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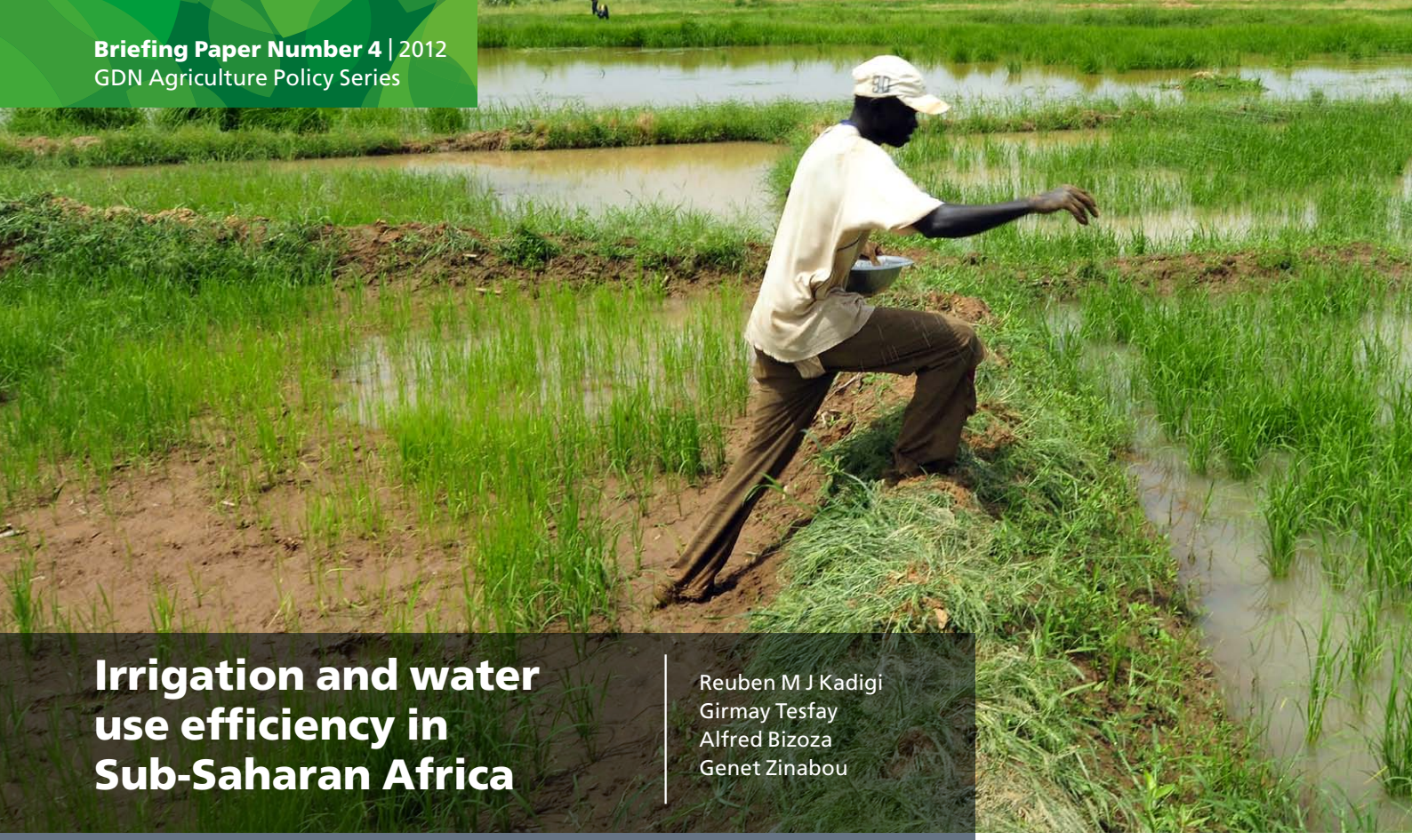

Irrigation and water use efficiency in Sub-Saharan Africa

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Greater use of Sub-Saharan Africa's ample water resources would substantially boost the production of food and export crops. As climate change threatens the livelihoods of farmers dependent on rain-fed agriculture, efficient irrigation is needed more than ever. Yet past schemes have failed due to poor planning, patchy consultation and insufficient maintenance. This briefing critically examines irrigation efforts since the 1960s and identifies factors which can determine success or failure.

