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Operationalizing irrigation water charges in sub-Saharan Africa: a case study from the Central Rift Valley, Ethiopia

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ABSTRACT

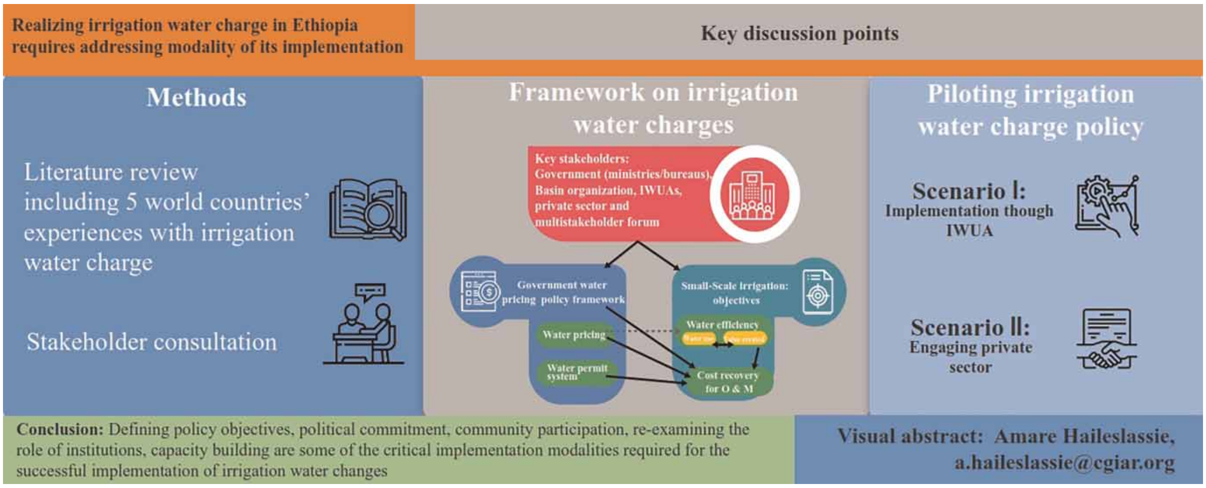
Fixing and implementing water charges in the irrigation sector is considered an important task for recovering operation and maintenance costs and promoting the efficient use of water. This study aims at developing an implementation strategy for water charges in the Central Rift Valley, Ethiopia. The study sets the agenda for this strategy by explaining why promoting the concept of fixing irrigation charges is necessary. Then it develops a conceptual framework, draws key lessons from global experiences, explores whether the new pricing policy is well aligned with national water policies and the roles and responsibilities of various actors and stakeholders involved, and identifies the factors for the successful implementation of this strategy. The study is mainly qualitative in nature, based on a review of the literature and consultations of key stakeholders. The study results call for clearly defining the key objectives of the policy, political commitment, and community participation, re-examining the role of institutions, capacity building, and establishing a multistakeholder platform. Basin-level implementation of this policy requires piloting and maintaining policy dynamics through adaptive management. The results provide generic lessons for other basins within Ethiopia and for sub-Saharan Africa (SSA).

Key words: Irrigation charges, Legal and political framework, Piloting, Recovery of operation and maintenance costs, Stakeholder engagement

HIGHLIGHTS

- This study is based on a literature review and consultations of key stakeholders.
- The water charge policy is well anchored in Ethiopia's water policies.
- Its implementation requires developing the necessary modalities, redressing stakeholder grievances, addressing the issue of effective fee collection, recovering operation and maintenance costs, and providing improved services.
- The piloting of the water charge policy in the Central Rift Valley, requiring the establishment of a multistakeholder platform (MSP), is critical for the upscaling of the policy.

GRAPHICAL ABSTRACT



1. INTRODUCTION

Agricultural production will need to increase by as much as 112% in order to overcome the challenges involved in providing food security to the people, eliminating poverty, and increasing the levels of nutrition in sub-Saharan Africa (SSA) by the year 2050 (African Union, 2020). There are reports to the effect that the development of the economy has been promising during the past few decades (AfDB, 2020). Despite rapid economic growth in the continent over the past few years, the performance of the agricultural sector is still poor, characterized by rural vulnerability, low resilience to climate changes, poverty, and poor nutrition (Lebdi, 2016). Therefore, SSA urgently needs to accelerate the pace of agricultural growth to improve livelihoods, ensure food security, and prevent droughts exacerbating famines.

A faster increase in smallholder irrigation development (World Bank, 2021) in the region compared with its current sluggish pace and an improvement in the efficiency of this sector by addressing the various challenges (Shah *et al.*, 2020) will greatly benefit the region.

Irrigation is considered as one of the pillars of the agriculture sector that can contribute to the agenda of agricultural transformation. In this regard, the African Union (2020) suggested that a reliable provision of water is essential to improve productivity and to mitigate the uncertainty posed by climate change. SSA is considered as the region that is the most vulnerable to climate change, which is evident by the significant changes in average temperature and the amount and distribution of rainfall and by the prevalence of extreme events (WMO, 2020; IPCC, 2022), greatly affecting agricultural productivity and food security (Kotir, 2011) and requiring an adaptive mechanism that includes faster and efficient irrigation development (Howden *et al.*, 2007; IPCC, 2022).

Several authors have argued that Africa has huge potential for irrigated agriculture (Xie *et al.*, 2014; African Union, 2020), both surface and ground water, which can be utilized for enhancing sustainable livelihoods and producing improved livelihoods, bringing about an agriculture-led industrialization, and thereby achieving overall economic development. Currently, about 6% of the crop land is irrigated in Ethiopia and SSA (FAO, 2020). Six to eleven million hectares of land highlight the potential for expansion of irrigation in SSA (Xie *et al.*, 2018), and irrigated areas are expected to more than double by 2050, benefiting millions of small-scale farmers (FAO, 2020).

