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Water User Associations:
A Review of Approaches and Alternative Management Options for Sub-Saharan Africa

Eefje Aarnoudse, Alvar Closas and Nicole Lefore

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Contents

Acronyms and Abbreviations

ADB	Asian Development Bank
AfDB	African Development Bank
CAADP	Comprehensive Africa Agriculture Development Programme
COTAS	Consejos Técnicos de Aguas
FAO	Food and Agriculture Organization of the United Nations
GDA	Groupement de Developpement Agricole
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
IMT	Irrigation Management Transfer
IWRM	Integrated Water Resources Management
LACOSREP	Land Conservation and Smallholder Rehabilitation
M&E	Monitoring and Evaluation
MSP	Multi-stakeholder Platforms
NGO	Nongovernmental organization
O&M	Operation and Maintenance
PASIDP	Participatory Small-scale Irrigation Development Project (Ethiopia)
PIDP	Participatory Irrigation Development Programme (Tanzania)
PIM	Participatory Irrigation Management
PPP	Public-private Partnership
RPCMU	Regional Programme Coordination and Management Unit
SDPMA	Smallholder Development Project for Marginal Areas (Tanzania)
SSA	Sub-Saharan Africa
WRUA	Water Resources User Association (Kenya)
WUA	Water User Association
WUASU	Water User Association Service Unit

Executive Summary

Irrigation in sub-Saharan Africa (SSA) is expanding, following years of neglect. Governments, international donors and private sector actors have renewed their interest in irrigation investments to make the region food and water secure by moving from drought-prone, rain-fed agriculture to irrigated agriculture. Until now, public investments have emphasized decentralized water management systems and the establishment of Water User Associations (WUAs) as the most prominent management approach to accompany the expansion of irrigation. Investors expect WUAs to deliver on user participation, full cost recovery and reliable service provision. However, implementation of WUAs is fraught with problems and hurdles, be it internally (pertaining to the community of irrigators and users) or externally, affected by specific political economies, ineffective policies, and rigid water bureaucracies.

Building on existing literature and the analysis of a portfolio of development projects (past and under implementation), this paper reviews the evolution of WUAs in SSA, reflecting on the conceptualization of how they operate, and the promised outcomes related to irrigation development and the efficient and effective delivery of irrigation services. It also moves one step further from the existing plethora of studies on WUAs, postulating that additional reflection is needed to understand the limitations of WUAs and propose alternative, viable and context-based adapted models. This need is particularly strong in SSA where irrigation is incipient, and governments and donors are still consolidating their development approaches. Whereas a growing body of international literature takes into account the sociopolitical context of decentralized irrigation management, practical indication on what remains to be done to address the various limitations found in SSA stays meagre and scattered. The objective of this paper is not to challenge the myth of WUAs but to learn how to better deliver on the promised outcomes. The underlying message is that, if the SSA region is to be made water and food secure while respecting resource sustainability, community development, livelihoods and equality of resource access, the recurrent templates for WUA management and governance need to be revisited and adapted to local needs.

In order to do so, this paper examines the main lines of thought on WUAs, defining a mainstream type of WUA and then proceeding to evaluate the main consequences for irrigation management in SSA brought about by its implementation. To that effect, this paper has developed a framework to analyze how WUAs function, centered around two main interdependent narratives underpinning the mainstream WUA approach: (i) full cost recovery of operation and maintenance (O&M) for system performance, and (ii) user participation in decision making at the WUA level. The juxtaposition of such a theoretical approach with the reality on the ground when it comes to the actual delivery of services by WUAs represents the next level of analysis included in this report. Here, the paper highlights how the complexities arising from the expected feedback loop generated by WUAs (irrigation performance – agricultural productivity – cost recovery – user participation) are extremely difficult to predict and prove due to the myriad of factors affecting irrigation management and agricultural productivity.

Following this, an additional analytical framework is proposed to characterize WUAs in its socio-technical and economic context, and to systematically analyze conditions under which WUAs would function in SSA. The framework provides a broad overview of WUAs in SSA, considering the socioeconomic and political setting of WUAs, the water resources system they manage, their governance structure and finally the type of users/members. This framework is used to study cases drawn from project reports and peer-reviewed literature mainly from the following countries: Senegal, Ghana, Burkina Faso, Niger, Mali, Tanzania, Kenya, Ethiopia, Malawi, Zimbabwe and

South Africa. The review of these case studies highlights that the compounded complexities of WUAs in SSA not only prevent the achievement of improved agricultural productivity, but weaken the assumed feedback loop through which improved irrigation performance strengthens cost recovery and user participation in WUAs. In turn, donors and public agencies conclude that WUAs, and often the irrigation projects, have failed.

As a result, policy makers and donor agencies have tried five main channels to strengthen conventional WUAs: (i) WUA policy and legal instruments, (ii) WUA bylaws, (iii) contracts with WUAs, (iv) training of WUA members, and (v) introducing monitoring and evaluation (M&E). All five channels are reviewed in this paper, concluding that the advancement of WUA policies, bylaws, contracts, trainings and M&E signals that even though donors and public agencies recognize the weaknesses of WUA management, it does not represent meaningful change in expectations from WUAs or a substantive change in the approach to irrigation scheme management. No evidence has been found to show that having national-level legal instruments or regulations, or ensuring that WUAs create bylaws, actually leads to the desired outcomes of improved cost recovery, equitable participation, and improved overall effectiveness of governance or O&M in an irrigation scheme.

Against this backdrop, this paper introduces seven alternative management options which deviate from the way WUAs are typically implemented and expected to function by water administrations, decision makers and donors. None of the options have been widely adopted so far; however, the first five alternative management options have been explicitly advocated by scholars and development organizations. A definition of alternative management options and an overview of the seven options are provided. The paper then explains each option in more detail with a specific emphasis on how the approach deviates and/or overlaps with the way WUAs are typically conceptualized and implemented. The alternative management options reviewed here shift the focus onto activities that are related to other actors and/or processes in irrigation management. WUAs may still play an important role in these alternative management options, but formalizing and training WUAs per se is no longer considered the only way to achieve cost recovery and user participation. In some options, the role and responsibility of WUAs may even be completely different from mainstream practices. Examples of its practice in SSA or other development contexts are also discussed. Finally, the most important opportunities and threats which may affect the implementation of this management option in the SSA context are outlined.

This paper then concludes by reflecting on how the general expectations of WUAs from water bureaucracies, decision makers and donors to deliver on cost recovery, user participation and, ultimately, irrigation performance are rarely met. One reason is that cost recovery through water user fees is often prioritized over user participation in decision making. Indeed, user participation is seen as a fundamental factor to ensure willingness of users to pay fees and undertake O&M. The underlying issue is the invalid assumptions that underpin the expected functions of WUAs (examined here). The review of case studies highlights that the socioeconomic context and agricultural conditions shape the ability of WUAs to deliver results, but these enabling conditions cannot be easily created by external institutions and actors. In SSA, WUAs are primarily promoted in a setting of smallholder agriculture by external agencies, such as national governments or donors, with a few notable exceptions.

To summarize, the main challenges that appear to constrain WUA management in SSA include the following:

1. WUAs are unable to collect user fees and therefore unable to pay for O&M. Scheme or project goals may not prioritize and undertake activities to support increased farmer income.
2. Farmers' incentives may not support payment of user fees; income from irrigated agriculture is low and contributes only partially to their livelihood strategies.

3. WUAs are not inclusive of different types of water users, including women, although, by default, the irrigation infrastructure is usually used for multiple purposes. WUA membership is biased towards irrigators (plot owners or managers).
4. Emerging irrigation, such as individual pump users, are not integrated into scheme planning or management. Individual irrigators encroach upon gravity irrigation systems managed by WUAs, but do not participate in WUA decision making, cost recovery or O&M.
5. Local institutions (customary, political, state) have contradictory objectives and incentives than formal water user institutions that are often externally imposed.
6. Low capacities of the state in rural areas limit technical and management assistance to consistently support WUA development.

The results of this study suggest the following key lessons in relation to irrigation WUAs:

1. Setting up WUA policies, bylaws, contracts, trainings and M&E constitute limited means to improve the performance of WUAs.
2. No simple alternative management arrangement exists within the existing WUA framework.
3. Adapt management roles, structures and infrastructure to deliver transformative services and improve rural livelihoods.
4. User participation is crucial for smallholder irrigation development, but does not mean that WUAs can or should be solely responsible for all the functions.
5. Performance indicators and the practice of M&E of WUAs are largely missing.

1. INTRODUCTION

Evidence suggests that there is large untapped potential to expand the irrigated area in sub-Saharan Africa (SSA) (Hanjra and Gichuki 2008; Pavelic et al. 2013; Svendsen et al. 2009; Xie et al. 2014; You 2008). Following years of neglected irrigation development, governments, international donors and private sector actors have renewed their interest in irrigation investments to make the region food and water secure by moving from drought-prone, rain-fed agriculture to irrigated agriculture. Until now, public investments emphasized the establishment of Water User Associations (WUAs) as the most prominent approach to decentralized water management systems. Investors expect WUAs to deliver on inclusive user participation, full cost recovery and reliable service provision. However, implementation of WUAs is fraught with problems and hurdles, be it internally (pertaining to the community of irrigators and users) or externally, affected by specific political economies, ineffective policies, and rigid water bureaucracies.

Researchers and development practitioners have subjected WUAs in the irrigation sector to critical scrutiny since their early implementation in the 1980s and 1990s (Meinzen-Dick et al. 1995; Turral 1995; Vermillion 1997). Worldwide, many case studies offer mixed results with regard to the functioning of WUAs and outcomes related to irrigation development (e.g., Groenfeldt and Svendsen 2000; Meinzen-Dick et al. 2002; Uphoff and Wijayaratna 2000). Most of those case studies do not fulfil the conditions for a rigorous comparative evaluation of WUAs, particularly as they use varying indicators to assess WUA performance (Senanayake et al. 2015). These indicators range from agricultural production factors to water fee collection rates and equitable water distribution. The wide range of indicators show that different kinds of assumptions are made on how WUAs are expected to function and what defines a successful WUA.

More recently, several reviews on WUAs have tried to put forward more conclusive insights on the impact of WUAs on irrigation performance by analyzing a large number of case studies (Garces-Restrepo et al. 2007; Ghazouani et al. 2012; Mukherji et al. 2009; Senanayake et al. 2011, 2015). However, the picture presented vis-à-vis their achievements remains unclear. Reviews show that, in most cases, WUAs do not live up to the expectations of water administrators, public decision makers and donors who initiated the establishment of WUAs. Some reviews primarily point to causes of failure such as the poor implementation, and unclear formulation of the roles and responsibilities of WUAs (Garces-Restrepo et al. 2007). Other reviews focus on critiquing the assumptions behind the WUA concept and question whether WUAs are the most appropriate institutional arrangement to improve irrigation performance (Mukherji et al. 2009). The two most prominent criticisms of WUAs to be found across the literature are the unrealistic expectations on cost recovery and the neglect of inclusive user participation during implementation of irrigation projects. All reviews conclude that the broader socio-technical and economic context in which WUAs are supposed to function is central to finding solutions for irrigation management, regardless of poor implementation or conceptual flaws.

Against this background, additional reflection is needed to understand the limitations of WUAs and propose alternative, viable and context-based adapted models. This need is particularly strong in SSA where irrigation is incipient, and governments and donors are still consolidating development approaches. Practical indications on how to address different types of limitations of WUAs in SSA remains meagre and scattered, despite the body of international literature that considers the sociopolitical factors that affect WUA performance (see, for example, Kemerink et al. 2013; Rap 2006; Suhardiman and Giordano 2014; Venot et al. 2011). The objective of this paper is not to challenge the underlying concept of WUAs, but to gather learning that will enable practitioners to better deliver on the promised outcomes of decentralized irrigation management.

The main message is that the recurrent templates for WUA management and governance need to be revisited and adapted to local needs, if the SSA region is to become water and food secure while also respecting resource sustainability, community development, livelihoods and equality of resource access. Practitioners, decision makers and researchers have documented and analyzed numerous cases and tried to wedge in theoretical solutions that continue to fail in the real context. Local management systems cannot be modelled according to specific externally determined models. The reproduction of particular irrigation system development narratives and associated pre-made solutions requires scrutiny, especially given the lack of effective solutions to date. Development investors and implementers often see WUAs as a preset model to deliver improved irrigation management. At the same time, assessments of irrigation schemes focus on what a WUA did wrong, rather than questioning whether the establishment of WUAs is the right approach to deliver improved irrigation management at all.

To critically examine the WUA approach and discuss alternative management models, this study is split into three parts. The first part of this study (section 2) summarizes the main lines of thought on WUAs so far by consulting reviews and assessments carried out globally. The second part (section 3) evaluates the consequences for irrigation management in SSA by providing a detailed description of the most important factors that influence WUA management. The third part (section 4) intends to go beyond the more common review of constraints and failures of WUAs in SSA by examining alternative and innovative management options developed, in part, as a response to past criticism of the WUA concept. Most interventions to strengthen WUAs have focused on minor adjustments in their implementation, but this paper highlights examples that display more fundamental changes based on a different rationale to achieve cost recovery and user participation. Section 4 presents exemplary case studies that enable the study to then synthesize lessons that can be learned from past investments in WUAs and promising alternative management options. Finally, the study suggests recommendations to adapt decentralized water management in different contexts in SSA.

2. THEORETICAL CONCEPT OF WUAs

This section introduces the theoretical concepts behind WUAs and outlines the main points of criticism on the operationalization of those concepts, using evidence from existing reviews on WUAs across the world. First, this section provides a working definition of WUAs. Second, it discusses the historical origins of the WUA, and its relationship with broader developmental and socio-technical paradigms. In doing so, it explores the prevailing rationale behind WUAs. Finally, the section addresses the reasons for high expectations on WUAs against the assumptions underlying the WUA concept. For each major assumption, practical experiences and critical literature which challenge the assumptions are presented.

2.1 Working Definition of WUAs

This paper uses a working definition for WUAs adapted from IFAD (2001) as a formal organization that brings together farmers for the purpose of managing a common irrigation system[1]. Other definitions may apply to contexts of domestic water use or traditional irrigation organizations

[1] In this paper, the term 'WUA' is used interchangeably for other names circulating for an organization with the same functionality, such as Water User Organizations, Irrigation Water User Groups, Irrigation Farmer Organizations and Irrigators Associations (Meinzen-Dick 1997; Mwamakamba et al. 2017; Salman 1997). WUA is most widely used as the generic term.

(i.e., non-formalized user organizations). Here, we introduce the term “mainstream” WUA to specify what is generally meant by the term WUA in the frame of current donor-funded irrigation development projects. Table 1 lists the main characteristics of mainstream WUAs. A WUA is a user-based organization that aims to manage the irrigation system for its members mostly on a non-profit basis. Its main tasks include the allocation of water within the irrigation system, operation and maintenance (O&M) of the system and the cost recovery of O&M through the collection of irrigation fees from its members. A WUA is generally small in scale with a limited number of members (usually no more than several hundred members), so that self-management by users is possible. The actual size of a WUA often depends on the irrigation system. For example, a WUA may be responsible for one tertiary block that is subdivided into smaller units of Water User Groups (WUGs), or one WUA may be responsible for the entire system.

TABLE 1. Main characterisitics of mainstream WUAs.

	Mainstream WUA
Status	Formalized, non-profit, user-based organization
Members	Farmers using water from irrigation system
Governance	Representatives elected by members
Mandate	Irrigation water management: - Water allocation between users - Operation and maintenance (O&M) of the irrigation system or part thereof - Collection and management of irrigation water user fees to cover O&M costs
Scale	Small scale where management by users is possible

Source: Based on Vermillion and Sagardoy 1999.

2.2 History of the WUA Concept

In the 1950s and 1960s, governments, international donors and development banks invested in large-scale, centralized irrigation systems worldwide. Yet, in the following decades, irrigation engineers and international development organizations realized that most of those large-scale irrigation systems managed by state bureaucracies were underperforming (Mollinga et al. 2007). Critiques of the large-scale public irrigation schemes pointed out failures, such as irrigation coverage below the designed command area, lack of significant improvements to agricultural productivity and infrastructure that degraded faster than anticipated due to poor maintenance. Researchers and development organizations from the late 1970s promoted decentralized management as an alternative to public institutions that they thought would ensure the effective performance of irrigation systems; organizing water users into WUAs (Turral 1995; Uphoff 1986). The public sector, alongside bilateral development institutions and development banks, initiated irrigation management reforms, transferring at least part of irrigation scheme management to newly established WUAs. The reform process through which management responsibility is withdrawn from state agencies and devolved to water users is often referred to as Irrigation Management Transfer (IMT) (Turral 1995). The

management mode with an important role assigned to WUAs is sometimes called Participatory Irrigation Management (PIM) (Groenfeldt and Svendsen 2000).

International donors supported early pilots of the proposed decentralized irrigation scheme management in the 1970s in the Philippines, followed by pilot projects in Thailand, Indonesia and Sri Lanka, among others (Bruns 1993; Meinzen-Dick 1997). By the 1980s, IMT to WUAs resonated with broader decentralization reforms taking place in developing countries. At that time, grassroots development implementers and democracy activists promoted the transfer of public services to communities' decentralized agencies or local organizations based on lack of trust in central government, while neoliberal advocates urged states to devolve roles to reduce deficits (van den Broek and Brown 2015). This occurred in tandem with the policies of global finance and development institutions, notably the International Monetary Fund (IMF) and the World Bank, through structural adjustment programs to encourage, and in some cases even require, national governments to reduce their range of responsibilities and activities in the delivery of public services (Konadu-Agyemang 2000). Extensive research on traditional community-based natural resource management inspired ideas on decentralization of resources such as water (Wegerich 2010). That research argued that decentralized organizations, such as WUAs, could better address a population's actual needs (Uphoff 1986). In short, the changes in irrigation management reflected a broader movement across sectors to reduce the role of central government, and increase the role for decentralized government agencies and local communities, as well as private companies.

The first WUAs were thus established during a period of political reorientation, and institutional and economic reforms. The abrupt shift from state to user management in large-scale irrigation systems was often accompanied with high expectations of newly established WUAs by governments and donors (Wester et al. 1995). However, early assessments of the impact of WUA management on the performance of irrigation systems showed ambiguous results, partly because different kinds of indicators were used to assess WUA performance. Vermillion (1997) concluded that, in general, IMT reduced irrigation expenditure by governments, but found no clear evidence that IMT increased agricultural productivity.

Disappointing results triggered a donor and development organization quest for the enabling conditions to improve WUA management (IFAD 2001; Garces-Restrepo et al. 2007). Development investors began to pay more attention to the implementation and the support of WUAs to prevent failures. Some evidence suggested that intensive training and support from external agencies could improve the performance of WUAs, but these conditions usually could not be sustained after initial project implementation or pilot phases. Nevertheless, successful examples were showcased by international policy networks (e.g., the International Network on Participatory Irrigation Management set up by the World Bank) to promote further reforms regardless of the actual evidence on management performance or governance practices (e.g., Mexico) (Rap 2006).

In the 1990s, international donor agencies advocated again for participatory water management within the Integrated Water Resources Management (IWRM) paradigm. IWRM stands for a holistic approach to water management, with stakeholder participation in decision-making processes regarded as an important pillar. Following the global push for IWRM with the 1992 Dublin Principles, more than 40 governments from developing countries incorporated IWRM principles in their water policies (Hassing et al. 2009). Consequently, governments did not retreat from the WUA approach, but increased expectations of WUAs "to play a critical role in promoting the IWRM reform at the community level" (Hu et al. 2014: 163). Hence, IWRM reforms consolidated the popularity of the WUA approach by public institutions, donors and development project implementers.

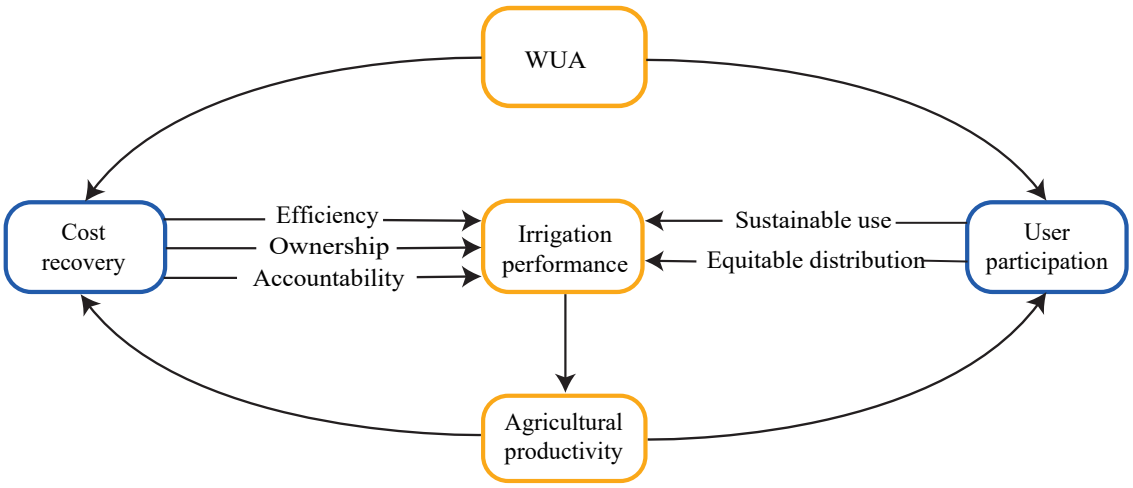
More recently, irrigation experts across disciplines directed fundamental criticism at irrigation management by WUAs, questioning the underlying assumptions of the WUA concept; unstated basic

assumptions essential to make WUAs function according to expectations by governments and donor agencies (Mukherji et al. 2009). At the same time, an implicit critique continued among development actors who signalled concern of WUA failure by advocating for public-private partnerships (PPPs) in irrigation management (Trier 2014; Darghouth 2007; Zekri and Easter 2007). Indeed, Singh et al. (2014) warned that the rejection of the WUA management model could be politically motivated and linked to the promotion of PPPs as the new governance model to replace WUAs by private companies in irrigation service delivery. Meinzen-Dick (2007) further challenged the attempts to replace WUAs and the underlying principles, arguing that a new panacea of profit-oriented actor participation is not the solution to problems faced by specific institutional arrangements of the past. Meinzen-Dick (2007) proposes to define the most appropriate mix of state control, user management and market mechanisms for irrigation systems based on context-specific conditions.

