



EXECUTIVE SUMMARY

The Growth of Small-Scale Irrigation in Kenya

The Role of Private Firms in Technology Diffusion

Executive Summary

Agriculture is a key factor in reducing poverty, improving food security and driving economic growth in Sub-Saharan Africa (SSA). By 2030, the agricultural market in SSA could triple to USD 1 trillion, from USD 313 billion in 2010. To realize this potential, however, the current low levels of agricultural productivity must increase significantly, and here irrigation can play a central role, with spill-over effects on food security, income and employment. For smallholders especially, irrigation could become a transformational technology, as it may stabilize, increase and commercialize farm production, potentially benefiting up to 369 million farm households in the SSA region.

Yet despite the large technical and economic potentials of irrigation, countries in SSA have failed to reap its benefits. Many irrigation projects have underperformed, and adoption rates of irrigation technologies are low despite continued donor support.

To address this challenge, this report focuses on the role of market factors in smallholder irrigation development, specifically regarding the market for irrigation technologies. A key actor in this market is technology suppliers, i.e. firms that manufacture and/or

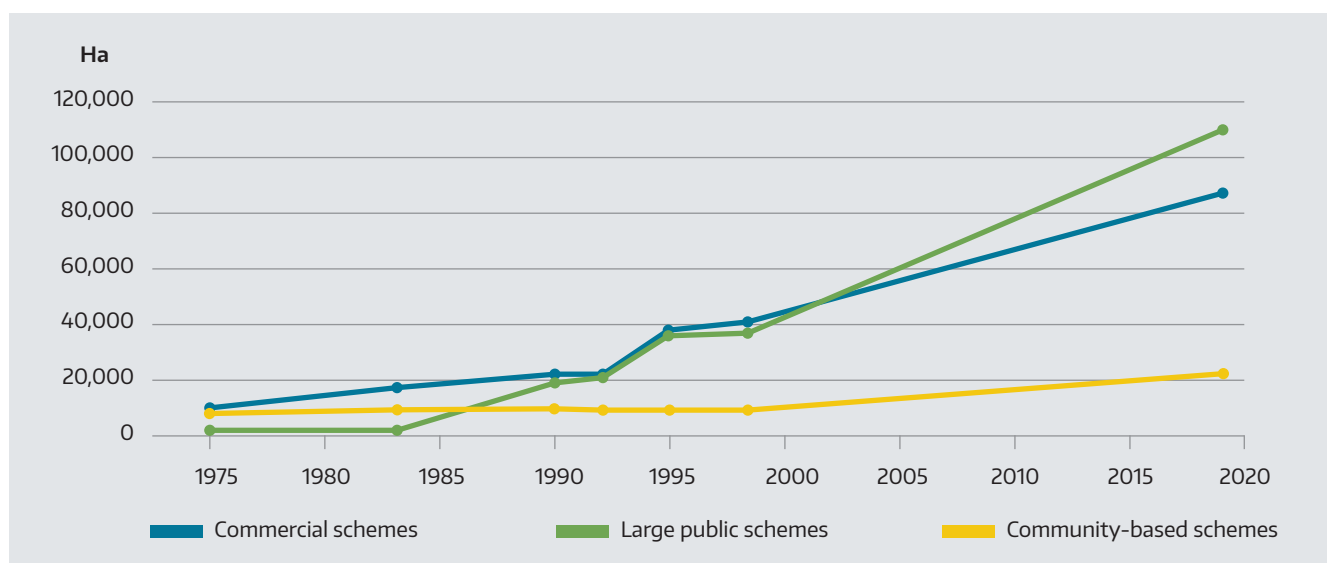
trade in irrigation equipment, often alongside auxiliary services, as their only business activity or as an important part of their business.¹ Technology suppliers form a direct link between smallholders and the irrigation equipment they need, and they can therefore be expected to play an important role in the diffusion and adoption of irrigation technologies. Yet despite the central position of these firms in the agricultural innovation system, we have little knowledge about their role in developing irrigation in the Global South.

