

EDITORIAL



## Exploring the productivity and profitability of small-scale communal irrigation systems in Sub-Saharan Africa

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This special issue explores the challenges associated with increasing the productivity and profitability of small-scale communal irrigation systems in a world with growing demand for food and scarce water supplies. Case studies from Mozambique, Tanzania and Zimbabwe in south-eastern Africa are used to detail the challenges, opportunities and possible solutions. At six irrigation schemes, two in each country, the project provided simple tools to farmers to enable them to measure soil water and fertility to develop their own, more efficient agronomic practices (Stirzaker, Mbakwe, & Mziray, 2017). The project also facilitated Agricultural Innovation Platforms for discussion among stakeholders, to identify barriers and opportunities, and to develop solutions for more profitable farming (van Rooyen, Ramshaw, Moyo, Stirzaker, & Bjornlund, 2017).

The articles in this special issue focus on initial research findings from the project Increasing Irrigation Water Productivity in Mozambique, Tanzania and Zimbabwe through On-Farm Monitoring, Adaptive Management and Agricultural Innovation Platforms. The project was primarily supported by AUD 3.2 million in 2013–17 from the Australian Centre for International Agricultural Research (Project FSC/2013/006) to identify means of improving the environmental and socio-economic sustainability of smallholder irrigation communities. The project is a partnership of eight African and Australian research and governmental organizations led by the Australian National University and including the Commonwealth Scientific and Industrial Research Organisation (Australia), University of South Australia, National Institute for Irrigation (Mozambique), Ardhi University (Tanzania), International Crop Research Institute for the Semi-Arid Tropics (Zimbabwe), University of Pretoria and the Food, Agriculture, Natural Resources and Policy Analysis Network.

Particularly in Africa, great reliance has been placed on irrigation to meet food security. Significant investments were made in irrigation infrastructure in the 1970s and 1980s. However, these schemes have had limited success and largely resulted in decaying infrastructure, financial failures, low productivity and low utilization of land (Mutiro & Lautze, 2015; Stirzaker & Pittock, 2014). Most attempts to overcome these issues have focused on hard solutions, that is infrastructural refurbishment or rejuvenation (Inocencio et al., 2007).

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However, it is a core tenet of the project on which this article is based that this approach is doomed to renewed failure. Failing to see small-scale irrigation as part of a highly complex socio-economic and socio-ecological system will result in failure, regardless of the efficiency of the infrastructure and irrigation (Mwamakamba et al., 2017). Further, it is not enough to focus on increasing yield in isolation. Increasing the yield of products for which there is no market, or for which prices are too low, will not increase the profitability of small-scale irrigation. Only if the effort to improve infrastructure and increase yield is coordinated with an effort to integrate small-scale irrigators into the value chain, connect them to information and resolve critical institutional and governance issues will investments in hardware and productivity result in better livelihood and food security (van Rooyen et al., 2017).

Bjornlund, van Rooyen, and Stirzaker (2017) first provide a comprehensive review of the international literature on the barriers and opportunities for increasing water productivity and profitability in small-scale irrigation schemes in developing countries. This provides an understanding of the global issues that are addressed by the African case studies. The article then provides a comparative and cross-country discussion of the main barriers and opportunities identified in the three country articles (de Sousa et al., 2017; Mdemu, Mziray, Bjornlund, & Kashaigili, 2017; Moyo, van Rooyen, Moyo, Chivenge, & Bjornlund, 2017).

In Mozambique, De Sousa et al. (2017) identify different types of small-scale irrigation households according to their access to resources and investigate their diversification strategies. They find that the most resource-poor households focus on traditional crops as they are easier to grow and provide both staple food and a source of cash income. Resource-rich households are better able to manage the challenges and risks associated with growing higher-value crops. The resource-rich households generally have a more diverse income stream, with significant off-farm incomes to support investments in farm input and non-family labour.

In Tanzania, Mdemu et al. (2017) focus on lack of access to finance as a barrier to improving productivity and profitability. It is argued that lack of finance might prevent farmers from timely access to equipment, with resulting suboptimal timing of farm operations; to adequate good-quality farm inputs; to transport, to take produce to the best-paying markets; and to safe crop storage, so farmers can sell when prices are optimal. Lack of finance and farmers' need for money also often force farmers to sell immediately after harvest, when prices are low. However, this article finds that, with the current level of market risk, farmers are reluctant to take out loans and banks are reluctant to lend farmers money.