2.3 Assumptions Underlying the WUA Concept – A Global Assessment of Theory and Practice

The two main narratives underpinning the mainstream WUA concept are full cost recovery of O&M and user participation (Figure 1). The cost recovery narrative implies that the performance of the irrigation system will improve when water users in an irrigation scheme fully pay the costs of infrastructure investment and O&M. The user participation narrative implies that the performance of the irrigation system will improve when users participate in the decision making on, and hands-on management of, the irrigation system. It follows that improved irrigation performance should then lead to increased agricultural productivity (i.e., extended irrigated area, and increased irrigation efficiency, cropping intensity and higher yields), which will create a positive feedback loop on the water users' ability and willingness to recover all costs and participate in management. Because cost recovery and user participation are supposed to enhance irrigation performance, the feedback loop is strongest when both conditions are met. Hence, cost recovery and user participation are considered to be interdependent. Often the two are discussed together, but they are presented in Figure 1 separately to emphasize the different assumptions underlying each condition.

FIGURE 1. Theoretical framework of WUAs.



Cost recovery – in theory

The cost recovery narrative is backed by the widespread conclusion of researchers, policy advisors and development organizations that poor performance of state-managed irrigation systems causes the deterioration of irrigation infrastructure (Huppert et al. 2003; Suhardiman and Giordano 2014). They perceive state management as being subject to a negative cycle of low cost recovery that leads to poor maintenance, and in turn to suboptimal irrigation performance and low agricultural productivity. Some analysts further argue that farmers benefit directly from irrigation projects, and should thus pay for O&M costs and a portion of the capital costs of irrigation systems (Easter and Zekri 2004). They posit that entrusting water users with the responsibility of cost recovery will lead to the positive performance of irrigation systems in multiple ways, including the following:

1. ***Efficiency*** – Cost recovery through WUAs increases the efficient use of financial resources because water users are local experts who know the best and most necessary investments in O&M. Hence, water users are motivated to invest their money in more cost-effective solutions than external agencies that lack an incentive for financial savings or profit (Garces-Restrepo et al. 2007).
2. ***Ownership*** – Mandating WUAs to contribute labor and funds for cost recovery promotes their sense of ownership of the irrigation system (Mutambara et al. 2016). When water users experience strong ownership, this creates an incentive for responsible use of the irrigation system (Uphoff 1986). This, again, prevents rapid deterioration of the infrastructure and reduces costs (Huppert et al. 2003).
3. ***Accountability*** – As decentralized, member-based organizations, WUA members can best ensure that scheme management is accountable for providing quality services. Hence, internalizing the expenditure on O&M reduces losses due to inappropriate use of funds (Easter and Zekri 2004).

Cost recovery – in practice

The main driver of transferring irrigation management to WUAs is often to attain financial sustainability of irrigation projects through cost recovery by water users (Garces-Restrepo et al. 2007). Such irrigation management reforms are consistently found to have reduced the financial burden on national governments (Senanayake et al. 2015). However, actual cost recovery and related O&M by water users often remains ineffective. An evaluation of agricultural water management projects funded by the World Bank from 1994 to 2004 found that cost recovery objectives defined in project proposals were unrealistic and actual achievements were unclear (Independent Evaluation Group 2006).

An extensive review of IMT in 33 countries by Garces-Restrepo et al. (2007) concluded that payment of water user irrigation fees was erratic. Sometimes, the ratio of farmers paying the fees increased shortly after WUAs became responsible for cost recovery, but declined again over time. Senanayake et al. (2015) reviewed 181 case studies from Asia, Africa and Latin America and found that only 33% of the IMT case studies reported a positive impact on the irrigation fee collection rate of WUAs. The same study reported that only 25% of the cases showed improved financial viability of WUAs[2], but did not indicate whether full cost recovery was obtained in those cases. Ghazouani et al. (2012: 10) argued that, irrespective of the payment rate and the price charged, "water fees are

[2] Overall, the impact on fee collection and financial viability was not reported for 29% and 39% of the cases, respectively (Senanayake et al. 2015).

always insufficient to cover operation and maintenance costs", based on their evaluation of WUAs in the Near East and North Africa. Shah et al. (2002: 3) argued that financial self-sufficiency of WUAs can only be met in commercial farming settings where "the costs of self-managed irrigation are an insignificant part of the gross value of product of farming". Examples of those settings can be found in Mexico, Turkey, USA and New Zealand (Shah et al. 2002). Yet, large variations are found even within countries. For example, in Mexico, the famous cases celebrated for successful WUA management are situated in the northwest, where irrigated agriculture is commercialized with better maintained infrastructure compared to the rest of the country (Rap 2006).

The above-mentioned findings show that the assumptions contradict the reality in most cases regarding cost recovery by WUAs. First, studies suggest WUAs lack the managerial skills for success (Garces-Restrepo et al. 2007). WUAs face severe difficulties regarding the O&M of complex irrigation technologies (IFAD 2001). Moreover, many irrigation projects have to provide WUA members with a range of trainings to ensure that farmers have obtained the skills required to conduct meetings and monitor accounts, operate the system and maintain the equipment (Meinzen-Dick 1997). This suggests that local expertise may not be readily available to find the most cost-effective O&M solutions.

Second, water users perceive the fees, fines and costs related to full cost recovery as a heavy financial burden rather than a means to enhance their ownership. In most cases, WUA members are not involved in decision making and, furthermore, lack full ownership rights of the main system (Meinzen-Dick 1997). The isolated duty of bearing the O&M costs of degraded infrastructure tends to discourage farmers rather than mobilize them to increase their commitment to the management of their schemes (Ghazouani et al. 2012).

Third, adequate financial contribution by farmers is difficult to enforce politically (Ghazouani et al. 2012). Fees set according to farmers' willingness to pay does not necessarily cover the O&M costs (Le Gal et al. 2003). Various reasons make it difficult to enforce farmer water fee payment. For example, China recently released farmers from paying high agricultural taxes, and a high water fee could be considered as a hidden agricultural tax (Nickum and Mollinga 2016). In other cultural contexts, water might be considered a natural good or a "gift from God" for which users do not perceive a need to pay (Ahmad 2000).

Fourth, WUAs are not necessarily homogeneous groups of water users with predictable relations of trust and a common purpose that would enhance collective action. Mosse (2006: 702) argued that collective action around irrigation is often "embedded in wider systems of patronage and 'corruption', as well as in village social hierarchies." This may contribute to farmers' disincentives to pay fees, and possibly to the inappropriate use of funds by WUA leadership. The lack of documentation of WUA financial management makes it difficult to estimate how often this occurs. According to the Independent Evaluation Group (2006), few project evaluation reports provide a clear indication of performance on O&M cost recovery through user fees. Ghazouani et al. (2012: 16) harshly criticized this situation and imply that full transparency is purposefully avoided by institutions, asking whether "anybody really wants to know."

Finally, some authors put forward a more fundamental criticism of the cost recovery narrative. They argue that the costs of irrigation systems are artificially inflated by state agencies to secure their own funding or resources (Suhardiman and Giordano 2014; Venot et al. 2011). One known phenomenon is the build-neglect-rebuild cycle, through which irrigation agencies benefit from infrastructure degradation; agencies apply for funding from governments or international donors to rehabilitate irrigation schemes regularly and thereby finance their own existence (Araral 2005). This critique suggests that the solution to infrastructure maintenance does not lie in demanding water users to pay more to the scheme, but in carefully investigating the actual required investments and costs from the outset.

User participation – in theory

The user participation narrative of the WUA concept is strongly inspired by lessons learned from community-based natural resource management of common-pool resources in traditional systems. Research on numerous cases worldwide illustrated that the state is not essential as an external authority to set and maintain rules on natural resource management (Ostrom 1990). In fact, user groups are capable of establishing long-lasting solutions for common-pool resource management through collective action. Examples of traditional irrigation systems in Indonesia, Nepal, Philippines and the Middle East provided successful prototypes (Meinzen-Dick 1997). As such, collective action is assumed to be triggered by the establishment of WUAs, allowing water users to actively participate in decision making. Strengthening user participation is expected to improve the performance of irrigation systems in various ways, particularly equitable distribution and sustainable use of water (Meinzen-Dick 1997; Ostrom and Gardner 1993), notably including the following:

1. ***Sustainable use*** – Collective institutions in traditional irrigation systems can assure sustainable use of common-pool resources over long periods of time by preventing unnecessary use and rapid depletion of water resources (Ostrom 1990). WUAs ideally provide a platform for water users to negotiate rules through bylaws that encourage sustainable collective water management and use over time, as observed in traditional irrigation systems (Meinzen-Dick 1997).
2. ***Equitable distribution*** – Collective institutions in traditional irrigation systems can assure equitable distribution between upstream and downstream water users (Ostrom and Gardner 1993). Equity in the distribution of water is commonly formulated as one of the main objectives of WUAs, based on the notion that WUAs promote collective action (Meinzen-Dick et al. 1995; Wegerich 2010).

User participation – in practice

The user participation narrative has frequently been used to argue in favor of WUAs as a decentralized water management approach, but actual participation during implementation remains poor. From a review of WUAs in the Near East and North Africa, Ghazouani et al. (2012: 8) concluded that "participation has been in most cases limited, if not cosmetic." An extended review of WUA management in Africa, Asia and Latin America showed an improvement in farmer participation in less than half of the cases, based on criteria of elected WUA leaders and member attendance at meetings (Senanayake et al. 2015). In their review of 33 cases worldwide, Garces-Restrepo et al. (2007) mentioned a general lack of participation by women and small farmers in the governance of WUAs, suggesting the absence of equitable and meaningful participation in decision making. A clear and consistent indicator to measure user participation is not apparent, but multiple reviews suggest that many WUAs lack meaningful user participation. WUAs do not function in the participatory manner expected for various reasons.

First, WUAs rarely consist of a homogeneous group of water users. In practice, levels of equitability within decentralized community-based systems (e.g., WUAs) can be affected by preexisting social and political local characteristics (Mollinga et al. 2007; Mosse 2006). Community-based organizations reflect locally established vested interests, including existing hierarchies with customary or political elites. WUAs replicate the unequal systems of power and rule, which tend to benefit those that control land and other resources, wealthier classes and men. Hence, WUA management based on traditional and customary institutions does not necessarily lead to equitable or democratic rules or management. Indeed, WUAs established along traditional governance or natural

resource management systems risk merely reinforcing the power of elites through institutional arrangements and governing rules, such as bylaws. Some argue that formalized WUAs even deepen existing inequalities, because those already in positions of power are "best placed to take advantage of the new institutional arrangements" (Sokile and van Koppen 2004: 1352). Many case studies worldwide (see, for example, Mosse [2006], Sokile and van Koppen [2004], and Brown [2011] for cases in India, Tanzania, and South Africa, respectively) show that those in powerful positions and leadership roles tend to dominate WUA executive bodies. In some cases, government authorities avoid entrusting traditional leaders with official WUA leadership positions; however, even then, wealthy farmers can occupy and misuse the positions (Zuka 2016). In sum, the existing differences in interests and power of members of a WUA tend to disadvantage the resource-poor and women farmers, and prevent realization of equal participation and decision making to benefit the overall scheme and all members of the WUA.

Second, WUAs as formal organizations often place men over women, even though women play an important role in irrigated agriculture (Meinzen-Dick and Zwarteveen 1998). This may be related to the existing gender relations in which men's customary and social positions vis-à-vis women become embedded into WUA institutions and rules, and can even enable men to mobilize the WUA structure to marginalize women further (Sokile and van Koppen 2004). This uneven power relation based on gender is institutionalized in WUAs in different ways, but often follows similar patterns that reduce the participation of women in WUA bodies and governance structures. Formal or de facto rules exclude women from joining a WUA or participating in governance structures within a WUA, for example, by requiring literacy, formal landownership for plots within a scheme, or holding elections or meetings when women have other responsiblities. In addition, women may be discouraged from participating in discussions at WUA meetings by customary norms, such as rules that prohibit women from sitting next to or speaking in front of an older male relative or in-laws (Lefore et al. 2017). These informal and formal rules and practices discourage women from equal participation in WUAs, or even from being members and participating at all in any form of decision making.

Third, the creation of WUAs does not ensure meaningful decentralization to empower local decision making. State agencies at national and subnational levels often have disincentives to fully devolve management decisions to WUAs. Many case studies show that WUAs imposed by external agents and not created based on water users' own initiative tend to be 'moribund' or 'dormant' organizations, lacking any kind of decision-making power in irrigation management (Acheampong and Venot 2010; Mosse 2006). Those WUAs differ considerably from groups formed by water users that represent collective institutions for sustainable resource use. State agencies tend to set up institutions "to manage something that the government can no longer handle itself!", being the infrastructure and related cost recovery for O&M, rather than collective institutions that "slowly develop the rules of association" based on users' needs (Ostrom 2001: 252). The role mandated to WUAs by state agencies is not primarily to encourage participation of all WUA members in the management of the irrigation scheme or related natural resources, but limited to a few activities that do not require inclusive participation. Ironically, the emphasis on collecting water user fees and basic O&M may be even more prevalent in large-scale irrigation systems, a context in which it is more difficult to achieve the kind of self-governance observed at smaller scales (Abernethy 2010).

Furthermore, dynamics of national politics may be played out at the local level and hinder real participation in decision making of local organizations such as WUAs. In many instances, centralized irrigation agencies and ministerial staff may be reluctant to hand over decision-making power to WUAs, as mentioned above, which limits the effective devolution of control over resources and services provided by WUAs (Mollinga et al. 2007). In other words, national-

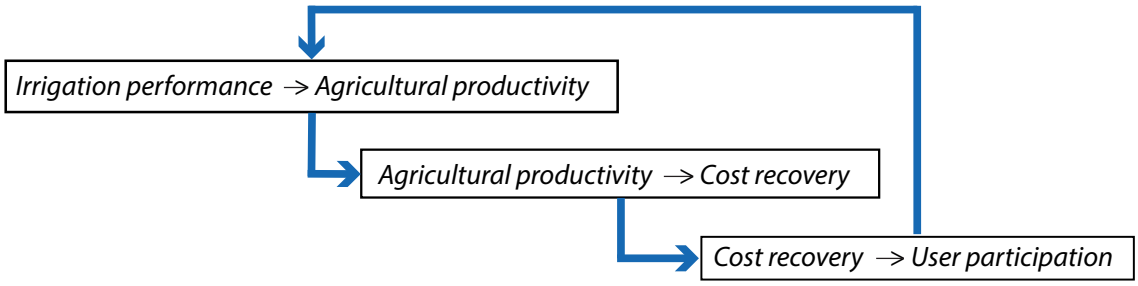
level political actors do not want to risk creating WUAs with strong local decision-making power over natural resources and built infrastructure that could threaten political interests. In addition, the disincentive to decentralize decision making through local participation can also be bureaucratic. This may include reasons such as an irrigation agency being relatively powerful within the national political structures, an irrigation agency whose budget relies on the collection of fees from water users (Van Vuren et al. 2005), or an irrigation agency that would shrink with decentralizing authority over schemes causing staff to be retrenched or reassigned to different positions (Garces-Restrepo et al. 2007). Across the various reasons, governments often achieve restricted participation and decision-making control in WUAs by dictating or imposing WUA bylaws that narrowly outline management structures and mandates (Abernethy et al. 2000; Yami 2013). Researchers suggest that the reliance on irrigation agencies for the implementation of WUAs is contradictive (Mukherji et al. 2009; Suhardiman and Giordano 2014), given the political, economic and social context.

Irrigation performance feedback loop – in theory

Governments and donor agencies hold a primary expectation that irrigation management by WUAs will lead to increased agricultural productivity through improvements in irrigation performance (Garces-Restrepo et al. 2007). Furthermore, they assume that water users will be the first to benefit from an increase in agricultural productivity through rising incomes. The costs of irrigation may initially increase for farmers after IMT, but additional income in the medium- to long-term should balance the higher costs (Garces-Restrepo et al. 2007). This argument suggests the evolution of farmer incentives to pay for irrigation scheme services; farmers' increased income will enhance both the ability and willingness to contribute to O&M costs over time. A similar change in farmer incentives also applies to user participation in WUA management; increased agricultural productivity and income would give farmers an incentive to strengthen and extend their active participation in irrigation management (Meinzen-Dick 1997). This anticipated feedback loop depicted in Figure 2 is based on the following three circular assumptions:

1. ***Irrigation performance → Agricultural productivity*** – Irrigation performance is the weak link that keeps agricultural productivity low. Therefore, improving irrigation performance will lead to increased agricultural productivity.
2. ***Agricultural productivity → Cost recovery*** – Irrigated agriculture is the primary source of income for water users. Therefore, agricultural productivity improvements (particularly increased cropping intensity and higher yields) will increase income and living conditions. Higher income will in turn enhance the ability and willingness of WUA members to contribute to O&M costs of irrigation schemes.
3. ***Cost recovery → User participation*** – An increase in cost recovery improves irrigation service delivery, as effective O&M improves water supply infrastructure and services. Improved irrigation services increase the confidence of users of the scheme, which generates WUA legitimacy and trust by farmers. Farmers will seek to increase their participation in the WUA.

FIGURE 2. Irrigation performance feedback loop for WUAs



Irrigation performance feedback loop – in practice

The impact of WUA management on agricultural productivity is extremely hard to prove due to the complexity and variety of factors intervening at the same time; even the most rigorous studies have not demonstrated a clear relationship (Senanayake et al. 2015). The complex linkages between yield, income, and technological developments such as irrigation have been subject to constant debate (Howlett 2008). Poorly performing WUAs may not be to blame for low agricultural productivity. Mukherji et al. (2009) argued that, particularly in Asia and Africa, the state or development partners constructed large-scale irrigation infrastructure systems to achieve national food security or for other aims, not commercially viable, financially self-sustaining systems. From the outset, irrigation infrastructure has been optimized to secure specific food (or fiber) crop production, largely to support urban areas, and not designed to enhance individual farmer income that would enable full cost recovery. Changing the management approach to an irrigation system along with changing development goals or approaches will not automatically lead to increased agricultural productivity and higher farmer incomes.

Other factors beyond a WUA's performance on infrastructure may cause low agricultural productivity. The general state of the agriculture sector may also not be conducive to improved agricultural productivity, despite changes in irrigation approaches. Shah et al. (2002) argued that irrigation performance in SSA is usually not the main constraint that keeps agricultural productivity low; the lack of access to agricultural input and output markets are significantly more important. Markets will largely determine the economic performance of irrigation systems as they relate to revenue and income generated from the crops cultivated, harvested and sold. In sum, the expected feedback loop that links WUAs with irrigation scheme performance through improved agricultural productivity, incomes, cost recovery and user participation does not hold.

3. WUAs IN SUB-SAHARAN AFRICA

Early reviews of WUA management often focused on creating the 'enabling' or 'essential' conditions for the success of management transfer programs to WUAs (IFAD 2001; Vermillion 1997). Reports suggested that certain conditions could be 'socially engineered' to *make* WUA management work (Wegerich 2010). More recently, researchers called for 'context-specific solutions' (Meinzen-Dick 2007; Senanayake et al. 2015). This argues for institutional arrangements for irrigation management that are adapted to the existing socio-technical and economic context in which irrigation development takes place, rather than trying to alter the broader socioeconomic factors in which WUAs are embedded. Accordingly, the most important factors that influence the functioning of WUAs should be understood. This paper proposes a framework that summarizes the critical factors

that influence WUA management performance. The framework helps to describe, in general, the common situation for WUAs in SSA and highlights key challenges. Measures piloted or undertaken by donor agencies and development implementers are then listed to illustrate approaches to adjust WUA operation to existing conditions.

3.1 Factors Influencing WUA Performance

Studies have identified the most important factors that shape WUA performance. Often a distinction is made between external and internal factors, in which external factors refer to the physical, socioeconomic and political environment, while internal factors describe the water management organization itself (IFAD 2001; Ghazouani et al. 2012). However, Wegerich (2010: 17) argued that such a distinction is arbitrary, because "internal factors are in fact a reflection of the external factors and vice versa." Likewise, Meinzen-Dick (2007) proposed a framework that includes the critical factors hypothesized to affect irrigation system management without differentiating between internal and external factors. The framework is based on previous studies and contains six broad categories used to analyze any kind of common-pool resource management (Ostrom 2007). These include: socioeconomic and political setting, resource system, resource units, governance system, users, and related ecosystems.

This paper further adapts the Meinzen-Dick (2007) framework in Figure 3 to characterize WUAs in the sociotechnical and economic context in SSA. More specifically, categories are simplified to broadly consider the natural and technical characteristics of water resources described under 'resource system', 'resource units' and 'related ecosystems' under one heading of 'water resource system'. The 'governance' category in the framework refers to local governance structures that directly influence irrigation management by WUAs. The category 'socioeconomic and political setting' entails the broader national and interlinked international governance setting. Both these categories taken together integrate multiple aspects that fall under the commonly used definition of water governance as "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society" (Rogers and Hall 2003: 7). Stated otherwise, governance processes largely determine decision making on the allocation of water resources and the regulation of use, while water management refers to the practical activities related to the allocation and regulation of water resources. The framework includes 'financial performance of user groups' as a separate subcategory under 'governance' because, as mentioned in the previous section, cost recovery and user participation can be considered as two separate strings of WUA performance.

3.2 Typical WUAs and Challenges in SSA

Each of the four categories in the framework in Figure 3 include typical conditions that influence the performance of WUAs in SSA. The description of the contextual conditions is primarily based on cases drawn from project reports and peer-reviewed literature from the following countries: Senegal, Ghana, Burkina Faso, Niger, Mali, Tanzania, Kenya, Ethiopia, Malawi, Zimbabwe and South Africa. Since the literature on WUAs in SSA is scattered, we focus on those countries for which sufficiently in-depth and recent data on WUAs are available. An assessment of the contextual factors is used to identify specific challenges for WUAs in SSA, which will be referred to in the next section of this paper on alternative management options.