Irrigation rates have been growing, but still do not match needs

More than 95 % of Kenya's agricultural output is grown in rain-fed farming systems, yet only 17% of the country's arable land is deemed suitable for rain-fed agriculture. Although the remaining 83% needs irrigation to ensure optimal crop growth due to inadequate rainfall, irrigated fields occupy only around 2% of Kenya's total area under crops.

¹ This definition excludes engineering firms and consultants that do not produce or sell irrigation equipment.

FIGURE 1. Trends in the area under irrigation in Kenya 1975-2019.



Source: Authors' computation based on data compiled from different sources (Heyer 1976; IDB 1990; Ragwa et al. 1998; Ogombe 2000, Ngigi 2002; MoW 2019).

Irrigation schemes covered 222,240 ha in 2018. There has been large-scale growth in Kenya's irrigated areas since the late 1990s (Table 1). The greatest change has occurred in private schemes (mainly large commercial farms) and community-based smallholder schemes, which each covered around 40,000 ha in the late 1990s and grew to 88,000 ha and 110,000 ha respectively in 2018. The area under large-scale public schemes has seen less growth, from around 9,000 ha in the late 1990s to 24,240 ha in 2018. Stakeholders also observe an increase in individually managed irrigation, but there are no data showing trends in this category.

The rate of irrigation varies with crop type. In 2013, 70% percent of rice production was irrigated (18,000 hectares), but only 20% of vegetable production (31,000 hectares). Other key crops such as coffee, fruit, sugarcane and cotton have even lower irrigation rates.

Increasing demand for small-scale irrigation technologies

The demand for small-scale irrigation technologies has been growing in recent years alongside the increase in irrigated area, especially for drip kits, greenhouse systems and solar PV pumps. Yet the market penetration of many technologies is still low in both the large- and small-scale market segments.

The increase in the demand for small-scale irrigation technologies has mainly been driven by donor- or government-supported schemes targeting smallholders. That said, an increase in the demand for small-scale technologies has also been observed from a growing non-agricultural middle class investing in irrigation for urban farming, backyard gardening, or rural farming. In contrast, private small-scale irrigation schemes, such as those organized as part of contract farming schemes, seem to be a minor source of business for technology suppliers.

Barriers to the diffusion and adoption of irrigation technologies

Several factors have influenced the development of the small-scale irrigation market in recent decades, so it is important to consider them in future efforts to develop the irrigation market in Kenya.

- Availability of technical knowledge. The diffusion of irrigation technologies depends on the existence of relatively high levels of knowledge and practical skills throughout the supply chain, including among system designers, technology suppliers, extension services, craftsmen and farmers. Limited expertise among farmers and inadequate public extension services are the key constraints to small-scale irrigation development.
- Economic and financial barriers. Irrigation equipment and support services are costly for smallholders. A major constraint on the expansion of the small-scale irrigation market is the gap between smallholders' capital needs and the availability of loan products.
- Supporting institutions. The successful diffusion of irrigation technologies depends greatly on the presence of supporting institutions and organizations, such as the National Irrigation Authority (NIA), the Ministry of Water, Sanitation and Irrigation, the Ministry of Agriculture, Livestock and Forestry (MALF), the Kenya Agricultural and Livestock Research Organization (KALRO) and specialized consulting firms. Irrigation is a complex system, so these actors should have expert knowledge of how different irrigation technologies function in a given environment regarding not only the biophysical aspects, but also the socio-economic conditions that may affect take-up.
- Factors related to the broader agricultural system. The demand among farmers for irrigation technologies depends on broader agricultural developments and functionalities across the agricultural

value chain. Systemic factors that tend to reduce the profitability, or increase the risk, of investing in new irrigation technology include limited access to water resources, a lack of agricultural inputs, and low and fluctuating prices for agricultural products.

Irrigation development involves multiple stakeholders

A variety of stakeholders or actors are contributing to the functioning and development of the Kenyan irrigation sector. Their roles are outlined in Table 1.