In Zimbabwe, Moyo et al. (2017) report a very low level of utilization of land as a result of small plot sizes and a focus on production of low-value staple foods. The authors identify the same barriers of access to input and output markets, transport, finance, farm and implements as in the literature. The article stresses the importance of a clear delineation of responsibilities and roles between the farmers, the local irrigation management committee and the different levels of government. There is confusion and uncertainty over who is responsible for maintaining various parts of the infrastructure and what farmers are paying for. This uncertainty also manifests itself in unclear responsibilities and powers within the irrigation management committee, which results in their inability and unwillingness to enforce rules. As a consequence, problems in the schemes include stray cattle damaging canals and crops, rampant water theft from the main canal, and low willingness to pay for water or participate in infrastructure maintenance.

Wheeler et al. (2017) explore the issue of extension services as a critical component of transferring the necessary skills and knowledge for improving productivity and profitability. While this article finds that government extension services are the main source of information for farmers, their availability differs significantly across schemes. In Tanzania, extension officers are difficult to access, as they are overworked, have many other responsibilities and are poorly funded; hence, farmers have to book a time for them to come, and pay for the officer's transport. The better-educated farmers use extension officers the least, which probably reflects that they can find better information elsewhere. In Mozambique, officers are often absent, as they are poorly paid and resourced. As a result, they have second jobs that take them away from the scheme, and they seek better-paid work elsewhere. In Zimbabwe, extension officers are readily available, and farmers trust their advice. However, productivity and profitability in Zimbabwe is the lowest of the three countries. This highlights that irrigation schemes are part of a complex systems and their issues need to be explored and addressed in a coordinated way.

Manero (2017) first discusses the problems associated with wealth inequality within small-scale irrigation communities in general. The more specific issues in the six smallholder irrigation schemes are then examined by comparing wealth distribution at community and national levels and by decomposing disparities by gender and income source. The evidence shows that the gap between rich and poor in farming communities is much greater at the community level than it is at national levels and that households that are solely dependent on agriculture are poorer than those with a more diversified income stream. Findings reported in other articles in this issue suggest that farmers are aware of this and use the time saved by irrigating less on non-farm money-earning activities.

Stirzaker et al. (2017) report on the process of introducing and using simple tools to enable farmers to learn from measuring and monitoring soil moisture and nutrients to develop their own, more efficient agronomic practices. The authors found that farmers were willing to engage in the process of learning by using the instruments. Generally, farmers were able to understand and interpret both the colour patterns of the Chameleon soil moisture sensors and the nitrate patterns from the FullStop wetting front detectors. As a result, farmers made significant changes in their irrigation management practices, significantly reducing the frequency of irrigation and achieving much higher yields. There is also evidence that this learning spread to other farmers in the scheme who are not directly involved in the project, and also to extension workers and managers of irrigation schemes.

Van Rooyen et al. (2017) outline the different stages of implementing Agricultural Innovation Platforms. The article concludes that the process of establishing and working with the platforms has developed a greater understanding of the importance of involving all stakeholders in the value chain – including local and national stakeholders who are able to contribute to the process of change – when identifying mutually agreed goals and developing strategies to achieve them. It is the interaction of these diverse actors and their collective knowledge and skills that facilitates the development of the improved strategies and institutional arrangements, which are necessary to bring about systemic change. This process acknowledges that these small irrigation schemes are part of complex systems and that solutions need to go beyond technological approaches and fixing hardware problems.

Mwamakamba et al. (2017) review all the findings from the previous articles with the aim of identifying the major policy reforms required to enable small-scale irrigators to become more productive and profitable. The article identifies four key areas in need of policy reforms.

First, land tenure systems need to be changed to allow farmers to use the land as collateral and so they can acquire more land to consolidate farms into viable sizes. Second, ownership of and responsibilities for infrastructure need to be clearly defined, as well as irrigation management committees' powers and responsibilities, so these bodies can enforce rules and secure the maintenance of infrastructure. Third, farmers need secure access to tools that enable more efficient water use and the development of local capacity to learn from these tools – including the training of the agricultural extension officers who support farmers – to become more productive and profitable. Fourth, a legal and regulatory framework is required that facilitates farmers' access to: (1) quality seed; (2) information on market prices of outputs and inputs; and (3) imported agricultural input and equipment without tariffs and other bureaucratic barriers.

In the concluding article, Pittock, Bjornlund, Stirzaker, and van Rooyen (2017) draw some overall lessons from the four-year research process. For both the farmers and researchers in this project the last four years have been an inspiring process of mutual learning. This project differs from many other projects by not offering monetary or equipment aid, apart from the simple monitoring tools. What we offered the farmers was engagement in a learning process with the researchers and other project staff, to identify ways of improving both the productivity and the profitability of water use. The combination of the use of the monitoring tools and the interaction with Agricultural Innovation Platforms has proven very successful. As reported in the following articles, significant changes have taken place in the schemes. Farmers are irrigating less, spending more on inputs, increasing their yields and growing more valuable crops. Farmers see themselves as transitioning from producing staple crops for their own food security to being commercial farmers.

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