Despite the positive impacts of irrigation (FAO, 2020), its sub-sector is challenged by different bottlenecks. Some of the reported constraints are the absence of a water-pricing policy and modalities for its implementation, weak irrigation water users' associations (IWUAs), and the lack of public–private participation (PPP) (Berhane *et al.*, 2016; Teshome *et al.*, 2018; Froebrich *et al.*, 2020). Disaggregated evidence indicates that 61% of the irrigation schemes are found to have siltation, 53% suffer from leakage, 22% suffer from insufficient inflow, 25% have structural damage, and 21% have spillway erosion problems (Berhane *et al.*, 2016). Moreover, overirrigation is a common practice (Berhane *et al.*, 2016; Haileslassie *et al.*, 2016; Teshome *et al.*, 2018), leading to unfair distribution of water contributing to crop water scarcity and conflicts across the various reaches (Yohannes *et al.*, 2017; Teshome *et al.*, 2018). Due to these and related challenges, irrigation projects in Africa have failed to deliver the promised benefits (Higginbottom *et al.*, 2021).

Technical solutions to increase water-use efficiency include the promotion of improved irrigation technology (Multsch *et al.*, 2017), modernization, and automation of irrigation infrastructure (Koech & Langat, 2018) and institutional solutions such as creating incentives for users for water conservation and saving (Hafied *et al.*, 2019; FAO, 2020). This study focuses on institutional solutions, particularly on identifying factors for implementing the irrigation charge policy.

Studies so far in Ethiopia have focused on estimating farmers' willingness to pay for irrigation water using discrete experiments (Mekonnen *et al.*, 2020) and contingent valuation (Aman *et al.*, 2020). Water pricing is not widely practiced in developing countries. Davidson *et al.* (2019) and Backenberg *et al.* (2014) indicated that implementing such a policy is difficult because of unclear objectives, a lack of understanding the conditions for its implementation, and the phenomenon of market failures. There is now an attempt to introduce a flat-rate area-based pricing system and blanket prescription in the present two large-scale schemes in West Africa (Sidibe & Williams, 2018). In this context, this study aims to explore implementation modalities and stakeholder roles thereof and the preconditions for scaling up. The study also aims to develop an implementation strategy, document the importance of the water charge policy in developing countries, and identify pathways for the fixing and implementation (as an example) of irrigation water charges in the Central Rift Valley (CRV) in Ethiopia.

This study is based on a literature review and consultations of key stakeholders, a study of institutions at the federal, regional, and basin levels to capture different perspectives on the need for water pricing, and on the need to fill the existing gaps to operationalize and implement modalities such as alignment with national water policies.

2. CONCEPTUAL FRAMEWORK OF THE IRRIGATION WATER PRICING POLICY, ITS NECESSITY, AND KEY GLOBAL LESSONS

Recently, there have been efforts in Ethiopia to introduce irrigation water charges. A regulation for applying water charges has been already drafted (FDRE, 2019) and is pending approval by the appropriate higher bodies. This section describes the use of a conceptual framework of such an irrigation policy, explains why such a policy is necessary, and draws lessons from global experiences.

2.1. Conceptual framework

The framework (Figure 1) has three major components: (1) the involvement of multiple stakeholders in making the policy, (2) policy instruments – regulatory instruments, persuasive instruments, and market instruments, and (3) the objectives of irrigation water pricing and the issues embedded in it.

Water pricing is a promising tool for efficient use of resources and cost recovery (Sampath, 1992; Backenberg *et al.* 2014; Young & Loomis, 2014; Dinar *et al.*, 2015; Davidson *et al.*, 2019). Pricing policies employ a combination of regulatory (using mainly the license and permit system and non-volumetric pricing), persuasion

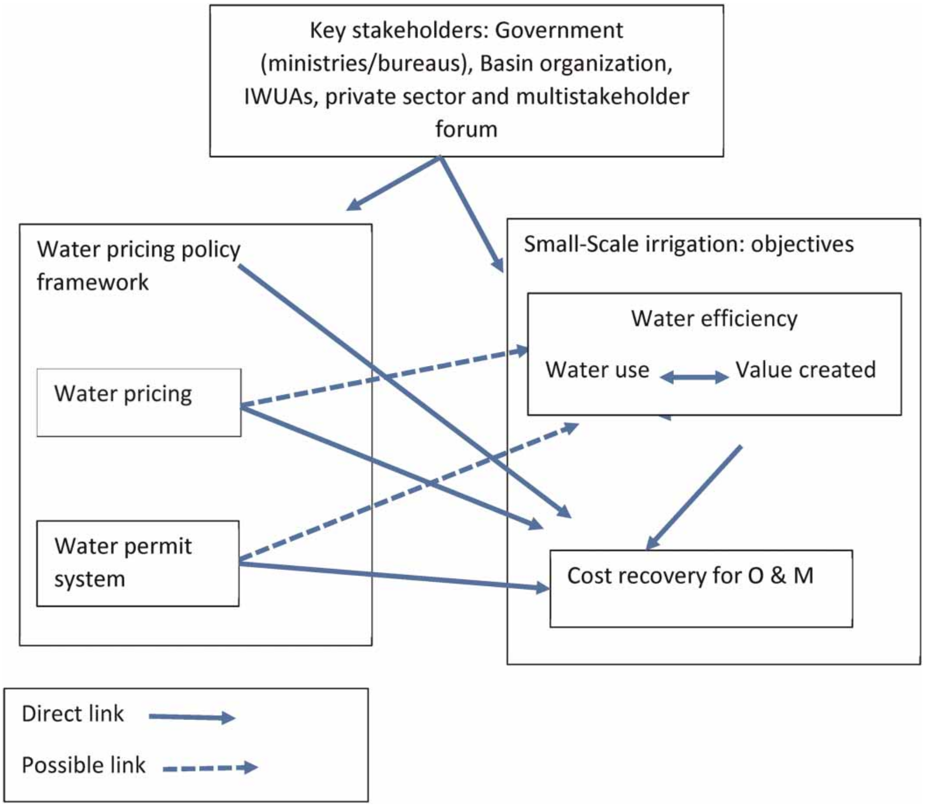


Fig. 1 | Framework on irrigation water charges. *Source*: Speelman *et al.* (2008) and Davidson *et al*. (2019), modified by the authors.

