, national and State support, which also contributed to its success.

The project produced excellent results in the pilot areas, exemplified by increased productivity of crops by threefolds (from 400 to 1200 kg/hectare), and forage by 50 per cent compared with the traditional rain-fed agricultural method. This project demonstrated a good IWRM practice, though its scale was a concern as the unit used is not a catchment unit.

3. Butana Integrated Rural Development Project. This International Fund for Agricultural Development project in Gedaref State aimed to improve, in a sustainable manner, the livelihoods and resilience to drought of poor rural households. The project helped to establish a coherent and cost-effective governance framework that ensured regulated access to land and water resources. It also developed the capacity of community-based organizations (CBOs) to engage in environmentally sound, social and gender-equitable development initiatives in the Butana area.

The project resulted in improved access to domestic water supplies, which is considered as a lever for communities (especially women) to actively participate in development activities. It also increased the involvement of communities in successfully combating botulism, which is a common livestock disease in the area. Organization and empowerment of communities, supported by local policy acts and orders, are proven to be effective. The project significantly contributed to protecting the community reserved rangelands and assuring a high level of follow-up and good productivity. There were also partnership among water committees (WCs), the Rural Water Corporation (RWC), localities and the project, thus allowing better participation leading to a higher probability of sustainability of services and innovative interventions in soil and water conservation.

Generally, there was improved crop productivity, range-carrying capacity, biodiversity and water availability.

The project demonstrated IWRM good practices, especially in the empowerment of women, through the use of pilot areas for further up-scaling.

4.Khewei Water Supply: West Kordofan State. Khewei (West Kordofan) water supply is an example of a community-owned and -managed water yard (deep-borehole) system whereby all of the water users were shareholders. As shareholders, water users had an interest in providing close enough oversight of the finances and management of the borehole to ensure effective management, but a light enough touch to ensure efficiency in their oversight. The system worked and cost recovery was adequate to cover pre-emptive purchase of spares and a management team that had the capacity for the technical and clerical demands of the job. The use of tankers to supply bladders for livestock feeding also had benefits for management of rangeland resources.

Stakeholder involvement and the right to oversee the process enhanced the ownership feeling, while the service cost recovery enhanced system sustainability and expansion.

The project presented an IWRM good practice as it provided a safe water supply, reduced overgrazing and maintained natural resource management (NRM). The cost recovery fee brought about sustainability of the systems and reflected the economic value of water.

5. Hawata Wad-Elageili Water Supply Improvement Project. This was a pilot project supplying clean and potable water for more than 60 villages and towns in four main localities (Rahad, Qala en nahl, Mafaza in Gedaref State and Dinder in Sinnar State).

The project had a Board of Directors comprising 13 representatives of water user associations and five technical representatives. Stakeholder participation in administration was practised through the Board of Directors. The project was operated on a self-autonomy basis. System maintenance was undertaken pre-emptively.

The administration of the project was shared by the Executive Administration of Hawata Water Works and the Beneficiaries Board of Trustee (Board of Directors). This mixed administration operated according to the policy of self-autonomy based on revenue collection from selling water through a water tariff. Revenue collection and all the components (mechanical/electrical or vehicles) had to be utilized for the project only. The application of these agreed protocols gave a very high level of confidence in the project to its beneficiaries and the governmental authorities as one of the leading projects in Sudan.

The pre-emptive nature of the system maintenance and the independence of the project were critical success factors. Two of the striking features of the project were the highly qualified technical staff employed and the high degree of moral and motivation of the team.

The project was an IWRM good practice as it provided a sustainable safe water supply, contributed to rural development achievement, improved the life quality for local resettlement communities, improved the ecological situation in the project area and improved the income for local communities.

6. Rural Water for Sudan Project. The Rural Water for Sudan programme was designed to bring sustainable access to water for all users, improved hygiene and better sanitation practices to 600,000 people living in the Gedaref, Kassala, Red Sea, North Darfur, South Darfur and West Darfur States in Sudan. A consortium of organizations led by ZOA collaborated in implementing the project through an IWRM approach.

The work was done through establishment of catchment-level water resources management committees that represented key stakeholders and facilitated the development of catchment-level water resources management plans through a participatory planning process and through provision of expert input to analyse the feasibility of different options. The project also provided secure access to safe water for domestic use, crops and livestock through renovation and construction of water points and infrastructure for enhancing groundwater recharge, as flowing from the catchment-level water resources management plans, and promotion of improvements in hygiene and sanitation practices. Successful and good IWRM case studies resulting from the Rural Water for Sudan have been documented by Bromwich (2018). Among the key successful approaches is the use of catchment studies to inform planning of water infrastructure development, pre-engagement of the community before intervention in order to promote ownership and reduce conflicts, sensitisation to promote equitable access to the water resource and gender mainstreaming aimed at promoting the participation of women and girls in communities that are traditionally strict on women public participation at community level decision making.

The table below shows a matrix of diagnosed case studies based on the diagnostic procedures outlined above.

MATRIX OF DIAGNOSTIC IWRM GOOD PRACTICES IN THE SELECTED CASE STUDIES

No.	Project name	Environmental, economic and socially sustainable	Gender sensitive	Technically feasible	Participatory	Scalable	Coordinated	Integrated	Replicable and adaptable	Reduces risks
1	Wadi El Ku Catchment Management Project	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	National Adaptation Programme for Action: Climate Change Adaptation Project	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Butana Integrated Rural Development Project	✓	✓	✓	✓	✓	✓	✓	✓	✗
4	Khewei Water Supply Improvement Project	✓	✓	✓	✓	✓	✓	✓	✓	✗
5	Hawata Wad-Elageili Water Supply Project	✓	✓	✓	✓	✓	✓	✓	✓	✗
6	Rural Water for Sudan	✓	✓	✓	✓	✓	✓	✓	✓	✓

LESSONS LEARNED

The lessons learned from the case studies can be summarized as follows:

1. Building ownership of projects by communities is key to IWRM implementation and sustainability of projects.
2. Strengthening community-based decision-making enhances IWRM implementation processes.
3. Prior awareness-raising and capacity-building at all possible levels is crucial for successful IWRM.
4. Community organizations play great roles in IWRM implementation.
5. Adequate horizontal and vertical coordination among water-related sectors and at various IWRM stages is essential for developing an integrated and holistic approach for sustainable water resources management.
6. Strong management instruments enable monitoring, assessment and development of water resources as well as providing water allocation data and information and conflict-resolution mechanisms.
7. Human capacity-building is essential for a paradigm shift in IWRM practices.
8. Data, information and knowledge-sharing are essential for understanding and managing water resources in a holistic and efficient way.
9. Solicitation of political will is crucial.

RECOMMENDATIONS FOR SCALING UP INTEGRATED WATER RESOURCES MANAGEMENT

To scale up IWRM good practices in Sudan, it is recommended to:

1. Document and disseminate good IWRM practices case studies.
2. Create outreach of success stories and key issues that bring about success.
3. Encapsulate successes into a clear and understandable language, as well as in Arabic, and disseminate them in a sectoral manner indicating key issues for upscaling.
4. This document includes good practices only, so it is also recommended to document malpractices to be avoided.