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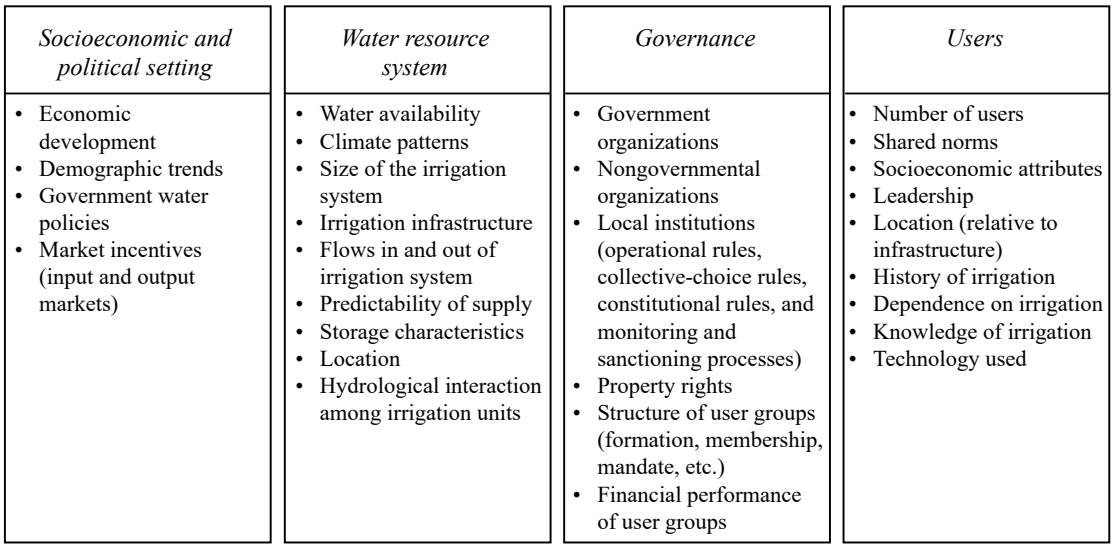
FIGURE 3. Factors influencing WUA management.



Source: Adapted from Meinzen-Dick 2007.

This paper follows Namara et al. (2010) to differentiate between 'conventional' and 'emerging' irrigation as two broad categories of irrigation systems in SSA. Conventional irrigation refers to those systems primarily developed by the state and often financed by public or donor institutions, such as development banks or bilateral development agencies. In contrast, individual users or private enterprises (sometimes in cooperation with the state) lead emerging irrigation. Such private irrigation is emerging in most SSA countries (de Fraiture and Giordano 2014). So, the two categories are useful to classify typical irrigation systems subcontinent-wide.[3] Currently, WUAs are most likely to be found in conventional irrigation systems, so is the focus of this study. However, emerging irrigation is rapidly spreading, so is included where relevant.

Socioeconomic and political setting

Irrigation in SSA was primarily developed through centralized irrigation systems until recently (Oates et al. (2015). After independence, African national governments built large-scale irrigation systems[4] or took over the management of existing systems from colonial authorities (Carpenter et al. 2017; Oates et al. 2015; Vandersypen et al. 2007). International development banks and bilateral agencies provided grants and loans to African governments to rehabilitate or extend systems in the post-colonial era. Yet, from the beginning of the 1980s, international donors criticized centralized irrigation (Carpenter et al. 2017; Wester et al. 1995). A decline in the levels of public spending on agricultural services, including irrigation in the 1980s and 1990s, followed the stabilization and structural adjustment programs promoted by institutions such as the World Bank (Poulton 2012). In most countries, but notably Ghana, South Africa, Mali and Mozambique, the annual growth rate of conventionally irrigated areas actually dropped to zero by the year 2000, though increased in Kenya, Nigeria and Senegal between 2000 and 2003 (Svendsen et al. 2009).

[3] Other terms whose definition overlap with emerging irrigation are: informal irrigation, atomistic irrigation, distributed irrigation or small private irrigation (Burney et al. 2013; de Fraiture and Giordano 2014; Namara et al. 2010, 2013). Here, we use the term emerging irrigation because it provides the clearest distinction between irrigation systems in which WUA management is prevalent or not.

[4] In most African countries, large-scale systems are defined as irrigation systems with an area over 500 ha (Frenken 2005).

As public spending on agriculture declined, international development banks and agencies promoted IMT and the formation of WUAs as a mechanism to reduce government spending, as well as to increase farmer 'ownership' of irrigation schemes (Turral 1995). The first wave of WUAs in the 1980s and 1990s in West African countries such as Senegal, Burkina Faso and Mali aimed to simultaneously decentralize and upgrade the management of existing irrigation systems, while reducing the costs for governments (Aw and Diemer 2005; Wellens et al. 2013; Wester et al. 1995). Under these conditions, the public sector placed more responsibilities on irrigation water users (Aw and Diemer 2005; Wester et al. 1995). The often abrupt disengagement of public irrigation agencies contributed to improper O&M of the irrigation systems by WUAs (Vandersypen et al. 2007; Wellens et al. 2013).

Recently, public institutions and donor agencies have increased their interest in irrigation development (Woodhouse et al. 2017). The Comprehensive Africa Agriculture Development Programme (CAADP) consolidated national ambitions and provides policy directives for African states to increase investments in the agriculture sector, including expansion of the area under irrigation (Brüntrup 2011). CAADP aims primarily to increase smallholder agricultural productivity, though governments often find themselves in a dilemma whether to prioritize large-scale commercial agriculture for national economic stimulation or smallholder agriculture for poverty alleviation (Oates et al. 2015).

More specifically, the national governments of emerging economies, notably Ethiopia, Kenya and Nigeria, have plans to promote irrigated agriculture (Gunda et al. 2013; Oates et al. 2015). New investments seek to rehabilitate the old and develop new infrastructure, as well as strengthen management. For example, in 2014, the World Bank signed an agreement with the Government of Nigeria to invest USD 495 million in the rehabilitation of large-scale irrigation systems in the Northern Region with strengthening WUAs as a critical component (World Bank 2014a, 2014b). The Sahel Irrigation Initiative Support Project is in the pipeline with a potential investment of USD 173 million in both large and small-scale irrigation systems in Chad, Burkina Faso, Mali, Mauritania, Niger and Senegal (World Bank 2015b). In that case, only the small-scale irrigation systems are to be managed by local communities through WUAs (FAO 2017). The project plans for the management of large- to medium-scale irrigation systems to be led by public authorities or PPPs. This reflects the trend since the mid-2000s of national governments and donor agencies driving the increase in the annual growth rate of the irrigated area in SSA (Svendsen et al. 2009) with mixed approaches to management systems.

Growth in irrigated area has become the general trend in SSA, but the situation varies vastly by country. Some countries have experienced a large increase in irrigated area over the last decade. For example, the area equipped for irrigation increased by 335% between 2001 and 2015 in Ethiopia, by 97% between 2002 and 2013 in Tanzania and by 45% between 2003 and 2010 in Kenya (FAO 2016). In other countries, the growth rate is smaller. For example, the area equipped for irrigation increased by 13% from 2000 to 2011 in Mali and by 11% from 2004 to 2010 in Nigeria (FAO 2016).

These investments in irrigation development relate to an overall increase in commercial agriculture in SSA (Hall et al. 2017). Major irrigated crops in SSA are rice, sugarcane, fiber (e.g., cotton) and vegetables, varying by subregion. Cereal crops such as wheat, maize, sorghum and millet may also be irrigated, but this is not always profitable, hence such crops tend to be produced under rain-fed conditions (Svendsen et al. 2009). Irrigated production of vegetables is growing rapidly, particularly near urban centers (Frenken 2005). According to Dittoh et al. (2013), over 75% of the irrigated area in West Africa (including both conventional and emerging irrigation) is for vegetable production. Most of the smallholders producing cash crops, especially fresh vegetables, rely on emerging irrigation concentrated in urban and semi-urban areas with direct access to urban

consumers (de Fraiture and Giordano 2014; Dittoh et al. 2013). Although private smallholder agriculture may be transitional and only produce partially for commercial markets (Olwande et al. 2015; Wiggins et al. 2014), they provide about 80% of the food supply in SSA (FAO 2014). Production for export is often by large-scale commercial farms with privately operated irrigation systems or out-grower schemes not within the purview of public governance structures.

Private investments have increased through both foreign investment in farmlands and on-farm irrigation schemes for commercial farming (Cotula 2011), as well as private smallholder investments in irrigation technologies (Woodhouse et al. 2017). The majority of farms, both emerging private small- and large-scale commercial production, are not within conventional schemes and not required by public institutions to establish WUAs to manage water or related infrastructure.

In most of SSA, WUAs are established as part of conventional irrigation development projects based on requirements set by donor agencies and less by the public institutions. However, only a few countries have officially set out laws or regulations for WUAs in national legislation, notably Kenya and South Africa, and through proclamation in Ethiopia. More countries are, however, working toward the formalization of WUAs in national law or through other procedures, albeit not incorporating emerging irrigation systems. In some cases, WUA guidelines remain outside national policy, but may still be instituted by irrigation agencies, such as World Bank-supported guidelines in Malawi.

Water resource system

Large parts of SSA are characterized by seasonal water scarcity, where rainfall is concentrated during a few months of the year (Burney and Naylor 2012). Generally, the spatial disparity of water availability on the subcontinent is high, with extremely wet regions neighboring extremely dry regions. Both the spatial and seasonal variability of water resources are increasing (Kotir 2011). This will affect the predictability of water supply in irrigation schemes.

Based on the AQUASTAT database of the Food and Agriculture Organization of the United Nations (FAO), the irrigated area of SSA was 7 million hectares (Mha) in 2006 (equivalent to 6% of the cultivated area), which is significantly below the world average of 18% (Svendsen et al. 2009). Most of the irrigated area in SSA is under small-scale irrigation schemes, with only approximately 17% of the current irrigated area in SSA is under large-scale irrigation systems (Lankford et al. 2016). Unsurprisingly, current infrastructure-based irrigation is most prevalent in the semi-arid and arid regions of SSA, mainly in the Sudano-Sahelian Region and Southern Africa (Frenken 2005). Lowland irrigation is practiced in regions with relatively abundant water resources, while irrigation during flood recession is most common in West African coastal states (Frenken 2005). Compared to other regions in the world, infrastructure to capture water resources for irrigation is scarcely developed in SSA, yet many studies indicate that sufficient water is available to significantly increase the irrigated area in the region. According to multiple studies, SSA has a large potential of untapped water resources which can be used for irrigation (Hanjra and Gichuki 2008; Pavelic et al. 2013; Svendsen et al. 2009; Xie et al. 2014; You 2008). You (2008) estimated that another 2 Mha could be irrigated by large-scale systems, with water stored behind dams, and 23 Mha could be irrigated by small-scale irrigation technologies, such as rainwater harvesting, pumping installations, small dams and river diversions. The potential is strongly dependent on cost assumptions and could be as high as between 27 and 82 Mha (Xie et al. 2014).

Overall, most irrigation development projects in SSA since the 2000s have focused on small-scale irrigation systems with irrigated areas up to 500 ha per scheme. Small reservoirs or river diversions are built to collect and store the water and convey it to farmers' fields. Usually, a single WUA holds the responsibility for managing the scheme. Most infrastructure, such as reservoirs,

has been financed through grants and loans from international development banks and agencies. Generally, the management of the infrastructure is transferred to newly established WUAs after construction.

This is exemplified by a focus on small-scale irrigation in participatory irrigation development projects since 2000, co-funded by the International Fund for Agricultural Development (IFAD), in Tanzania, Ethiopia and Malawi (IFAD 2007a, 2007b; World Bank 2015a). To some extent, these projects built upon existing water harvesting and irrigation practices, but also included new river diversions and gravity schemes. In Tanzania, the irrigated area per scheme lies between 200 and 250 ha (IFAD 2007b), whereas programs in Ethiopia included river diversion schemes with irrigated areas of 100 ha and spate irrigation schemes with irrigated areas between 200 and 500 ha (IFAD 2013). In Malawi, the participatory irrigation project included so-called mini-scale schemes with irrigated areas below 20 ha (World Bank 2015a). In small-scale irrigation schemes, water control can be more flexible, but the schemes are also vulnerable to local weather extremes; 85% of the small-scale schemes built for the above-mentioned project in Tanzania are not resilient to drought and are easily damaged during extreme rainfall events, such as floods (IFAD 2007b).

The use of groundwater resources is currently estimated to cover only 20% of the total irrigated area in SSA with high potential for more development (Villholth 2013). Public investments in pumping installations for groundwater irrigation are rarely accompanied by the formation of WUAs in SSA. In the rare cases where WUAs are set up on groundwater irrigation schemes, the mandate of WUAs may be both O&M and cost recovery to use the pumps, and also ensure sustainable water use. For example, WUAs in Niger are organized around the use of pump installations with the primary task to "protect, restore and rationally and equitably exploit the water resources" (IFAD 2015: 8). Promoting WUAs for sustainable groundwater use is a relatively new approach, particularly implemented in those regions of the world where groundwater over-exploitation poses a threat to the socioeconomic and environmental sustainability of irrigated agriculture. For example, in Yemen and China, WUAs can play an important role in restricting farmers' groundwater abstraction, with a few particularly successful examples of participatory WUA processes and roles (Aarnoudse et al. 2012; Taher 2016).

Generally, farmers often rely on the same water resources used for the irrigation scheme to also serve domestic and livestock needs, largely due to the limited development of water infrastructure in SSA. Land and water resources are widely used for multiple purposes by the rural population, including providing water for livestock, fishing and domestic use. The diversity of water users for multiple purposes frequently causes local conflict of water sources and infrastructure, particularly related to irrigation and livestock.

Beyond conventional irrigation development, emerging irrigation accounts for 15% to 75% of the actual irrigated area across SSA (Abric et al. 2011). Emerging irrigation is generally overlooked in terms of the establishment of WUAs, despite its increasing importance. The exact figures for emerging irrigation are difficult to calculate, as data on emerging irrigation and particularly small-scale private irrigation remain unreliable and scarce (de Fraiture and Giordano 2014; Dittoh et al. 2013). The AQUASTAT database of FAO excludes areas not under permanent irrigation equipment (Svendsen et al. 2009), so analysis based on that data likely underestimates current emerging irrigated areas (Woodhouse et al. 2017). Small-scale emerging private irrigation depends on a variety of technologies that facilitate the access, distribution and use of water, such as treadle pumps, small petrol or diesel motor pumps or watering cans (Burney et al. 2013; Dittoh et al. 2013). The technologies are used to access either groundwater or surface water from rivers, underutilized irrigation canals and small reservoirs (de Fraiture and Giordano 2014; Villholth 2013). Those technologies tend to be concentrated on individual farms in which "access, distribution and

use all occur at or near the same location" (Burney et al. 2013: 12513). In addition, individual pumping may take place inside canal irrigation command areas managed by WUAs (Foster and van Steenbergen 2011). The deterioration of canal irrigation infrastructure sometimes accelerates the conjunctive use of surface water and groundwater within canal irrigation schemes (Kuper et al. 2012). However, farmers using individual technologies, including in canal systems, are generally excluded from WUAs and lack any organization to collectively manage infrastructure or commonly exploited water resources. Collective management will likely be required to ensure sustainable resource use as this type of irrigation continues to increase.

Governance

In SSA, WUAs usually receive little technical support from local state agencies. State agencies responsible for irrigation are typically "small in size, dispersed over several ministries, and remote from the ground" (Venot 2014: 536). Development banks and agencies aimed for such lean state irrigation agencies. However, at the same time, they provide funding for nongovernmental organizations (NGOs) to implement irrigation development projects and establish WUAs, often isolated to individual projects within a short project cycle (Tafesse 2003). This leads to situations in which external actors oversee local government institutions in the planning and management of irrigation systems (Venot 2014). Such arrangements expand the disconnection between WUAs and local institutions, such as agricultural extension, which otherwise have potential to facilitate meaningful user participation in WUAs.

Development actors, whether external organizations or public agencies, generally create WUAs as irrigation schemes are constructed or rehabilitated. In principle, the governance rules of WUAs, the 'internal code' or 'bylaws', should be set by WUAs themselves through a participatory process (Vandersypen et al. 2007). In reality, WUA bylaws are likely to be prescribed by the external funding agents or by national government agencies and not developed by the WUA members themselves (Abernethy et al. 2000; Ferguson and Mulwafu 2007; Kemerink et al. 2013; Vandersypen et al. 2007; Yami 2013). In addition, irrigation scheme farmers often effectively ignore rules or bylaws or replace them with local institutions that have their own political interests. The ability of the WUA to manage infrastructure and water resources is undermined by the combination of the external requirement for a WUA, lack of effective and inclusive participation of WUA members in determining bylaws, and the appropriation of WUA activities by other bodies with powerful interests.

Indeed, some scholars argue that WUAs cannot be defined as user-driven participatory organizations because they are formed under such external influences. Based on an in-depth study of 37 small reservoirs in Ghana, Venot et al. (2012: 18) concluded that WUAs "remain promoted by outsiders rather than being the expression of a collective decision-making process emerging from the community". Others sketch similar situations in different countries. For example, Ferguson and Mulwafu (2007) reported that the top-down enforcement of WUAs weakened smallholder farmer participation in Malawi. Also, in Kenya, Kemerink et al. (2016: 1072) found that WUA members cannot participate meaningfully due to "predetermined and biased organization structures introduced by the policy" despite the established legal basis for WUA formation. In Mali, scheme users largely disregard formal WUA institutions put forward by donor agencies; official positions of WUA committee members are filled, but meetings do not take place (Vandersypen et al. 2007).

As noted, local institutions in rural villages also interfere in WUA operations. Gaps left by weak irrigation agencies and intermittent NGO interventions, or unclear institutional mandates and legal pluralism contribute to this situation. For one, customary authorities based on customary values and rules take on responsibilities that are meant to be the mandate of the WUA (Sokile and van

Koppen 2004; Vandersypen et al. 2007). Local claims on land and water are often not codified in state laws, but function within parallel, powerful customary institutions (Hodgson 2016; Sokile and van Koppen 2004). In most of SSA, customary structures did not evolve around irrigation systems, as in Asia or Latin America, but rather around kinship and chieftaincy (Kemerink et al. 2013). As such, roles related to the management of the irrigation scheme may be subsumed under preexisting customary institutions, which may not necessarily reflect the principles of equitable participation or current natural resource management practices and ultimately contradict the aims of WUAs. Hence, collective irrigation institutions – WUAs - are usually introduced for the first time within potentially conflicting sociopolitical settings. In Ghana, formal WUA tasks mainly consist of minor maintenance and daily management, but traditional authorities remain responsible for "settling disputes, resolving conflicts and maintaining social cohesion" (Acheampong and Venot 2010: 5). This is similar to Malawi, where local village headmen maintain responsibility for all conflicts, even those within the public irrigation scheme (Lefore et al. 2017). This amalgamation of institutions and roles, sometimes contradictory, can hinder substantial user participation in practice. It may also obscure the allocation of funds by WUA leaders and constrain cost recovery objectives (Kemerink et al. 2016).

In other cases, non-irrigation public agencies commandeer control over WUAs in the absence of a strong irrigation agency. For example, in Ethiopia, WUAs are officially registered as cooperatives, which have a history of politicization. The public agency responsible for cooperatives dictates the WUA bylaws in line with its own interests (Yami 2013). This undermines cooperation and enforcement of scheme rules, and encourages water users to revert to traditional water distribution practices. However, Ethiopia represents an exceptional case in SSA as one of the few examples of historical collective irrigation institutions.

Case studies also show interference in WUA membership composition. The implementing agency that sets up a WUA during project inception tends to predefine WUA membership based on a national law or a WUA bylaw template. For example, WUAs in Ghana and Burkina Faso tend to center on downstream irrigators and exclude other users of small reservoirs in 85% of the cases (Venot 2014). In Tanzania, membership criteria based on landownership favors men, as women usually do not hold official or customary land rights (IFAD 2001). Follow-up projects attempted to redress this issue by setting targets, i.e., quotas, for female WUA membership (IFAD 1999), but intra-household gender discrepancies were not fully resolved through this approach (IFAD 2007b). In addition, WUA membership criteria in Ethiopia based on land-use rights within the irrigation command area exclude landless farmers from WUAs (Yami 2013).

In a more extreme example, Kemerink et al. (2013) described the situation in South Africa, where large, commercial farmers, predominantly white, exploited the formation of WUAs for their own benefit based on the historical foundation of formal institutions and collective water use. Farmers within the former homelands used traditional institutions based on kinship, as they were not familiar with the formal procedures of the commercial farmers. Farmers within the former homelands could not influence the mandate and structure of the WUA, despite the formal prescriptions on their inclusion after the end of apartheid.

Leadership selection is no better on inclusion, though nominally should be done through a transparent election by all members. Leadership positions are often assumed by local elites through various means (Ferguson and Mulwafu 2007; Kemerink et al. 2016; Sokile and van Koppen 2004), even when they have technically been 'elected' by all WUA members (Zuka 2016). In this position, local elites benefit most "from new opportunities provided by the irrigation reform in terms of training, access to information and abilities to shape the rules governing scheme functioning" (Ferguson and Mulwafu 2007: 224). For example, in Malawi, WUA leaders were able to reallocate

plots within the irrigation system to their own family members (Ferguson and Mulwafu 2007), and informal and formal procedures often excluded women (Lefore et al. 2017).

The prescription of WUA bylaws and membership composition by external agencies without taking into account the local context, compounded by the interference of self-interested local institutions, reduces representation and participation of different groups and classes within a scheme. This ultimately undermines the WUAs' ability to operate with transparency and equality. Yet, public and donor agencies also expect WUAs to be financially transparent and independent as management bodies. The official mandate of WUAs remains the O&M of the irrigation system, but donors often prioritize financial independence. For example, WUAs in an IFAD-supported, community-based watershed management project in Rwanda are expected "to operate without external assistance and to mobilize funding for system maintenance and repairs" (IFAD 2016: 47). One case of successful cost recovery is highlighted in the IFAD-supported Participatory Irrigation Development Programme in Tanzania, but notes the case "is outstanding and is a unique approach that is contrary to most other schemes where they will wait for government or donors to resolve any problems with funding" (IFAD 2007b: 27).

At the same time, the financial performance of WUAs is rarely documented in detail and WUAs fail to keep adequate financial records. Overall WUAs do not sufficiently collect fees and/or transparently spend the resources collected. In the Tanzania case noted above, farmers became increasingly reluctant to contribute to O&M costs throughout the duration of the project (IFAD 2007b). Also, farmers in Malawi persistently resisted paying irrigation maintenance fees, because they felt their decision-making power in irrigation management had been curtailed even with the formation of WUAs (Veldwisch et al. 2009). In Mali, very few WUAs actually collect financial contributions (Vandersypen et al. 2007). In Senegal, studies found WUAs deliberately set low water fees, which kept fees affordable for farmers and improved payment rates, but was too low to recover O&M costs (Le Gal et al. 2003). In Kenya, reports show that WUAs collected contributions from their members, but farmers' access to water had not improved despite increased fees; it was unclear how the money was spent (Kemerink et al. 2016). Also, farmers in Zimbabwe were reluctant to pay fees, because they suspected WUA leaders of using the money for personal benefits (Mutambara et al. 2014). Summarizing the findings from studies in Mozambique, Tanzania and Zimbabwe, Mwamakamba et al. (2017) stated that farmers usually do not pay fees because WUAs have no means to enforce payment. Donors and public agencies often expect fees to be collected to cover O&M costs and ensure WUA financial independence, but they rarely provide guidance for fee collection.