(such as education and extension), and market instruments (Davidson *et al.*, 2019). Pricing instruments are not objectives by themselves, but a means to an end, i.e., more efficient water resource management, including the provision of improved water services (Luiz Gabriel & Baltar, 2005). Right prices and efficient allocation of water have become increasingly important as the demand for food and water increases (Johansson, 2000; Kummu *et al*. 2016) and supply reallocation within agriculture becomes a major objective (FAO, 2004).

Designing a water pricing system requires a clear statement of objectives: recovery of operation and maintenance (O&M) costs and equity (not considered here) and ensuring water-use efficiency. The major objective of the current water policy in Ethiopia relates to a more reasonable and sustainable use of water resources (FDRE, 2019). Macroeconomic concerns of resource allocation between sectors, pollution charging, and benefit taxation are recorded in the literature, but they are seldom the drivers of national policies (FAO, 2004).

2.1.1. Why is irrigation water pricing necessary?

Those who have access to irrigation in developing countries receive water at no charge, but quantity, frequency, and reliability may be limited without adequate revenue for O&M. Moreover, the absence of fees means that there are no pricing signals to encourage the conservation of this scarce resource (Mekonnen *et al.*, 2020). Looking at the pricing policy in Ethiopia and others, one comes across a charging policy that is coarse, usually one that is area- and crop based (Hagos & Haileslassie, 2019). Volumetric pricing requires infrastructure to routinely measure the volume of water used. Where this possibility exists, a two-part tariff system, which is a fixed element to cover O&M costs and a variable element to reflect consumption, is used. de Azevedo & Baltar (2005) and Easter & Liu (2005) summarize that fixing and implementing water pricing (1) gives users a sign of the economic value of the resource, thus promoting its efficient use; (2) provides financial resources to guarantee adequate administration and O&M of water infrastructure; and (3) ensures funding for water resource management and development.

Various reasons are provided for considering why irrigation water pricing is crucial: (1) Water pricing is a way of improving allocations and encouraging the conservation of water (Johansson, 2000; Howe, 2005), (2) farmers facing water shortage/scarcity may be encouraged to improve its management or invest in capital that yields a more efficient irrigation system (Gibbons, 1986); the adoption of water-saving technologies could be one entry point, (3) another strategy involves making changes in crop mix to maximize the value per unit of water (Gibbons, 1986), and (4) water pricing could enhance the financial capacity of Irrigation Water Users' Associations (IWUAs) to offer better services to their members (Tardieu, 2005; Lempériere *et al.* 2014) or the generation of revenues for the O&M and expansion of the water system (Howe, 2005).

Achieving efficient allocation of water through water charging, however, requires setting the right pricing that is often sensitive to social, economic, institutional, and political settings (Johansson, 2000). Moreover, the introduction of a water pricing policy should not be viewed as a universal remedy; it should be seen as part of a larger package of measures (Rios *et al.*, 2018). Moreover, the issue is not principally about how to determine the level of water charges but about how to enforce the pricing policy by putting in place measures to improve revenue collection and strengthen enforcement systems (FAO, 2004), and this enforcement is the focus area of this paper.

2.1.2. Global experiences of the irrigation water charge policy and its implementation

Despite the pervasiveness of water pricing in developed countries, there is still disagreement over the appropriate means by which to price irrigation water and fix the levels of water charges (Johansson *et al.*, 2002; Dinar *et al.*, 2015). This section focuses on reviewing the experiences of selected countries in Asia and Africa, namely, India, Pakistan, China, Morocco, and South Africa, to draw important global lessons for Ethiopia or SSA.

2.1.2.1. Experiences in India. A wide range of water pricing approaches are followed in different states of India, depending on different field conditions and the institutional and administrative capacities of government authorities (Palanisami *et al.*, 2015). Pricing is often determined by the amount needed to recover the O&M costs of an irrigation project. Direct charging, such as area-based charges and flat rates per unit area irrigated, and output-based prices are the main pricing mechanisms implemented in various states in India. Volumetric pricing is not implemented in that country (Palanisami *et al.*, 2015). The reason for following this charging procedure is its simplicity to administer and ease of revenue collection. Volumetric pricing is not practiced because it is unfeasible, needing heavy capital inputs and high administrative inputs.

Major Indian states fix and revise the water rates and methods of charging. However, the collection of water charges often falls short due to poor compliance, farmers' free-riding attitude and a lack of willingness to pay and a lack of trust in the system, inefficiency in allocation and water use, and the poor availability of finances for the maintenance of infrastructure and investments in new supply sources (Malik *et al.*, 2014; Palanisami *et al.*, 2015). Water scarcity is increasing in the country due to the absence of political incentives, subsidized water charges, and poor recovery rates, undermining the efficient maintenance of existing water infrastructure (Malik *et al.*, 2014).

Now, there are plans to introduce variable water tariff estimates, based on variable water demand in the cold and hot seasons, aimed at covering O&M costs and shifting to a fully volumetric assessment system (Palanisami *et al.*, 2015).

2.1.2.2. Experiences in Pakistan. In response to water scarcity, a water charge system, underlying legal, administrative, and system designs, is in place in Pakistan. However, cost recovery and water allocation at the farm level is far inferior to that of India. Water charges are lower and collection rates are poor (FAO, 2004). Over the last half-decade, user charges (Abiana) have been enforced on a flat rate basis, which are different for various crops and vary among different provinces in Pakistan (Watto & Mugera, 2016). The physical system has not been maintained well, leading to inequitable distribution of water in all areas. Moreover, Watto & Mugera (2016) indicate that canal water supplies may not be sufficient to supply water, given the increasing crop water requirements due to the expansion of irrigation and water-intensive crops. Qamar *et al.* (2018) indicate that severely undercharged canal water, in the command area of selected distributors, negates the idea of having a self-sustainable irrigation system in the country. Also, the rate of irrigation fees is set to cover only one-quarter of the O&M costs (Bell *et al.*, 2014).