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ACKNOWLEDGEMENTS

The United Nations Environment Programme (UNEP) is grateful for the generous support of the United Kingdom's Department for International Development (UKaid). UNEP also wishes to thank and acknowledge the contributions of:

Atila Uras, Sudan Country Programme Manager, UNEP

Amin Gasim, Information Management Officer, UNEP

Dr. Eiman Karar, Integrated Water Resources Management Expert, UNEP

Dr. Hamid Omer, Senior Integrated Water Resources Management Expert, UNEP

Jumana Eltigani, Programme Assistant, UNEP

Maxime Paquin, Media and Communications Specialist, UNEP

Rajashekara Sorekaidoddi, Programme Management Officer, UNEP

Rob Elsworth, Environmental Governance Advisor, UNEP

Robbert Bekker, Senior Programme Advisor, UNEP

Sara Eltigani, Communications Specialist, UNEP

Tayallah Elmedani, Integrated Water Resources Management Expert, UNEP

Xinyue Gu, Communications Assistant, UNEP

ANNEX 1. FURTHER DETAILS OF THE SELECTED CASE STUDIES

1.WADI EL KU CATCHMENT MANAGEMENT PROJECT

Background

In Darfur's arid climate, the seasonal water courses originating from the Jebel Mara highlands represent a vital resource for the region's rapidly growing population. One of the largest is Wadi El Ku, which runs south-east through North Darfur, before moving south into East Darfur, where it terminates in an outflow delta.

Over the past half-century, Darfur has experienced rapid population growth and periodic drought, which exert pressure on its already fragile natural environment. Since 2003, conflict has held back economic development and caused significant displacement of rural populations, which have concentrated in urban centres and in large camps, often on the edges of towns and cities. These concentrations of population, along with continued insecurity in many areas, have had generally unfavourable consequences for local ecosystems. The result has included accelerated deforestation, overuse of groundwater resources, over-cultivation of available arable land and overgrazing of available rangeland. The situation is neither environmentally sustainable nor supportive of post-conflict economic recovery and peaceful coexistence.

Such conditions are seen in and around Wadi El Ku, in the environs of El Fasher, North Darfur's State capital. In the 50 km reach of this wadi, the livelihoods of around 87,000 residents of farming, agropastoral and agro-pastoralist communities, 430,000 residents of El Fasher town and 220,000 internally displaced persons (IDPs) living in nearby camps all depend on the effective management of natural resources.

Keys to success

1. Stakeholder participation.
2. Community involvement.
3. Institutional reform.
4. Integration.
5. Capacity-building.
6. Coordination.
7. Political will.

Title

Livelihoods, development and sustainable peace

Situation

The project is located in a marginal agroecological zone. Its proximity to El Fasher, a regional trading hub and home to large populations of IDPs, has increased demands on land and water, beyond the carrying capacity of the environment and the planning capacity of the government. Combined with the ongoing conflict, this has resulted in degradation of the environment, including deforestation, erosion, soil fertility depletion and uncoordinated water management. This has negatively affected the livelihoods of the population and created a maladapting relationship between environmental and economic recovery and peaceful coexistence of stakeholders.

Problems

1. Uncoordinated water(shed) management leads to tension between upstream and downstream populations, inefficient water use and erosion.

2. Poor soil fertility management leads to low land productivity.
3. Complete degradation of Qoz soils causes farmers to exploit increasingly larger plots of land to meet food needs.
4. Continuous tillage of the light topsoil leads to wind and water erosion that renders the soil unproductive while threatening wadis.
5. Removal of trees and shrubs leads to shortages of wood while further exposing the fragile soils to rain and wind erosion.
6. Increasing pressure on limited natural resources caused by the rising population.
7. Shifts towards more individualized short-cycle cash crops that compete for water.
8. Conflicts over resources.
9. Lack of coordination and cooperation.
10. Lack of capable institutions.
11. Conflicting institutional roles.

How the problems were overcome

There were sustainable increases in agricultural and related value-chain production in and around the critical section of the wadi, through the rehabilitation and improved management of its land, forest and water resources. This was done through IWRM and ecosystems-based adaptation to NRM and addressing governance challenges of Wadi El Ku.

Actions were taken that opened and improved livelihood options and practices for farmers, agro-pastoralists and pastoralists living in or migrating through Wadi El Ku near El Fasher. These motivated communities to manage better their soil, water and forest resources, both on farms and communally, and to address a growing soil erosion problem in the area.

The activities were used to strengthen community-based decision-making and problem solving around NRM issues, and to promote community participation in an improved system of integrated catchment management and governance.

The State government was enabled to better support, scale up and replicate integrated and inclusive catchment management, at technical and policy levels.

Capacity-building was targeted at those institutions in North Darfur responsible for NRM and governance.

Wisdom of the keys to success

1. Ensure effective coordination and cooperation of interests among stakeholders and ensure their participation.
2. Raise community awareness and consensus.
3. Build capacity.

Conditions and limitations in applying the keys to success

1. Water should be managed scientifically based on data sets, including meteorological, hydrological and socioeconomic data.
2. Data should be the basis for a participatory approach and cooperation to prevent conflicts of water at all levels.
3. Weak community-based water institutions to resolve water related disputes in years of low rainfall and run off.

Ideas for enhancing applicability of the keys to success

1. Build awareness and consensus.
2. Strengthen community-based decision-making.
3. Develop sound problem-solving procedures around NRM issues.
4. Obtain political will in advance.
5. Effective stakeholder participation.

Results

The project was an IWRM and an NRM project, given the clear link between water science and water planning in a specific wadi sub-catchment on the one hand, and natural resources development in the same sub-catchment, on the other hand. This is different to the Eastern Nile Watershed Management Project, where water science was mostly linked to Lake Nasser, and NRM was supported in two sub-catchments on the Ethiopian border. In the case of the Wadi El Ku project, NRM mostly concerned agricultural development, along with modest forestry and range components.

The result was 7,200 feddans of flood irrigation near El Fasher (a net positive impact) for 2016. The estimated socioeconomic benefits and cost–benefit ratios were very high. Sustainability of water-spreading dams was good due to the effectiveness of local dam committees. In 2017, maintenance costs were estimated at 30 Sudanese pounds (SDG)/feddan/year, which was only one to two per cent of the added land lease value (the difference between the land value before and after the project).

Socioeconomic re-distribution was also good. Previously before the project, mostly wealthy farmers and town-based investors used water through pumped agriculture. After the project, poorer farmers directly benefited and thousands of IDPs benefited through farm labour, sharecropping and free access to fodder (where there was none before). Finally, markets supplies were so high that prices were much lower than recorded previously. This benefited many urban-based consumers in El Fasher and the camps, whereas the very high productivity still left farmers well off. For the first time, traders were able to purchase cucumber and other horticultural products in El Fasher for sale in Khartoum.

