Do African dams and irrigation schemes deliver the promised agricultural returns?

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One of the most controversial topics within the African food-water-energy nexus is the development of dams and large-scale irrigation schemes. Colonial authorities began constructing these schemes in the early 20th century, with construction accelerating in the 1960s helped by support from the World Bank and multi-lateral institutions. However, over the following decades evidence of the environmental, financial and social costs incurred by dams began to mount, leading to a hiatus on new developments by the early 1990s. Yet this pause is now ending, and many new dams and large-scale schemes are planned for Africa and Asia. It is therefore essential that mistakes of previous eras be avoided.

In this study, we quantify how the size of irrigation schemes successfully delivered compares to the initial project proposals, and what factors contribute to any observed discrepancies. We combined novel data on the size of proposals, obtained from planning documents, with satellite-derived cropland maps for 80 African irrigation schemes constructed between 1945 and 2008, from 23 nations. Firstly, We calculate what proportion of the initial proposal is successfully delivered. Secondly, we model these proportions against a suite of potential explanatory variables - covering hydroclimatic, socioeconomic, national, and site-specific factors- in a variable selection process.

We show that the average proportion of proposed irrigation successfully delivered is low, with a mean of 48% and a median of 18%. However, there was considerable variation in performance depending on the initial proposal size, with large schemes — that propose over 10,000 ha — proving far less efficient, delivering 10 - 20% and never reaching 100%. Smaller schemes performed slightly better, with 15 sites delivering over 80%. Hydro-climatic factors were not significant predictors of the successful delivery; contradicting narratives of drought-induced failure for many schemes. However, national government effectiveness, as measure by the World Bank, was a significant predictor. There was no trend in the proportions of successful delivery over the study period, indicating a failure to learn from issues that arouse on previous schemes. We proposed that the underperformance of irrigation projects is driven by the following factors: 1) over optimistic proposals, which are unrealistically large in order to generate investment; 2) large schemes being overly complex, in technology and maintenance, and therefore being difficult to
manage, and 3) governance capacity for developing and handling large investments being limited and hindered by inefficient bureaucracy.

Our findings highlight that major issues remain for large-scale irrigation development in Africa. If dams and large-scale irrigation schemes are to be a helpful component of future development strategies for poverty alleviation and food production, these issues require urgent attention.