

Review of Factors Affecting Small Scale Irrigation Schemes in Ethiopia

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Abstract

This paper reviews some of the factors affecting small-scale irrigation schemes in Ethiopia based on Environmental factor, Social and Climate related factor, Irrigation scheduling and Siltation of the structure, lack of awareness creation, Land factors and poor on farm irrigation water management. Ethiopian small-scale irrigation schemes were often characterized by low water use efficiency as a result of poor on farm water management. There is water logging, siltation of the structures, technical constraints, inadequate awareness of irrigation water management, improper irrigation scheduling techniques and operation and maintenance of irrigation facilities problem which affects irrigation schemes. Sedimentation of structures reduces canal conveyance efficiency leading to risk of canal breach, inadequacy and inequity in water distribution to crops. The Main gaps of awareness like, Faulty design, Lack of knowledge on use of modern irrigation technology, Poor land management and Poor management capacity affects small scale irrigation schemes. Therefore investigating the sources, extent, and types of sedimentation entering into scheme, linkage between research and extension, proper irrigation scheduling techniques and awareness creation is the basis for reducing maintenance costs and for effective management of small scale irrigation schemes.

Keywords: water management, small scale, irrigation performance, environment, Sedimentation

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Introduction

Irrigation water can be abstracted from the source and conveyed to the field by farmers individually or in a group as an irrigation scheme. Accordingly, an irrigation scheme can be defined as an agricultural project involving multiple holdings that depend on a shared distribution system for access to irrigation water and, in some cases, on a shared water storage or diversion facility (van Averbeke et al., 2011). Ethiopian small-scale irrigation schemes were often characterized by low water use efficiency. Thus, efficient water use and management are currently major concerns (Derib et al., 2011). The country has abundant rainfall and water resources however, its agricultural system does not yet fully benefit from the technologies of irrigation and water management (Awulachew, 2010). In Ethiopia, improper irrigation scheduling practices have been considered as the major problems for the sustainability of irrigation schemes because of the lack of simple and practical scheduling methods, cost, inaccessibility of soil water monitoring tools and lack of local climate data (Yohannes et al., 2019). The aim of water management is to minimize yield gaps by optimizing the time of water application to increase plant water uptake (Rockström and Barron, 2007). Irrigation water is generally limited or mismanaged in many irrigation schemes, and are among the major problems constraining agricultural production in Ethiopia (Haileselassie et al., 2016). The performance of irrigation water in Ethiopia has been characterized by inefficiency and poor on farm management. There are several challenges on the performance of irrigation schemes and most are not performing at the best of their capacity. Irrigation development in Ethiopia, as well as in sub-Saharan Africa affected by serious problems related to poor irrigation water management (Mesfin et al., 2020). The key challenges impeding the success of irrigation development are; poor scheme management, sedimentation of structure, imperfect market, financial shortage, insufficient technical skill, lack of awareness about the use of irrigation, environmental and social impact. This review summarizes some of the factors affecting small scale irrigation schemes in Ethiopia like, Environmental factor, Social and Climate factor, improper Irrigation scheduling and siltation of structure, lack of awareness creation and poor on farm water management.

Environmental factor

Environmental factors that affect irrigation schemes refers to any change in the environment or in its components that may affect soil, air, water, climate, natural or cultural heritage, and other physical structures, (Ulsido et al., 2013). In addition soil alkalinity and irrigation water quality problems are commonly found in the arid and semi-arid regions of the Ethiopia due to insufficient annual rainfall to leach down accumulated salts from the plants root zone. As result of this, many soils have been and are being changed into the class of problematic soils due to different natural hazards and poor agricultural practices (Haile, 2019). Salinization of land and water resources is a major landscape degradation which could affect small scale irrigation structures. In Ethiopia Much of the

success of irrigation management as a means to improve system performance depends on farmers' willingness to take on an expanded role in operation and maintenance above the outlet. In some small scale irrigation schemes Water withdrawn for irrigation Cause landslide which affects irrigation canal in addition to water logging (Meinzen-dick & Raju, 2000). Waterlogging is the main drainage problem in the small scale irrigation schemes in the Vertisols dominated highland areas while salinity and salinization is a common phenomenon in the large and medium scale irrigation schemes located in the lowlands of the country's major river basins with predominantly salt affected soils. The lack of functional drainage system and poor water management practices have also significantly contributed to the frequent occurrence of waterlogging and salt build-up in irrigation fields.(Gebrehiwot, 2018).

Social and Climate related factor

In Ethiopia Climate change is a major environmental and socioeconomic factor. Therefore, a better understanding of area-specific and adaptation is crucial to develop and implement proper adaptation strategies that can alleviate the adverse effects of climate change. Expansion of small scale irrigation is one of the priorities of policymakers of Ethiopia for rural poverty reduction and boosting growth(Marie et al., 2020). In Ethiopia, after infrastructure development such as roads, investments in irrigation are a key factor triggering rural upliftment. Moreover; the potential multiplier effects of investments in agricultural intensification are considerable. Irrigation must hold out a promise of making significant improvements in the livelihoods and food security situation of the irrigation farmers. The cost of sustainable farmer management of the schemes (including infrastructure, technology, water user associations, etc.) must be an acceptably small proportion of the income derived from irrigation, i.e., benefit cost ratios must give incentives that facilitate rational production decisions. The schemes must have a certain level of access to institutional support services, including access to inputs, output markets, credit, extension, institutional framework defining and enforcing secured and use rights to land and water(Awulachew & Merrey, 2005).