Pakistan, which has the dubious distinction of being the third largest global groundwater consumer, is widely recognized as one of the countries with depleting groundwater resources (Giordano, 2009). Farmers are generally willing to pay more for tube wells than for surface water irrigation costs (Bell *et al.*, 2014), although surface water is a free resource and farmers who have the means to invest in tube-well technology can even extract and sell groundwater.

2.1.2.3. Experiences in China. As a response to rapid development and the urbanization process, where water scarcity and water quality degradation problems are mounting, China has implemented a comprehensive water pricing framework, enhancing competition among water-supplying companies and developing incentive systems for water saving (Che & Shang, 2015; Shen *et al.*, 2015). China has developed a legal framework to encourage the participation of private players and the operation of the market for providing water services (Che & Shang, 2015). Several water resource management instruments, including command and control, incentives, and self-regulation are adopted (Che & Shang, 2015; Shen *et al.*, 2015). The water policy focuses on creating finances for Water Saving Irrigation (WSI) investment, coordinating incentives from different stakeholders, and strengthening farmers' irrigation institutions (Yao *et al.*, 2017). Moreover, the pricing mechanism, where prices vary by cities and irrigation districts, raises awareness for the need to save water and rewards water-saving behavior.

However, water prices and the collection rate of water fees are too low, leading to a lack of efficient supervision, resistance to accept higher water prices, the absence of market competition, and not well-developed public disclosure of cost mechanisms. Hence, new approaches are needed to enable sustainable management by coordinating incentives for different stakeholders in the management (Yao *et al.*, 2017). Che & Shang (2015) have suggested a new approach and reforms where pricing will be based on the principle of sustainable development and cost recovery and a block rate structure mechanism based on variable quantities, qualities, and timescales.

2.1.2.4. Experiences in South Africa. South Africa has a strong and well-considered pricing framework for both water resources and water service charges (Schreiner, 2015). The principles underpinning the pricing framework are largely sound and provide a balance between the need to pay for the costs of services and ensure the rights of the poor to access water (Schreiner, 2015). Growing water scarcity and the increasing pressure to allocate water more efficiently require farmers to pay for the water they use (Speelman *et al.*, 2008). Farmers are supposed to pay prices for irrigation use and infrastructure charges. However, most irrigators are still paying less than the annual O&M costs (Schreiner, 2015).

The major challenge in South Africa has been poor implementation because of poor billing systems and poor asset management systems, resulting in the inability to calculate the exact maintenance and replacement/refurbishment costs, and a lack of political will to implement water charges or to raise charges to the appropriate levels (Schreiner, 2015). Chipfupa & Wale (2019) recommend a shift toward on-farm volumetric water pricing and an improvement in agricultural production and productivity and market access to enhance farmers' willingness and their ability to pay.

2.1.2.5. Experiences in Morocco. Moroccan Water Law came into force in 1995 and introduced a decentralized integrated water management and rationalization of water use, including the user- and polluter-pays principles (Schyns & Hoekstra, 2014). It proposes legal and institutional reforms for the proper implementation and enforcement of these measures. Assouli *et al.* (2018) suggest more stringent rules in water-scarce regions where both surface and underground water resources are fast depleting.

Following the framework of the Green Morocco Plan 2007 to foster irrigation transition, different programs have been implemented, aiming to convert 550,000 ha to localized irrigation systems in 15 years. Financial and technical support has been provided to farmers to promote the adoption of water-saving irrigation techniques and practices.

To summarize the key lessons from these experiences, the absence of appropriate policy frameworks and clear regulatory mechanisms is the main constraint for the successful implementation of the water pricing policy (FAO, 2004; Davidson *et al.*, 2019). Establishing new institutions, as well as formulating and ratifying appropriate rules and regulations to achieve the intended policy goals, is important. Countries do revise the existing policies, laws, and regulations to match the contemporary contexts and emerging issues. Studies on farmers' WTP and other relevant scientific works provide important inputs for devising an effective policy on water charge.

Countries in SSA are expected to draw generic lessons from the global experiences but need to develop specific policies reflecting specific contexts. FAO (2004), Dinar *et al.* (2015), and Mekonnen *et al.* (2020) indicate that there is no general strategy or model for water pricing, and countries must develop their own 'strategy' or practices. The idea of applying the same level of irrigation water charges across all basins in Ethiopia, as stipulated in the new legislation, is not supported by global evidence. Sidibe & Williams (2018) reported that a flat-rate area-based pricing system and a blanket prescription in the two large-scale schemes in West Africa were ineffective.

Charging policies need to be formulated in full recognition of the various institutional and political factors that can limit cost recovery (to be indicated later in section 3.3) (FAO, 2004). Establishing a legal and political framework is necessary, but it is not a sufficient condition for its effective implementation. Farmers are willing to pay for irrigation if the money generated through payment is used to provide improved services for their local schemes (Levidow *et al.*, 2014; D'Odorico *et al.*, 2020). The main objective for charging users' irrigation fees is to regularly finance the O&M of the irrigation system and, if necessary, undertaking watershed rehabilitation, in combination with other policy instruments. These objectives must be clear from the outset.

Institutional reforms related to the strengthening of farmers' organizations is also important to increase collection efficiency (Malik *et al.*, 2014; Schyns & Hoekstra, 2014; Palanisami *et al.*, 2015; Schreiner, 2015; Assouli *et al.*, 2018).

Furthermore, lessons from the global experiences indicate the importance of the presence of an effective inbuilt system for monitoring and evaluation (M&E) for the successful implementation of the water pricing policy (Che & Shang, 2015; Shen *et al.*, 2015; Assouli *et al.*, 2018).

