Thematic Brief 5

Water Use Efficiency

Brief prepared for the Entry phase of the project:

Strengthening Agricultural Water Efficiency and Productivity on the African and Global Level

The Project

The GCP/INT/166/SWI "Strengthening Agricultural Water Efficiency and Productivity on the African and Global Level" has the aim to improve Agriculture Water Management (AWM) practices and mainstream AWM in national frameworks and processes on the African and global level. The project is funded by the Swiss Agency for Development and Cooperation (SDC) and is composed of three phases: Entry Phase, First and Second Implementation Phases.

The overriding goal of the entry phase is to share the project document with a broad range of stakeholders and beneficiaries in each of its countries, in order to refine it in accordance to their interests and priorities, and to ensure that the final document is endorsed by the concerned parties. The First Implementation Phase will focus on Africa and will be implemented in the three countries – Burkina Faso, Morocco and Uganda - within three years. The Second Implementation Phase will have a global focus and will expand to other three countries in Africa, the Middle East and South East Asia. The purpose of this phase is to develop country cooperation to promote knowledge transfer and experience sharing in improving AWM practices and mainstreaming them into national frameworks and processes.

This thematic brief is part of the Entry Phase work and relates to the proposed outcome of the project - *Enhanced capacity for increased water use efficiency in small scale irrigation.* This will be achieved by applying an FAO Water Tool, known as the Water-Downed MASSCOTE (WD-MASSCOTE), in project countries.

Water Use Efficiency

In irrigation, Water Use Efficiency (WUE) represents the ratio between effective water use and actual water withdrawal. It characterizes, in a specific process, how effective is the use of water. Efficiency is scale and process dependent.

Along a canal, the conveyance efficiency is the ratio between the volume of water at delivery points and inflow at entrance. At field level, effective water use is the water transpired by the crop and some other special requirements (land preparation, salt leaching). Runoff, deep percolation and evaporation from bare soil or standing water in paddy fields, are losses.

Water-Downed MASSCOTE

The WD-MASSCOTE is an adaptation of the FAO's tool *Mapping System and Services for Canal Operation Techniques*, also known as MASSCOTE, that is used to assess the performance of canal operation and field application efficiency in large irrigation schemes. WD-MASSCOTE was adapted to fit the characteristics of small-scale irrigation schemes. The methodology will include baseline system analysis through Rapid Appraisal Procedures and proposes improved field operations and water services to users.

Food and Agriculture Organization of the United Nations

AgWA
Partnership for agricultural water for Africa

Water Use Efficiency

Burkina Faso

Types of irrigation schemes

- Total irrigated area is 40 000 ha, which corresponds to 17% of the total irrigation potential.
- Irrigation schemes are commonly categorized according to size (Table 1).
- Nowadays irrigation development is mostly led by the private sector.
- Irrigation use varies between seasons: in the dry season irrigation is the only water supply, in the wet season it is supplemental.

Table 1 – Typology and size of Irrigation Schemes

Type	Size
Large systems	> 300 ha
Medium systems	50 - 300 ha
Small scale irrigation	< 50 ha
Wetlands	---

Irrigation practices

- Furrow irrigation (Length < 200 m) and border irrigation (Length = 10 m) is used for vegetables.
- Basin irrigation is used for water intense crops, such as rice.
- Sprinkler irrigation is applied in large sugar systems.
- Low pressure drip irrigation is used to grow vegetables.
- Rotation distribution is the main practice: irrigation turn is frequent, every 3-4 days.

Water use in irrigation schemes

- Since 1980, successive performance assessment studies (EIER, PMI-BF, APPIA) have shown that performance is lower than expected and irrigation infrastructure is rapidly deteriorating, mostly due to lack of maintenance and, in some cases, because of construction issues.
- Water management efficiency: in storage, evaporation is about 2 m/year or 5 mm/day, infiltration is 2 mm/day. Water available for irrigation is between 60-65% of the total storage capacity.
- WUE at system level has been measured at 60% and decreases with time.

Irrigation water policies

- The National Strategy for economic growth (2011) states that irrigation should contribute to 50% of agriculture production in 2015.
- Policy at national level is well developed, examples: *Politique Nationale de l'Eau* (PNE), *Plan d'Actions pour la Gestion Intégrée de la Ressource en Eau* (PAGIRE), *Stratégie Nationale de Développement Durable de l'irrigation* (SNDDI).