Senegal, Orkadiere. Moussa Dianor works in his father's rice field. An irrigation project permits the cultivation of rice in this region of the Sahel.
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Key messages

- Sub-Saharan Africa has vast untapped water resources. Expansion of the irrigated area has the potential to make a substantial contribution to agricultural development and address the problem of food insecurity.
- Many irrigation schemes in the past failed due to a combination of factors, including high investment costs, poor planning and a lack of maintenance. It is recommended that new irrigation schemes are initiated in response to demand from farmers, increasing the chances of local management and maintenance of the schemes.
- Irrigation cannot be treated in isolation and must be considered alongside other elements of agricultural development, including improved markets (proximity, information), institutional and legal transparency, clarity of land rights, efficient use of inputs (seeds, fertilizer, pesticides), extension services for farmers, research and development and environmental management.
- Simple, participatory approaches have proved powerful tools to enable farmers to improve water management practices. Successful schemes have created a sense of ownership among farmers. Examples in this briefing include role-playing games and farmer field schools.
- Suggestions for increasing effective irrigation in Sub-Saharan Africa include the rehabilitation of existing, failed schemes, combined with more secure land tenure for farmers, supplementary inputs and farmers' involvement in decision making.

This briefing paper is one of the 10-part Global Development Network (GDN) Agriculture Policy Series for its project, 'Supporting Policy Research to Inform Agricultural Policy in Sub-Saharan Africa and South Asia'. It is based on a longer synthesis paper, ***Irrigation and water use efficiency in Sub-Saharan Africa***, which draws on extensive published and unpublished research. The full paper can be downloaded at: **www.agripolicyoutreach.org**

It will be of value to policymakers, experts and civil society working to improve agriculture in Sub-Saharan Africa.

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Irrigation: key to food security

Sub-Saharan Africa is water-abundant but uses less than 2 per cent of its total renewable water resources. Food production in the region is almost entirely rain-fed with irrigation currently playing a minor role.

Only 4 per cent (6 million ha) of the region's total cultivated area is irrigated compared to 37 per cent in Asia and 14 per cent in Latin America (You *et al*, 2010). It is far from achieving its irrigation potential, which is estimated at 42.5 million ha.

Greater use of the region's ample water resources would substantially boost the production of staple foods and high-value export crops. Irrigation is also an important tool in helping farmers insure against droughts, and plays an integral role in transitions from subsistence to commercial farming.

Yet there are many challenges still confronting water use in agriculture. These include the allocation of water across competing users (and uses), the appropriate pricing of water resources and the efficient harvesting of water.

'Instead of giving food aid, donors should manage the problems at the roots by investing in irrigation.'

David Muginya

Sociologist,
Rufiji Water Basin Office,
Dar es Salaam, Tanzania

Burkina Faso, Kouni. Mahamadi Ganemtore, 24, is able to irrigate the fields of his small farm with water pumped from a nearby dam reservoir. He grows a wide variety of vegetables including tomatoes, onions, cabbage and cucumber. Previously he used to water the fields with a bucket, which prevented him from expanding the farm. Thanks to the pump he has been able to enlarge his farm.
AUBREY WADE | PANOS PICTURES

The success of irrigation projects has been mixed, however, even for those countries which have reformed their irrigation programs. As a result, much of the current irrigation infrastructure is degraded due to a lack of investment and maintenance.

A challenge facing policymakers is to expand the area under irrigation while improving the efficiency and productivity of existing and future irrigation practices.

To further irrigation development, governments must carry out institutional reform consisting of transparent policies and guidelines, more flexibility in implementing irrigation schemes and greater support for small-scale farmers, particularly by providing extension services and encouraging greater farmer participation.

Methods

This briefing paper is based on a systematic review of published and unpublished literature on Sub-Saharan African and South Asian irrigation schemes. It also draws from field case studies, as well as semi-structured interviews with policymakers and other stakeholders, primarily in Tanzania and Ethiopia.

These include the IWMI (International Water Management Institute), the World Bank, FAO (Food and Agriculture Organization) and IFPRI (International Food and Policy Research Institute); publications from national governments such as water policies, irrigation sector strategies and five-year plans, and academic journal articles; as well as conference proceedings, PhD theses, presentations given by experts in the field and other relevant unpublished material.