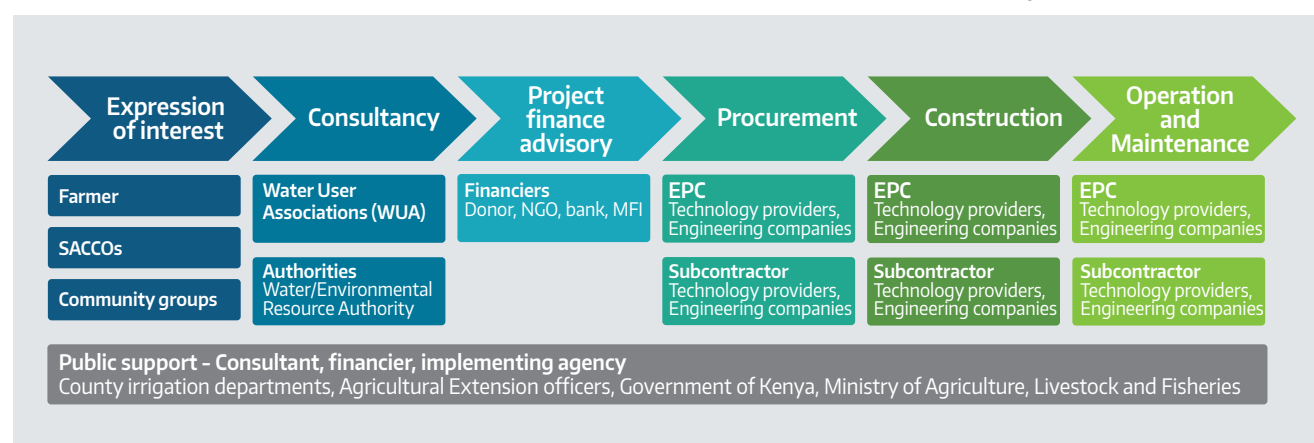
TABLE 1. Typology of stakeholders in the Kenyan irrigation sector

No.	Category	Description
1.	End-users	Individual small-scale farmers or farming communities (associations, cooperatives) that acquire and use irrigation technologies.
2.	Technology suppliers	Retailers, wholesalers, manufacturers, consultants and other firms that design, produce, sell, install and maintain irrigation equipment and irrigation systems to and for small-scale farmers (and other farmers).
3.	Financiers	Organizations providing finance to end-users to purchase and maintain irrigation equipment, i.e. commercial banks, donors, NGOs (using donor funds), or micro-finance institutions (MFI).
4.	Public-sector, donor and civil-society organizations	Public-sector and civil-society entities involved with the irrigation sector, policy-makers, regulatory authorities (irrigation authority), implementing agencies, and entities such as donors and NGOs providing capacity-building and other forms of support to farmers. This category also includes water-user associations (WUA) that influence farmers' access to irrigation water.
5.	Research institutions	Organizations and individuals focusing on irrigation research or having significant expertise in the sector.

Different actors have different roles in the development and implementation of a typical irrigation scheme (Figure 2). Public-sector organizations, and sometimes NGOs, play important roles as implementing agencies, permitting authorities, or technical advisors, or as providers or facilitators of finance to farmers. Engineering, procurement and construction (EPC) companies, as well as subcontracted engineering companies and technol-

ogy retailers, are important in the procurement phase and remain key actors in the subsequent phases. While engineering companies establish the basic irrigation infrastructure at the scheme, technology suppliers deliver the irrigation equipment used by the farmers, such as drip kits, water tanks, or sprinklers. Technology suppliers sometimes assume the role of an EPC.

FIGURE 2. The role of actors at different stages of irrigation scheme development and implementation.



Source: the authors.

Irrigation technology suppliers play a central role in technology diffusion

The demand for equipment and consultancies from government- and donor-supported irrigation projects or schemes has greatly stimulated the entry of more technology suppliers into the market, sales to such schemes currently being an important share of the total sales of many such technology suppliers. Hence, since 2000, twelve new technology suppliers have entered Kenya's irrigation sector.

This development has not only increased market competition but also changed the size structure of the sector in the direction of a greater proportion of small companies. The growth in technology suppliers has occurred alongside an increase in the volume and variety of irri-

gation equipment in the market. Moreover, hardware shops increasingly sell irrigation equipment, making it more readily and locally available for farmers.

This study identified nineteen irrigation technology suppliers operating in Kenya today. These comprise large and SME irrigation equipment retailers or wholesalers, and equipment manufacturers. Most manufacturers also retail their own products, while many trading companies perform both retail and wholesale functions.