The institutional dimension of the project was probably key to its success. Locally, it invested in strong community and producer organizations. For instance, dam management committees were established and well trained so that sustainability was likely. The local committees informally monitored and analysed wadi surface water hydrology and land use, organized local stakeholders, collected funds from beneficiary land users and allocated those funds. They also had a large catchment perspective: for example, a financial contribution was made by the local Goz Beina dam committee for the benefit of downstream stakeholders (who face water access constraints). Village action plans and their implementation were supported beyond the water-spreading areas.

At the State level, the project supported NRM/agricultural extension through the non-governmental organization (NGO) Practical Action so that capacity-building in communities was instant. This avoided a pitfall of the Eastern Nile project of working only through government extension. However, it also started building the capacity of government extension agencies, so that they became more effective over the next few years. Some 315 government staff participated in training, workshops and local and international study tours. Nine extension packages were developed through close interaction of communities, Agricultural Research Corporation (ARC), and government and NGO extension staff. Farmer field schools were an effective tool, along with the provision of community extension workers. Practical Action and government extension agencies coordinated their extension work so that there was increased likelihood of sustainability

after the project. The achievement was that government extension contacts reported by farmers increased from 0.5 per cent (baseline) to an average of 20 per cent (in 2016).

Water resources management institutions are essential in IWRM. A catchment management forum was established and made operational for Wadi El Ku with participation of representatives from government, community, civil society and academia, including women. The forum was well equipped and trained, and it is poised to achieve its objectives. Most members were town-based, and effective participation of rural members was constrained by travel costs. The forum developed a common vision on water and natural resources for Wadi El Ku. Endorsement of the forum by government requires a formal, statutory dimension that has not yet been achieved. In addition to this multi-stakeholder forum, there are many active local water institutions in the wadi. Together, they are a potentially powerful combination for the second phase of the project.

A ministerial decree was issued by the State Ministry of Agriculture banning the establishment of unregistered dams and terraces in the State, upon recommendation of the forum. The State Ministry of Agriculture (SMOA) Decree has not yet been endorsed by the State Assembly. The outcome needs to be monitored, but it is a sign of effectiveness of the forum that lobbied for the measure.

The science part of IWRM has been supported in several ways. Hydrological monitoring tools and training have been provided to the Groundwater and Wadis Directorate in El Fasher so that data collection is being improved. Water resources monitoring and rigorous water balance development are scientifically complex. One constraint is that hydrological equipment installed in the wadi may be vandalized. This problem can be overcome; or at least minimized by involving and training the local people and local institutions in monitoring and protection of the equipment.

The project supported development of a hydrological model, including future water supply and demand scenarios, for the wadi. Training and workshops were conducted to strengthen the capacity of water specialists and also many others. However, much remains to be done to achieve rigorous science as the basis for water distribution and management in the wadi. Stronger teamwork among water experts/hydrologists and experts from the other sectors remains a challenge. It is as yet unclear exactly how expanded flood irrigation near El Fasher will influence water availability downstream. Nevertheless, a good start has been made.

The effects of the project also concern conflict mitigation including improved relations, which is an important issue in the case of North Darfur. Improved relationships have been noted among the following groups as a result of the project:

1. IDPs and local communities. These relationships were poor at the start of the project, but the new economic opportunities created by expanded flood irrigation have improved economic and social relations.
2. State government representatives/agents, and local community leaders and members. The forum is a good example.
3. Pastoralists and farmers. These relationships were poor in Darfur for widely documented reasons. The project has contributed through a conflict mitigation conference and livestock corridor demarcation. The assistance provided to pastoral CBOs, para-veterinary services and camel production has improved goodwill. More will be required, but water spreading has benefited settled populations.
4. State government agencies. These relationships have improved through numerous joint actions (workshops, study tours, extension packages, forums, etc.). During training courses, for instance, care was taken to train different agents staff together (such as agricultural extension, Forest National Corporation (FNC), range department, water) so that inter-sector communication and team building was improved.

Water harvesting infrastructure for livelihoods and the environment © Practical Action

2. NATIONAL ADAPTATION PROGRAMME FOR ACTION: CLIMATE CHANGE ADAPTATION PROJECT – SUDAN

Background

The National Adaptation Programme of Action (NAPA) is an initiative agreed under the United Nations Framework Convention on Climate Change (UNFCCC) at its Conference of Parties in 2001. It aims to build adaptive capacity in the most vulnerable countries – least developed countries (LDCs). The main objective of NAPAs is "to serve as a direct channel whereby the LDCs may communicate their urgent and immediate adaptation needs". The NAPA document should also identify links to more long-term strategy frameworks, such as Multilateral Environmental Agreements, Poverty Reduction Strategy Papers and others. An LDC Expert Group, developed under UNFCCC, provides guidance and advice on preparation of NAPAs.

The NAPA process in Sudan represents the collective efforts of government agencies, rural households, CBOs and NGOs. It has been strongly endorsed by the Council of Ministers, and a Council of Ministers Decree signed by the President of the State was issued on 25 March 2007 in support of its conclusions. The most important conclusion reached was the need to see NAPA preparation as a process and not as an end product.

NAPA Sudan projects related to water resources are on the following topics:

1. Improving sustainable agricultural practices under increasing heat stress.
2. Enhancing the resilience of water-stressed agricultural systems through agroforestry.
3. Reducing the vulnerability of rangelands in Butana to climate variability.
4. Developing Gardoud lands to ensure food security and improve coping capacity.
5. Producing fodder for livelihood improvement and avoidance of conflict over resources.
6. Developing Geraih Alserha for adaptation to climate-induced changes and poverty reduction.
7. Enhancing resilience to rainfall variability through rangeland rehabilitation and water harvesting.
8. Developing the Sudd lake to reduce the vulnerability of food security caused by recent frequent flooding.
9. Reducing the vulnerability to drinking water shortages due to climate change through construction of a stony and earthy sudd around Gedaref town.
10. Rehabilitating hafirs for increasing the coping capacity to drought and reduction of human and animal vulnerability to drinking water shortage and pollution.

NAPA Sudan conducted two follow-up projects. The first was on implementing NAPA priority interventions to build resilience in the agriculture and water sectors to the adverse impacts of climate change in Sudan. It was funded by the Least Developed Countries Fund with the main objective of implementing an urgent set of adaptation-focused measures that would minimize and reverse the food insecurity of small-scale farmers and pastoralists, thereby reducing the vulnerability of rural communities to climate change, including variability.

The second project was on implementing priority adaptation measures to build resilience of rain-fed farmer and pastoral communities of Sudan, especially female-headed households, to the adverse impacts of climate change. It was funded by the Canadian Department of Foreign Affairs, Trade and Development and the Canadian International Development Agency. The main objective was achieving food security and enhancing the coping capacity for 3,500 families of small-scale farmers and pastoralists with at least 50 per cent of female-headed households.

Keys to success

1. Community awareness-raising.
2. Stakeholder participation and involvement.
3. Pilot demonstrations.
4. Capacity-building and institutional strengthening.
5. Coordination and communication within and across horizontal and vertical scales.
6. Interventions and innovative technology.