The aim was to document the major challenges to irrigation projects encountered, and highlight both successes and failures. Its insights can help to inform strategies for sustainable future management and water use in Sub-Saharan Africa's agricultural sector by:

- Identifying where irrigation is profitable.
- Exploring the role of farmers in design, management and maintenance.
- Investigating the potential of groundwater irrigation.
- Exploring the current state of water markets.

The overarching aim is to ask which priority actions Sub-Saharan African governments should take to ensure that irrigation contributes its maximum potential to a vibrant agricultural sector in Africa.

Reforming irrigation planning

The review identifies five main factors which led to the failure of past schemes.

- Irrigation schemes were more expensive than they needed to be.
- Poor initial planning led to poor operations.
- Farmers did not see the benefits of investing in irrigation.
- Expectations of yield improvements were overly optimistic.
- Infrastructure was not maintained and fell into disrepair.

In spite of great disappointment and excessive spending on previous large-scale irrigation schemes in the past, Sub-Saharan African governments are reviewing their approach to water management and are instituting a new wave of reforms. Among them are a reduction in government involvement, encouragement of greater farmer participation, cost recovery of irrigation development and a shift from large-scale to small-scale schemes.

Ngezi Mamina Scheme in Zimbabwe

The Ngezi Mamina irrigation scheme in Zimbabwe was built as part of an aid project in 1994. Since its inception, the scheme has failed to perform well, largely because farmers were not effectively consulted about the initiative. Farmers have been reluctant to take over the responsibility of running and maintaining the scheme, complaining that the design was substandard. There have also been regular disputes between the farmers and government institutions responsible for collecting fees for water use.

Key lessons from the case of Ngezi Mamina.

- It is essential for farmers to truly participate throughout the project planning, implementation and evaluation phases and be treated as owners and not just beneficiaries of projects.
- Only projects that are technically sound should be handed over to farmers.
- Governments need to produce a clear, transparent and systematic strategy for handing over government-managed schemes to farmers.
- The issue of land tenure should be decided in the planning and management of smallholder irrigation schemes.

Source: Kay M (2001)
Smallholder irrigation technology: Prospects for Sub-Saharan Africa, International Program for Technology and Research in Irrigation and Drainage, IPTRID, FAO

'If the government is serious about treating agriculture as the mainstay of Tanzania's economy, irrigation is the way out and funds must be allocated accordingly.'

Mbeya Zonal Irrigation Office
Dar es Salaam, Tanzania

Irrigation schemes frequently fail because infrastructure falls into disrepair. Pictured, a water project in Nkhulambe in Malawi's Blantyre district.
ALFREDO CALIZ | PANOS PICTURES

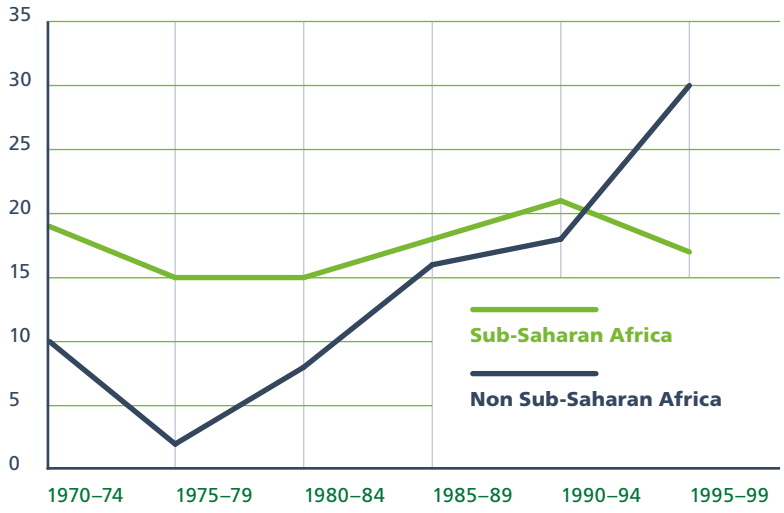
Eritrea, Massawa. Irrigation channel at Seawater Farms Eritrea, the world's first commercial-scale integrated seawater farm.
STEFAN BONESS | PANOS PICTURES

Return on investment

Returns on investments in irrigation in the region between the 1960s and the 1980s were lower than those in South Asia. The main factors responsible were poor planning, high investment costs, and weak management of infrastructure.