Many technology suppliers offer a range of support services in relation to their products and have a significant technical expertise (Table 2). This allows them to engage in project design and implementation, thereby selling both products and services, both within and outside Kenya.

TABLE 2. Support services undertaken by irrigation technology suppliers in Kenya

Service category	Support services	Description
Financial	Provision of financial services	Access to credit through loan products tailored with and offered through financial institutions, payback arrangements (subject to risk assessment) and pay-as-you-go finance models (offered only through SunCulture and FuturePump).
Technical	Training and demonstrations in irrigation systems	Training in irrigation practices, including operation and maintenance of equipment. Permanent demonstration site showcasing equipment to farmers, as well as participation in agro-fairs to undertake demonstrations.
	Design and installation of irrigation equipment	Customizing irrigation solutions to fit the needs of clients, as well as the installation of irrigation equipment.
	Provision of irrigation operation and maintenance service	After-sale maintenance of irrigation systems in case of operational difficulties or malfunctioning equipment.
Output and input marketing	Provide market information and assist in marketing	Guiding farmers to identify and select the available market options, including linking farmers to buyers (wholesalers and exporters).
	Provision of agri-inputs and training in crop management	Providing farmers with agricultural inputs (e.g. fertilizer and seeds) and training in optimal application with irrigation system (including fertigation and crop management).
Management	Management of farm production and economy	Help farmers develop production and business plans, e.g. training and business advisory services.

Source: authors' interviews with irrigation technology suppliers in Kenya.

A variety of business models can help promote small-scale irrigation

The study applied a business model perspective to identify opportunities for technology suppliers to market small-scale irrigation technologies. A business model outlines how a company must operate to generate a positive return on its investments or meet other objectives. The technology suppliers' business strategies included several features and differentiation strategies. First, different modes of product distribution were used, often

associated with the company's size and technical capacity. Second, technology suppliers had created partnerships with public organizations and financial institutions, which were used to reach a greater share of the small-sale market segment. Third, many firms specialized in specific types of irrigation equipment, such as drip kits or greenhouses.

The business models outlined in Table 3 represent the different ways in which technology suppliers in Kenya may develop and grow their businesses.

TABLE 3. Business models for small-scale irrigation technologies.

Business model	Direct sales without finance	Technology bundled with finance	Irrigation schemes
#	1	2	3
Value proposition	Cost efficient. Low risk.	Larger customer base than without finance.	Economies of scale.
Possible disadvantages	Limited customer base. Slim profit margins.	Risk of default, farmers walking away from loan. Slim profit margins.	Risk of delayed payments. Susceptible to macroeconomic situation, e.g. hold in government spending or donor priorities.
Customers	Individual farmers.	Individual farmers.	Development organizations, government agencies, SACCO agencies, Agro-food exporters.
Farmer segment targeted	Commercial.	Commercial, emerging commercial.	Subsistence, partly subsistence
Type of financing for farmer	None.	Loans from commercial banks, MFI or SACCO.	Donor grant or loan. In outgrower model, a loan.

Source: the authors.

TAKEAWAYS AND RECOMMENDATIONS REGARDING SMALL-SCALE IRRIGATION IN KENYA:

- 1.** The growth in the small-scale irrigation market since 2000 has been driven mainly by the demand for equipment and consultancies from donor- or government-supported schemes, and by demand from a growing middle class wanting to invest in irrigation for urban farming, back-yard gardening, or rural farming.
- 2.** Irrigation companies undertake a range of activities in addition to technology provision, including training, financial packaging and knowledge dissemination, and thus play an important role in irrigation technology diffusion and adoption.
- 3.** There is a need to develop and support innovative financial solutions that enable more small-scale farmers to access irrigation technologies.
- 4.** There is a need for improved import regulations so that tax exemptions also include individual parts and new imports are easier to register for exemptions.
- 5.** There is a need to improve farmers' access to irrigation technologies through the presence of more retailers or other forms of outlet locally, which would also enhance farmers' awareness of the technologies.
- 6.** The opportunity for increasing smallholders' access to irrigation through contract-farming schemes and similar arrangements should be investigated further.