The gap between the national state and local areas appears to present an opportunity for increasing the role of farmers in water management through WUAs. However, lack of institutional backstopping and capacity development by the state also forms an obstacle to implementing and maintaining WUA operations in the long run (Mutambara et al. 2016). For example, IFAD found that WUAs in Tanzania functioned well as long as donor-funded staff were employed at district level, but support for WUAs faded once this role had to be taken over by the district government itself (IFAD 2007b).

Users

The average farm size in SSA is a little more than 1 ha per agricultural worker (Svendsen et al. 2009). Land availability for smallholder farming is constantly shrinking with a rapidly growing population and foreign land investments (Cotula 2011). Therefore, participatory irrigation development projects often explicitly target poor, small-scale farmers with landholdings below 1 ha. In addition, donors and NGOs target a considerable share of female-headed households with limited access to land,

who are considered particularly poor and marginalized (IFAD 1999; World Bank 2015a). WUAs usually group together several dozen to several hundred smallholders, depending on the size of the scheme. In some cases, the scheme size is deliberately kept low following administrative or village boundaries, so that each WUA represents one village (IFAD 2007b).

Most smallholder farmers in SSA produce for subsistence with the surplus used for commercial sale (Frelat et al. 2016; Wiggins et al. 2014), depending on diverse livelihood strategies, including animal husbandry, fishery and trade (Shah et al. 2002). Overall, smallholder farming in SSA is still characterized by low incomes and limited access to credit (Barrett et al. 2017; Burney and Naylor 2012). At present, 83% of smallholder farmers sell only part of their crops produced on the market (Frelat et al. 2016). Small-scale irrigation development projects may simultaneously promote new staple crops and cash crops, particularly high-value vegetables (African Development Fund 2007; Burney and Naylor 2012). However, most farmers reserve at least half of their land to produce crops for home consumption (Wiggins et al. 2014).

Generally, farmers have little to no experience with irrigation prior to development projects, as rain-fed farming is still widespread in most countries (Oates et al. 2015; You et al. 2011). Moreover, irrigation at individual farmer level does not necessarily prepare farmers to manage collective water resources and irrigation schemes, as these approaches often rely on the individual use of simple irrigation technologies, such as watering cans (Dittoh et al. 2013), or partial water control techniques, such as spate irrigation (Woodhouse et al. 2017).

Furthermore, investments in small-scale irrigation systems common for SSA often aim to alleviate poverty in rural areas and improve food security rather than increase incomes for farmers. In fact, irrigated income is only a small part of overall income, and in itself often too low to make cost recovery of irrigation systems feasible (Merrey et al. 2002). Overall, the subordinate importance of irrigated agriculture as part of rural livelihood strategies, and the correspondingly small landholdings and limited access to input and output markets, reduce the impact irrigation performance has on agricultural productivity and rural income (Shah et al. 2002).

The common attributes of smallholder farmers transitioning to irrigated cultivation belie internal differences. As noted above, WUGs are not homogenous and members not necessarily ‘equals’; differences exist within communities in terms of wealth, gender and ethnicity (van den Broek and Brown 2015). Water infrastructure in the irrigation scheme often also serves others in addition to the smallholder farmers, including pastoralists, fishermen and domestic water users. Nevertheless, WUA membership is often restricted to those who are expected to use water for irrigation whether they are plot owners or managers (Venot 2014). WUAs rarely include large-scale commercial farmers, except in South Africa, where an attempt to unite smallholders and large-scale commercial farmers in WUAs failed (Brown 2011; Kemerink et al. 2013). Acheampong and Venot (2010) argued that those multiple uses and users are not accounted for in the official role of WUAs as determined by external agencies. In addition, this excludes potential revenue streams and economic benefits other than irrigated agriculture (Venot et al. 2012), which are neglected in full cost recovery.

An Overview and Analysis of challenges in SSA

The main factors influencing WUA management are contrasted with the situation in South and Southeast Asia, and North Africa as shown in Table 2 to highlight the unique character of WUA management in SSA. Differences can be found within each region, but the characteristics shown here represent the dominant conditions which distinguish the three regions from one another. The main challenges conventional WUA management currently faces in SSA are also summarized.

TABLE 2. Typical conditions affecting WUA management in sub-Saharan Africa, South and Southeast Asia, and North Africa.

	Sub-Saharan Africa	South and Southeast Asia*	North Africa**
Socioeconomic and political setting	Investments in smallholder irrigation for poverty alleviation	Investments in smallholder irrigation for food security	Investments in irrigation for economic development
	Weak irrigation agencies and decentralization	Powerful irrigation bureaucracies	Powerful irrigation bureaucracies
Water resource system	Small-scale irrigation systems	Large-scale irrigation systems	Large-scale irrigation systems
	Vulnerability to climate and water supply variability		Upgraded small-scale irrigation systems
Governance	Mixed state, customary institutions	Poor decentralized irrigation management structures	Traditional collective water management
	Imposed rules, memberships, leaders		
	Low user fee collection		
Users	Small landholdings	Small landholdings	Small to medium landholdings
	Little experience with irrigation	Livelihood strongly dependent on irrigated agriculture	Livelihood strongly dependent on irrigated agriculture
	Heterogeneous	Access to private groundwater wells	Access to private groundwater wells
	Low access to alternative water resources; multiple uses in one system		

Notes: * Based on Mukherji et al. 2009; ** Based on Ghazouani et al. 2012.

In South and Southeast Asia, WUAs are primarily established to manage large-scale irrigation systems, which have been built or rehabilitated by post-colonial governments for national food security purposes. Previously, these systems were centrally managed by powerful water bureaucracies. Those bureaucracies with poor decentralized structures later became responsible for initiating management through WUAs. The livelihoods of smallholder farmers are strongly dependent on irrigated agriculture. Yet, a large share of irrigation requirements is currently supplied by privately owned equipment to pump water from aquifers and, to some extent, also from rivers and canals.

In North Africa, formal WUAs can be found in both large-scale irrigation systems which used to be managed by state bureaucracies as well as upgraded small-scale irrigation systems which used

to be managed by farmers. Investments in irrigation are primarily made to stimulate the region's economic development. Smallholder agriculture is increasingly commercial and strongly relies on irrigation development. Private investments in groundwater wells have substantially increased farmers' access to water over the last few decades.

The context in Africa, however, differs considerably from other regions. Shah et al. (2002: 5) stated that "in many aspects, the SSA smallholder situation differs from situations where IMT worked and was sustained." The cases above suggest that this argument still holds true (Bjornlund et al. 2017). In summary, smallholder irrigation schemes often seek mixed and contradictory goals that fail to consider the context. In almost all cases, farmer incomes remain too low for full cost recovery. In addition, the scheme's water source and sometimes the scheme itself serves multiple uses and users, which can increase conflict both on the scheme between those within the WUA and off the scheme between irrigators and the users excluded from the WUA. This compounds the complexities of the heterogeneous composition of WUAs, in which members have diverse preexisting socioeconomic status. Again, this is aggravated by institutions, including NGOs, customary institutions, and political organizations, that seek to fill the gaps left by low state presence and insinuate their own agendas at local level into scheme governance. At the same time, the state and donor-supported agencies may impose top-down directives, often through mandated scheme bylaws or rules, which undermine genuine WUA leadership and equitable, inclusive member participation. WUAs and irrigators may be constrained by such directives, but also confront little to no technical support or capacity strengthening needed to ensure productive irrigation schemes. This is occurring as emerging irrigation is expanding. Individual, dispersed irrigators often operate in the same watershed, aquifer or reservoir command area as formal irrigation schemes, but are outside of the governance scope of WUAs. The parallel and uncoordinated operations can undermine water resource sustainability, water allocation equity and therefore participation of WUA members within an irrigation scheme. It can also create discord between members of a scheme and individual irrigators nearby. Together, these factors not only prevent achievement of improved agricultural productivity, but weaken the assumed feedback loop through which improved irrigation performance strengthens cost recovery and user participation in WUAs. In turn, donors and public agencies conclude that WUAs, and often the irrigation projects, have failed.

This summary comparison illustrates the differences between contexts of SSA and those in which donors and public agencies establish conventional WUAs. It highlights the limitations of transferring WUA templates or lessons from North Africa and Asia to SSA. WUAs may encounter difficulties to deliver on cost recovery and user participation in all three regions, but some intractable challenges predominate in SSA. This may reflect unrealistic expectations of WUAs to function uniformly.

3.3 Attempts to Strengthen WUAs in SSA

As summarized above, researchers and policy advisors identified flaws in WUA management after the establishment of WUAs, but many donors presumed the flaws could be fixed through slight modifications to implementation strategies. For example, IFAD published a report in 2001 that evaluated the performance of WUAs in small-scale irrigation projects in Africa, Asia and Latin America (IFAD 2001). The report presented a long list of recommendations to guide future design processes. Likewise, many irrigation projects implemented after 2000 incorporated additional suggestions or in some cases requirements for WUAs to mitigate common problems. However, those 'second generation' participatory irrigation projects did not fundamentally change the donor or public agency expectations of WUAs. Rather, most initiatives invest in WUAs to deliver on the

same core functions, i.e., cost recovery and user participation. Policy makers and donor agencies have tried five main channels to strengthen conventional WUAs: (i) WUA policy and legal instruments; (ii) WUA bylaws; (iii) contracts and formal agreements with WUAs; (iv) training of WUA members; and (v) introducing monitoring and evaluation (M&E). A few examples below illustrate recent efforts.

WUA policy and legal instruments

Donors and policy makers turned to the development of national-level legal instruments to regulate WUA operations to make them more effective. In some cases, donor agencies push national governments to put forward desirable WUA regulations that enforce the 'norms' in conventional WUAs, including cost recovery and user participation based on principles of equity. For example, in Malawi, the National Irrigation Policy and Development Strategy of 2000 included the preparation of WUA regulations to be adopted by the national government for broad roll-out in schemes (World Bank 2015a). Kenya, Tanzania and Ethiopia have recently introduced national-level policies or legal instruments. Mozambique also approved national regulations for WUAs in 2015 (Mwamakamba et al. 2017). In Kenya, the Water Act 2002 legally recognizes WUAs, defined as 'community projects' allowed to apply for a water permit at the water authority when at least two-thirds of the people occupying the area are WUA members (Kemerink et al. 2016). Tanzania's National Water Policy of 2002 and Water Act of 2009 also provides a legal basis for the formation of WUAs, which can be established by a majority of users of a common waterway. In Tanzania, the mandate of WUAs is to apply for a user permit, allocate water among its users, resolve water conflicts and collect water user fees on behalf of the river basin organization (Komakech and van der Zaag 2013). Ethiopia issued the Irrigation Water Users' Proclamation in 2014 that recognizes WUAs as a unique legal entity primarily responsible for the O&M of irrigation systems (Haileslassie et al. 2016) and demands mandatory WUA membership of all users of the system. Generally, the formalization of WUAs in national regulations officially aims at strengthening community-based irrigation management through WUAs, but often entails more state regulation, e.g., requiring water use permits (Lein and Tagseth 2009). Hence, codifying WUAs may also set the foundation to illegalize previously tolerated water use by smallholders (Harrison and Mdee 2017; Kemerink et al. 2016).

WUA bylaws

Bylaws are "the constitutional rules of each WUA" (Lempériere et al. 2014: 21), sometimes referred to as the 'internal code' or 'constitution' (Vandersypen et al. 2007; Zuka 2016). Important aspects included in bylaws are structure and mandate of the WUA board, rights and duties of WUA members, procedures for calling meetings and setting irrigation fees (Lempériere et al. 2014). Generally, water users themselves are supposed to set WUA bylaws to ensure they are fit to purpose. Nevertheless, governments and donor agencies often require certain elements to be integrated into bylaws. This can be stipulated in national-level legal instruments, as mentioned above, but can also be achieved by assisting or guiding WUAs as they establish their statutes. For example, in Malawi, the Department of Irrigation has a template which is used for establishing all WUA bylaws (Lefore et al. 2017). Similarly, WUA trainings provided by donor-supported or public agencies often include instructions on drafting specific bylaws. For example, one of the WUA training objectives of an African Development Bank (AfDB)-funded irrigation project in Kenya was to "facilitate the elaboration of constitution and by-laws by the farmer organizations" (African Development Fund 2006: 15). This is reinforced in cases where setting up bylaws is a specific condition for WUAs to receive funding for initial operations. In Nigeria, for instance, the technical proposal for a planned irrigation project states that WUAs will receive additional funds

given that "they are compliant with their own by-laws in terms of governance and accountability" (World Bank 2014a: 52).

The suggestions or requirements for bylaws tend to address previously encountered problems or perceived failures in WUAs. The implementation of quotas for women's participation is one clear example of how bylaws are mobilized to address past failures. Ethiopian guidelines for WUA regulations suggest that "there should be at least two women in leadership positions in WUA" (IFAD 2013: 48). Also, the IFAD-supported Land Conservation and Smallholder Rehabilitation (LACOSREP) project in Ghana set a quota of 40% women; it did so by opening up the WUA membership to all farmers and community members, rather than restricting membership to landowners or primary irrigators (IFAD 2001). The outcomes for "technocratic" quotas for women's participation are mixed, at best (Cleaver 1998; van Koppen 1998). Imposed bylaws also sought to address the accountability and financial transparency of WUA leaders (Zuka 2016). However, a recent case study in Malawi shows that WUA regulations on leadership election and financial audit reporting do not influence the actual functioning of WUAs (Zuka 2016). Governments and donor agencies approach bylaws as a tool to compel democratic governance mechanisms, ignoring the fact that forced participation has limited impact given the persistence of traditional institutions, and the power of local elites and entrenched interests.

Contracts and formal agreements with WUAs

A more direct way to enforce requirements upon WUAs is the enactment of contracts or agreements with WUAs. These can be transfer agreements between the WUA and the government and/or donor agency defining the rights and duties of each party. The agreement may include cuts in financial support, if requirements are not met. This is foreseen in Nigeria where WUAs are expected to sign a transfer agreement prior to receiving financial support (World Bank 2014a). The agreement sets the duties of WUAs in terms of governance and accountability. Similar agreements in advance of project implementation may be signed between WUAs and local project implementing agencies. Participation is arguably the main objective of signing the agreement. For example, in Ethiopia, "WUAs that participated directly in the planning process would be required to sign-off on all agricultural and irrigation plans before they are submitted to the Regional Programme Coordination Unit (RPCMU) for approval" (IFAD 2013: 6). However, the agreements may also formalize the cost recovery obligation. Similarly, in the case of Ethiopia, the agreements include a clause on WUA members' voluntary labor contribution during construction (IFAD 2013). Contracts can also be signed between WUAs and construction companies to assure the participation of WUAs in the planning process of projects or in-kind labor or material contributions. In Tanzania, a project mandated that "chairmen of WUAs participate in tender evaluation, contract and certificate signing during construction" (IFAD 2007b: 29). Finally, agreements may also be signed between landowners and WUAs in an attempt to avoid conflicts over land and water use rights, as practised in Malawi (World Bank 2015a). These examples show that signed agreements are applied in new projects to rectify a range of constraints faced by WUAs in the past. However, the focus is on formalizing institutions, similar to the WUA policies and bylaws, which does not necessarily address the underlying contextual factors.

Training of WUA members

Another approach to improve WUAs is through training. Here, the focus is not so much on formalizing institutions, but on building internal capacities with regard to the technical, financial and managerial skills considered necessary to manage a WUA and take over O&M tasks. Irrigation development projects initiated during the late 1990s and 2000s tried extended training programs for

WUA members. A good example is the Irrigation, Rural Livelihoods and Agricultural Development Project in Malawi implemented from 2005 to 2011, which was considered among "the first of a new generation of irrigation projects" (World Bank 2015a: 2). During the design of the project, the inability of farmers to operate and maintain rehabilitated irrigation systems was considered one of the project's main risks. Therefore, existing WUAs were 'revamped' through trainings on basic O&M to mitigate this risk, according to the project's evaluation report (World Bank 2015a). Those existing WUAs were originally established during the Smallholder Flood Plain Development Programme which ran from 1998 to 2007. Despite the added investment in training, the capacity and sustainability of those WUAs were evaluated as 'doubtful' at the end of this project (ibid). Hence, IFAD concluded that "[i]t was recognized that participatory planning, consensus building and design, combined with WUA strengthening and training, would have to start at least one year prior to construction [of irrigation systems]" (IFAD 2001: 43-44).

A similar rationale was followed in the project design of the IFAD-supported Participatory Irrigation Development Programme (PIDP) from 1999 to 2006 in Tanzania, which included a comprehensive capacity development component for WUAs. The project design was informed by lessons learned from the Smallholder Development Project for Marginal Areas (SDPMA) implemented from 1989 to 1996. The PIDP project proposal states that the previous SDPMA project focused too much on infrastructure "at the expense of training, particularly of WUAs in the operation and maintenance of their schemes" (IFAD 1999: 2). The new PIDP project included a broad set of trainings, including: an introductory seminar for all members, a general course on WUA bylaws and financial administration, a course tailored for WUA leaders and a specific course for women to enhance their participation. Similarly, the Participatory Small-scale Irrigation Development Project (PASIDP) in Ethiopia which ran from 2006 to 2017 also planned specific trainings for women "to assist them to better participate in the management of WUAs" (IFAD 2013: 65). The proposal of Transforming Irrigation Management in Nigeria project also considers the training of WUAs an essential element to "re-align existing WUAs and establish new ones to achieve a transformed institutional structure for effective water management" (World Bank 2014a: 15). The project foresees a long training trajectory that includes the design of the training process itself, as well as subsequent implementation of the WUA trainings.

These examples show that intensified efforts have been made to train WUAs in 'second generation' participatory irrigation projects. These trainings concentrate on two main aspects. First, the skills and capacities of WUA members – and WUA leaders in particular – to operate and maintain the irrigation system, including financial and administrative management. Second, the inclusion and participation of women in WUAs. As mentioned explicitly in the project proposals, the trainings respond to difficulties faced by WUAs in the past. However, whereas training can be an effective way to sensitize WUA members for such potential difficulties, it does not necessarily address the underlying causes for the failures. For example, in the case of poor financial management, the main challenge is related to low income from irrigated agriculture, as discussed in the previous section, which may not be addressed through financial literacy training. Training may have a positive effect on WUA performance where such efforts are consistent and sustained over time, as suggested in a recent case study by Balasubramanya et al. (2018) in Tajikistan. However, more often, capacity development is limited to a few trainings in a short project cycle.

Monitoring and evaluation

Development banks and agencies have sought to introduce or strengthen monitoring and evaluation (M&E) within and on WUAs toward ensuring effectiveness. M&E of a WUA income and expenditure, as well as water use and levels, could contribute to the transparency of its financial

governance and improved service delivery. However, monitoring data on the availability and distribution of water is often lacking at WUA level, which can undermine the ability of WUAs to control water use and impose sanctions when users do not respect irrigation turns or any other operational rule. Several authors argue that monitoring water levels at field level, in particular, can be an effective tool to improve irrigation performance without the need for expensive technical interventions (Poussin et al. 2006; Vandersypen et al. 2008; Wellens et al. 2013). Ambitious plans to implement such M&E may exist at the project planning phase. For example, the appraisal document of the 'Transforming irrigation management in Nigeria' project seeks to "raise the capacity of the country to collect, store, share and manage data related for the management of dams, irrigation investments and agricultural mechanization and transform this data into usable information across stakeholders to underpin and plan their actions" (World Bank 2014a: 92).

However, actual M&E of irrigation schemes is low. In Malawi, it has been reported that WUAs collect and share data with its members on simple indicators such as the number of WUA members, the cultivated area in dry and wet seasons, and membership fees (World Bank 2015a). Yet, this data collection is only common in larger irrigation schemes; such activities are too time and resource consuming in the smaller schemes for WUA executives to take up in addition to other tasks. The IFAD-funded Participatory Irrigation Development Programme' (PIDP) in Tanzania outlined participatory M&E to be carried out by government district offices (IFAD 2007b). Yet, IFAD observed "less intensive monitoring and follow up to the schemes" once the project support for those district offices was phased out (IFAD 2007b: 21). Also, the mid-term report of PASIDP in Ethiopia indicated the urgent need to monitor and evaluate project implementation (IFAD 2013), but the M&E system planned at project design stage was not put in place. The reports provided no clarification of the reasons for the delay in M&E implementation. M&E could potentially provide data to identify constraints before they contribute to WUA failures, but it may also contradict an underlying principle of WUAs to reduce the size of the state irrigation agencies. The lack of state presence and capacity at local level, particularly within most irrigation departments in SSA, lowers the likelihood of implementing M&E, much less as an early alert system to problems at institutional level. In any case, M&E initiatives seek to collect data and potentially document weaknesses, but do not directly address the contextual causes of failures.

Conclusion

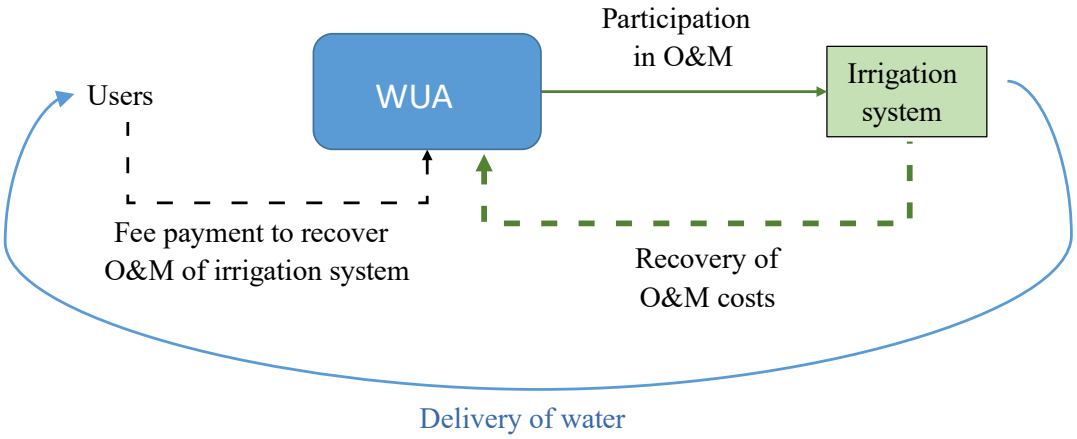
The advancement of WUA policies, bylaws, contracts, trainings and M&E signal that development banks and agencies, as well as public institutions, recognize the weaknesses of WUA management. However, such efforts do not represent meaningful change in expectations from WUAs or a substantive change in approach to irrigation scheme management. No evidence is available to show that having national-level legal instruments or regulations, or ensuring that WUAs create bylaws, actually lead to the desired outcomes of improved cost recovery, equitable participation and improved overall effectiveness of governance or O&M in an irrigation scheme. Rather, the cases above suggest that development actors continue to assume that mainstream WUAs are the correct vehicle for both cost recovery and user participation to achieve improved irrigation performance. In order to move away from this approach, alternative management options which assume a different role for water users are discussed in the next section.