Since the mid-1990s, returns on investment appear to have improved. The best available evidence estimates that irrigated agriculture in the region is between 1.5 and 3 times as productive as rain-fed agriculture. Perhaps most importantly, studies of the socio-economic benefits of irrigation at the community level have documented significant contributions to poverty reduction.

Trends in the Economic Internal Rate of Return (EIRR) of irrigation projects



Data source: Inocencio (2005)

Water is a highly complex resource to manage. In the majority of Sub-Saharan countries, water is considered 'as good as free' and there are no formal markets for trading the resource. Some countries, for example Tanzania, have a system of water rights or permits in place, and a few others, including South Africa, have already established a form of water markets in parts of the country, but such initiatives are still in their infancy. Even so they rarely attempt to recover capital costs from users. Nevertheless most countries in the region recognize the need to introduce water pricing, partially to recover costs as well as to protect the environment and conserve water.

Governments would benefit from formulating clear water and irrigation policies, a clarification of roles and responsibilities of public offices in irrigation, and making investments in physical infrastructure to enable better monitoring and control of water flows.

Measures to improve irrigation efficiency

In Sub-Saharan Africa the available groundwater resources are 100 times those of renewable surface water. But farmers often hold back from investing in groundwater irrigation because of the high drilling costs of tube wells and lack of information about groundwater availability. Furthermore the evidence suggests that the region has significant groundwater resources but that in most cases the hydrology is suited for low-yielding boreholes that can only be operated by hand-pumps.

Newer technologies such as drip and sprinkle systems have the potential to increase productivity but are really only accessible to those farmers who can afford to buy them and who are growing cash crops such as vegetables, fruits and flowers.

Shallow groundwater irrigation has contributed significantly to reducing poverty and food insecurity in the region. It may hold significant potential to support small-scale agriculture in Sub-Saharan Africa and should be accordingly supported with hydrological studies, information dissemination and offers of low-cost drilling and lifting technology.

'I have been able to send all my three children to school as irrigation enabled me to produce onions and increase my harvests from one to two or three times a year.'

Hailu Meshesha

Small-scale farmer, beneficiary of Gum Selasa micro dam, Ethiopia

Niger, Aguie (Sahel region). Farmers on an IFAD-supported irrigation project pump water from a borehole well in order to irrigate their land. The International Fund for Agricultural Development (IFAD), a specialized UN agency established to finance agricultural projects in developing countries, runs several irrigation programs in the dry Sub-Saharan Sahel region.
SVEN TORFINN | PANOS PICTURES

'Seeing is believing, the major constraint to irrigation development is knowledge and understanding on the farmer's side.'

Mr Alene Aregay

Relief Society of Tigray Water Resources Division, Mekelle, Tanzania

Supporting farmers to manage irrigation

If small-scale farmers are to take a more active role in the management of irrigation schemes, governments will need to invest in market infrastructure and agricultural extension services as well as the capacity building of farmers. It is generally not worthwhile for farmers to invest in irrigation and produce more output if they cannot sell it.

A review of the literature suggests there is potential for the expansion of irrigation schemes where the government acts as facilitator but they are funded by private investment and managed by farmers themselves. This model has not been employed widely in Sub-Saharan Africa but examples from elsewhere outside the region (for example in Morocco and Egypt) indicate the potential of this approach.

Burkina Faso, Kouni. Fatimata Rabdo Rabdo, carrying her baby Aziz Rabdo on her back, waters her small vegetable garden with water collected in buckets from a nearby dam reservoir. She says: 'I would like to have a manual water pump one day so that watering my garden would be easier. For now I have to fetch water from the lake with my bucket and it is hard work.'
AUBREY WADE | PANOS PICTURES

Many of the donor-financed projects that have been evaluated as successful on completion in recent years have been characterized by both decentralized and participatory approaches.

Major drawbacks which hinder farmers from taking part in the management of schemes include insecure land tenure and a lack of knowledge of water management and irrigation mechanisms. Irrigation was not a traditional practice among many communities and is bound to be met with suspicion. In addition, insecure and unclear land rights have deterred farmers from investing in irrigation management. These disadvantages, coupled with the high costs of fertilizer, seeds and pesticides, poor links to markets to sell their goods and a lack of post-harvest storage, have proved considerable constraints.