Title

Improving livelihoods

Situation

The project selected four areas with different geographic and climatic zones to demonstrate climate change adaptation. The situation in the four selected areas was characterized by one or more of the following issues:

1. Water scarcity.
2. Low land productivity.
3. Degradation of land and water resources.

Problems

Due to the fragile environment and lack of local community capacity, the selected areas have experienced different kinds of suffering. As a result, agricultural land and rangeland deteriorated highly, and productivity declined sharply. The problems were exacerbated by climate variability and climate change.

How the problems were overcome

The project made efforts in raising community awareness, involving stakeholders, building capacity, setting up demonstration farms, encouraging institutional reforms, providing suitable interventions and solicitating high political involvement, together with coordination and communication among and within the different scales.

Wisdom of the keys to success

1. Build community orientation and capacity in the participatory approach.
2. Promote institutional reforms (establishment and registration of CBOs).
3. Raise awareness and consensus among stakeholders along with effective coordination and cooperation of their interests.
4. Use demonstration farms, piloting activities and alternative energy sources.
5. Provide suitable interventions.
6. Develop political involvement, coordination and communication within and among the different scales.
7. Conditions and limitations in applying the keys to success.
8. Participation is crucial for success, but it should be managed carefully.
9. Interventions that brought about success could be adapted to other places but not directly copied.
10. Sustainability of revolving funds is a real challenge.

Ideas for enhancing applicability of the keys to success

1. Build awareness and consensus.
2. Create good CBOs.
3. Improve participation as an effective way to improve water management because it includes cooperation, negotiations and transparency.
4. Provide basic services and infrastructure, including marketing facilities, to boost coping capacities.
5. Coordinate different project partners.
6. Promote proper community project management to ensure sustainability.

Results

Gedaref State: The project established and rehabilitated women's collective farms at each village (120 women) using solar pumping of groundwater, supported home gardens (27 households), planted 156 fruit tree seedlings and introduced organic agriculture and apiculture (five units) using drip irrigation systems.

North Kordofan: For water supply, the project drilled four wells and rehabilitated another four wells with an average yield of 12000 litres/hr/well (benefiting seven villages), and five wells were equipped with solar pumps. The availability of water contributed to establishment of seven vegetable farms (one in each village) and introduction of new housing techniques.

For animal production, the project improved goat milk production from 0.17 l/day to 1.7 l/day, improved sheep fattening with a weight gain of 11 kg in 45 days, increased twin incidence from 1.5 per cent to 21 per cent, established one poultry farm (150 hens) to benefit 56 female-headed households, increased goat restocking (290 animals to 145 families) and provided a veterinary drug revolving fund and four feed centres.

For horticulture, the project established seven irrigated women Jobrakas (one per village) with an average area of 4 feddans, planted 1,090 improved fruit tree seedlings, cultivated 2.7 t of vegetable seeds, introduced integrated pest management techniques and constructed three composting basins.

For natural resources and alternative energy, the project distributed 440 butane gas cylinders (revolving fund), established five community nurseries (approximately 23,000 seedlings produced) and conducted sand dune stabilization of 90 feddans (51,965 seedlings used), in addition to village afforestation.

South Darfur: *For agriculture and water harvesting*, the project supported treatment and distribution of improved seeds (5,773 farmers), distribution of 300 improved animal-drawn ploughs on a revolving fund basis, preparation of 1,547 feddans (700 farmers) (including demonstration farms) using different water harvesting and tillage practices, cultivation of 14,210 feddans using traditional ploughing methods, and distribution of 130 kg of improved vegetable seeds (80 rain-fed and 50 irrigated) for the benefit of 824 farmers.

The impact of improved production packages was that in 2015 (rainfall of 257.8 mm), the combination of water harvesting, and chisel ploughing resulted in increasing the crop productivity by 8.5 times its original productivity and dry matter productivity (animal feed) by 10 times compared to that of natural rangelands. Fodder production was 1.4 t/feddan using water harvesting and chiselling, 0.4 t/feddan with chiselling only and 0.1 t/feddan with traditional methods.

In 2016 (rainfall of 419 mm), a combination of water harvesting, and chiselling resulted in crop production of 1,325 kg/feddan, chiselling only produced 841 kg/feddan and traditional ploughing produced 419 kg/feddan. For fodder in 2016, production was 1.5 t/feddan for chiselling and

water harvesting, 1 t/feddan for chiselling only and 0.17 t/feddan for traditional methods.

For forestry and range improvement renewable energy, the project conducted a Training of Trainers (TOT) in intensive special package (ISP) for 40 participants and trained 750 women in ISP. And as result of this training productivity of clitoris and cowpea increased by four and five times, respectively. Use of improved stoves reduced firewood consumption by 50 per cent. Production and distribution of 35,000 forest and fruit tree seedlings was supported for 1,165 beneficiaries, and the survival rate was 65 per cent.

For animal production, the project distribution of 21 improved breeding goat males (986 offsprings). This resulted in increasing goat milk production from 0.7 kg/day to 1.6 kg/day and body weight gain at the age of 6 months (9-17 kg). The difference in price at age of 6 months was 100 per cent (50-100 SDG). Improved breeding cockerels were also introduced.

River Nile: For agriculture and forestry, there was distribution of 28 irrigation units, establishment of 55 shelterbelts, and distribution of 729 butane gas units (revolving fund) and 15 gas ovens. This resulted in reduction of policed cases in the violation of the Forestry Act by 40 per cent in the project area.

A 5-feddan women's collective farm equipped with an irrigation unit was also established. A total of 34 demonstration farms led to tremendous improvement in the productivity: fava bean production increased from 405 kg to 990 kg and broad bean production from 660 kg to 1,265 kg.

For animal protection, 8,624 farm animals were treated and 1,811 were vaccinated, 30 wooden moulds for cheese production were distributed, 108 improved breeding goat males were introduced, and pesticide application pumps were distributed.

Rainfall harvesting for improved agriculture National Adaptation Programme for Action (NAPA), South Darfur © Sudan Higher Council for Environment and Natural Resources (HCENR)

3. BUTANA INTEGRATED RURAL DEVELOPMENT PROJECT

Background

Like most of Sudan, Butana area (East of Sudan) is characterized by erratic rainfalls, high temperatures and strong winds. Herds have traditionally grazed freely, and livestock production is the most important economic activity in the Butana region of Central Eastern Sudan. However, an increase in livestock population over recent years, the presence of nomadic pastoralists from Southern Sudan and fluctuating rainfall patterns have all contributed to severe deterioration of grazing resources. This has led to the collapse of the existing economic system, which has particularly affected sedentary farmers, who lost many animals. To support these farmers, the local government fenced a large area of land close to the town of As-Subagh in 2006, trying to protect it from harmful dust and erosion. This was to serve as a demonstration plot to build awareness on environmental degradation and the need for natural resource protection, conservation and restoration. The fence also protected the area against unwanted grazing, allowing space for the cultivation of crops. However, no additional activities were carried out, and eventually large portions of the fence were looted or dismantled, leaving the land unused.

The development goal of the project was to improve the livelihoods and resilience to drought of poor rural households in a sustainable manner. The specific objectives were to:

1. Establish a coherent and cost-effective governance framework that ensured regulated access to land and water resources of Butana.
2. Improve the access and bargaining position of women and men in the marketing of livestock.
3. Develop the capacity of CBOs to engage in environmentally sound, social and gender-equitable development initiatives.

