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## IRRIGATION DEVELOPMENT IN SUB-SAHARAN AFRICA:

The past, present, and future role of dams for food security, rural growth, and climate adaptation.

# The need for Irrigation Development

Image: Tom Fisk (CC 2.0)

Expansion of irrigated agriculture has played a crucial role in improving food security and supporting rural economic growth across the world since the midtwentieth century. In Sub-Saharan Africa (SSA), irrigation development historically has been achieved through the development of large-scale irrigation schemes supported by networks of dams and canals. These large-scale schemes aim to store and tap the region's substantial but highly variable water supplies, drawing on the colonial model of seeking to engineer and tame SSA's rivers for human and economic development.



Investments in large-scale irrigation schemes in Sub-Saharan Africa declined significantly in the latter decades of the twentieth century, falling out of fashion in part due to concerns about the substantial economic costs, social and environmental impacts of these engineered water infrastructure projects. However, stagnant crop yields, rising prices of food imports, and increasing volatile rainfall patterns due to climate change have led to a renewed focus amongst governments and donors on the construction of large-scale schemes to expand and intensify irrigated agriculture in countries across Sub-Saharan Africa. Examples include Pwalugu dam in Ghana and Kandadji dam in Nigeria, both of which are pitched as solutions to unlock agricultural productivity and, in doing so, transform rural livelihoods and economies.





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## Historic Performance of Irrigation Investments

Will a new era of large-scale irrigation projects help to transform agricultural systems in Sub-Saharan Africa?

Our research as part of the FutureDams project suggests success is unlikely without changes to the way such schemes are designed and implemented. Using historic planning records and contemporary satellite remote sensing, our work has shown that irrigation schemes have significantly fallen short of their stated goals to expand and intensify agricultural production. In Sub-Saharan Africa, the median rates delivery are as low as 16%, with larger schemes (> 10,000 ha proposed areas) proving far less efficient despite multi-million dollar investments. Even more concerningly, we find no evidence in scheme performance over time, with large-scale schemes constructed in recent decades fairing no better than those developed in the mid twentieth century.

Fig 1: Percentage of originally proposed irrigation area delivered that has been delivered for 79 large-scale irrigation schemes across Sub-Saharan Africa.



Notes: Vertical dashed lines show the median delivery rates for each region median values, with the solid black line showing the the median across all sites. Source: Higginbottom et al., 2020

### **Root Causes**

The consistent failure of large-scale irrigation schemes in SSA has several route causes.

First, many schemes have arguably been doomed by design. Schemes have often focused on increasing production of staple crops such as rice to reduce reliance on food imports, improve national food selfsufficiency, and create new trade opportunities. However, production of low value staples offers little revenue generation potential for farmers managing land within the scheme, a factor that is compounded by small land sizes allocated to farmers. Farmers therefore have little capacity to contribute financially to maintenance of the scheme, creating a cycle of dependence on external investment and subsidies. Once this tap is turned off, many schemes deteriorate rapidly and, in some cases, are ultimately completely abandoned.



Photo: Farmer-led irrigation workshop, Tanzania, 2018

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Second, the focus on large-scale irrigation schemes as opposed to other forms of irrigation development is in large part politically motivated. Donors prefer to fund large, centrally managed infrastructure projects, which are seen to be less complex and challenging to manage than a multiplicity of smaller scale projects. Governments and politicians in SSA therefore are incentivised to propose ambitious large-scale irrigation infrastructure projects to bring in much needed financial resources, while also providing an opportunity to win votes through headline grabbing investment projects. The result is a tendency to significantly overstate expected benefits of large-scale schemes during the planning process, which then fail to materialise post-construction. Indeed, research suggests that few large-scale irrigation schemes in SSA would be considered economically viable when accounting for their actual performance and costs.

### Unlocking the Potential of Irrigated Agriculture in SSA

How can governments and donors more effectively support farmers to expand and intensify irrigated crop production in SSA in the coming decades?



Large-scale irrigation schemes and storage infrastructure still have an important role to play as a means of buffering agriculture against water supply risks caused by climate variability and change. However, there must be much greater focus on post-project monitoring and evaluation to ensure that these projects deliver on expectations. Here, data-driven technologies such as satellite remote sensing have a key role to play in improving post-project monitoring and evaluation, providing a scalable solution at much lower cost than in-situ assessments. At the same time, reforms to the way large-scale schemes are designed will also be needed, with a greater emphasis placed on farmerdriven business models capable of financially sustaining these capital-intensive investments.

In parallel, there is a need to reconsider the historic notion of large-scale schemes as a one size fits all solution for agricultural development in SSA. Over recent decades, there has been an emergence of marketoriented small-scale irrigation developments across SSA, typically initiated by farmers independent of official government support. Our research, for example, has demonstrated the rapid growth in small community reservoir irrigation projects in Northern Ghana over the last seven years. These community projects have played an important in expanding and diversifying access to water, increasing agricultural productivity, and strengthening adaptive capacity to climatic shocks at substantially lower costs than largescale schemes. This is leading to shift in government planning in Ghana towards supporting these types of developments, with development of small reservoirs at the heart of plans for irrigation development through the 'One Village One Dam' policy. Similar trends have been documented in other parts of SSA, including the 'Participatory Small-scale Irrigation Development Programme' in Ethiopia.

#### Fig 2: Agricultural production costs and value of production across different irrigation typologies in the Upper east region of Ghana in 2019



Source: Adhikari et al., Work in Progress

while farmer-led irrigation development (FLID) may provide complementary, low-cost solutions for improving food production and alleviating poverty, these developments come with their own set of risks, challenges and issues. Despite many farmers benefiting from these developments, research has found that others may be negatively affected, notably through local effects such as land alienation, downstream effects of reduced water flows and other multiplier effects such as reduced agricultural prices. Similarly, there are also risks associated with management of water resources and governance of infrastructure. The expansion of existing small-scale irrigation schemes has been driven by farmers themselves with little to no support from public bodies. In this context, there is a risk that centralized policies from national planning authorities may respond to farmerled irrigation in ways that over-regulate or even curtail farmers' bottom-up irrigation initiatives. Therefore, farmer-led irrigation poses specific challenges to legislative and regulatory bodies, which must be overcome to deliver truly equitable and sustainable expansion of irrigated agriculture in SSA.

## Recommendations for future irrigation development

Ultimately, unlocking the potential for irrigation-led agricultural development in SSA will require a fundamental shift towards more integrative and holistic approaches to water management planning that leverage benefits of large- and small-scale schemes as complementary rather than competing solutions. Our findings demonstrate some opportunities to rapidly expand and intensify irrigated agricultural systems across SSA, but to reach their potential future irrigation development policies and investments must pay strong attention to:

- 1. Overhaul the design and management of large-scale irrigation infrastructure projects, for example through providing greater autonomy and decision-making power to farmers, to improve the cost effectiveness and sustainability of such developments.
- 2. Ensure that irrigation development projects, regardless of size, are subject to rigorous and transparent post-project monitoring and evaluation (e.g., via remote sensing) to ensure projects deliver promised benefits to communities and provide a cost-effective return on investment.
- 3. Broaden state support agricultural development and intensification to include irrigators outside of government irrigation schemes, who are often neglected in official irrigation development narratives despite demonstrated potential to advance food security and economic growth
- 4. Adapt regulatory frameworks for irrigation development to explicitly identify and recognise FLID's role in water and food security, including ensuring farmers do not lose ownership of past irrigation developments and that farmer-led initiatives are not unduly restricted or stifled.

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