Irrigation management transfer efforts, in which small-scale farmers take an active role in the maintenance, operation and management of schemes, continue to be hampered by a lack of understanding by farm institutions such as water user associations, as well as a lack of time, funds for machinery or marketing opportunities. Governments must recognize that the transfer of a scheme to participants can only take place when the scheme is running effectively and when extension services are in place for training. Transaction costs must be low for participants and a variety of complementary investments must be in place (inputs and outputs, improved access to credit and secure land rights).

Sub-Saharan African countries suffer from a shortage of extension workers, at about one per 200 farmers. Extension workers are crucial in combating the significant shortcomings in farmers' knowledge about optimal irrigation practices. Therefore, for irrigation management transfer to work, extension services need to be in place for training. By lowering transaction costs and providing investments in areas such as inputs and outputs, governments can tackle some of these obstacles.

The key policy lessons drawn from this review of irrigation development in Sub-Saharan Africa are:

- Irrigation has the potential to enhance food security and economic growth. To achieve this, investment must be profitable for the farmer.
- Water use policies should be developed within a broader framework that promotes agricultural growth through profitable investment and market-oriented production.
- Efforts should be made to identify the investments in irrigation development that give the best return.
- Subsidies or other government-provided incentives might be needed to spur technological innovation. Furthermore, research should continue to be publicly sponsored as the private sector is unlikely to undertake these activities.
- If governments see irrigation as part of a wider agricultural strategy and invest in complementary policies such as land reform, farmer education and empowerment, and market infrastructure development, it will raise the returns to irrigation and drive up private sector willingness to invest in it.
- It will remain important for governments to invest in irrigation schemes, which cannot attract private financing, and where there is a clear need to lift farmers out of poverty.
- Farmers need incentives to adopt new technologies and move towards intensification of agricultural production.
- The respective role of public and private investment must be clarified in order to foster private investment in agricultural inputs and output markets.

Case study 1

Iganjo Irrigation Scheme in Tanzania: a successful farmer-led, government-supported irrigation project

The Iganjo Irrigation Scheme was started in 1967 as a private farmers' initiative. It originally consisted of an 800m-long earth canal and a weir made of stones and sand-filled gunny bags.

The Iganjo farmers succeeded in winning government funding in 2006 to replace the stone and sand weir with cement and line 621m of the canal.

Today they enjoy the benefits of an aqueduct, four culverts and will soon benefit from 2km of lined secondary canals. The scheme supports 1,016 farmers, more than half of whom are women. Output for potatoes, tomatoes, peas, beans and other crops has nearly tripled. Farmers continue to carry at least 20 per cent of new investment costs in a combination of cash and in-kind payments. Farmer morale is high and the Irrigation Cooperative meets monthly.

Factors in Iganjo's success:

- Farmer-led: the farmers had a history of practicing irrigation and sought government support.
- Market proximity: Iganjo is only 16km from the city of Mbeya enabling them to sell goods.

Source: site visit and interviews with farmers and officials of the Zonal Irrigation Office in Mbeya, Tanzania

Case study 2

Mkoji sub-catchment in Rufiji River Basin, Tanzania: participatory games convince farmers to manage irrigation water sustainably

Downstream communities in the Mkoji sub-catchment area believed that over-extraction of water by users upstream was denying water to those downstream during the dry season. In response the government introduced a practical dialogue and decision-support tool called the river basin game, over three different two-day workshops.

As a result of the interactive games, participants learned that:

- The actions of water users at a local level have an impact on the entire water basin, including environmental degradation and reducing the volume of water available to those living further downstream.
- Many solutions and strategies exist whereby crops can be grown using less water.
- A sub-catchment committee is required to oversee water allocation and management.

Tracer and impact studies have shown that the river basin games triggered discussions about equitable water allocation, but also changed the way people regard and use water. Following the exercise, there has been a resurgence of water recharges in sources which were completely dry, and an increase in dry season water flows for the Great Ruaha River.

Source: Rajabu (2007)

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The full paper ***Irrigation and water use efficiency in Sub-Saharan Africa*** is available for download at www.agripolicyoutreach.org

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Further information

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