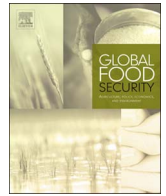




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A review of trends, constraints and opportunities of smallholder irrigation in East Africa

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ABSTRACT

Smallholder irrigation expansion would significantly increase agricultural production, and reduce food insecurity and poverty levels in East Africa. This paper reviews literature on trends, constraints and opportunities of smallholder irrigation in four East African countries: Ethiopia, Kenya, Tanzania and Uganda. Irrigation development has been slow in these countries, and has been mainly through traditional schemes. Recently, individual irrigation technologies such as small motorized pumps, drip kits, treadle pumps, rope and washer pumps are being promoted. Adoption of these technologies and expansion of smallholder irrigation however face a number of challenges including land tenure issues; lack of access to appropriate irrigation technologies, improved agricultural inputs, reliable markets, finance and credit services, and research support; poor transport and communication infrastructures; poor irrigation water management; poor extension systems; and the over dependence on national governments, NGOs and donors for support. Despite these challenges, opportunities exist for smallholder irrigation expansion in East Africa. Such opportunities include: high untapped irrigation potential; rainwater harvesting to improve water availability; high commitment of national governments, NGOs and donors to smallholder irrigation expansion; low cost irrigation technologies adaptable to local conditions; traditional schemes rehabilitation; growing urbanization; and increased use of mobile phones that can be used to disseminate information.

1. Introduction

1.1. Background

Worldwide, 20% of the total land cultivated receives irrigation water to produce about 40% of the world's total food (FAO, 2015a). Sub-Saharan Africa (SSA) has with its 4%, the lowest percentage of irrigated land to the total area cultivated globally (Burney et al., 2013) whilst having the highest depth of food deficit i.e. the highest amount of energy needed for people who are undernourished to attain the average dietary requirement (Fig. 1). For the four East African countries considered in this paper, namely: Ethiopia, Kenya, Tanzania and Uganda, Ethiopia has 289,600 ha of irrigated land out of the 16.5 million ha of cultivated land; 103,200 ha are under irrigation in Kenya with total cultivated area of 6.1 million ha; in Tanzania, 184,300 ha are irrigated out of the 16.7 million ha that are cultivated, and in Uganda, only 8716 ha out of the total cultivated area of 9.2 million ha (FAO, 2015a). On average, 2% of the four countries' cultivated area is under irrigation. Nevertheless, irrigated land although minimal in SSA when compared

to the total cultivated land, it produces about 20% of the total agricultural output (Foster and Briceño-Garmendia, 2009). The estimated irrigation potentials for Tanzania, Ethiopia, Kenya and Uganda are as shown in Table 1. The irrigation potentials and area irrigated in these countries however vary strongly among sources. When comparing irrigation in SSA with that in Asia, 41% of the cultivated area in Asia was under irrigation in 2000 (Portmann et al., 2010); which is a tenfold that of the irrigated area found in SSA. Irrigation together with mechanization of agriculture, use of improved seeds, and use of inputs such as fertilizers and pesticides in the 1960s significantly contributed to the Green Revolution in Asia (Hazell, 2009). As such, sustainable irrigated agriculture expansion in SSA presents opportunities to reproduce conditions that led to production gains witnessed in Asia over the last 50 years (Fujiie et al., 2011).

Agricultural production in Eastern Africa is mainly rainfed despite rainfall being highly variable and in many areas, insufficient. Risks and vulnerabilities of climate change and variability in the world are now noticeable (Adger et al., 2003); the Intergovernmental Panel on Climate Change (IPCC) warns that climate change and variability will add more

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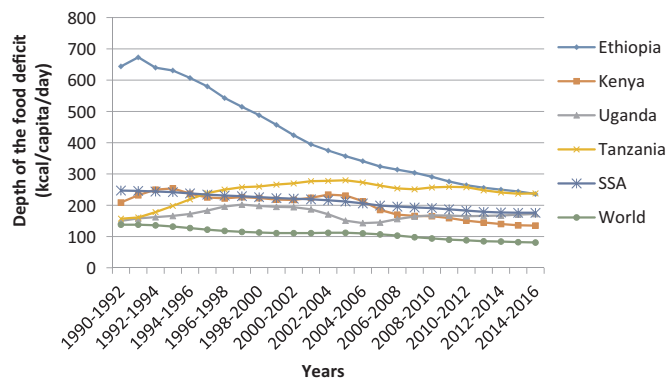


Fig. 1. 3-year average of depth of the food deficit. FAOSTAT database

Table 1
Irrigation potentials of the four countries.
Source: FAO AQUASTAT database