Finally, another lesson that is relevant to Ethiopia and beyond is that charging users alone to cover O&M costs may not be a realistic proposition and exercise. The government should continue to have a responsibility in financing the O&M of the head work and primary canals, while farmers and their local institutions should maintain the secondary and tertiary canals. Molle & Berkoff (2007) concluded that progress in the implementation of water pricing policies had been slow and uneven and that farmers typically paid only a fraction of the O&M costs. Keeping in mind such realities and enhancing the involvement of the private sector in irrigation water management, as a service provider, through a public–private partnership (PPP), are necessary.

3. POSSIBLE IMPLEMENTATION MODALITIES

3.1. Alignment of the pricing policy to national water management policies

It is important that the water pricing policy is anchored to national water policies to ensure its proper and successful implementation. The legal and policy framework of national water policies consists of the collection of provisions in the constitution, policies, laws, regulations, and legally binding guidelines on water management in the country or regional states (FDRE, 2018a; World Bank, 2019b). The Ethiopian Water Policy (FDRE, 1999) emphasizes that pricing systems should be geared toward conservation, protection, and the efficient use of water, as well as promoting equity and ensuring sustainability. The Ethiopian Water Resource Management Proclamation (FDRE, 2000) and the Ethiopian Water Sector Strategy (MoWR, 2001) also promulgate that farmers must pay fees for water use. The Ethiopian Water Resources Management Regulations (FDRE, 2005) provide guidelines on granting water-use permits, water charges, and water quality control. The River Basins Council and Authorities Proclamation (FDRE, 2007) establishes river basin councils and authorities responsible for implementing Integrated Water Resources Management (IWRM). The newly established Basin Development Authority (BDA), which replaces the 2007 provisions, stipulates that BDA is responsible for collecting water charges from users and planning, implementing, and monitoring IWRM (FDRE, 2018b).

The proclamation for the establishment and strengthening of IWUAs (FDRE, 2014) aims to develop incentive mechanisms to conserve water and regularly conduct the O&M of irrigation infrastructure. Sjödin *et al.* (2016) indicated that IWUAs are used to assist in implementing the water pricing policy and pooling the resources of several individual farmers to jointly manage the water system and its associated costs. The proclamation stipulates that the associations will get water permits from the government on behalf of their members and will be responsible for collecting water tariffs. It further stipulates that a group of farmers – a minimum of six farming households – using surface or groundwater can form an IWUA (FDRE, 2014).

The draft National Water Policy and Strategy[1] (FDRE, 2020) is meant to address the shortcomings of the previous water policy, aiming at ensuring water security through water development, including building water-regulating hydro-infrastructures, buffer management, and environmental conservation. It recommends the use

[1] This policy is in line with the Africa Agenda 2063, Africa Water Vision for 2025, UN General Assembly's recognition of the human rights to drinking water in 2010, the 2030 Agenda for Sustainable Development, the 2016 Paris Agreement on climate change and other national developments.

of efficient technologies, improvement in water resource management and governance by strengthening regulatory institutions, the establishment of basin institutions, the issuance of procedures and guidelines, among others.

Water Uses Charges Regulations (FDRE, 2019), which is expected to be the stepping stone for initiating the practice of charging irrigation water in the country, requires further approval from the Council of Ministers.

3.2. Re-examining the roles and responsibilities of actors

Ethiopia has a federal government structure (FDRE, 1995), where ministries at the federal level are responsible for formulating the overall development strategies and policies of the country, with possible inputs gathered from the regions and other stakeholders. The MoWIE, for instance, develops the National Water Policy and Strategy, with provision for other policy directions, financial support (e.g., medium- and large-scale irrigation infrastructure investment), technical backstopping, and M&E. The regions are mandated to develop the respective regional legal and policy frameworks, considering their context and in line with the federal laws and policies. The regional bureaus are engaged in carrying out development and operational activities and reporting to the regional executive organ (FDRE, 1995; Bryan *et al*., 2020).

The BDA, alongside its basin offices, is expected to play a key role in the implementation of the water charge policy in the country. The BDA Establishment Regulation (FDRE, 2018b) states that the collection of water use charges by the basin offices, which are accountable to the BDA, shall be limited to rivers and lakes linking two or more regional states. A regional state, otherwise, fixes water charges on the basis of proclamations (FDRE, 2014) and regulation (FDRE, 2019) if a lake or river falls within its jurisdiction. The BDA or the basin office may also delegate its power of collecting water use charges to the appropriate government body for efficient execution of its duties (FDRE, 2018b). The roles and responsibilities of important actors in irrigation water management are summarized in Table 1.

The basin offices are responsible for promoting and monitoring the implementation of the IWRM process. Users within a scheme are obliged to be members of IWUAs, responsible for rehabilitation and maintenance of the scheme, fair distribution of water, conflict resolution, collection of water fees, and training members on irrigation techniques, water-saving, and new methods of irrigation. IWUAs can form a federation or union that will be responsible for making decisions at the watershed level. Finally, water user groups (WUGs) could be organized in an irrigation block and groups of WUGs can create IWUAs.

Despite such job classification, however, Key Informant Interviews (KIIs) conducted during 23–25 November 2020 with RVLBO, Bureau of Water Resources in Southern Nations Nationalities and Peoples Region (SNNPR) and Small Scale and Micro Irrigation Support Project (SMIS), indicated (a) a lack of clear understanding of water policies and laws and objectives of the water charge policy by these actors, (b) inconsistency in the perception of mandates between the regional state and the basin offices in the management of transregional water resources (Hailu *et al*., 2017), and (c) an element of centralization lately (see FDRE, 2018b), which is a growing concern.

In the light of the perceived ambiguity of roles within basin offices, and by extension the BDA and regional states, clarifying the mandates of the stakeholders concerned, the objectives of water pricing, and the responsibility of fee collection need further attention. Decentralization could be effective and improve the governance of water resources when clear roles and responsibilities are shared among different actors at different levels and scales (Hegga *et al*., 2020).