The project components were:

1. Institutional support and project management.
2. Agricultural, range and water development.
3. Livestock and marketing development.
4. Community development.

The Butana Development Agency (BDA) carried out coordination and backstopping functions for five State Coordination Units (SCUs) and their development teams. Direct/indirect beneficiaries were 40,000 households with total project costs of 29.8 million United States dollars.

Keys to success

1. Capacity-building and institutional strengthening supported by local policy acts and orders.
2. Community involvement.
3. Innovative interventions in soil and water conservation for rangeland rehabilitation and development.
4. Organization and empowerment of communities.

Title

Integrated rural development

Situation

In the Butana area Domestic water supply is not easy, and women and children suffer a great deal in fetching and carrying water over long distances.

Drought recurrences are frequent; thus, improved crop varieties need to be promoted where a dual-purpose crop could reduce the risks in drought years. Feed rationing should be based on what is available and/or could be made available through strengthening range, pasture, forest and rain-fed crop development.

There is a need for a coherent cost-effective governance framework that ensures regulated access to land and water resources of Butana so that community and open grazing areas can be protected, improved and supplemented with dual-purpose dryland crops, irrigated fodder, leguminous crops, left-over crops and agriculture by-products.

Problems

1. Communities have no easy access to domestic water (it takes 2-4 hours to carry water from the source to the home).
2. Spread of botulism.
3. Lack of governance framework.
4. Severe degradation in land and grazing resources causing low productivity of agriculture and livestock.

How the problems were overcome

Involvement of communities has been a key factor in successfully combating the dreadful botulism. The solution was to start a process within communities to address the problem. This involved creating an understanding of the disease, namely the bacterium Clostridium botulinum, which flourishes in animals with deficiencies.

Organization and empowerment of the community, supported by local policy acts and orders, before the introduction of soil and water conservation interventions for rangeland rehabilitation and development are proven to be effective. They significantly contribute to protecting the community reserve rangelands and assuring a high level of follow-up.

Access to improved domestic water supply is a prerequisite for communities to actively participate in development activities, especially for women. In the interest of communities' access to potable water services, partnerships among WCs, RWC, localities and the project allowed increased participation, leading to a higher probability of sustainability of services.

The innovative interventions in soil and water conservation improved the productivity.

Wisdom of the keys to success

The close coordination between the institutions at the State, locality and community levels along with BDA.

The State line ministries' involvement in decision-making over planning and execution (SCUs) and coordination mechanisms at locality level, and CBOs showed a high degree of national ownership for the project.

Community awareness, gender sensitization and community organizations provided significant input to the governance of natural resources, exemplified in protecting and rehabilitating range and forest areas. Communities showed their potential as champions and drivers for upscaling. Women and men played active roles in the protection, rehabilitation and utilization of these range and forest areas. This resulted in improvement of the range capacity, as manifested in the restricted movement of sheep flocks.

Conditions and limitations in applying the keys to success

1. Difficulty in solicitation, involvement and coordination among the different relevant institutions.

2. Absence of proactive institutions coupled with policy acts and legal framework.
3. Ideas for enhancing applicability of the keys to success.
4. Build awareness and consensus.
5. Strength community-based decision-making.
6. Stakeholder participation at all stages.

Results

Areas for open-access ranges and community ranges were delimited. BDA was established and had a unique set-up, which is perceived as being powerful and important. The Board of Directors was active in guiding BDA.

Generally, there was improved crop productivity, range-carrying capacity, biodiversity and water availability.

Enhanced terrace cultivation: the project helped in enhancing irrigated fruit and vegetable gardens and annual coverage of fire lines. The benefits of demonstration farms, wadi cultivation and water harvesting for rangeland improvement were evident. About 51,348 feddans of rain-fed areas were treated with terrace cultivation, benefiting 6,427 households. Farmers have already adopted tree boundary planting, while some have developed fodder (clitoria, filpesera and guar) plantation in terraces. An approximate 540-900 kg/feddan increase in sorghum productivity was recorded compared to 180-270 kg/feddan under traditional cultivation. Considerable achievement was made in wadi cultivation and contour ploughing cultivation.

Rangeland improvement and conservation: About 3,726 feddans was treated with water harvesting and conservation techniques on the community and open-access rangeland area. Out of a total target area of 357,000 feddans and 670,000 feddans under community and open rangeland, respectively, about 238,000 feddans was covered with direct re-seeding and conservation. This activity included broadcasting of range grasses, trees seeds and seedling plantations. In addition, the success accomplished in the economic benefits of the rangeland caused some individual agro-pastoralists to adopt and devote part of their farmland for this purpose.

Irrigated fruits and vegetables gardens: Achievement included establishment of irrigated gardens covering 535 feddans. This resulted in water, fuel and labour savings increasing by more than 50 per cent, as well as crop yield increments. Based on repayments for shallow dug wells and pumping units, three new small-scale farms benefiting 24 households were established, commanding 30 feddans as investment.

Gardens irrigated by women: The project has succeeded in providing women with support to establish irrigated gardens covering about 100 feddans. The result was an increased number of women able to meet the cost of operation and maintenance (O&M) of farms and satisfying the vegetables needs of their group members. This intervention spilled over to neighbouring communities in Gezira and Gedaref States.

Water supply: The project succeeded in providing drinking water supply through rehabilitation and construction of hafirs and water yards, hand pumps and dams to 10,820 households living in 48 communities, in addition to a large number of livestock. Water management committees were trained on improved O&M of water points. The result in the River Nile State was that the community of Alabar village succeeded in constructing an additional new water tank through fees collected from water sale. Another example of better O&M of water points was that of communities in Kasala, who developed and prepared a pre-paid coupon system, while one community in Gezira collected money that enabled better control of water abstraction and maintenance of the hafir. The water management committee managed to establish a working relationship with RWC in shouldering O&M responsibilities under certain charges/fees in the

River Nile State. Women could visit the market, involve themselves in interest group activities, establish vegetable gardens and/or grow seedlings, etc., due to the time and money saved as a result of the established/rehabilitated nearby water supply facility.

Sand dunes fixation: An area of about 22.8 feddans in the villages of Timaid Haj Altahir and Algihaid was fenced using metallic posts and rabbit mesh to keep off animals. In addition, the most degraded area was planted with different tree species and perennial plants (Panicum turgidum) to stabilize the dunes and protect the area against windblown sand. For expansion of vegetation cover, the community thought this enclosure could be moved to another area, while its protection could be carried out by the benefiting communities. This resulted in an increase of plant density, and the community cut the Panicum plants as animal feed, enhancing natural re-growth.

Community-irrigated shelterbelt and woodlot: 19 feddans was planted as windbreaks and to provide fuelwood to reduce tree cutting in Timaid Haj Altahir.