Institutional set-up of different types of irrigation systems

- There is a big variety of expertise at national level with several consultant firms, engineering schools, research institutes, professional organizations and NGOs
- There are several irrigation development constraints, such as: local expertise is lagging behind; landholding issues; high investment costs; and local conflicts between old agriculture associations and newly created irrigation associations.
- Management set-up of irrigation schemes varies with size (Table 2).

Table 2 - Management of irrigation schemes

Type	Management
Large	State agency management (Bagré and Sourou); farmers associations (Kou Valley, Banzon, Karfiguéla) with state intervention; private: sugar based systems (SN-SOSUCO) and agro-business in part of Bagré and Sourou.
Medium	farmers associations
Small	village associations or individual

Morocco

Types of irrigation schemes

- Irrigation contributes to 75% of agriculture exports and to 45% of the agri-production (higher during dry years).
- Total irrigated area is over 1,4 million ha characterized by:
  - Large irrigation systems (GH), covering about 0,7 million ha and are managed by public agencies;
  - Private irrigation for agro-business farming, covering more than 0,4 million ha; and
  - Small and medium scale systems (PMH), covering approximately 0,3 million ha with 2927 systems.
- PMH systems can be subdivided into 2 types: permanent/semi-permanent supply and intermittent supply. They can be traditional (e.g. oasis, mountain, Khettaras, flood irrigation) or recent/modern (e.g. built by the state).
- Private small scale systems are becoming important either as isolated schemes with groundwater supply or as part of PMH and GH, supplementing surface water service with groundwater.
- Main sources of water are surface (60%) and groundwater (40%).
- In conclusion, extreme diversity of small scale systems does exist, having implications on water resources, rights, access to markets, management set up, water fees, etc.

Irrigation practices

- Gravity irrigation is the main technique used.
- Land levelling degradation, water distribution at field head, and non optimized technique for flow and length are the main reported problems.
- *Robta* is the mostly used small basin technique (40 m^2) that is labour intense with low efficiency.

Water use in irrigation schemes

- Water efficiency at field level is by design between 50-60% for surface irrigation, 90% for drip irrigation, and 50% for sprinkler. However an increasing number of studies have shown that drip and sprinkler efficiencies can be as low as gravity.
- Collective system efficiency is between 61-77% (gravity) and 85-95% (pressurized).
- Agriculture production on PMH is not market oriented due to distance/access to market, lack of storage capacity, landholding too small, low competiveness, and complexity of traditional water rights.

Irrigation water policies

- Ambitious *Stratégie Nationale de l'Eau* (SNE) (2009) focused on water savings and water development (e.g. barrages, water harvesting).
- Traditional and modern laws.

Institutional set-up of different types of irrigation systems

- There are three main actors: state; associations; and water agency (recently created).
- *Association d'Usagers de l'Eau Agricole* (AUEW) (1990) defines water associations.
- Small scale systems are traditionally managed by tribes.
- Water fees vary according to groups: no fees for traditional systems; others pay based on the *Code des Investissements Agricoles* (Dahir 1-69-25), the sustainability principle (annual fees to cover recurrent costs) and equity principle (state recovers 40% of the added value on land).

Water Use Efficiency

UGANDA

Types of irrigation schemes

- The total irrigated area of the country is almost 67 150 ha with:
  - 14 148 ha of full control irrigation.
  - 53 000 ha of informal irrigation (swamps around streams flowing into lake Kyoga developed for irrigation).

Table 3 – Typology and size of Irrigation Schemes

Type	Size
Large systems	> 500 ha
Medium systems	50 - 500 ha
Small scale irrigation	< 50 ha

Irrigation practices

- The most common surface irrigation methods are:
  - Flood/basin irrigation majorly utilized for rice cultivation and furrow irrigation.
  - Overhead sprinkler/micro-sprinkler irrigation.
  - Drip irrigation used for seedlings, green house irrigated flower sand horticulture farms.
- Center-Pivot irrigation is mainly used in large plantations, only for seedlings (profitability).

Water use in irrigation schemes

- So far, there have been no comprehensive studies to assess water use efficiency on the existing irrigation schemes in Uganda. However it is known that water use efficiency in the country is poor and that systems are operating far below their potential.
- Agriculture accounts for 40% of water withdrawals (less than 0.16% of total renewable water resources).
- Predictions indicate that water scarcity will likely affect economic development/food security by 2025.