Country	Irrigation potential (1000 ha)
Ethiopia	2700
Kenya	353
Tanzania	2132
Uganda	90

pressures on water availability, accessibility and demand in Africa (Boko et al., 2007). Heavy dependence on rainfed production makes communities in these countries more prone to droughts and periods of water scarcity which significantly affect crop and livestock production. For instances, during the financial year of 2010/11, Uganda's Ministry of Agriculture, Animal Industry and Fisheries (Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)) reported a 16% decline in cash crops (i.e. coffee, cotton, tea, tobacco, sugar cane, flowers and horticultural crops) production due to poor rains and droughts across parts of the country (Ministry of Agriculture, Animal Industry and Fisheries MAAIF, 2011). As a result of a 40 – 55% reduction in cumulative rainfall observed in the October – December rainy season of 2016 from the long-term average, a 70% reduction in maize production was recorded when compared to the average of the previous five years in the southeastern cropping areas of Kenya that include counties of Kitui, Makueni, Tharaka Nithi, North Meru and Embu (FAO, 2017). In the coastal cropping counties of Kenya, the October – December cumulative rains were 55 – 90% below the long-term average leading to total failure of the maize crop (FAO, 2017). As such, in January 2017, about 2.2 million people were estimated to be in need of humanitarian aid. The IPCC projects that reductions in yields in some African countries due to climate change and variability could be as high as 50% by 2020; with smallholder farmers being the most affected (Boko et al., 2007).

Smallholder farmers, defined here as farmers who carry out farming activities on pieces of land that are 2 ha or less, dominate agricultural production in Eastern Africa (Salami et al., 2010; Livingston et al., 2011). In addition to the unreliable rainfall, these farmers further face a number of challenges including volatile food and energy prices, lack of access to technologies, inputs, markets and credit to name a few. All these factors have contributed to the low agricultural productivity that is witnessed in most communities in East Africa. Although the population in these countries increases every year (Fig. 2), agriculture's contribution to these countries' Gross domestic product (GDP) has not followed a similar trend (Fig. 3) despite over 70% of each of the countries' population deriving their livelihood from agriculture (Toenniessen et al., 2008). Increase in food production in sub-Saharan Africa in the past has been through increasing the area cultivated and using more labor (DFID, 2004; Toenniessen et al., 2008). Due to current

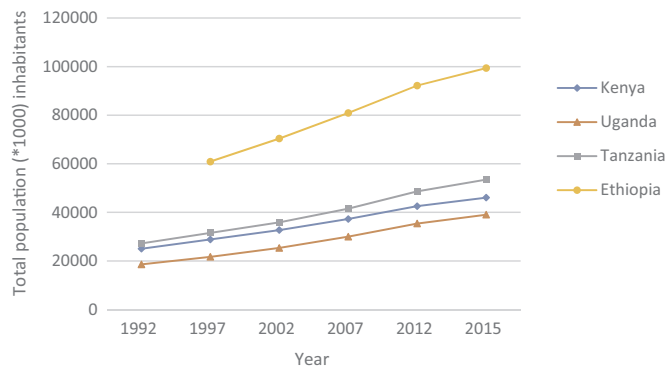


Fig. 2. Population growth of the East African countries. FAO AQUASTAT database

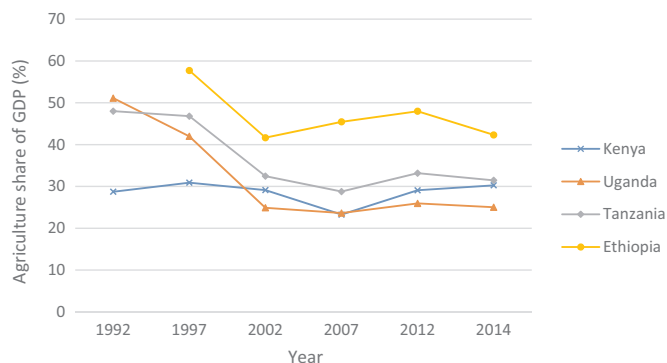


Fig. 3. Agriculture, value added to GDP. FAO AQUASTAT database

dense population patterns, cultivatable land is now scarce, and agricultural production thus needs to be intensified in order to increase yields that will ensure economic growth, food security and poverty reduction in especially the rural communities. Schultz et al. (2005) notes that 90% of the required increase in food production has to be achieved from already existing cultivated land and the other 10% will be from newly reclaimed land. Sustainable intensification is thus needed for both rainfed and irrigated agriculture, however, irrigated agriculture has shown to have a higher potential for intensification (FAO, 1997).

With the ever increasing population, dwindling land holdings, and rainfall being erratic in many areas, irrigation is an important tool to curb food shortages that are a recurrent problem in several communities of East Africa. Irrigation also plays a major role in moving farmers from subsistence to commercial farming. In areas where water sources are dependable both in quantity and quality, supplemental irrigation can be used to grow crops during the rainy seasons when rainfall is not sufficient, and in the dry seasons, high value cash crops that require reliable and timely water applications, can be grown. Irrigation thus allows for more than one crop season in a year making irrigated agriculture a significant contributor to food security (Burney et al., 2013). Having a more reliable and all year round supply of water and other production inputs also makes it possible to manipulate production times so as to coincide with higher seasonal prices of particular agricultural products. Furthermore, the positive impact of irrigation on livelihoods in Africa has been shown in several studies (Ngigi et al., 2000; Mati, 2008; Bacha et al., 2011; Hagos et al., 2012; Namara et al., 2013; Shah et al., 2013; Amede, 2015). Field survey of 1554 smallholder farmers in nine SSA countries, showed that irrigation added value per acre as well as per family worker (Shah et al., 2013). A study carried out in Ambo District in Ethiopia showed that poverty rates were significantly lower in households that were practicing irrigation

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