Nursery and community forests: Forest activity implemented by the project included establishment of 125 households, 7 community and 2 central nurseries, producing a total of 127,313 seedlings. Seedlings produced supported establishment of nine reserved forests covering 25,757 feddans, while others were planted in home gardens and public places (schools) and some were sold. The project has managed to mobilize and orient the community to devote voluntary forest guards, where 69 guards have been trained in all issues related to forest protection, thus enforcing local order and management. Trainees in nursery production techniques have trained others, who, in turn, have managed to establish their own home nurseries (six nurseries without project support were set up as income-generating activities).

Improved accessibility to markets and market services: This has been demonstrated in dairy processing, producer marketing groups, wadi crossings, animal production, cross-breeding the Nubian Desert goat, state vaccination campaigns and containment of botulism (Abu Regaiba).

Introducing, training, coaching and monitoring community animal health workers (CAHWs) – one woman and one man per community – has been successful. CAHWs have substantially contributed to improving animal health status, assisted by reporting of notifiable and transboundary animal diseases, to the outreach of vaccination schemes and to general awareness creation. Overall, communities reported an "improved health status" of their animals. However, poultry received only minor attention, but some female CAHWs have dewormed their poultry stock.

Community development through functional and representative CBO establishment: The project worked in the 141 communities. The main outputs were that the communities listed their priorities, 141 Community Development Committees (CDCs) were formed, 141 community development plans were prepared, 774 interest groups were formed, and 141 village profiles and community action plans were prepared. Community capabilities have increased significantly compared to the benchmark indices obtained in the year 2005, indicating that the project efforts yielded adequate improvement regarding community capabilities.

Community organization and strengthening: Legitimate, functional and representative formation of CBOs took place.

Gender sensitization: Empowerment of women (e.g. establishing their own businesses and saving and credit (registered) groups) happened and women also participated in lead positions on CBOs. Training on gender sensitization was incorporated into all training programmes during formal training sessions for community members or staff; 27 of the development team members received Training of Trainers (ToT) training sessions in gender issues, and these were made an integral part of extension sessions during fieldwork. Women have an equal chance to participate in the different activities according to their interests, while the project secured

special opportunities for women to participate in different formal training programmes (either managerial or technical training, for example, as CAHWs).

Skills training for groups and individuals took place. Community initiative funds were also developed.

Training of locality and State staff on community development and gender was also conducted. Development teams were trained in participatory approaches (27 males, 13 females), gender (15 males, 12 females and 5 on locality teams) and facilitation skills (16 males, 10 females and 7 on locality teams).

Ecological zonation of the Butana region was conducted. A first assessment was formed of the current state of the various natural resources and animal production conditions per agroecological zone of the Butana region and how these changed over time. This also provided practical information on the re-introduction of grass and shrub species that had disappeared, elaborated on the complexities of calculating the desirable pasture carrying capacities and included zonation maps with high resolutions. Together with the land-use maps developed through federal-level initiatives, these maps and related natural resources, animal production information (livestock and animal disease surveys, for instance) and observations provided a sound input for the process of formulating a coherent framework for governance of Butana's natural resources.

Water harvesting (hafir) for livestock in the Butana area © International Fund For Agricultural Development (IFAD)

4. KHEWEI WATER SUPPLY PROJECT

Background

Khewei water supply project lies in the northern parts of west Kordofan state, neighbouring north Kordofan State. It is located between desert climate to the north and more humid climate to the south, which affect its soils and agriculture. Rainfall is characterized by high variability and recurrent droughts; the water balance is in deficit except for in August only. The erratic rainfall, which falls in storms, is lost as high-volume run-off.

A fundamental constraint limiting agricultural and livestock production for traditional producers in the Kordofan region of Western Sudan is an insufficient and, at times, inappropriate, use of the resource base.

At first glance, the Khewei water supply scheme looks standard for rural Sudan. There is a borehole with an elevated tank that feeds tankers to take water to more remote locations. However, the shed behind the borehole holds a new generator and switchgear ready to be used in the event of breakdown. The explanation for this impressive spare parts management lies in the management arrangements for oversight of the project.

Institutionally, Khewei water supply is a private company in which all the water users are shareholders. As shareholders, water users have an interest in providing close enough oversight of the finances and management of the borehole to ensure effective management, but a light enough touch to ensure efficiency in their oversight. The system works. Cost recovery is adequate to cover pre-emptive purchase of spares and a management team that has capacity for the technical and clerical demands of the job.

There have been no reported difficulties relating to resource efficiency. The use of tankers to supply bladders for livestock feeding also has benefits for management of the rangeland resources. If permanent watering points are used, then natural resources around the water point often become depleted. However, by using bladders, then the location of watering livestock can be varied and the pressure on any given part of the rangeland reduced. Given the importance of livestock to the local economy, the maintenance of the natural resource base is an important foundation for a sustainable economy. The water is also transported by tankers to remote areas that suffer from water scarcity, where it is used for domestic purposes.

Keys to success

1. Stakeholder participation.
2. Stakeholder ownership.
3. Service cost payments.

Title

Institutional and technical interventions

Situation

The project area lies in the dry part of West Kordofan. The area has many nomadic pastoralists and makes an important contribution to Sudan's national economy as a recently developed centre of livestock export. Khewei lies in West Kordofan, which is famous for its baobab trees with hollow trunks. These trees have historically been used to store water and for their lush green pasture after the rains. The area has many nomadic pastoralists and makes an important contribution to Sudan's national economy as a centre of livestock export

Problems

1. Availability of water supply in the area is highly scarce, which is exacerbated by the developed centre of export.

2. Availability of a permanent water point attracted too large a herd for the surrounding rangeland, and the quality of grassland was degraded. Environmental sustainability needs to consider numerous resources – the viability of both range and water sources need to be considered to support grazing systems.

How the problems were overcome

Khewei water supply evolved as a private company in which all of the water users were shareholders. The shareholder water users provided close oversight of the finances and management of the borehole to ensure effective management and efficiency. Thus, the system worked with adequate cost recovery to cover pre-emptive purchase of spares and a management team that had the capacity for the technical and clerical demands of the job. This allowed the system to expand.

The use of tankers to supply bladders for livestock feeding provided benefits for management of the rangeland resources. The natural resources around permanent water points often become depleted. So, by using bladders, the location of watering livestock can be varied and the pressure on any given part of the rangeland reduced.

Wisdom of the keys to success

1. Enhance ownership feeling through stakeholder involvement and the right to oversee the process.
2. Enhance system sustainability and expansion through service cost recovery.
3. Conditions in applying the keys to success.
4. Involvement and empowerment of stakeholders to enhance ownership.
5. Stakeholder contributions to management and operation.
6. Ideas for enhancing applicability of the keys to success.
7. Build awareness and consensus.
8. Strengthen community-based decision-making.
9. More stakeholder participation.

Results

Water availability improved. The variation in location of livestock water points resulted in conservation of the rangeland and reduced stress and overgrazing. Competition and conflict were also reduced. Sustainability of the water supply source was enhanced through consolidating the sense of ownership among the stakeholders.