3.3. Broad and sustained political commitment

The literature cited earlier, specifically from India, China, and South Africa, indicate that introducing and implementing irrigation water charges is a politically sensitive agenda requiring broad and sustained political

Table 1 | Roles of important actors in irrigation water management.

Actors	Scale	Responsibility[a]
Ethiopian River Basin Development High Council (RBDHC)	Federal	Provides policy guidance and planning oversight to ensure a high level of coordination among stakeholders in each basin; direct the preparation of the river basin plan and submit the same for approval by the government; propose to the government the rate of water charges to be paid by water users in each basin; examine and decide on the appropriateness and prioritization of constructing major water works in each basin; examine and decide on water allocation rules and principles in normal times and in times of water shortage (times of drought) or flooding; manage water-use disputes between regional states in each basin; provide information and advisory support to the body in charge of negotiating with neighboring countries in a transboundary context; and establish standing or ad-hoc committees necessary for discharging specific activities.
Basin Development Authority (BDA)	Federal	Undertake policy studies, surveys, and research; facilitate and undertake activities necessary for the implementation of an IWRM within in the basins; issue permits applicable to water use and waterworks; collect water charges from permit holders; collect, compile, analyze, and disseminate information for proper planning, administration, and steering of water resources in the basins.
Basin Offices (accountable to the BDA)	River basin scale	Promote and monitor the implementation of the IWRM process in an equitable and participatory manner in the respective basin, e.g., the Rift Valley Lakes Basin Office (RVLBO).
Regional Bureau of Water (collaborate with Bureau of Agriculture)	Region, Zone, Woreda & peasant association (kebele)	The regional bureaus are mandated to develop policies and legal frameworks considering their local context and in line with federal policies and laws; plan and implement (using regional and federal budget) and monitor progress. There could be investments in infrastructures, in each region, by the federal budget.
Irrigation Water Users' Associations	Irrigation scheme	Farmers (users) within a scheme are obliged to be members of IWUAs, for rehabilitation and maintenance of the scheme, fair distribution of water, conflict resolution, collection of water fees, and training members on irrigation techniques, water-saving, and new methods of irrigation and technology (to enhance water-use efficiency). IWUAs can form a federation or union that will be responsible for making decisions at the watershed level.
WUGs	Part of a scheme	Water user groups (WUGs) could be organized in irrigation blocks. A group of WUGs can create an IWUA.
Group of farmers	Within a scheme	A minimum of six farming households can form an IWUA.

Source: Assembled from various proclamations by authors.

[a]The roles and responsibilities are verbatim taken from the respective proclamations.

commitment. The FAO (2004) reported that a lack of political will to impose higher costs on farmers, government reluctance to reduce costs by slimming down overstaffed government agencies, and a lack of motivation of stakeholders in fee collection, and fees once collected going into the treasury and not linked to recovery and improvement in services, thus increasing farmers' reluctance to pay can all hamper the full supply of cost recovery. This leads to a vicious circle of low O&M expenditure, leading to poor performance and increasing the reluctance of farmers to pay, insufficient resources (time, money, and training) for planning and implementing effective charging mechanisms, failure to enforce pricing policies and service delivery, and failure to promote more profitable agriculture (Malik *et al*., 2014). Burton *et al*. (2020) indicated that aligning the payment mechanisms and local water governance more closely with farmer preferences is likely to reduce the barriers to accepting participatory irrigation and the requirement to pay water charges. Hence, sustained political commitment and farmers' willingness to pay for water is one of the key strategies to implement the water charge policy.

3.4. Building partnerships

Agricultural water management requires the participation of many stakeholders in the decision-making process. Sjödin *et al*. (2016) indicate that there are multiple users and uses of water at the basin scale. These users do have different values (prices) of water. The development of a policy regime to achieve multiple goals tends to be a multi-stage process involving all these actors. This calls for policy coherence across the multiple levels of governance. Moreover, a agricultural (irrigation) development requires the engagement of various stakeholders (World Bank, 2019a) involving key stakeholders in water management. Hailu & Tolessa (2020) suggest multi-stakeholder platforms (MSPs) at different scales, involving different priorities, sectors, and actors, as an institutional framework and drive to IWRM. Establishing such a platform (now called the Water Charge Dialogue Platform (WCDP), involving the BDA/RVLBO, water users, small-scale, and middle- and large-scale farmers (including floriculture), relevant sector bureaus, and IWUAs, is quite important. The WCDP could serve as a point where opinions could be heard, grievances aired, and charges negotiated. Involving the private sector makes the collection process more efficient and the schemes sustainable. Melaku & Minh (2021) explored the influence of MSPs on policies and practices and their impact and sustainability. Guidelines on organizing, facilitating, and documenting such platform meetings are given by Lemma *et al*. (2020). The BDA, alternatively the RVLBO, may play a facilitating role, providing the necessary capacity-building measures to smallholder farmers, local irrigation institutions, and other key actors. More on these issues in section 3.8.

3.5. Clear institutional anchorage and better co-planning

A clear definition of the objectives of water charges and the corresponding mandates and responsibilities of the BDA, the RVLBO, regional bureaus, and IWUAs is necessary. It is unclear whether the water charges to be levied on water users by the BDA/RVLBO will be different from those to be levied by IWUAs (regional bureaus) and whether the money collected by the BDA/RVLBO will be used for recovering O&M costs. According to the World Bank (2020), the water charge collected by the BDA is for 'ecosystem services'. Farmers are required to pay irrigation water fee (Rey *et al*. 2019). This includes collection of fees from permit holders and irrigation charges to smallholder farmers. The water charge regulation specifies the amount of charges for different types of crops, without suggesting ways of assessment (billing).

Engaging the private sector, e.g., engaging organized unemployed youth as a service provider in irrigation is important. The organized unemployed youth have the mandate of undertaking regular O&M using money collected from users as water charges.

Two implementation modalities are suggested here: involving IWUAs and service providers in fee collection and undertaking O&M, respectively (see Figure 2). This involves co-planning of implementation details and co-developing protocols.