4. ALTERNATIVE MANAGEMENT OPTIONS

This study introduces seven alternative management options which deviate from the way mainstream WUAs are typically implemented and expected to function by water departments, irrigation agencies and donors, as described in section 2 on the theoretical concept of WUAs. Each option is described with a special emphasis on how the approach deviates and/or overlaps with the way WUAs are commonly conceptualized and implemented. Examples of the practice of the options in SSA or other development contexts are provided. Finally, the most important opportunities and threats that may affect the implementation of each option in the SSA context are outlined.

As described in the first sections of this report, governments and donor agencies typically expect WUAs to strengthen both user participation and cost recovery aspects of irrigation management. In practice, user participation is often equated with assigning O&M tasks to WUAs, while cost recovery concentrates on the collection of water user fees by WUAs. In line with this, development donors and agencies focus on organizing water users in WUAs and fortifying the role of WUAs through national policies and regulations, bylaws, contracts and training of WUA members particularly on financial administration and O&M matters. Figure 4 represents the basic components and interactions of a mainstream WUA. In short, users are engaged with the WUA through fee payment (and also through board or executive delegation). The WUA uses the fees to recover the costs of running the irrigation system. The WUA is also in charge of, and participates in, the O&M of the irrigation system, which is designed to deliver water for irrigation to users.

FIGURE 4. The role of mainstream WUAs.



Alternative management options primarily rely on other mechanisms to enhance user participation and/or cost recovery. Most importantly, the options shift the focus onto activities that are related to other actors and/or processes in irrigation management. WUAs may still play an important role in management options, but formalizing and training WUAs per se is no longer considered the only way to achieve cost recovery and user participation. In some options, the role and responsibility of WUAs may even be completely different from mainstream practices. To make a clear distinction between these different types of WUAs, we will refer to those organizations which follow the dominant WUA model as 'mainstream' WUAs.

Based on a literature review of smallholder irrigation development, this study identified seven alternative management options that development actors have promoted and/or implemented recently. As shown in Table 3, each option provides a different approach to issues of user participation and/or cost recovery.

TABLE 3. Alternative management options for WUAs and their role with regard to user participation and cost recovery.

Management option	User participation	Cost recovery
Mainstream WUA	WUAs are established and strengthened so that water users participate in the O&M of the irrigation system.	WUAs collect irrigation fees from water users to recover O&M costs of the irrigation system.
Alternative management options		
Participatory design	WUAs are involved in investment decisions and design of the irrigation system.	Low-cost solutions for irrigation systems are selected based on water users' financial capacity and potential labor input.
Overarching water user platform	Overarching water user platforms are established in which WUAs can join to participate in higher-level decision making on the allocation of water within the river basin.	In some cases, set and/or collect water user fees.
Multi-stakeholder and innovation platform	Stakeholders use the platform to share knowledge, communicate and for joint decisions.	-
Joint management	The role of field staff in irrigation agencies and their interaction with WUAs is strengthened to facilitate the participation of WUAs in O&M of the irrigation system.	Field staff are less concerned with infrastructure *as such* and more concerned with service provision compared to higher-level irrigation officials. Hence, a more prominent role for field staff allows breaking through the build-neglect-rebuild cycle keeping costs artificially high.
Multi-functional WUA	-	WUAs generate income by providing agricultural services which can be used to recover O&M costs of the irrigation system.
Public-private partnership (PPP)	WUAs become a partner in setting up a PPP contract with a private operator, which becomes responsible for delivering irrigation services.	As a specialized company operating under competitive market conditions, the private operator provides the most cost-effective solutions for O&M of the irrigation system.
Combined surface water-groundwater WUA	Both surface water and groundwater use are managed by a WUA, so that water can be accessed flexibly according to the water users' needs. This limits their dependency on the irrigation agency and/or competing users.	WUAs can charge fees for both surface water and groundwater use to recover O&M costs of the irrigation system.

The approach may largely replace the practice under mainstream WUA management (e.g., PPPs) or supplement current practices (e.g., overarching water user platforms). None of the options have been widely adopted so far; however, scholars and development organizations have explicitly advocated the first five alternative management options. These options are relatively well documented, so practical examples are available to illustrate how the options function, though not necessarily in SSA. The last option listed on combined surface water and groundwater WUAs is less developed. Several scholars hint at this option as a solution to challenges in irrigation development today (Foster and van Steenbergen 2011; Mukherji et al. 2012), but few practical examples are available. Hence, the option is explored based on experiences made with mainstream WUAs in a setting of conjunctive surface water and groundwater use.

The alternative management options presented here do not provide exhaustive solutions for all challenges faced by mainstream WUAs in SSA. The options presented offer alternative means to solve issues with cost recovery and/or user participation, but do not address the underlying causes of problems in irrigation schemes. As such, this section provides a broad overview of context-specific options for primary functions of WUAs.

4.1 Participatory Design

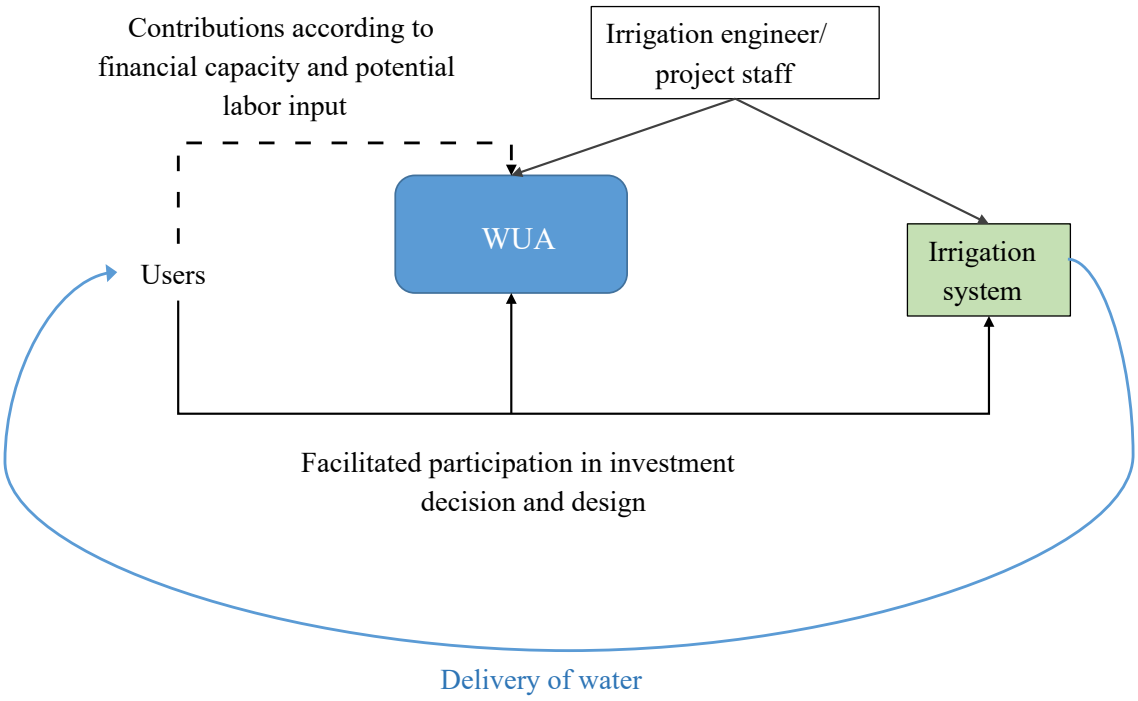
The concept

Participatory design (or interactive design) is a process through which the intended users of an irrigation system are involved in the decision making on the infrastructure (and partly managerial) design of the system. Figure 5 depicts the basic layout of a WUA when operating on the participatory design principle. This involves the contributions of users according to their own financial capacity and labor input. An external irrigation engineer or project staff is involved with the WUA to develop and design the irrigation system according to the needs of the users. Users also contribute directly through a facilitated process so that the irrigation system delivers.

In the context of externally funded irrigation development projects, participatory design implies that users also have an important say in a project's budget allocation (van Koppen et al. 2012). In a project developed through a participatory design process, most efforts concentrate on the participation of user groups during the design phase. Some scholars argue that an irrigation system developed through a participatory design process matches water users' managerial skills to maintain the system (Morardet et al. 2006). Therefore, O&M of the irrigation system is likely to be taken over by a WUA after the design phase, but other management options may also be selected depending on users' preferences. User participation during the design process promotes the selection of infrastructure and managerial solutions based on users' own financial capacity and potential labor input. Hence, participatory design is a promising approach to ensure that the O&M costs can be recovered by water users themselves after the design phase.

The idea of participatory design for irrigation development is not new. Beekman and Veldwisch (2016) referred to several scholars who advocated participatory design and developed guidelines for its implementation in the irrigation sector in the 1990s. Also, Scheltema (2002) reported on guidelines developed by the Government of Kenya to support participatory design in the 1990s. The different guidelines share a design process that follows a step-wise approach, whereby users can influence decision making at different stages of the design process. Beekman and Veldwisch (2016) identified three main steps in the design process: problem definition, conceptual design and construction. Preferably, multiple cycles of problem definition, conceptual design and construction are repeated and built upon each other. This means that construction work is not finalized at once,

FIGURE 5. The role of WUAs in participatory design.



and can be adjusted according to experiences or issues in the scheme. Strengthening facilitated processes of engagement and learning at multiple levels could enhance the iterative cycle needed for the participatory design approach (Hagmann and Chuma 2002; Lefore 2015).

Also, the issue of cost recovery is addressed through the selection of low-cost solutions which genuinely suit the local situation and input from water users. The WUA should not have to collect (unrealistically) high irrigation fees, because the scheme should be designed to fit the local economic circumstances and capacity. Overall, a participatory design approach is likely to imply longer time spans and higher costs for a project's planning and design phase, but costs would be kept lower on infrastructure construction and subsequent O&M (Wolfe and McCans 2009).

In order to adopt a participatory design approach, governments and donor agencies would need to reconsider some conventions in irrigation projects. First, budget allocation should not be narrowly defined by external actors (governments or donor agencies) prior to actual infrastructure design. Second, not only water users but project managers should also be regarded as important actors to enhance user participation. According to Morardet et al. (2006: 44), activities to strengthen user participation need to focus on:

- building capacities of project managers, specifically engineers, in participatory approaches;
- providing incentives that encourage them to interact with local stakeholders (for example, including criteria in their performance assessment system); and
- placing more emphasis on training rural people, both in terms of technical knowledge and empowerment.

Its practice

The actual implementation of a participatory design approach for the irrigation sector is limited. A review on the planning and implementation of irrigation projects in SSA by Morardet et al. (2006: 37) concluded that "participation often comes after the overall project is designed; i.e., the design is not based on beneficiaries' demands and interest." Some elements of the approach appear promising and have been integrated into mainstream WUA approaches, particularly in IFAD projects. Notably, projects have consulted water users *before* detailed infrastructure design. For example, social issues were integrated in the planning and design of the irrigation schemes in the PIDP in Tanzania through consultations with intended users (IFAD 2007b). However, project designers did not always successfully merge the needs expressed by communities with technical knowledge on water availability. As a result, irrigation infrastructure was constructed on places where not enough water could be delivered. The project completion evaluation report draws the lesson that more time should be assigned to the design process (ibid.).

In some cases, water users have participated in the selection of contractors for the construction of infrastructure, and in the M&E of project development. For example, the IFAD-funded participatory irrigation projects in Ethiopia and Tanzania anticipated that WUAs would participate in the tender committees for awarding construction contracts (IFAD 2007b, 2013). That said, construction work was still of low quality in Ethiopia due to inappropriate design and poor workmanship (IFAD 2013).

These cases highlight the role of facilitating the participatory design process and ensuring that the design matches technical requirements for irrigation. Beekman and Veldwisch (2016) reported on a case in Mozambique (Box 1) which provides an example of the importance of the facilitator in understanding farmers' day-to-day water use issues and suggesting technically sound solutions. The process should be facilitated by an actor that is not part of the engineering-based irrigation authority, in order to avoid local demands being subsumed or dominated by technical experts on infrastructure. More training on how to facilitate participation to strengthen meaningful input of communities into planning would be needed. Refer to IWMI (2014) for one example of such a training curriculum.

Opportunities and threats in the SSA context

Low-cost technologies – You (2008) argued that small-scale irrigation in SSA is beneficial under the condition that low-cost technologies are used. The participatory design approach intends to seek such low-cost solutions in cooperation with water users based on their needs and capacity to contribute money or labor. In this regard, the approach suits situations where farmers face many constraints to full commercial farming, and incomes may not increase substantially to recover the costs of capital-intensive infrastructure.

Multiple uses – Irrigation infrastructure is often used for multiple purposes, such as water for livestock and fishing (Venot et al. 2012). Advocates of participatory design expect the approach to break through the typical centrally developed project cycle, enabling the integration and consultation with non-irrigation scheme users, including emerging individual irrigators, livestock owners and domestic water users, among others. This would entail budget allocation and infrastructure that is flexible with regard to water uses and livelihood goals. In cases where that is realized, a participatory design approach can reduce losses caused by damage due to unplanned uses of infrastructure (i.e., by building bridges over deep canals for cattle) (van Koppen et al. 2012), as well as improved management of water resources in the landscape.

Box 1. Participatory design project in Mozambique.

The Messica Irrigation Pilot Project was an action research project which was financially supported by the Dutch government and ran from 2012 to 2014. The project was carried out in a smallholder farmer-led irrigation system covering around 500 ha in Central Mozambique. The aim of the project was to support farmer-led irrigation development and increase benefits from irrigated agriculture. The participatory design process was divided into three phases: (i) problem definition, (ii) conceptual design, and (iii) construction and redesign. Each phase was characterized by intensive interaction between the engineer (project staff), a preexisting Management Committee representing the community as a whole, and the farmers using water from the system.

In the problem definition phase, emphasis was put on understanding underlying problems and difficulties faced by farmers. This helped to avoid solving problems of an organizational nature with infrastructural solutions. For example, farmers experienced a large amount of leakage from the main canal due to the habit of digging multiple breaches to flood a single field. Whereas this problem could be solved by lining the canal, more stringent rules restricting the number of breaches per field was brought forward as a more cost-effective solution. Another problem identified during the first phase was the washing away of intake constructions during the rainy season.

In the conceptual design phase, possible infrastructural solutions for the intake problem were further explored. In this phase, a local contractor joined the discussions. The design of permanent constructions, as well as the provision of labor by the farmers was decided upon and captured in a signed contract. One of the solutions proposed by the engineer was the construction of a gabion weir (mesh wire box filled with rocks) as intake from bigger rivers – its construction is considered less costly than concrete diversion structures.

During the construction and redesign phase, farmers were expected to contribute labor to the construction of the gabion weir. However, this phase was characterized by much renegotiation over the original contract agreed upon. As the technology was unknown to the farmers, they were not eager to contribute labor after all. At a certain point in time, it was considered to abandon the gabion weir in the frame of the project. Yet, after long discussions, farmers resumed the work and the construction was completed.

A similar cycle of problem definition, conceptual design, and construction and redesign was repeated in the second year of the project. During the second project cycle, the farmers willingly contributed labor to the construction of gabion weirs, because the weir built in the first year had worked properly during the rainy season.

Source: Adapted from Beekman and Veldwisch 2016.

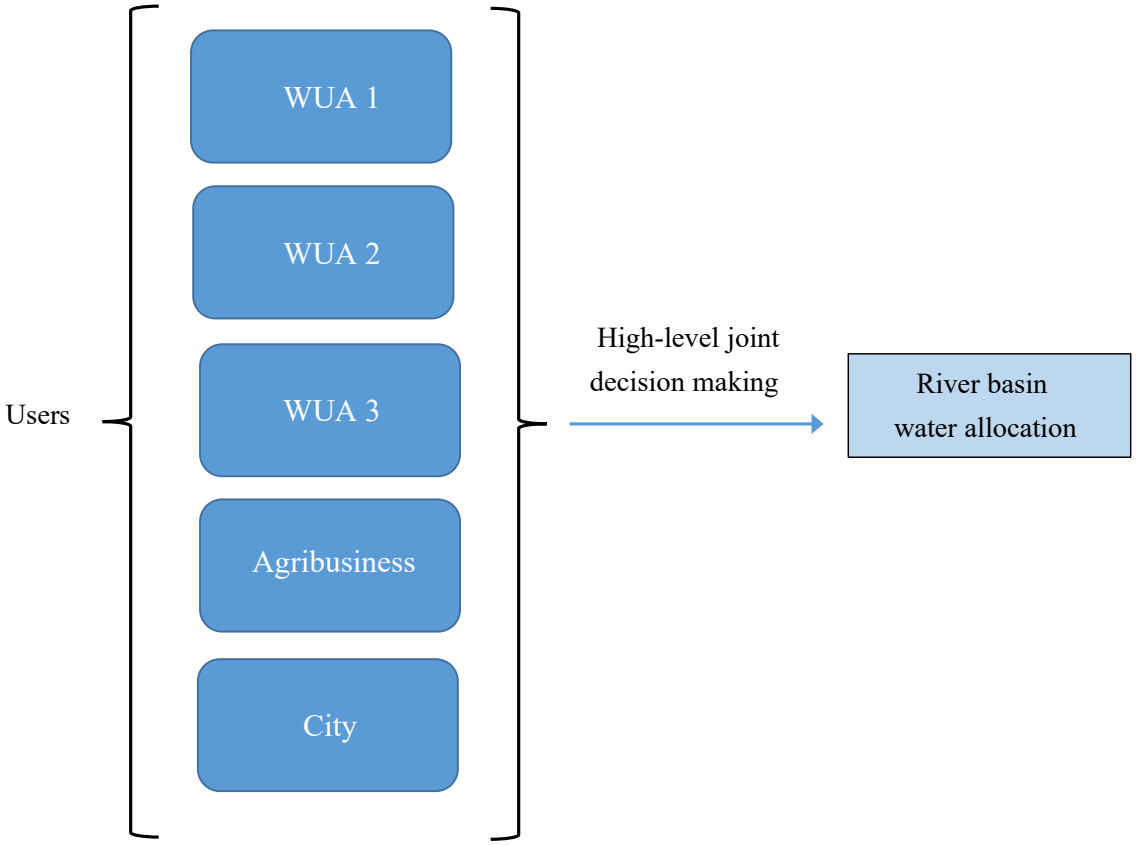
Representation of water users – Before a participatory design process commences, the potential water users who will participate in the design process need to be identified. This step is decisive for the subsequent participatory design process. For example, the Mozambique case involved a six-month participatory rural appraisal phase (Beekman and Veldwisch 2016). This is necessary to ensure adequate representation of different water users and stakeholders in the area, who will be required to cooperate in the design process and in the management functions later. Not ensuring adequate representation of a range of water users could undermine participation in a WUA and irrigation scheme, leading to the types of failures commonly seen from lack of participation.

4.2 Overarching Water User Platform

The concept

Overarching water user platforms, sometimes called water user forums (Komakech and van der Zaag 2013), are higher-level organizations which bring together smallholder representatives and other water users, such as cities, industries and large-scale farmers, to negotiate water distribution at river basin or sub-basin level.[5] Figure 6 depicts the basic functioning of a water user platform, where users are represented through different associations and stakeholder groups, and together they participate in the allocation of water within a river basin. Sometimes, the platform includes other stakeholders active in the water sector, such as government agencies and NGOs. Local-level smallholders are brought together with large-scale water users, and water resource planners and regulators to ensure improved water access for the smallholders (Hoogesteger 2012). In this regard, overarching water user platforms can strengthen smallholders' participation in water governance and secure their water access even in the presence of strong competition by more powerful players in the context of limited water resources.

FIGURE 6. The role of WUAs in overarching water user platforms.



[5] In large-scale irrigation systems, overarching water user platforms may also bring together representatives of multiple WUAs. Such platforms are often referred to as federated WUAs. The aspect of a multiplicity of stakeholders involved in catchment management is further developed in the subsection Multi-stakeholder and Innovation Platform, which goes beyond river basin management and includes other aspects of water management and agriculture.

Smallholder users participating in overarching water user platforms are usually representatives of WUAs. Overarching water user platforms do not replace WUAs, but provide the mechanisms to integrate smallholder-based WUAs into decision making on water allocation at catchment level. As such, overarching water user platforms are mostly beneficial in cases where WUAs are situated in a stressed river basin characterized by highly competitive water uses. In such a context, ensuring that smallholders take part in higher-level decision making may be an important driver for them to get organized and participate in WUAs (Hoogesteger 2012). A water user platform may secure or increase smallholder water rights, but does not tackle the issue of cost recovery of infrastructure built to capture the water (Kemerink et al. 2016). The intention is to improve water allocation to the smallholder irrigation scheme, which in turn is expected to incentivize WUA members to pay their water fees to maintain infrastructure.

Its practice

The idea of overarching water user platforms has received considerable attention since the early 2000s (McCornick and Merrey 2005). In SSA, attempts to bring this new mode of water governance into practice have been made in Burkina Faso, Tanzania, Kenya, South Africa and Zimbabwe (Kemerink et al. 2016; Komakech and van der Zaag 2013; Manzungu 2002; Roncoli et al. 2016). The creation of water user platforms is usually introduced through a reform in the national law. These reforms are often based on the IWRM principle of stakeholder participation in water management (Sally et al. 2011). However, prescriptions on the organizational forms may differ from country to country. In Burkina Faso, water policy reforms prescribe the establishment of local water committees with voluntary membership and an advisory role to the government (Roncoli et al. 2016). In Tanzania, the water law provides for catchment and sub-catchment committees that can be delegated functions by the river basin authority (Komakech and van der Zaag 2013). Kenya's Water Act 2002 facilitates the creation of Water Resources User Associations – an organization of multiple local stakeholders responsible for allocating water permits and resolving water conflicts (Carpenter et al. 2017). The formation of water user platforms often follows a formal process in line with those legal reforms.