Community-owned and community-managed water yards provide sustainable water for human and livestock, Khewei, West Kordofan State © Ministry of Water Resources, Irrigation and Electricity (MoWRIE)

5. HAWATA WAD-ELAGEILI WATER SUPPLY IMPROVEMENT PROJECT

Background

The Hawata project in Gedaref State is an oasis of engineering technology and good management. In the wet season, this area of black cotton soils may be cut off altogether. This geographical challenge lies behind the existence of the project. There is no reliable source of either groundwater or surface water. Therefore, unusually, a group of 50 villages with a population of over 150,000 is served by a network of some 300 km of pipelines.

Hawata Wad-Elageili Water Corporation is a pilot project supplying clean and potable water for more than 60 villages and towns in four main localities (Rahad, Qala en nahl, Mafaza in Gedaref State and Dinder in Sinnar State).

It was established due to the need to get water to all the people in the area including those in refugee settlements. The Government of Sudan approached the Federal Republic of Germany in 1982. As a result, Germany offered to provide technical assistance on a wide scale that incorporated Elhawata/Qala el nahl Water Supply project, including the villages located in close vicinity to the above-named towns. Eventually, the entire project was implemented in six phases at a total cost of 60 million Deutschmarks.

According to the protocols signed by the Sudanese Government represented by the federal Ministry of Finance and the German Government represented by Kreditanstalt Für Wiederaufbau:

1. The administration of the project was to be shared by the Executive Administration of Hawata Water Works and the Beneficiaries Board of Trustee (Board of Directors) later.
2. This mixed administration must work according to the policy of self-autonomy based on

revenue collection from selling water through a water tariff; it has been applied since that time with success.

3. The revenue collection and all the components (mechanical/electrical or vehicles) had to be utilized for the project only.
4. The application of the agreed protocols was executed with a new concept for rural water supply practice, that is, more than 49 villages and towns were supplied through one pipe network system from the same source (well field Wad-Elageili). This was about 30 km west of Hawata town where the water pumped from the wells was collected in a big concrete reservoir (1,100 m^3) and then pumped to the different supply zones through pipe networks and reservoirs.

Hawata Wad-Elageili water supply system is distinguished from other supply systems in Sudan by the following aspects:

1. The O&M system, which depends on preventive maintenance.
2. The control panel operation, which depends on the control system and remote sensing of the well field, reservoirs, elevated tanks and the pipe network.
3. The use of a standby system for wells, generators and pumps as sources of water and power.
4. Recruitment of labourers on the basis of no redundancy.
5. Revenue collection depending on water meter readings, which give exact water consumption compared to the quantity produced.
6. The practice of public participation policy through the Board of Trustees and later the Board of Directors.
7. The supply system covering areas in two States (Gedaref and Sinnar), which led to an independent corporation called Hawata Wad-Elageili Water Corporation.

The Hawata Wad-Elageili water supply was established in 1986. During its operational years, many parameters changed. The population increased due to settlement and durability of the water supply, which led to excessive demand for potable water. According to the design period some improvements were made in the system by 2006 to cope with the increased water demand for more than 300,000 inhabitants in addition to the huge amount of livestock.

The project objectives were to:

1. Provide a water supply for new beneficiaries of 90,000 inhabitants and about 2,500,000 head of livestock.
2. Resettle communities in the project area.
3. Decrease health hazards by providing clean and potable water.
4. Increase rural development.
5. Strengthen the existing system.

The project components were:

1. Drilling and installation of five boreholes at the well field in the Wad-Elageili area with complete full control panels devices and control chambers with pumping sets.
2. Providing and connecting electrical high-tension lines (8,000 m) with one step-down transformer (500 kVA) and five step-down transformers (50 kVA) to the wells.
3. Providing and laying of pipelines of 150 mm diameter, high-density polyethylene (HDPE) from the wells to the main line (5,000 m) at a pressure of 25 bar.

4. Providing and laying a parallel line to the trunk main to Elhasira with about 8,000 m of HDPE material (150 mm DIN) at 25 bar.
5. Providing and laying a transmission pipeline (24,000 m) from Hawata to Gurein of HDPE material (150 mm DIN) at 25 bar.
6. Providing and constructing 21 manholes for flushing and aeration.
7. Providing and constructing water points (15 kiosks) according to Hawata style.
8. Providing and constructing distribution networks to connect the kiosks with the main lines (20,000 m) of 100 mm DIN HDPE at 10 bar.

Keys to success

1. Operation on a self-autonomy basis.
2. Stakeholder participation in administration through a Board of Directors.
3. Project components strictly used for project purposes only, including revenues.
4. Service cost payment.

Title

Institutional and technical interventions

Situation

This geographical challenge lies behind the existence of the project. As there are no ground and surface water resources which can be developed in the area, therefore, a group of villages with a population of over 150,000 is served by a network of some 300 km of pipelines. The project is a community-based managed water corporation to supply clean and potable water for more than 60 villages and towns in four main localities (Rahad, Qala en nahl, Mafaza in Gedaref State and Dinder in Sinnar State).

Problems

1. Availability of water supply in the area was highly scarce and the quality of available water was questionable (exacerbated by the geographical setting).
2. Influxes of population attracted by the project services; thus, resulting into excessive demand for potable water.

How the problems were overcome

The system maintenance was undertaken pre-emptively, and spare parts, including a standby generator, were held in the stores. However, this scheme had considerably greater capital and operational costs, and fees were commensurately higher compared to cost of water supplied by the state government (state water corporation). The Board of the project comprised 13 water users and five technical representatives, which approved an increase in water charge to 5 SDG/m^3. It is interesting to note the value put on reliability of supply by the water users themselves. There was some opposition for this charge in Gedaref, but the Wali of Gedaref State provided political leadership in support of the decision made by the water users The Wali's role safeguarded the political independence of the scheme, which was cited as a critical success factor in the scheme according to project staff.

The administration of the project was shared by the Executive Administration of Hawata Water Works and the Beneficiaries Board of Trustee (Board of Directors). This mixed administration operated according to the policy of self-autonomy based on revenue collection from selling water through a water tariff. The revenue collection and all the components (mechanical/electrical or vehicles) had to be utilized for the project only.

System maintenance was undertaken pre-emptively. The independence of the project was a critical success factor. Two of the striking features of the project were the highly qualified technical staff employed and the high degree of moral and motivation of the team.

Wisdom of the keys to success

1. Involve stakeholders and allow the right to oversee the process through a Board of Directors nominated by stakeholders.
2. Operate the project on a self-autonomy basis.
3. Use a tariff system for service cost recovery.
4. Use a pre-emptive nature of system maintenance.
5. Use project components strictly for project purposes only, including revenues.

Conditions and limitations in applying the keys to success

1. High political leadership support of the decision made by the water user stakeholders is essential for success.
2. Guaranteeing self-autonomy is very important.
3. Pre-emptive system of O&M.
4. Ideas for enhancing applicability of the keys to success.
5. Promote political leadership support.
6. Strengthen community-based decision-making.
7. Curtail stakeholder participation.

Results

The beneficial effects of the project in the area can be summarized as follows:

1. Enhancement of safe water supply availability.
2. Achievement of rural development.
3. Improvement in life quality for resettled local communities.
4. Improvement in the ecological situation.
5. Improvement in the income of local communities.
6. Long-term duration required development in the area.