3.6. Inclusive and accountable process

Implementing the water charge policy requires community consultation and sensitization in identifying problems and solutions and communicating policy decisions. Water management evolving from the traditional top-down approach to more integrated initiatives, focusing on community-led action (Rolston *et al.*, 2017), is critical for effective implementation of the new policy. Engineering solutions to water management do not yield good results; it calls for the establishment of effective and efficient participatory water institutions (Gandhi & Johnson, 2020). Akhmouch & Clavreul (2016) and OECD (2018) also suggest stakeholder engagement for making informed and

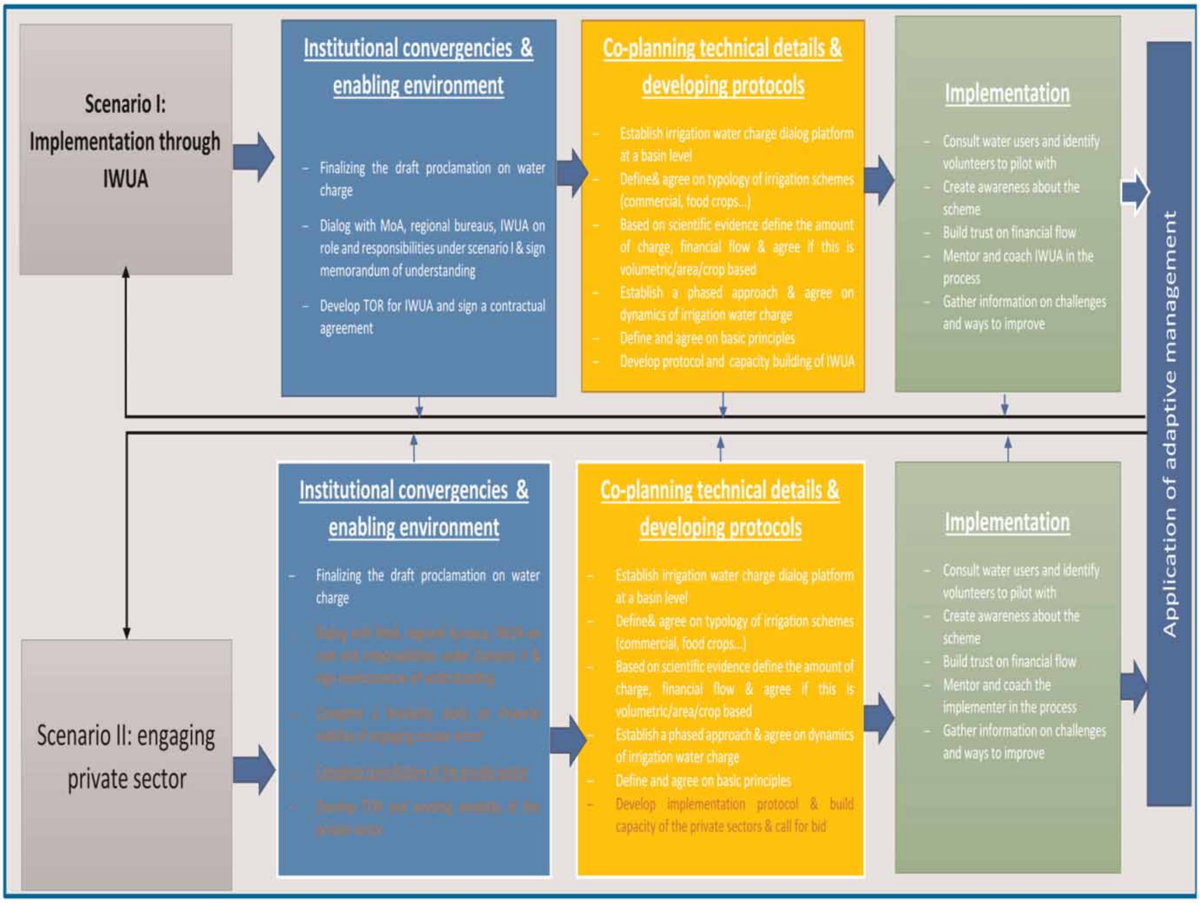


Fig. 2 | Framework on implementation modalities and guiding piloting of irrigation water charges. *Source*: Authors.

outcome-oriented contributions to water policy design and implementation. Moreover, this policy needs to advocate and promote more inclusive growth, considering the situation of women and youth in the water charge policy.

3.7. Institutionalizing water permit

Permit systems were expected to be the best available legal system across the world for governments, as custodians of water resources, to govern water in public interest (Schreiner & van Koppen, 2020). The advantages of these systems include the following: serving as a tool for guiding planned intervention, avoiding depletion of the resource base, avoiding increased flood risk, enforcing important safeguards, enhancing equity, enabling the control of pollution and rehabilitation of polluted ecosystems, giving priority to sectors with high socioeconomic returns and better environmental benefits, and giving reliable information about the prevailing situation in the basin (Borghesi, 2014; Latinopoulos & Sartzetakis, 2015).

FAO (2004) costs related to the preparation and adoption of legislation, registration, recording water rights, monitoring water resources, and enforcing the legislation relating to a water rights regime are relatively complex processes requiring efficient administrators as well as other technical skills. Borghesi (2014) indicates the existence of significant difficulties during implementation, which can prevent the full functioning of a water permit system. The FAO (2006), hence, suggests staged implementation, focusing initially on those basins or aquifers where there are problems such as overabstraction/overuse. In Kenya, for instance, Schreiner & van Koppen (2020) indicated that implementing water-use charges for a large number of small-scale users spread across a large terrain proved difficult. Schreiner & van Koppen (2020) suggest a hybrid water rights systems including a suite of tools for selective use and adjustment to local situations to serve the interests of both the state and small-scale users. These are good lessons for Ethiopia and beyond.