Opportunities and threats in the SSA context

Stressed water basins – SSA (excluding Southern Africa) is still one of the regions in the world where human alteration has a limited impact on natural river flows (Döll et al. 2009). Nevertheless, the pressure on water resources is rising in upcoming economies where water use by large-scale commercial farming and urban areas is growing, such as in Tanzania and Kenya. Here, river basins are characterized by intense competition over water resources and frequent water shortages (McCornick and Merrey 2005). Smallholders in these areas experience conflicts over water with competing users. These can be conflicts between smallholders and international agribusinesses or between smallholders and cities (de Bont et al. 2016; Harrison and Mdee 2017). Whereas conflicts can sometimes be solved by shifting from surface water to groundwater resources, this is likely to present a superficial, short-term solution when groundwater is feeding into the river's baseflow (de Bont et al. 2016). In worse cases, smallholders' access to land and water is threatened due to the conflict (Harrison and Mdee 2017). In this context, overarching water user platforms may be beneficial to integrate smallholders into decision making on allocation and thereby help to secure their access to water.

Financial viability – A major challenge faced by overarching water user platforms in SSA is the lack of appropriate financial budgets for their operation. Indeed, cases of overarching water user platforms in SSA demonstrate that legal reforms are not effective as long as no financial means are made available for the participation of smallholders. In part, the formation of completely new organizational structures based on legal reforms may be too ambitious, not taking into account local

institutional and financial capacities (McCornick and Merrey 2005). This may keep the platforms in a dysfunctional state after formal establishment (Komakech and van der Zaag 2013). Contributions by financially strong water users (e.g., large farmers) may keep the platform running, but this does not enhance the participation of smallholder representatives. In Tanzania, it was found that so-called sub-catchment WUAs face serious financial difficulties and stay dysfunctional (Box 2) (Komakech and van der Zaag 2013). Similarly, it was found that the WUA representatives in Burkina Faso could often not attend meetings due to non-reimbursement of transport costs (Roncoli et al. 2016). Also in Kenya, the impact of overarching water user platforms on smallholders' access to water is limited due to a lack of financial resources to invest in infrastructure (Box 3). This allows large powerful users with sufficient financial means to "tweak the rules of the game in such a way that it better serves their interest" (Kemerink et al. 2016: 1073). Lack of financial resources can threaten the legitimacy of the platform (Roncoli et al. 2016).

Box 2. Kikuletwa Catchment forum in Tanzania.

The Kikuletwa Catchment is located in the Pangani River Basin in Northeast Tanzania, near the border with Kenya. Water users in the catchment include smallholder subsistence farmers, pastoralists, large-scale commercial farmers, cities, mines and tourist facilities. Recently, the number of conflicts over the allocation of water resources has been increasing. To address this issue, the Pangani River Basin Organization and development partners established four so-called sub-catchment WUAs in 2010. These four sub-catchment WUAs were planned to be united in one large catchment WUA at a later stage. Representatives from different wards in the sub-catchments were selected to enter the sub-catchment WUA committees. Yet, after formal registration and establishment of the sub-catchment WUAs, little has happened. The water authorities and development partners reasoned that the sub-catchment WUAs were created in the interest of water users and should thus be financed by membership fees. However, most of the water users were ignorant about the existence of the sub-catchment WUA and challenged the legitimacy of the organization once confronted with the request to pay membership fees.

Source: Based on Komakech and van der Zaag 2013.

Komakech and van der Zaag (2013) suggested that, in the case of Tanzania, parallel customary arrangements exist which could have been integrated to establish a user platform at catchment level. Hence, they argue that any government or development organization planning to establish a user platform should: "First invest in research to identify existing arrangements and understand their strengths and limitations. Subsequently, based on this understanding, a program can be developed to strengthen the positive aspects of the existing institutional arrangements while attempting to minimize some of the negative aspects" (Komakech and van der Zaag 2013: 246-247).

Meaningful participation of multiple users – Another problem faced by overarching water user platforms in SSA is a lack of meaningful participation of smallholder users, a problem already mentioned which undermines the main objective as an alternative management option to mainstream WUAs. Sometimes, this is related to a lack of financial means as mentioned above, but it may also be produced by the role of powerful water users during the formation process. For example, in Kenya, commercial farmers in prominent positions in the platform were found to hinder individual smallholders from applying for a water permit (Kemerink et al. 2016). Water forums tend to be comprised of representatives of formal organizations such as farmer unions (e.g., in Zimbabwe) or more often WUAs (e.g., in Kenya and Burkina Faso). In Zimbabwe, those so-called representatives

Box 3. Likii Water Resources User Association in Kenya.

The Likii sub-catchment is located in Central Kenya. Water users in the catchment include smallholder subsistence farmers, pastoralists, large-scale commercial farmers, a water utility and wildlife conservancy with tourist facilities. In 2002, the Likii Water Resources User Association (WRUA) was established to coordinate water allocation at sub-catchment level and to mitigate conflicts. In the sub-catchment, nine WUAs had been established earlier. Altogether, these WUAs represent about 2,500 smallholder irrigators. The organizational reform was prescribed by Kenya's Water Act 2002. The formation of the WRUA was initiated by one of the large-scale commercial farmers. It was decided that membership of the WRUAs, and consequently the right to apply for water abstraction, was confined to smallholders organized in WUAs and large-scale users. Smallholders not organized in WUAs and pastoralists were thus excluded from the platform. This urged many smallholders to join the existing WUAs; however, those WUAs lack the financial means to build infrastructure to supply all additional WUA members with sufficient water. Hence, some smallholders, whose land is located near the river, decided not to join the WUAs and individually divert water to their land with pumps. This practice is considered illegal under the Water Act 2002. Although there are some exceptions under which individual smallholders may apply for water abstraction rights, they tend to refrain from doing so because they are afraid they may be forced to join the WUAs.

Source: Based on Kemerink et al. 2016.

were found to have weak linkages with the actual water users (Manzungu 2002). In Burkina Faso and Kenya, individual water users, such as pastoralists and riparian irrigators, were found to be excluded (Kemerink et al. 2016; Roncoli et al. 2016). This may stimulate individual users to become members of WUAs, as was the case in Kenya (Box 3). However, it can also encourage water users to find other ways to voice their opinions, as illustrated by the demonstration of riparian users in Burkina Faso (Roncoli et al. 2016). Not only formal prescriptions can influence the selection of representatives in the overarching water user platforms, but also initiators of the platforms may play an important role in this regard. In both Kenya and Burkina Faso, large-scale commercial farmers/ agribusinesses were found to lead the formation process and steer the inclusion (or exclusion) of other users (Kemerink et al. 2016; Roncoli et al. 2016). To avoid this, a different stakeholder who is not a water user themselves (such as the government or an NGO) should oversee initial proceedings and facilitate the organization of WUAs under the platform.[6]

4.3 Multi-stakeholder and Innovation Platform

The concept

The development of multi-stakeholder platforms (MSPs) has been proposed to increase user participation in irrigation management, embedded in a larger context of user participation through partnerships in development (Chambers 1994; Evans et al. 2010). MSPs are in essence a negotiation body that provides a facilitated space for stakeholders to share opinions, define common problems and seek negotiated solutions (Evans et al. 2010; Faysse 2006). A word of caution, however, is put forward by Warner (2007), as MSPs do not need to be tangible or physical (an office in a building

[6] For example, Hoogesteger (2012) stressed the role of NGOs as facilitator to organize WUAs in a federate organization in Ecuador.

where people meet), and can also be ‘a state of mind’ or a phenomenon that enables participation and communication between stakeholders. MSPs come in many ways and forms, incorporating several components (linked to the specificity of the case, context and problem at hand) allowing “shared learning, collaborative planning and interventions, but not all of them can be said to achieve real mutual planning and action” (Evans et al. 2010: 358). As a result, Warner (2006) suggested to weigh in expectations when developing goals and attaching expectations to these MSPs as stakeholder objectives for the platform might differ. Stakeholders participate with pre-conceived ideas and agendas, e.g., some might see communication as a goal per se while others demand a tangible result (ibid.).

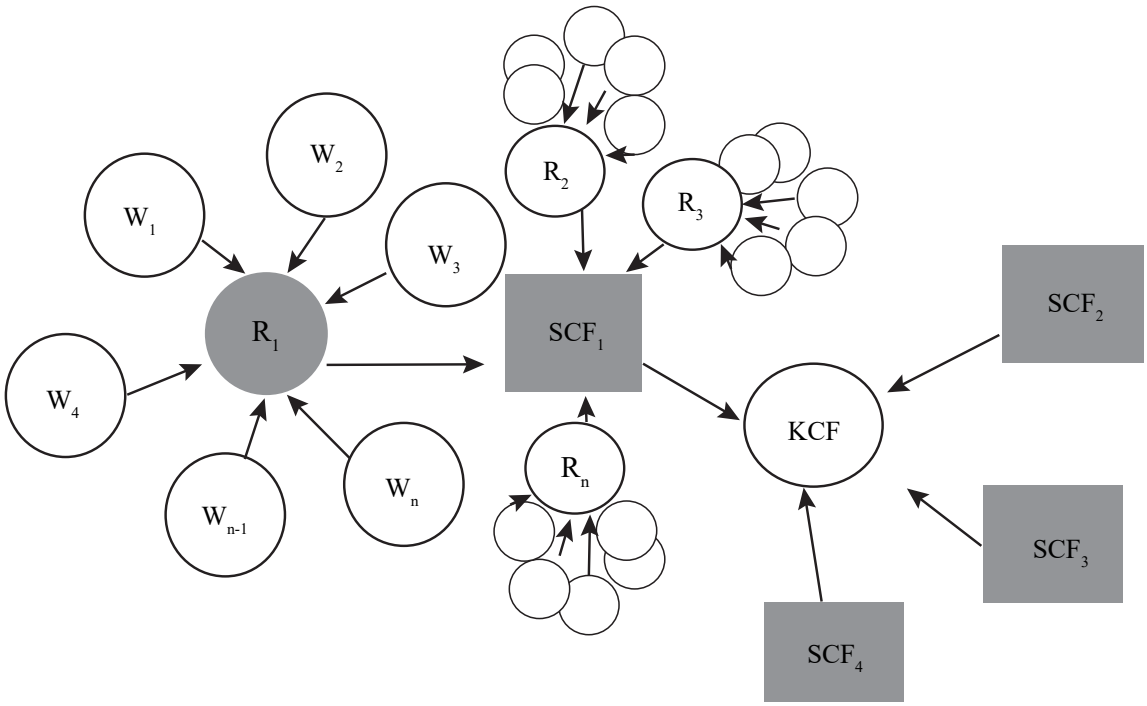
Innovation platforms are a type of multi-stakeholder platform with the aim of facilitating open communication and collaboration between stakeholders usually within a value chain to promote collective resource management or bring new products or processes and organizational forms into economic use (Martey et al. 2014; Rajalahti et al. 2008). They extend beyond the creation of knowledge and include factors affecting demand for and use of knowledge (Rajalahti et al. 2008). Innovation platforms are usually initiated by a research or development organization, a government agency or an NGO (Homann-Kee Tui et al. 2013). A broad and diverse group of stakeholders is identified, and the first few meetings are convened by the organization to define a focus and a problem to address (ibid.). Then, platform members decide on the appropriate options and solutions to address the problem, usually guided or supported by a moderator or facilitator (external or internally chosen by the stakeholders). Based on the problem definition and designed solutions, additional resources may be required (e.g., training, or further testing of technology) (ibid.).

Its practice

In South Africa, Catchment Management Forums are non-statutory water management organizations set up to enhance citizen participation in water management at the grassroots level (Boakye and Akpor 2012). Similar platforms have been created in Tanzania (Figure 7) (Komakech and van der Zaag 2013). In South Africa, these forums are used as knowledge sharing platforms by stakeholders, and communication channels facilitating discussion about shared problems and identification of common problems (Boakye and Akpor 2012). However, participants of the Msunduzi River catchment management forum still struggle to understand the purpose and objectives of the forum, having minimal contact with ministry officials.

It is also possible that MSPs fail to provide sufficient empowerment to stakeholders and often do not succeed in delivering expected outputs (in some instances, expectations are set too high or power relationships frustrate or limit participation and representation among stakeholders), thus affecting the legitimacy of the process itself (Warner 2006; Faysse 2006). In Tanzania, communication and collaboration are limited by power imbalances between stakeholders (as collaboration implies joint decisions with power sharing, and acceptance of decisions and implications) (Komakech and van der Zaag 2013). In Mexico, Consejos Técnicos de Aguas (COTAS) (technical committees for groundwater management) were set up by the central government to unify multiple stakeholders under a common groundwater resource management platform. However, a lack of sense of ownership among water users proved to be an obstacle for their consolidation (Wester et al. 2011). This lack of representation due to a poor democratic process of stakeholder selection and representation also created the perception among users that COTAS were just an extension of the state government in the form of an ‘appendix’ organization (Valdés Barrera 2014; Wester et al. 2011). COTAS are also restrained by the overruling power of other government agencies and have no faculties to control groundwater abstractions, having to rely on the users’ goodwill and on the

FIGURE 7. Example of a multi-stakeholder platform in the Kikuletwa Catchment, Tanzania.



Source: Komakech and van der Zaag 2013.

Notes: W - Elected ward representatives; R - Elected representatives of river systems; SCF - Sub-catchment WUA committees; KCF - Kikuletwa Catchment Forum.

National Water Commission, the only government agency with the power to issue pumping permits and responsible for the enforcement of aquifer regulations (Perez Fuentes 2010; Wester et al. 2007).

Innovation platforms can extend much further than the mere management of natural resources, and have been conceived as entry points "for the operationalization, validation and dissemination of agriculture technology" (Martey et al. 2014: 1). As challenges associated with natural resource management are multi-faceted, they can require multiple interventions in parallel (e.g., market access, institutional reform, infrastructure design, rural development, government policies, etc.). Innovation platforms enable users and stakeholders to develop new forms of communication, decision finding/making, and equality of access to information, knowledge and accountability of community-based management institutions (Martey et al. 2014).

Opportunities and threats in the SSA context

As presented by Martey et al. (2014) for Northern Ghana, multi-stakeholder and innovation platforms can enhance coordination, communication and collaboration between stakeholders within a value chain, and ultimately promote collective resource management. As described by Martey et al. (2014), MSPs to increase rice production and food security support the sharing and dissemination of knowledge, and coordinate decision making at local, national and regional levels. The platform equally serves the purpose of increasing competitiveness of agriculture, or improving access to markets (national and international). This point is mentioned by Homann-Kee Tui et al. (2013: 2), when they specify that "innovation platforms can be used to explore strategies that can boost productivity, manage natural resources, improve value chains, and adapt to climate change."

Bjornlund et al. (2017) explored a similar thesis and presented innovation platforms as a potential opportunity for small-scale irrigation in SSA to become economically sustainable, reduce

external investment, and become self-supported by farmers. This is achieved through a proactive and realistic problem-solving approach rather than the implementation and transmission of a set of principles top down (ibid.). They function as a way to develop a common mission and achieve specific goals (Homann-Kee Tui et al. 2013). The participants of agricultural innovation platforms benefit from the close contact, which can generate innovation, information sharing between different types of farmers, technology transfer, and learning-by-doing (Bjornlund et al. 2017).

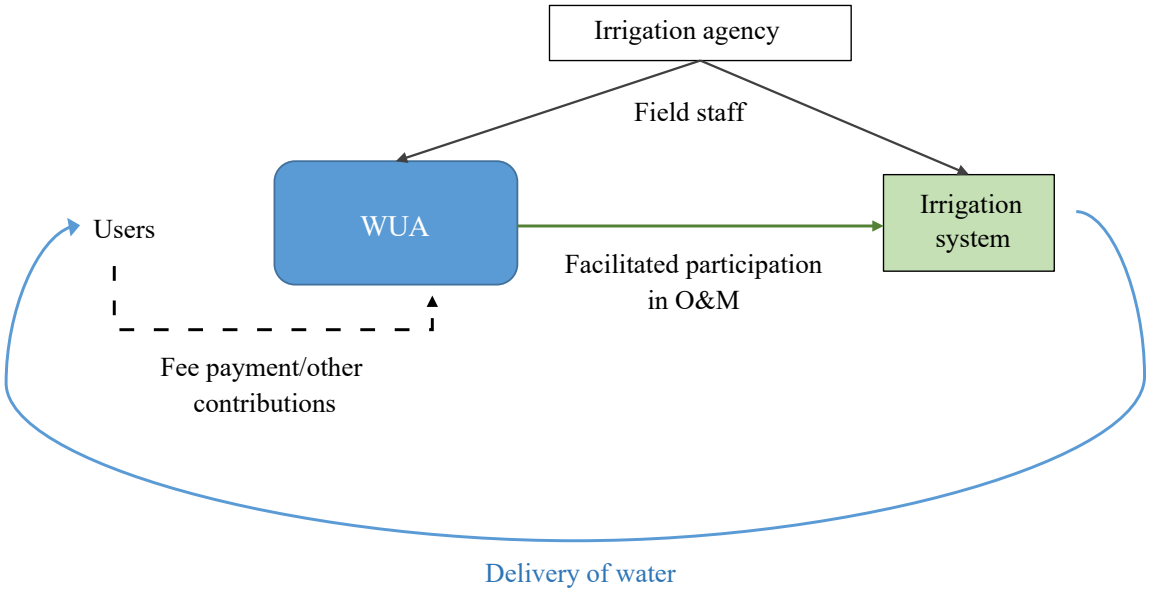
The problem of spatial fit, nested institutions, and customary arrangements that arise from the various definitions of problems and solutions between MSPs and river basins are highlighted by Komakech and van der Zaag (2013). These issues can be addressed by modularizing catchments, i.e., simultaneously establishing a basin-wide MSP and sub-basin catchment MSPs "to ensure the catchment-wide group does not get overwhelmed by the many interests and conflicts across an entire river basin, and also does not develop strategies or initiatives that do not make sense in all the sub-catchments" (Verhallen et al. 2007: 260). In Morocco, irrigation authorities coordinate timidly with farmer organizations at the community and irrigation scheme levels through MSPs and WUAs in matters related to water allocation at the scheme level, negotiation process for milk prices with milk cooperatives (as part of the value chain for milk intersects the water and irrigation systems), and the catchment management governing boards (Faysse et al. 2010). For each case, however, weak links between family farmers and representatives from WUAs make coordination and effective management difficult (ibid.). According to work in Tanzania by Komakech and van der Zaag (2013), even if catchment forums can provide consensus over issues such as water allocation negotiation and conflict resolution, such modularization does not ensure that optimal allocation principles and rules are found between stakeholders. For example, participation of certain stakeholders (e.g., large farmers) may be constrained if they perceive these processes as a potential threat to the status quo and therefore their interests. Thus, the identification of optimal and suitable subunits and their effective coordination is paramount to the success of these forums (ibid.).

4.4 Joint Management

The concept

Joint management is a generic term often used to describe irrigation management where O&M tasks are divided between an irrigation agency and WUAs (Subramanian et al. 1997; Uphoff 1986). Based on Suhardiman and Giordano (2014), we narrow down the definition of joint management as a management mode whereby the exchange on daily water delivery practices between field-level staff of an irrigation agency and water users is the central building block for irrigation development. Figure 8 depicts the basic layout of a WUA participating in joint management, where the delegated irrigation agency interceding through field staff, oversees the contribution of the WUA in the joint management and O&M of the irrigation system. Users continue to contribute through fees or other contributions and receive water for irrigation through the system. Cooperation between the two can be based on regular collaborative meetings or organized through a combined management committee (Ricks 2015). Suhardiman and Giordano (2014) assumed that irrigation outcomes can be improved by reshaping field-level practices of water delivery through joint management, and without striving for a perfect physical state of the irrigation system. Contrary to mainstream WUA implementation, joint management places more importance on the role of the field-level irrigation department or extension staff as catalysts of user participation. Hence, it requires governments and donors to spend more attention to mobilizing and training field-level staff to engage with and support water users.

FIGURE 8. The role of WUAs in joint management.



Joint management as defined here also requires governments and donor agencies to shift their focus from infrastructure maintenance to daily water delivery practices. Suhardiman and Giordano (2014) argued that investing more in field-level staff and their engagement in daily water delivery practices will reduce O&M costs, because expensive infrastructural solutions favored by rent-seeking officials at higher levels are avoided. Ideally O&M costs can be maintained at levels affordable for WUAs. Overall, joint management would require a larger long-term budget available for field-level staff and less recurrent investments in rehabilitation of the physical infrastructure.

Its practice

In many irrigation systems, irrigation agencies continue to assume specific management responsibilities, even after the establishment of WUAs (particularly in irrigation systems that were previously centrally managed) (Mwamakamba et al. 2017; Subramanian et al. 1997). Nevertheless, development support often concentrates on the duty of WUAs to carry out O&M and recover related costs. Meanwhile, capacity building of irrigation agency staff stays out of focus (Mukherji et al. 2012). Also, incentives for field-level staff to actively engage with WUAs are most of the time lacking because of the focus on infrastructure development and securing donor funding (Suhardiman and Giordano 2014).

Overall, a joint management approach is not widely practiced in SSA. However, cases where WUAs have not been solely responsible for O&M of irrigation schemes and received long-term technical support demonstrate positive results. For example, a comparative study of three irrigation schemes developed in the 1970s in Benin shows that only the scheme under continuous technical support was still fully operational by 2006 (Djagba et al. 2014). In the other two schemes, the irrigation infrastructure was almost completely taken out of use. In all the schemes, "an irrigation scheme manager was appointed to monitor the irrigation facilities and supervise the farmers' organization" after initial construction (Djagba et al. 2014: 334). This arrangement was maintained over time, only in the scheme which stayed fully operational.

Similarly, WUAs may receive intensive technical assistance from field-level staff during pilot projects or early project phases. This explains why WUA management often displays more positive

outcomes at early stages of implementation than at advanced stages (Suhardiman and Giordano 2014). An example of this can be found in Tanzania, where WUAs were reported to function well as long as project staff were stationed at the district government. However, once the external staff left, the support to WUAs by district governments was limited "due to lack of resources for transport, computer skills and lack of incentives in general to support the schemes" (IFAD 2007b: 29).

Similar experiences are found in Malawi, where capacity building of local government staff and the setting up of Water User Association Service Units (WUASU) at the irrigation department were foreseen to facilitate support for WUAs in schemes previously managed by the government (World Bank 2015a). However, WUASUs only stayed actively involved in scheme management, budgeting and accounting, and infrastructure maintenance during a restricted phase of joint management (e.g., 2 years) before those responsibilities were transferred to WUAs.

The Krasiew and Mae Yom Joint Management committees in Thailand are two cases in which strengthening the interaction between agency staff and water users has been a deliberate approach to improve irrigation management in the long term (Box 4). The two cases show that intensive

Box 4. Krasiew and Mae Yom Joint Management Committees in Thailand.