Standby generators to secure sustainable water supply © Japan International Cooperation Agency (JICA)

Hawata Board of Directors represented by water users © Japan International Cooperation Agency (JICA)

6. RURAL WATER FOR SUDAN PROJECT.

Background

The Rural Water for Sudan programme was designed to bring sustainable access to water for all users, improved hygiene and better sanitation practices to 600,000 people living in the Gedaref, Kassala, Red Sea, North Darfur, South Darfur and West Darfur States in Sudan. The project is currently (2018) under implementation by a consortium composed of seven organizations (ZOA, International Aid Services, Islamic Relief Worldwide, Plan International, Practical Action, SOS Sahel and World Relief) and coordinated by a Project Coordination Unit (PCU), housed within ZOA. Founded on the concept of partnership among, the Project aims to deliver results through an Integrated Water Resources Management (IWRM) approach over a 46-month period at a cost of £30 million, funded by UK Aid and €6 million funded by the European Union.

To ensure sustainability, the programme works to strengthen sector management and co-ordination across the six states, enabling the applied cost-effective approaches to be continued and shared more widely in support of national development agenda. The programme is based on catchment management planning approach linking water with sustainable use of natural resources for livelihoods.

Keys to success

1. Creating understanding of the catchment approach at community and committee level through intense awareness raising, workshops and site visits within the catchment area.
2. Relevance and appropriateness of the project; addressing the felt needs of the communities and contributing to poverty reduction and improvement of water supply services in a sustainable manner.
3. Institutionalization, establishment and training of catchment management committees in the targeted catchment areas.
4. Good coordination between different project layers of the organizational structure, reporting, and communication.
5. Knowledge-based approach by conducting hydrological and Catchment assessment to fill the critical gap in data.
6. Community empowerment through community organization, involvement in planning and implementation.

Title

Rural Water for Sudan project (implemented by the Aqua4Sudan Partnership)

Situation

Sudan's eastern states of Gedaref, Kassala and Red Sea went through a period of violence and turmoil, which was partly caused by fragile ecosystems, deeply entrenched poverty and underinvestment. Livelihoods in the three states are predominantly rural, centered on animal husbandry and agriculture. Average annual rainfall varies from less than 100 mm in parts of Red Sea and Kassala to over 700 mm in the southernmost parts of Gedaref. Water is a primary factor that constrains rural livelihoods in the three states.

One of the main drivers of local conflict and poverty in the Darfur region in Sudan is availability of water. Climate variability means that rainfall is unreliable, and during dry years very little water is available for people, livestock, fodder and crops. Where water is available, competition over access to water (and competition over access to fodder for livestock, which only grows if water is available) is key a cause of local conflict.

Hinged on sound technical understanding of the catchment water balance, the project has increased the reliability and availability of water for the rural communities in the targeted areas. By improving access to sanitation, hygiene, and access to safe drinking water, the project would contribute to an improved health status and improved general well-being of the targeted population.

Problems

1. Limited water resources due to low rainfall and nature of the geological formations which are non- groundwater bearing.
2. High malnutrition rates exceeding the emergency threshold of 15 per cent.
3. Limited access to safe drinking water and sanitation facilities and high under-five mortality and maternal mortality rates. According to Drinking Water & Sanitation Unit of the federal Ministry of Water Resources, Irrigation & Electricity, the targeted localities are classified as "critical to poor" in terms of accessibility to safe water and improved sanitation.
4. Cycles of frequent and severe droughts since 1970s, especially in the Red Sea State causing famine and famine-like conditions; and displacement.
5. Limited capacities of government and community-based institutions to undertake sustainable operation, maintenance and management of water supply services.

How the problems were overcome

1. The project helped in strengthening the capacity of the targeted groups, enabling them to contribute effectively in providing services to their communities and improved relationships and networking with the local authorities (at locality level) and in enhancing resilience of livelihood systems to water scarcity and climate change.
2. Rural Water for Sudan project has been co- implemented and enriched by the livelihood's component with a five-layered set of interventions that all evolve around improving food security through strengthening of agriculture/ livestock productivity, providing effective extension service and training to farmers, and pastoralists on use and application of agricultural techniques in the demonstration area.
3. Delivering water supply services in paradigm of integrated water resources management (IWRM) with a view of ensuring sustainability of the limited water resources within the catchment boundary and level.
4. Establishment, training and Institutionalization of the catchment management committees linking them with the local government institution, awareness raising on IWRM, and development of community-based catchment development plans.
5. Setting of data collection systems, undertaking water resources assessment studies, catchment mapping and building database system as enabling water resources management tools.
6. Construction of dams to increase groundwater recharge to ensure sustainability of the constructed water supply facilities.

Wisdom of the keys to success

1. Availing water for multiple uses (human, livestock and agriculture) and promotion of locally appropriate methods for household water treatment.
2. Enhanced community ownership through establishment and training of catchment management Committees to foster sustainable. operation and maintenance of the constructed water infrastructures.

3. Delivering of water supply and sanitation services in context of IWRM framework; with duly consideration to catchment as a planning unit.
4. Conducting catchment-specific water feasibility studies on water resources and water supply structures.
5. Close project back-up support given by the project coordination unit (PCU).

Conditions in applying the keys to success

1. Certain levels of prevailing peace and reconciliation between conflicting groups is a prerequisite before a catchment committee can be established and function accordingly.
2. Involvement and empowerment of the catchment management committees to enhance ownership and foster sustainable management.
3. Addressing water supply and sanitation issues in context of IWRM principles and considering the catchment as the appropriate planning unit.
4. Linking water provision with livelihoods and food security.
5. An enhanced implementation modality based on a consortium of seven NGOs.
6. Trained project implementation team on IWRM and catchment management.
7. Linking with government structures for institutional support.

Ideas for enhancing applicability of the keys to success

1. Provide articulated capacity building support to Catchment Management Committees on organizational management, governance, and IWRM approach.
2. Organize regularly State level platforms to advocate and promote IWRM approach.
3. Institutionalize Catchment Management Committee through registration and approved water management plans.
4. Increase and support representation of women in the committees.
5. Strengthen linkage of the Catchment management Committees with water authorities in the states and localities.
6. Document and disseminate successful stories on good practices resulting from this project to the government partners and other NGOs for replication.

Results

The project results can be summarized as follows:

1. Established and functional catchment management committees and development of inclusive mechanisms for IWRM.
2. Completed water resources assessment studies in the targeted catchment areas.
3. Increased availability of safe water on sustainable manner; due to increased groundwater recharge resulting from constructed subsurface dams.
4. Improved sanitation and behavior change in hygiene practices.
5. Promotion and adoption of participatory approaches in decision making.
6. Documentation and dissemination of IWRM successful stories from the project area.

ANNEX 2. LIST OF PRACTITIONERS (CONTRIBUTORS) IN IWRM GOOD PRACTICES CONSULTATION WORKSHOP (28TH MARCH 2018) AND PEER REVIEWERS OF THE REPORT

Name	Organisations
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Mr. Mohmed Osman	World Bank, Kassala State
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