In the Ethiopian context, water permit means official authorization to make particular use of a water body or release alien materials to water bodies (FDRE, 2000, 2005, 2018b). The FDRE Water Charge Regulation (FDRE, 2019) defines 'water use charge' as water abstraction charges stemming from user-pay principles, payable by permit holders. It presupposes the possession of water-use permits for water abstraction and, hence, payment of water-use charges. However, permit is not a guarantee for access to water, implying no commitment or guarantee for water availability by the permit giver toward the permit holder (FDRE, 2005). Moreover, water users shall be exempted from paying charges if they are victims of natural calamities or unexpected accidents such as drought, flood, or fire and suffer from losses.

However, modern water rights must confer a sufficient degree of security upon right holders (FAO, 2006).

FDRE (2019) indicates that traditional water users, whose average holding is less than 0.25 ha, are not required to have permit and are exempted from payment of water charges, perhaps showing a significant inability (Schreiner & van Koppen, 2020). Some care is needed, in this connection, as an excessively large number of 'free' water users may still negatively impact available water resources (FAO, 2006).

3.8. Institutional capacity building

Severe deficiencies in irrigation services and fee collection, which manifest in Asia and Africa, are caused, among others, by financial and capacity constraints. Effective billing and fee collection are critically important for ensuring the viability of a pricing system. Removing these defects has an immediate impact on the revenue streams of the government and service providers (World Bank, 2008). These depend on many internal factors, including the availability of customer databases, the extent of metered and unmetered water measurement, tariff and billing structures, delivery of bills, facilities for customer payments, and the institutional arrangements under which service providers operate and provide services.

These are important in Ethiopia and similar countries, where local irrigation institutions have limited experience in improving services. Rogers & Black (1993) have suggested that improved irrigation water management is impossible without irrigation water measurement. Capacity-building measures on measuring the amount of water a farmer uses and effective billing and collection are critical. Besides, the instrumentation for measuring the volume of water and monitoring the quality of water is important. Metering of water requires additional infrastructure and design and installing meters for new schemes. There is growing global interest in promoting smart techniques, including sensor monitoring, real-time data transmitting, and controlling water systems (Lika *et al*., 2017; Li *et al*., 2020), which will be helpful for billing and, hence, effective collection. Furthermore, support and advice from research and extension is important.

3.9. Start small: piloting the irrigation water charge policy

Little guidance is available on the practical aspects of designing and implementing the irrigation water charging policy. Its effective implementation in the CRV, thus, requires piloting with a few interested farmers, small-scale farmers organized in IWUAs, farmers who withdraw water (small- and large-scale farmers) from lakes or rivers, and water-use permit holders. The immediate objective of this piloting is to optimize water use (avoid wastage), encourage farmers to partly cover the annual O&M costs, improve irrigation services, profitability, and the ability to pay, and identify and address farmers' training needs.

Some steps are required for piloting the implementation of irrigation water charges in the CRV:

- The water charge regulation policy has not been approved yet, but once it is approved, creating awareness through a series of sensitization programs is the first step to be carried out by the BDA/RVLBO.
- Another important step is establishing WCDPs involving IWUAs, small-, middle-, and large-scale private farmers, the BDA/RVLBO, sector bureaus, etc. They can be used for co-planning of implementation details and co-developing protocols.
- The third important step is to set up an appropriate technical team for the execution of the piloting process. A clear mandate and institutional anchorage are required for the proposed institutional framework. Piloting of water charges will help us to learn which approach works better and under what circumstances and ascertain whether involving organized youth as a service provider is a sound strategy. The supervision and follow-up can be conducted by both the RVLBO/BDA and the regional sector bureaus (or bodies delegated) with the technical team.
- Undertaking capacity-building measures, as indicated above, during the piloting, with the support of the RVLBO/BDA.
- The implementation of water prices based on co-planning and co-developing implementation details requires gathering information and regular M&E and review and scaling up. At each step, a transparent process must be followed, recording and documenting each relevant information and activity. This could provide adequate data to adaptively revise the procedure as further experiences are gained, to draw lessons for scaling up (Haileslassie *et al*., 2020).

4. CONCLUSIONS AND POLICY IMPLICATIONS

In the face of rapid population growth and climate change, irrigation development has been considered as the main policy intervention in SSA, which is reported to have led to an improvement in food security and a reduction in poverty. However, the irrigation sector has been plagued by poor performance, characterized by overirrigation, low water-use efficiency, low crop intensity, and water scarcity. It is also characterized by an unfair distribution of water across reaches, the absence of regular O&M of irrigation infrastructure, and poor irrigation services.

Various technological and institutional solutions are suggested to overcome these challenges. The Government of Ethiopia has a plan to introduce agricultural water charges in all basins in the country to overcome some of these challenges. The aim of this paper is to document, mainly using literature review and stakeholder consultations, conceptualizing this policy change and its importance, drawing lessons from global experiences, and examining factors for its successful implementation.

Global experiences show large differences in charges and charging mechanisms within a single country, reflecting differences in objectives, water sources, degrees of water scarcity, and differences in technologies in irrigation schemes, farm types, etc. The idea of applying a blanket level of water tariffs across all basins in Ethiopia is not realistic, and adopting tiered pricing approaches, responding to specific water-resource conditions, is necessary (Schoengold & Zilberman, 2014; Zilberman *et al.*, 2017). The possibility of covering O&M costs through charging farmers alone may not be realistic. The government may continue financing O&M costs of the head work and primary canals. Keeping these realities in mind in the area of water management is necessary in Ethiopia and beyond.

The results indicate that the water charge policy is well anchored in national water policies, a necessary condition for its operationalization, and as such, a lesson for SSA. Suggesting modalities for its implementation requires examining the role of institutions, mainly the role of the BDA, its basin offices, regional states, and IWUAs, and private service providers need further scrutiny.

Finally, the introduction of an irrigation water charging policy in the CRV or beyond requires piloting and the establishment of a multistakeholder forum, as little guidance is available on the design and implementation of such a policy in a specific context. The implication of this study is the requirement for maintaining dynamics in the charging policy, reflecting the changes in political and economic developments and following adaptive management.

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DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

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