The Krasiew irrigation system is located in Southwest Thailand. It has an area of around 18,000 ha and over 6,000 farmers. After construction of the Krasiew Dam in 1981, nine WUAs were officially established by the irrigation agency. However, in practice, the irrigation system was centrally managed by the irrigation agency. In 2001, a new impulse was set by an Asian Development Bank (ADB)-funded project promoting user participation. The head of the local office of the irrigation agency was in favor of the participatory approach recommended by ADB, and encouraged his staff to spend more time in the field with the farmers. It took the field staff around 3 years to build a trust relationship with the farmers. In 2003, a Joint Management Committee was established. The committee operates at system level, and primarily coordinates cooperation between irrigation officials and local farmer representatives. The intensified cooperation led to various changes in day-to-day water delivery practices. For example, a temporary weir was placed on top of the dam, making more irrigation water available during the dry season. Farmers had initiated the construction of the weir, and participated in the planning and building process. Moreover, farmers now inform the irrigation agency when too much water is released at certain outlets, so that water can be saved for future use.

In the Mae Yom irrigation system, the successful case of the Krasiew was taken as an example. The irrigation system is located in Northern Thailand. It covers an area of approximately 36,000 ha and has 62 WUAs which had been formally established in the 1980s. In 2005-2006, farmers in the system had conflicts over water after severe droughts. In 2006, a new official, native to the region, was moved to the local irrigation agency to promote farmer participation. The farmers acknowledged the official's personal commitment to encourage their involvement. In response, they started to seek more assistance from the irrigation agency to deal with practical water delivery issues. In 2010, a Joint Management Committee was also set up here by the irrigation agency and WUA representatives. During biannual meetings, representatives of different WUAs at different ends of the main canal are brought together. This allows the irrigation agency to oversee all users' needs and better coordinate water delivery in the system by adjusting the irrigation schedule. As a result of the increased efforts by the irrigation agency to bring WUAs together, upstream farmers agreed to refrain from using water on three to four days during the dry seasons. Hence, more downstream farmers are currently able to grow dry-season crops.

Source: Based on Ricks (2015).

interaction between field-level staff and strong relations of trust are needed to expose the most eminent problems in water users' day-to-day irrigation practices. It is only then that practical, cost-effective solutions to address those problems can emerge. In the cases presented here, the correct incentives to achieve this were created by personally engaged officials at the local irrigation agency.

Opportunities and threats in the SSA context

Large-scale irrigation systems – Joint management is particularly suitable in a context where the influence of irrigation bureaucracies is strong and their role cannot be fully replaced by water users themselves (Suhardiman and Giordano 2014). In SSA, joint management may thus be most appropriate in the Sudano-Sahel Region, where large-scale irrigation systems are in place. For example, in Northern Nigeria, irrigation agency staff and WUAs are currently reported to hold uncooperative attitudes towards each other which limits possibilities to improve irrigation performance (Haruna 2015). In light of planned investments in existing large-scale irrigation systems in Nigeria as well as other Sahel countries, joint management presents a promising approach to achieve better results (World Bank 2014b, 2015b).

Potential to reduce infrastructure costs – The notion that joint management can reduce the costs of O&M of irrigation systems is based on the assumption that maintenance costs are kept artificially high by irrigation officials who personally gain from the build-neglect-rebuild cycle (Suhardiman and Giordano 2014). This argument has been developed for the case of powerful irrigation bureaucracies in Southeast Asia. For SSA, Venot et al. (2011: 418) argued that, although the irrigation bureaucracy is smaller in scale and influence than in Asia, "corruption finds its breeding ground in the workings (daily practices) of multiple actors all along the project cycle."

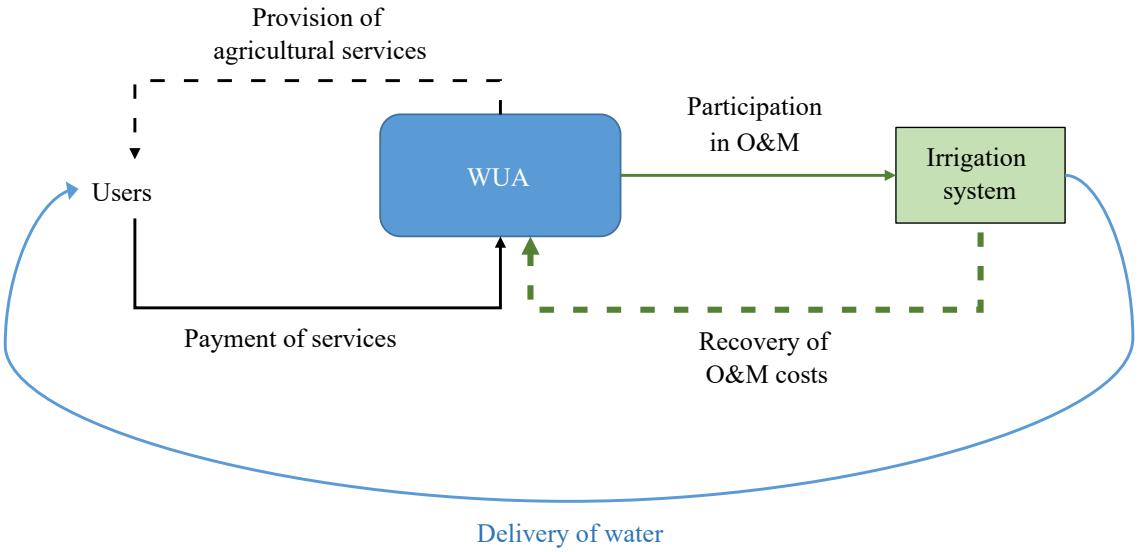
Incentives for field staff to engage with water users – Many authors argue that, in SSA, current support by the government to WUAs falls short and should be enhanced (Acheampong and Venot 2010; Morardet et al. 2006; Zuka 2016). However, the question remains as to how incentives can be strengthened for field staff to engage with water users. Personal engagement of local irrigation officials, as in the two successful cases in Thailand, is hard to be out-scaled under many government policies or donor programs. Local government budgets may be inadequate to cover salaries for local staff and many extension services in SSA are severely understaffed. One solution could be to provide more long-term financial support to WUA service units as part of internationally-funded irrigation development projects, such as the above-mentioned WUA service units which operated in Malawi for a short while only (World Bank 2015a).

4.5 Multi-functional WUA

The concept

Within the frame of donor-funded rural development projects, non-irrigation services, such as provision of credit, storage, processing and marketing of agricultural products, may also be supported. However, these services are usually assigned to separate organizations, such as savings and credit cooperatives, rural banks or various agricultural cooperatives (IFAD 2007b; World Bank 2015a). One alternative to mainstream WUAs is a multi-functional WUA that engages in activities in addition to irrigation infrastructure management activities. Figure 9 presents the layout of a WUA engaging in the provision of additional services. These may include provision of agricultural services to its members, such as the supply of fertilizers and seeds, land levelling, granting of agricultural credits or assistance with crop processing and marketing. Users can access these services through additional payments to the WUA. The O&M costs of the irrigation system are recovered through these various financial strands.

FIGURE 9. The role of multi-functional WUAs.



The idea to encourage WUAs to engage in additional activities has been promoted by several scholars as a means to increase WUAs' financial viability (Arun et al. 2012; Garces-Restrepo et al. 2007; Ghazouani et al. 2012; Pradhan 2002). The diversification of WUA activities is expected to address the problem of cost recovery currently faced by mainstream WUAs in two ways. First, multi-functional WUAs can gain additional income from service provision for the recovery of O&M costs (Ghazouani et al. 2012). Second, WUAs can support water users to increase productivity in irrigated agriculture by providing improved access to agricultural input and output markets, and in doing so, increase income (Arun et al. 2012). This would increase water users' ability to pay for irrigation O&M. In addition, Garces-Restrepo et al. (2007) argued that good quality service provision by WUAs can strengthen its members' loyalty and willingness to contribute money and labor to the organization.

Its practice

The proposal for multi-functional WUAs has found some resonance in the literature, yet it has not been widely adopted. In some cases, governments are not in favor of granting WUAs the permission to make profit or engage in financial activities outside O&M fee collection (Garces-Restrepo et al. 2007). One reason given by governments is that WUAs might make profit and would not maintain tax-exempt status. Garces-Restrepo et al. (2007) found that in 21 out 32 countries WUAs are not allowed to engage in agribusiness and make profits.

Examples of multi-functional WUAs are sporadic cases initiated by WUAs, as illustrated by the case of the Jradou WUA in Tunisia (Box 5). The example suggests that successful diversification of WUA activities depends on the capacity and skills of WUA leaders. Similar cases of WUAs taking up economic activities elsewhere show both positive and negative results. Koppa (2008) reported on three WUAs in India which undertook additional activities, such as purchasing input supplies and marketing, but only one made gains, while the other two suffered losses due to non-recovery of money invested in the additional activities. A detailed analysis on the income and expenditure of two WUAs in India demonstrates the limited impact additional economic activities may have on WUA budgets (Bhatt 2013). One of the WUAs studied made profits of around USD 40 through the resale of fertilizers to its members, which is equivalent to only 5% of the income from irrigation fees. In the case of Tunisia, financial viability resulted from WUAs adding multiple economic activities.

Box 5. Commercial activities by Jradou WUA in Tunisia.

The WUA of Jradou is located in North Tunisia. It has 45 members and manages 60 ha of land irrigated by two tube wells. In Tunisia, WUAs officially have a larger mandate than irrigation management only. WUAs are registered as 'Groupements de Developpement Agricole' (GDA), whose tasks may include among others: provision of equipment, agricultural inputs, technical advice and marketing. However, this is not well known and profit-making activities are often regarded as illegal. An IFAD-funded project which ran from 1998 to 2008 provided technical support to the WUA of Jradou. However, the initiative to undertake commercial activities came from the WUA leaders themselves. Its approach stood out against the other 120 WUAs in the region, including those supported within the frame of the IFAD project. By the end of the project, the WUA had undertaken a wide range of commercial activities. For example, the WUA bought fertilizers and seeds in large quantities to sell at affordable prices to WUA members. Besides that, the WUA applied for a loan from a local NGO to grant credit to its members. The WUA also engaged in selling water to non-WUA members. By 2010, revenues from those activities allowed the WUA to recover regular irrigation O&M costs as well as larger, unforeseen expenditure.

Source: Based on Ghazouani et al. 2012; Mehdi and Venot 2012.

Examples of multi-functional WUAs in SSA show mixed results. Abernethy et al. (2000) described difficulties faced by WUAs in Niger to engage in purchasing fertilizers for its members. Although WUAs were officially allowed to expand activities and make profit, they were constrained by financial rules imposed by the government. Government rules dictated that profit revenue had to be used to offset or reduce farmers' irrigation fees. Therefore, the WUAs could not increase overall revenue. Ironically, WUA members became less willing to contribute irrigation fees when the WUA failed to buy fertilizers as expected.

Scheltema (2002) reported unsuccessful cases of WUAs being set up as cooperatives responsible for supplying agricultural input in Kenya. WUAs lost money buying inputs when farmers did not pay, further reducing the ability to undertake O&M. Randall (2012) described the history of one such cooperative in the Mwea Irrigation Scheme in Kenya. In another example from Kenya, in 1998, farmers assigned the Mwea Rice Growers Multipurpose Cooperative to take over the management of the irrigation scheme after a conflict arose with the state irrigation agency. However, the cooperative failed to manage the scheme well, and farmers substantially reduced the amount of rice sold through the cooperative by 2003. This raises questions about expanding the roles of WUAs into functions of marketing cooperatives.

More positive examples are found in Zimbabwe and South Africa. In Zimbabwe, one WUA in Mtandahwe was found to collectively purchase fertilizers and have a subcommittee for marketing farmers' products (Mutambara et al. 2014). Although the WUA did not have significant savings, it also did not have any debts. Farmers in the scheme found they had fewer difficulties to market their produce compared to neighboring farmers. Also, the collective purchase of fertilizers allowed uniform and timely operation of the irrigation scheme. In Mphaila in South Africa, farmers in one WUA collectively purchased organic fertilizer, which saved costs on the input and transportation to farm gate (Rootman and Stevens 2016). Moreover, farmers found the handling of different tasks through one organization as a way of reducing the number of meetings and limit the time spent away from the farm.

Opportunities and threats in the SSA context

Access to agricultural input and output markets – WUAs can invest in improving access to agricultural input and output markets for smallholders to improve productivity, efficiency, and potentially farmer incomes and satisfaction with WUA services. Collective purchases of agricultural production inputs and selling of outputs can improve market access and reduce per unit costs for farmers, among other benefits.

However, WUAs may lack the capacity to overcome market access constraints. Over the last two decades, donors have sought to integrate investments in irrigation and additional agricultural services in SSA (World Bank 2015a). In that context, multi-functional WUAs could serve as a suitable organizational form to advance both irrigation management and the provision of other agricultural services at local level. Alternatively, donor and public agencies could facilitate coordination between WUAs and agricultural service providers in reinvestment models for improved irrigation performance, without necessarily fusing the functions in one organization.

Legal status of WUAs – In most SSA countries, the legal status of WUAs is not (yet) clearly defined. This allows flexibility to register WUAs as profit-making entities or multi-functional agricultural cooperatives. For example, in Tanzania, WUAs can be registered as cooperatives with the Ministry of Agriculture, Food Security and Cooperatives or as associations with the Ministry of Home Affairs (Komakech and van der Zaag 2013). However, Abernethy et al. (2000) suggested that strict requirements by the government on WUAs can inhibit collective initiatives by farmers and lead to unproductive situations, so overregulation should be avoided.

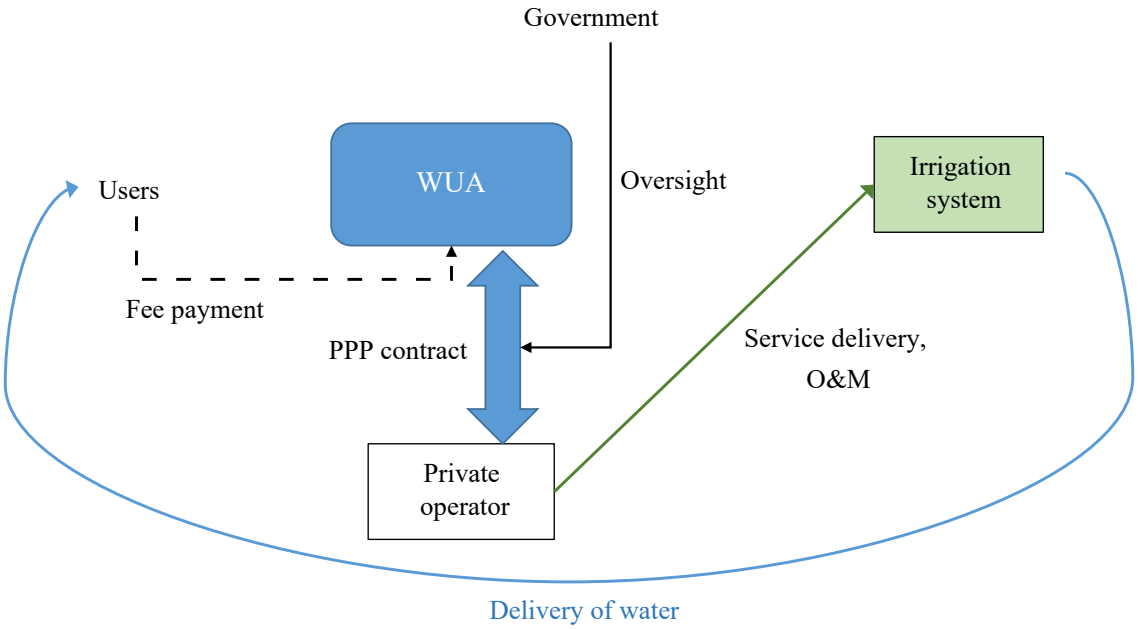
Skills and capacities of WUA members – WUAs need more skills to add roles related to market access and service provision (Ghazouani et al. 2012). In this regard, the potential to transform WUAs that are poorly functioning at present into multi-functional WUAs may be limited. Many WUAs already have low technical capacity and lack technical advice from public agencies. Garces-Restrepo et al. (2007) suggested adopting a two-step approach, whereby WUA activities related to irrigation system management are well-established before secondary activities are added.

4.6 Public-Private Partnership (PPP)

The concept

Public-Private Partnership (PPP) irrigation services entail a private operator providing services to irrigators in a scheme or schemes over a given period of time based on a contract between the government, a private operator and potentially also the WUA. Figure 10 represents these relationships where WUAs contract a private operator to ensure the delivery of services and O&M of the irrigation system. The contract and process is supervised by a public or government agency. The range of irrigation services taken over by the private operator differs from case to case. Involvement can be limited to infrastructural investments or include more managerial tasks from on-farm water delivery to product marketing (Bernier and Meinzen-Dick 2015). The private operator will generate a revenue based on service provision, which can be recovered from public funds or from user fees (Mandri-Perrott and Bisbey 2016). Advocates of PPPs in the irrigation sector argue that the private sector will bring in "efficient management skills and fresh funds" (Darghouth 2007: 1). They expect improved financial viability and quality of irrigation services (Mandri-Perrott and Bisbey 2016). The private operator becomes responsible for providing the most cost-effective solutions (and sometimes also for collecting the fees), although costs may still be recovered from user fees, as is the case in the management of mainstream WUAs. User participation is not by definition part of a PPP approach, but it can contribute to viability, as discussed below.

FIGURE 10. The role of WUAs in public-private partnerships (PPPs).



Its practice

The idea to set up PPPs for irrigation development has gained popularity among policy makers and donor agencies (Trier 2014). Despite the increased attention on PPP solutions, "there are few studies and there is little available evidence as to what works" (Bernier and Meinzen-Dick 2015: 1). Often literature on PPPs for irrigation in SSA has a theoretical or explorative character (see, for example, Penning De Vries et al. 2005; Gadelle 2002; Mwendera et al. 2013). Reports on PPPs in irrigation commissioned by the World Bank showcase several examples in SSA (Mandri-Perrott and Bisbey 2016; Darghouth 2007). However, most cases are assessed based on the formal structure of the PPP laid out during the planning phase, while the long-term impact of the institutional arrangement stays out of scope. In part, this may be because the reports rely on desktop reviews and little data is readily available on the ongoing activities of the PPP. Some of the projects mentioned have not been fully implemented yet. For example, the implementation of the PPP in the Megech-Seraba scheme in Ethiopia, prominently presented in both reports (Mandri-Perrott and Bisbey 2016; Darghouth 2007), has suffered long delays. Recent newspaper articles announce that the scheme will only start operating this year. According to the business website 2Merkato.com, the Megech-Seraba irrigation project was to be operational at the end of 2017 (2Merkato 2017).

Cases on PPPs in SSA with regard to the impact on smallholders and their irrigation practices are found for Zambia, Swaziland, Burkina Faso and South Africa (Houdret et al. 2017; Mapedza et al. 2016; Wellens et al. 2013). Those cases suggest that the involvement of farmers in the planning phase is critical to achieving sustainable outcomes. Bernier and Meinzen-Dick (2015) warned that smallholder farmers are typically excluded from the process of drafting PPP contracts, though a World Bank report indicated that WUAs participated in the contract process in four out of the eight cases in SSA (Mandri-Perrott and Bisbey 2016). WUAs were found to participate particularly when the private operator only took over O&M of the irrigation and was not involved in capital investments. However, actual performance of the projects has yet to be thoroughly assessed.

The negative effect of drawing up a contract without meaningful participation of users is illustrated by the case of Joint Venture Schemes in Limpopo, South Africa (Mapedza et al. 2016).

Here, the government mediated between smallholders and a large-scale commercial farmer to enter into a partnership as a prerequisite for public investments in new irrigation technologies. However, the choice of the technology was made without smallholder involvement. Officially, the investments were made to benefit smallholder farmers, but in reality the smallholders lost out. They faced low profits, and high water and energy bills, and did not have access to their land and water for other purposes, except for irrigation of the main crop. In response to the disappointing outcome and protests by the farmers, the program was ended after 3 years. Mapedza et al. (2016) argued that the main reason for failure is a lack of involvement from the smallholder farmers in planning the partnership.

A positive example in Burkina Faso is provided by Wellens et al. (2013) (Box 6). Here, WUAs were found to be actively involved in drafting the conditions for the PPP contract. The arrangement also foresaw long-term exchange on day-to-day irrigation practices between the water users and field staff employed by the private operator. Similarly, Houdret et al. (2017) argued that the active involvement of representatives of WUAs in establishing PPP contracts in Swaziland and Zambia has been crucial to its success. In both cases, smallholders set up their own companies, which in turn contracted private operators for irrigation management, service provision and market access.

Box 6. Public-Private Partnership for Kou Valley irrigation scheme in Burkina Faso.

The Kou Valley irrigation scheme is located in Southwest Burkina Faso and covers an area of 1,200 ha with around 1,300 plot owners. In the 1990s, irrigation management was transferred from the government to a newly established WUA. The WUA was unable to keep the scheme running well, leading to low yields and land abandonment. In 2006, a process was started, with support from Belgian development agencies, to set up a PPP to manage the irrigation scheme. Three main activities were taken up right from the start: (i) a team of staff members from the public and private sector was set up to develop an improved water delivery schedule; (ii) a full-time irrigation advisor was employed by the private operator to assist WUAs with day-to-day water delivery; and (iii) discharge readings were recorded on a daily basis at the inlets of all secondary canals.

All three activities facilitated the development and implementation of the water delivery schedule. The schedule was developed based on a FAO decision-support tool. WUA representatives participated in several meetings during which different water delivery scenarios were discussed. Finally, the WUA opted for a "deficit irrigation scenario." The new irrigation schedule has been followed since 2009. It was only after the WUAs had gained their first experiences with the private operator that a PPP contract was drafted and external financial support was phased out. From 2010 to 2013, operational costs were gradually taken over by water users.

Source: Based on Wellens et al. 2013.

Based on a preliminary analysis of PPPs in Asia, Mukherji et al. (2009) concluded that PPPs are most likely to function in highly commercialized farming systems. The case of a PPP including high capital investments in irrigation infrastructure by the private sector in Morocco highlights the risk it contains for smallholders not fully depending on commercial farming (Houdret 2012). The PPP provided for the construction of a water transfer pipeline to irrigate 10,000 ha of land. However, the PPP contract obligated all farmers in the irrigated area to make significant private

investments in drip irrigation and produce citrus fruits. Also, branch connections and irrigation fees amounting to EUR 15,000 (equivalent to USD 19,000) for 15 ha had to be paid. This eventually led to the exclusion and abandonment of smallholder farmers from the area.