Different authors confirmed that education has an impact on the involvement of farmers on irrigation practices. However, it is also important to note that SSI is practiced by people with different educational levels ranging from analphabets to those who attended university(Mengistie & Kidane, 2016). It is believed that educated farmers are more aware of irrigation's technological inputs, utilizations, and risks.

Irrigation scheduling factor

Irrigation scheduling provide farmers with recommendations on timing and amount of irrigation, thus contributing to improving on-farm schemes irrigation water management (Montoro et al., 2011).In most of the world including Ethiopia, irrigated agriculture has been faced with increased scarcity in irrigation water. Moreover, Improvement of on-farm irrigation systems and the introduction of low cost water saving irrigation technologies important. Among those technologies, proper irrigation scheduling, by which the precise timing and amount of irrigation are determined, has long been advocated as an improved water management technique (Howell, 1996).(García et al., 2020) concluded that technical training and willingness to accept irrigation schedules is needed for stakeholder's .Hence, irrigation advisory services (public or private) can play a key role in this water management technology adaptation. Over-irrigation should be decreased by training of farmers on the management of soil moisture content in crops' root zones and informing them by irrigation expert or by conducting joint field experiments on their plots together with scientists and agricultural development agent (DA)(Sajid et al., 2022).

Siltation of the structure

Siltation affects water distribution; its accumulation can create hazards, including diversion of water from its original channel and the sediments can gradually fill reservoirs, suffocate spawning beds, clog or damage water inlets and gates (internet source). Sedimentation has been reported as one of the major problems affecting irrigation schemes within the African region including Ethiopia. Sedimentation reduces canal conveyance efficiency leading to inadequacy and inequity in water distribution to crops in addition to risk of canal breach due to reduction in freeboard and waterlogging (de Sousa et al., 2019). The irrigation structures do not always run with the design discharge and to fulfill the water requirement for different growing stage of a cropping period the canal is operated leading to change of the water flow. This variation of water flow would generally lead to the siltation in the canals which will ultimately decrease its capacity and leading to poor serviceability. The problems associated with sediments have been led investments costs in maintenance and rehabilitation work(Yangkhurung et al., 2018).

From study conducted in Ethiopia at Arata-Chufa and Ketar for three years (2016–2018), Small holder Farmers reported increased sedimentation over time and difficulty paying operation and maintenance fees instead preferring to contribute labor for the desalting campaigns (Zerihun et al., 2022).The authors further concluded that investigating the sources, extent, and types of sedimentation entering a small-scale irrigation

scheme is the basis for reducing maintenance costs and for effective management of sedimentation problems. (Yangkhurung et al., 2018) from observation of Gimbora, Alewha, Geray, Kility irrigation schemes in amhara region concluded that, the functioning of an irrigation canal network depends not only on how the network is operated, but also on the condition of the canals and on the condition of the hydraulic structures. The authors described that most common problems seen in structures of the surveyed projects were leakage, erosion, siltation, rot and rust.

Land factors

The main land factors are slope and holding size of the farm land. Land is one of the most basic and mandatory natural resources as an input for agricultural production. Cultivable land size positively and significantly influenced farmers' decisions to increase cultivated irrigation land size. An increase in land holding size would increase the probability of households expanding their irrigated land size. This result implied that irrigation user farmers with larger land holdings were more likely to extend their irrigated land size than those with smaller land holdings (Daru et al., 2023). Cultivable land size had significant positive influence on use of small scale irrigation at 5% significance level (Masresha Tadesse et al., 2020). Households having larger land sizes easily perform crop production and livestock rearing compared to households owning smaller land sizes or not owning land at all. This is because of the high land rental price for crop production and for grazing (Molla & Sisheber, 2017; Muleta & Milkias, 2021). Therefore, land owned was among the important factors that determined household participation decision in small scale irrigation (Muleta & Milkias, 2021). The slope of the farmland that would be suitable or unsuitable for irrigation practice is a determining factor in small-scale irrigation participation. Topography (sloppiness) of farming land was negatively affected households' decision to participate in small-scale irrigation. As a household had sloppy (unsuitable for irrigation) farm land, the possibility of their participation in small-scale irrigation would decrease (Daru et al., 2023).

Lack of awareness and poor management

Knowledge gaps and broad research needs in effectively implementing the technologies of irrigation in Ethiopia. The Main gaps of awareness are; Faulty design, Lack of knowledge on use of modern irrigation technology, Poor water management, Poor land management, Poor input utilization, Poor management capacity, Lack of information and database, and Lack of post-harvest technology and management. Furthermore, poor linkage between research and extension in the area causes to weak irrigation water management (Mesfin Meja et al., 2020).

Conclusion

This paper reviewed the factors that affect small scale irrigation schemes in Ethiopian on the basis Environmental factor, Social and Climate related factor, Irrigation scheduling and Siltation of the structure, lack of awareness creation, Land factors and poor on farm irrigation water management. Ethiopian small-scale irrigation schemes were often characterized by low water use efficiency as a result of poor on farm water management. During reviewing, different literatures reports that small scale irrigation schemes were also affected by other factors like seepage, deep percolation and salinity problems. Therefore, investigating the sources, extent, and types of sedimentation entering a small-scale irrigation scheme, proper irrigation scheduling, linkage between research and extension, awareness creation on irrigation water management is the basis for improving performance efficiency, reducing maintenance costs and for effective management of sedimentation problems in irrigation schemes.

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