Irrigation water policies

- There are significant recent efforts to streamline policies for optimum water use in agriculture.
- Irrigation development is part of the Uganda Vision 2040, the Agriculture Sector Development Strategy and Investment Plan (DSIP) (2010/11-2014/15), and the Uganda National Agricultural Policy, 2011.
- The National Irrigation Master Plan (NIMP 2010-2035) provides a Framework Master Plan (FMP) for a reinvigorated, expanded and upgraded irrigation sub-sector in Uganda. It includes:
  - Establishment of new irrigation schemes (informal, small scale, commercial);
  - Capacity development (guidelines, regulations, standards, technical assistance, etc.); and
  - Transfer of irrigation knowledge and skills: pilots and demonstrations on small scale; and monitoring framework for water for crops.

Institutional set-up of different types of irrigation systems

- Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and its Agencies are responsible for irrigation development and management.
- Ministry of Water and Environment (MWE), in collaboration with MAAIF, covers water management, development and rights.
- The District Local Government supervises irrigation infrastructure at scheme level.
- Farmer Cooperative Society (Water Users Association) duties include: operation and maintenance of the scheme, revenue collection, community mobilization to carry out scheme activities, and so on.

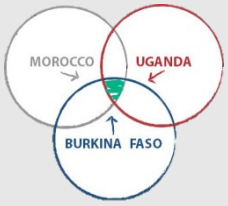

Table 4 - Irrigation capacities, diagnosis and perspectives for WD-MASSCOTE in the 3 countries

	National capacity	Local capacity	Systems for this project	Main diagnosis	Perspectives / Focus
BURKINA FASO	Fair, recently developed	Poor, to be developed	Small & medium scale <300 ha	Very low performance, operation and maintenance	Improving existing systems and developing new ones
MOROCCO	Good, long tradition in irrigation	Very good (e.g. Oasis)	Small & medium scale (PMH) <3000ha	Highly water stress country and extreme diversity of small scale systems	Improving management of existing small scale systems
UGANDA	Poor, irrigation is recent	Poor, lack of data and weak management structures	Small & medium scale <500ha	Few functional irrigation systems	Developing new irrigation schemes NIMP: from 57 000 ha to over 253 000 ha, by 2035

On Water Use Efficiency

The generic MASSCOTE approach has been widely successfully applied on medium to large systems. A version of this approach WD-MASSCOTE adjusted to the specificities of small scale systems, is to be applied in several systems of the 3 countries. The approach will raise the capacity in performance assessment and planning modernization ultimately contributing to crafting national strategies for water efficiency improvements in irrigation. The in-country findings and processes which are of common nature can be synthesized and scaled up to other countries and regions.

The focus of the WD-MASSCOTE component is to enhance national and regional capacity for increased water use efficiency in small scale irrigation in Burkina Faso, Morocco and Uganda. Similar to the MASSCOTE method, it will integrate other aspects of agricultural water management, such as, water productivity, water harvesting, water accounting together with the approach of service and cost.

WD-MASSCOTE will support small scale farmers to use water more efficiently

Project Development

RECOMMENDATIONS

Table 5- Outcomes expected and the medium term targets with the WD-MASSCOTE approach

	Outcomes expected from WD-MASSCOTE applications	Medium term targeted outcome
All 3 countries	• National capacity to use FAO approaches for performance assessment and modernization planning (MASSCOTE) is built	• Integrate the regional expertise and FAO approaches into the centers of excellence
BURKINA FASO	• Capacity in performance assessment is raised • Local capacity for irrigation management is built • Comprehensive performance assessment for water efficiency (field, system, scheme and surrounding rainfed agriculture) is conducted • Lessons learned about irrigation modernization are derived	• Develop modernization projects (pilots) • Design a national strategy for investment in irrigation
MOROCCO	• Capacity in performance assessment is enhanced • Comprehensive performance assessment for water efficiency (field to system and basin) is conducted • Lessons learned about irrigation modernization are derived	• Develop modernization projects (pilots) • Design national policy for water use efficiency and water productivity
UGANDA	• National and local capacity for irrigation management and performance assessment is built • Lessons learned for new investments, from a sample of 12 existing and 25 planned areas, are derived	• Design a strategy for developing the national and local capacity • Design a mater plan for investment in irrigation • Develop new pilots and modernization projects

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