In contrast, the PPP in Burkina Faso did not involve financial investments in the irrigation infrastructure. The involvement of private operators has been limited to rescheduling water delivery in the existing irrigation system. Also, two proposed PPPs in Zambia and Ethiopia are planned to take place under conditions of subsistence farming (Mandri-Perrott and Bisbey 2016). Mandri-Perrot and Bisbey (2016) suggested that in such cases private operators' revenue can only be secured when the system is subsidized by the government.

Opportunities and threats in the SSA context

Low income from irrigated agriculture – Smallholder agriculture in SSA is largely characterized by low incomes from irrigated agriculture. Trier (2014) argued that O&M contracts, such as the one adopted in Burkina Faso (Box 6), are a good option in such a context. However, PPP contracts which foresee high capital investments by the private sector are most appropriate for 'modern' irrigation systems with commercial farmers. Smallholders in SSA would not be able to pay the high irrigation fees that private operators may charge to recover high capital investments, as illustrated by the case of Morocco (Houdret 2012).

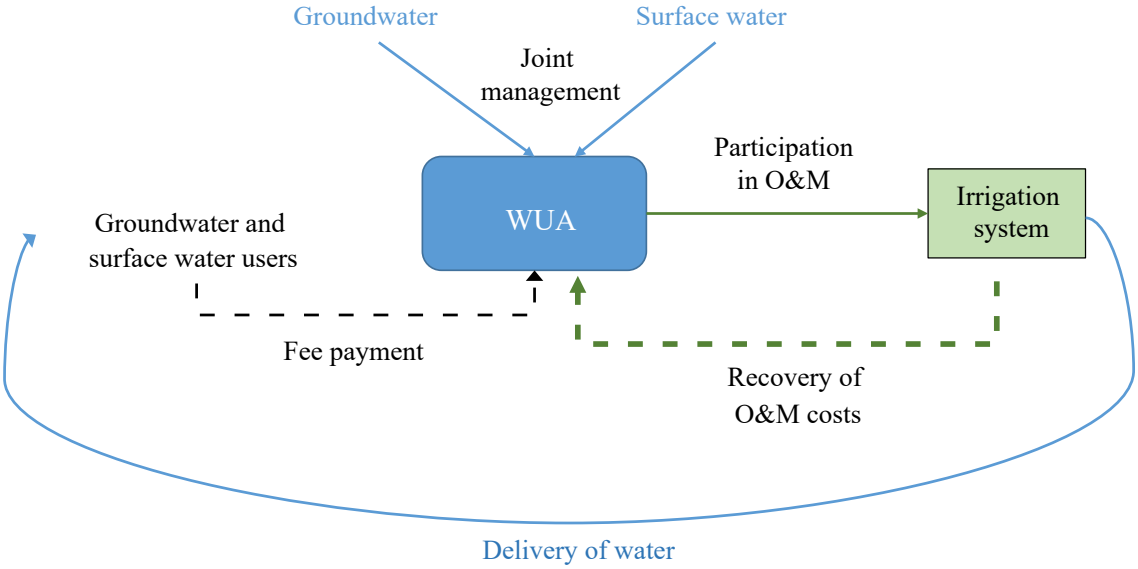
Capacity and skills of private operators and WUAs – One important argument in favor of PPPs is that the private sector will bring in specialized skills in irrigation management (Darghouth 2007). However, this requires that private operators can employ capable staff, which is not necessarily available everywhere in SSA (Houdret et al. 2017). Also, the involvement of WUAs in drafting PPP contracts would require substantial training of water users in the technical and legal aspects of the contracting process. An alternative would be to let an externally financed trial phase precede the signing of long-term PPP contracts, as in Burkina Faso. This allows WUA members to clearly understand the role of the private operator before agreeing upon the contract's conditions, including water users' financial contribution.

4.7 Combined Surface Water-Groundwater WUA

The concept

Worldwide, most WUAs have the mandate to manage irrigation from surface water-based canal systems. However, recently, the establishment of WUAs to manage groundwater-based pumping installations is on the rise, mainly related to the regulation of groundwater pumping and sustainable use of the resource (Lopez-Gunn and Cortina 2006; Taher 2016). The idea to combine the management of canal irrigation systems and pumping installations under a single user organization has not yet been widely developed. Figure 11 depicts the basic layout of a WUA involved in the conjunctive management of surface water and groundwater. Groundwater and surface water users jointly contribute and participate in the WUA, and the WUA has delegated management and regulation powers over the two types of resources (well permits, monitoring, etc.). Groundwater can contribute directly to the irrigation system (e.g., through wells controlled by the WUA itself) or through individual wells owned by the users. The WUA recovers O&M costs from user fees.

FIGURE 11. The role of combined surface water and groundwater WUAs.



Based on their review of WUAs in Asia, Mukherji et al. (2009: 49) claimed that to unlock the potential of surface irrigation systems, those systems "must morph in ways they can support and sustain the rising groundswell of atomistic irrigation." Technological innovations in canal irrigation systems, such as intermediate storage structures, could be used to recharge aquifers and increase farmers' flexible irrigation use (Mukherji et al. 2012). However, such innovations can only come about when surface water infrastructure is not only managed for the purpose of surface water irrigation and groundwater infrastructure not only managed for the purpose of groundwater irrigation. The idea to widen the mandate of WUAs to include both surface water and groundwater is one suggestion to deliberately guide such a process.

Recently, the concept of coordinated surface water and groundwater management for irrigation in development contexts has received increased attention (Evans and Evans 2011; Foster and van Steenbergen 2011). Coordinated conjunctive use of surface water and groundwater has the potential to optimize the water availability for all users within the given hydrological boundaries (Foster and van Steenbergen 2011). Currently, this is often hindered by the split responsibility for surface water and groundwater over different organizations and individuals. Hence, Foster and van Steenbergen (2011) suggested that groundwater-only users should also join existing WUAs in charge of canal irrigation.

The integration of surface water and groundwater management at WUA level may provide solutions to deal with issues of water delivery and financial viability currently faced by mainstream WUAs. First, irrigation through pumping installations (mostly, but not exclusively tapping from groundwater resources) is by definition more flexible than irrigation through canal systems. Hence, WUAs whose mandate include the O&M of canal irrigation systems and pumping installations can operate relatively independent from irrigation bureaucracies and respond effectively to water users' demand. Second, income from flexible pumping irrigation is often higher than from centrally-led canal irrigation (Shah et al. 2007). The additional income can contribute to recovering O&M costs of canal systems. This would make sense particularly in those areas where users of pumping installations benefit from the canal infrastructure (i.e., when groundwater is recharged through surface water irrigation).

Its practice

Foster and van Steenbergen (2011: 959) defined conjunctive water use for irrigation as follows: "situations where *both* groundwater and surface water are developed (or co-exist and can be developed) to supply a given […] irrigation canal-command – although not necessarily using both sources continuously over time nor providing each individual water user from either source." The conjunctive use of groundwater and surface water for irrigation is common in many developing countries worldwide (Foster and van Steenbergen 2011). Prominent examples can be found in North Africa and Asia (see, for example, Kuper et al. 2012 in Morocco and Mekonnen et al. 2016 in Pakistan).

Nevertheless, cases of WUAs taking managerial responsibility over both surface water and groundwater irrigation are difficult to find. The main reason is that conjunctive use happens informally. Most of the time, WUAs in conjunctive use areas are externally initiated and implemented by an irrigation bureaucracy responsible for surface water irrigation only, while groundwater irrigation is most of the time developed by individual farmers.[7] This means that users belong to WUAs to access surface water, but rely on private wells to complement their irrigation needs with groundwater (Nagrah et al. 2016).

WUAs for local groundwater management are rare in areas of conjunctive use "due to the larger complexity of the water systems" (van Steenbergen et al. 2011: 167). In the Northern Plains of China, the government assigned the responsibility of enforcing groundwater regulations to WUAs in 2007. WUAs were involved in the selection of groundwater wells which had to be taken out of use. They also became in charge of the allocation of surface water and groundwater use rights per household. Because all WUA members irrigated with both surface water and groundwater, it was relatively easy to mobilize the WUAs to engage in groundwater management.

The functioning of WUAs for canal irrigation systems may also benefit from groundwater use within the system. The study of Nagrah et al. (2016) in Pakistan showed that farmers who rely around 50% on groundwater tend to have stronger incentives to participate in WUAs involved in canal irrigation management than farmers who rely solely on surface water. They explain this phenomenon by the productivity-enhancing effect of groundwater, which stimulates farmers to engage in collective action and pay fees to improve the access to all available water sources. Kuper et al. (2012: 52) made a similar observation for the Tadla irrigation scheme in Morocco, arguing that the functioning of the canal irrigation system depends on "the water fees paid by farmers for surface water. This is only possible when farmers are able to grow crops in a conjunctive use environment."

These practical examples illustrate that combined surface water-groundwater WUAs are most likely to be found in conjunctive use situations, where surface water and groundwater resources are tapped by the same group of individuals. Moreover, some form of collective institutions for groundwater use, i.e., the shared ownership and use of wells, facilitates effective inclusion of groundwater management in WUAs. Although, currently, most WUAs in conjunctive use areas focus on the management of surface water irrigation, two important observations are made: (i) groundwater users who solely rely on groundwater at tail-end reaches may benefit from WUA management; and (ii) the (financial) viability of WUAs may be strengthened by farmers' conjunctive use of groundwater within canal irrigation systems. These phenomena can be strengthened through the establishment of combined surface water-groundwater WUAs.

Currently, groundwater use in SSA is more often developed in regions which used to rely on rain-fed agriculture (Namara et al. 2013), but it may also take place in a context of surface

[7] Whether the implementation of combined surface water and groundwater WUAs is feasible also depends on the type of conjunctive use taking place, i.e., the spatial and temporal distribution of surface water and groundwater use.

water irrigation (de Fraiture et al. 2014; van Soelen 2013). Some anecdotal evidence exists on the impact of groundwater irrigation on WUA management of canal irrigation systems. As mentioned earlier, de Fraiture et al. (2014) reported how farmers using surface water organized in a WUA are affected by upstream groundwater use of non-WUA members in Burkina Faso. Ironically, those groundwater users benefit again from the infrastructure built for surface water irrigation. Similarly, Kemerink et al. (2016) described how smallholder farmers in Kenya decided not to become members of the local WUA to avoid membership fees, and instead individually pump water from surface water canals and groundwater wells. Also, Ducrot (2016) stated that the development of private pump-based irrigation (potentially tapping groundwater resources) induces struggles over land in Mozambique. The author mentioned one case in which collective irrigation organized by a WUA had to make space for the development of private pump-based irrigation for commercial farming. The WUA is still waiting for the negotiated compensation two years after handing over its land. These practices show that in SSA "ignoring groundwater use can reduce [WUAs'] effectiveness" (Nagrah et al. 2016: 295), which underlines the relevance of combined surface water-groundwater WUAs in the SSA context.

Opportunities and threats in the SSA context

Planned investments in groundwater irrigation – Both international donor agencies and governments plan increased investments in groundwater irrigation in SSA (Chokkakula and Giordano 2013; van Steenbergen et al. 2015). This presents an important opportunity to take into consideration the institutional integration of groundwater and surface water irrigation at field level and involve existing WUAs in new groundwater irrigation projects. Despite the tremendous untapped groundwater potential on the African continent as a whole, the potential to irrigate with rechargeable groundwater resources differs per country (Pavelic et al. 2013). In some countries, such as Kenya and Niger, groundwater development will soon reach its sustainable limits (ibid.). Under these circumstances, groundwater use is likely to interfere with surface water resources, which particularly demands a conjunctive management approach.

Lack of data on conjunctive use situations in SSA – Currently, little information is available on the extent of groundwater use and its impact on farmers' livelihoods in SSA (Kamwamba-Mtethiwa et al. 2016). Even less is known on conjunctive surface water and groundwater use practices. This situation needs to be further assessed to understand what role combined surface water-groundwater WUAs can play to address related irrigation management issues.

5. CONCLUSIONS

5.1 A Summary of the Main Insights

The literature presents WUAs as a vehicle for cost recovery and related user participation in irrigation management. In academic literature and project proposals, both aspects are considered essential to improve irrigation performance and increase agricultural productivity. Yet, WUAs rarely meet expectations of water agencies, decision makers and donors to deliver on cost recovery, user participation and, ultimately, irrigation performance. The underlying issue is the invalid assumptions that underpin the expected functions of WUAs. The review of case studies highlights that the socioeconomic context and agricultural conditions shape the ability of WUAs to deliver expected results, but these enabling conditions cannot be easily created by external institutions and actors.

This study assessed the most important factors influencing WUA management in the SSA context. In SSA, WUAs are primarily promoted in a setting of smallholder agriculture by external agencies, such as national governments or donors. With a few notable exceptions, WUAs are established in small-scale irrigation systems. The main challenges that appear to constrain WUA management in SSA include the following:

1. WUAs are unable to collect user fees and therefore unable to pay for O&M. Scheme or project goals may not prioritize and undertake activities to support increased farmer income.
2. Farmers' incentives may not support payment of user fees; income from irrigated agriculture is low and contributes only partially to smallholder livelihood strategies.
3. WUAs are not inclusive of different types of water users, including women, though by default the irrigation infrastructure is usually used for multiple purposes. WUA membership is biased towards irrigators (often plot owners or managers).
4. Emerging irrigation, such as individual pump users, is not integrated into scheme planning or management. Individual irrigators encroach upon gravity irrigation systems managed by WUAs, but do not participate in WUA decision making, cost recovery or O&M.
5. Local institutions (customary, political, state) have contradictory objectives and incentives; formal water user institutions are often externally imposed within this context.
6. Low capacities of the state in rural areas limit technical and management assistance to consistently support WUA development.

Over time, governments and donors have noted these and related difficulties faced by WUAs. Both have made attempts to intervene to salvage WUAs. Efforts have focused on WUA formalization, such as regulations at national level, mandated WUA bylaws, and contracts between the state or private organizations and WUAs. In addition, interventions have included trainings on both technical and managerial skills. However, these interventions do not fundamentally change the context in which WUAs operate, so have not enabled the desired improvements.

In addition, WUAs in SSA undertake very little data collection and maintain poor records, which prevents proper assessment and continual performance evaluation. Indeed, indicators and standards for performance measurement are often unavailable or unclear. Irrigation or water agencies cannot monitor the quality of service delivery without indicators for performance or data, even assuming those institutions had the reach and capacity for monitoring and evaluation functions.

Establishing decentralized irrigation management need not translate into state rollback and complete decoupling of centralized service provision, oversight and regulation. The poor allocation of resources to the water sector at state level in general, including lack of staff and financial resources, contributes strongly to WUA failure. Inclusive and broad user participation to achieve a legitimate mandate needs to be facilitated, and proper financial and infrastructure management requires continual training, data collection and monitoring, all of which require funds and institutional support. Complementary activities, such as market linkages, mechanized services and credit provision, may be added to WUA functions to increase farmer incomes, but also require state capacity and resources.

The failure of WUAs to deliver on expected full cost recovery and O&M resulted in the emergence of alternative management options, though not as widely implemented as mainstream WUA approaches. These options focus on other processes and actors in irrigation development and management, often assigning different roles to WUAs. Each option may have merits for context-specific solutions. The following alternative management options have been identified:

1. *Participatory design* – Water users participate in the design, budgeting and implementation of water use development projects.
2. *Overarching water user platform* – A platform for WUA representatives and other water users, such as cities, industries and large-scale farmers, to negotiate water distribution at river basin or sub-basin level.
3. *Multi-stakeholder and innovation platform (within/parallel to WUA)* – Multiple actors along irrigated value chains interact and share information, and link across services and products to increase farmers and others' capacities, identify joint opportunities and strengthen market access.
4. *Joint management* – Field-level staff from irrigation agencies closely cooperate with WUAs on water delivery activities.
5. *Multi-functional WUA* – WUAs provide agricultural service activities to mechanize practices, finance farm or plot O&M activities, and ensure market access.
6. *Public-private partnership (PPP)* – A private operator takes over O&M of the irrigation system in close cooperation with WUAs.
7. *Combined surface water-groundwater WUA* – WUAs are responsible for both surface water and groundwater irrigation within the given command area.

Table 4 provides an overview of all the alternative management options (including mainstream WUA) and their relevance in the SSA context. For each option, the main processes and actors are listed. Moreover, the table summarizes the role of WUAs in different decision-making processes, the major actor responsible for O&M and the method through which financial viability of the irrigation system is secured.

TABLE 4. Alternative management options for smallholder irrigation in SSA.

Management option	Process	Actors	User participation in decision making	O&M	Financial viability
Mainstream WUA	O&M of irrigation system	WUA	User participation in decision making limited to O&M at field level	WUA responsible for O&M	Users pay irrigation service fee to WUA
			Alternative management options		
Participatory design	Planning and design of irrigation infrastructure and management	Project managers, engineers, WUAs	WUAs participate in decision making on infrastructure (and managerial) design of the irrigation system	Optional	O&M costs are kept within limits of water users' financial capacity
Overarching water user platform	Water allocation between different users within the river basin	Multi-sectorial water users (cities, industries, agribusinesses and WUAs)	WUAs participate in decision making on water allocation at river basin level	-	-
Multi-stakeholder and innovation platform	Supporting agricultural innovation beyond mere water resources management	Multiplicity of users and stakeholders	Stakeholders use the platform to share knowledge, communicate and for joint decision making	-	-
Joint management	Daily water delivery practices	Irrigation agency's field staff, WUAs	WUAs participate in decision making on O&M at irrigation system level	WUA and irrigation agency's field staff jointly responsible for O&M	Irrigation performance is improved without expensive infrastructural investments

(Continued)

TABLE 4. Alternative management options for smallholder irrigation in SSA. (Continued)

Multi-functional WUA	Access to input and output markets	WUAs	-	WUAs responsible for O&M	WUAs generate revenue through agricultural service delivery Water users' capacity to pay fees increases through improved market access
Public-private partnership (PPP)	O&M of irrigation system	Government, private operator, WUA	WUAs participate in drafting PPP contracts	Private operator responsible for O&M	Cost-effective solutions are provided by the private operator
Combined surface water-groundwater WUA	Coordinated conjunctive use of surface water and groundwater	Groundwater and surface water users	Water supply is more responsive to users' demands	WUA responsible for O&M	Revenue generated from groundwater irrigation is invested in O&M of canal irrigation system

5.2 Lessons Learned

The results of this study suggest the following key lessons in relation to irrigation water user groups or associations:

Setting up WUA policies and regulations, bylaws and contracts with WUAs, and providing WUA trainings constitute limited means to improve the performance of WUAs. These activities have been implemented by governments and donor agencies in response to poor results of WUA management in the past. Yet, the focus on formalizing and strengthening WUAs has been primarily to strengthen (financing) O&M of irrigation systems. However, the roles and responsibilities of WUAs need to be reconsidered to address the underlying challenges of WUA performance, and other actors and other processes need to receive more attention.

No simple alternative management arrangement exists within the existing WUA framework. In the past, donor agencies and financial institutions believed that irrigation performance could be improved by transferring irrigation management responsibilities from one actor (the state) to another (the users). Given the failures in that management structure, the same organizations are now promoting transfer of the responsibilities to other actors, either the private sector or customary institutions. Based on this review, the factors that contribute to WUA failure cannot be solved by a quick 'organizational fix', such as the PPP. At the same time, decentralized community management based on customary rules and structures is also not a panacea to ensuring inclusivity and participation. Local management can be affected by power struggles and vested interests of ruling classes, political organizations and men farmers, which in turn can affect water (and land) allocation. This can reinforce existing social disparities, and undermine effectiveness and equitability of water services. Care should be taken that such approaches do not have negative effects on smallholder farmers. Instead, national or project goals and the conditions of each context should be assessed to identify the processes and actors most crucial to enhance irrigation performance.

Adapt management roles, structures, and infrastructure to improve delivery of transformative services and improve rural livelihoods. WUAs, together with a range of stakeholders, need to develop, pilot test, and then incorporate more innovative and responsible management rules and frameworks. This is required to deliver on expected services that effectively contribute to improving the livelihoods of the farmers dependent on irrigation schemes. In cases of existing irrigation infrastructure, more effective bylaws and service delivery arrangements can be facilitated through interaction between strengthened field staff of irrigation agencies and water users (i.e., joint management). Development assistance should emphasize improved water delivery services, rather than exclusive attention being given to user pay mechanisms. In some, but not all, cases 'low-technology' solutions and innovation can reduce the costs that must be recovered by the users, though this should not justify poorly constructed infrastructure to merely save costs. A participatory design process can support the co-selection of affordable infrastructural and managerial solutions by users, and irrigation managers and officials, while also utilizing innovations in technology and mechanization. The aim should be to deliver services through beneficial infrastructure and technologies that users have an incentive to pay.

User participation is crucial for smallholder irrigation development, but does not mean that WUAs can or should be solely responsible for all functions. All the empirical cases of alternative management options reviewed in this study highlight the importance of user participation in

irrigation management. In fact, in most cases, existing WUAs are not dismantled, but their roles and responsibilities have changed. Irrigation design and management take place in close interaction with other actors, such as irrigation engineers (in participatory design), field-level staff of irrigation agencies and private operators (in joint management or PPPs), or other actors in related institutions or value chains (multi-stakeholder, innovation, or overarching water user platforms). This suggests that more attention should be directed to encouraging other actors involved from irrigation design and management to markets and value chains, to actively engage with water users and facilitate participatory processes.

Performance indicators, and the practice of monitoring and evaluation of WUAs need to be developed and applied consistently. The review shows an absence of systematic follow up of water service delivery within a framework of monitoring and evaluation (be it internal or external at multiple levels), as well as very few indicators for performance evaluations. In the few cases when such an evaluation is undertaken, the focus is on full fee collection and user payment for O&M, but almost no attention is given to the quality of service provided to irrigators, access to water, equity and allocation of water turns, or user satisfaction. Monitoring activities funded within projects tend to stop once a project is finalized and a scheme is handed over to the state or water users.

In summary, the WUA concept initially suggested a disengagement of the state from public service provision at community or group level during irrigation management transfer. The implementation of the concept through programs and policies led to lower funding for local water agencies and staff, which in turn created critical gaps in roles needed to ensure effective WUA operations, monitoring and follow up. The result of transferring irrigation management to users and communities did not encourage increased control by water users, but rather a partial and incomplete 'forced' decentralization of irrigation services from water agencies amid reluctance by the state to fully devolve management authority and powers to local services and staff, or to user groups themselves. The evidence suggests that effective water user participation in fee payment and O&M, as well as support for additional activities needed to increase irrigator incomes and strengthen livelihoods, actually requires continuous supervision and funds from state agencies. The institutional contradictions and associated resource constraints must be addressed, otherwise WUA reforms will continue to have limited effectiveness.

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