AGWATER SOLUTIONS

Improved livelihoods for smallholder farmers

# Supporting smallholder private pump irrigation in sub-Saharan Africa

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## The opportunity

Smallholder private irrigation in sub-Saharan Africa (SSA) provides millions of poor farmers with additional income when they need it most. Those with access to irrigation have substantially higher incomes and better food security than those who solely depend on rainfed production. In particular, vegetable cultivation during the dry season sold on the local market is very profitable. Consequently, smallholders increasingly engage in dry season, high value crop production using motorized pumps to draw water from a variety of sources (rivers, reservoirs, lakes, ponds, canals and groundwater).

While smallholder private irrigation has existed for decades, particularly in South Asia, it received enormous impetus from the availability of small, cheap motorized pumps manufactured in China and, increasingly, in India. As a result, the sector is growing, financed primarily by smallholder farmers with little or no outside support. We estimate that the **sector employs more than a million smallholders in SSA**[1]. In Ghana alone, our surveys suggest that about half a million smallholder farmers are engaged in irrigated vegetable cultivation, which is 50 times more than farmers in public irrigation schemes. **And the scope for further growth and poverty reduction potential is substantial.**

## Why support is needed

While small private irrigation is spreading spontaneously, is relatively low-cost and has positive impacts on smallholders' incomes, its unchecked and dispersed proliferation can result in equity, environmental and efficiency challenges. Generally wealthier farmers have better access to information and technology than their poorer counterparts who face several hurdles including absence of, or lack of, access to proper financing tools, lack of information to move into new crops/cropping systems (e.g., shifting to high value, dry season crops), and limited access to necessary information to make the right investment and marketing choices. Our research shows that this is particularly true for women farmers.

Further, unchecked proliferation of pumps can lead to a decline in water quantity, unauthorized use of protected lands, loss of soil fertility, and pollution due to over, or inappropriate, application of agro-chemicals. In some cases conflicts between different water users occur due to competition between public and private schemes and/or upstream and downstream users. These risks are aggravated by the individualistic nature of smallholder private irrigation, which makes it more difficult to control and regulate.

Lastly, there is room for improvement along the value chain. The equipment supply chain is poorly developed, the quality of available pumps questionable and choice in specifications very limited. Moreover, output markets are often dominated by middlemen and are prone to cartel forming due to a lack of supporting institutional frameworks.

**With appropriate support, smallholder private irrigation using motorized pumps can fully realize its poverty reduction potential while avoiding adverse social and environmental impacts.**

[1] No official statistics are available. This is our estimation based on field surveys and key informant interviews.

## Benefits

Supporting smallholder private pump irrigation means leveraging farmers' initiatives and their own investments, so that it becomes accessible to a broader range of smallholders, in particular women, while minimizing resource conflicts and environmental concerns. Millions of smallholder families throughout SSA stand to benefit.

More specifically:

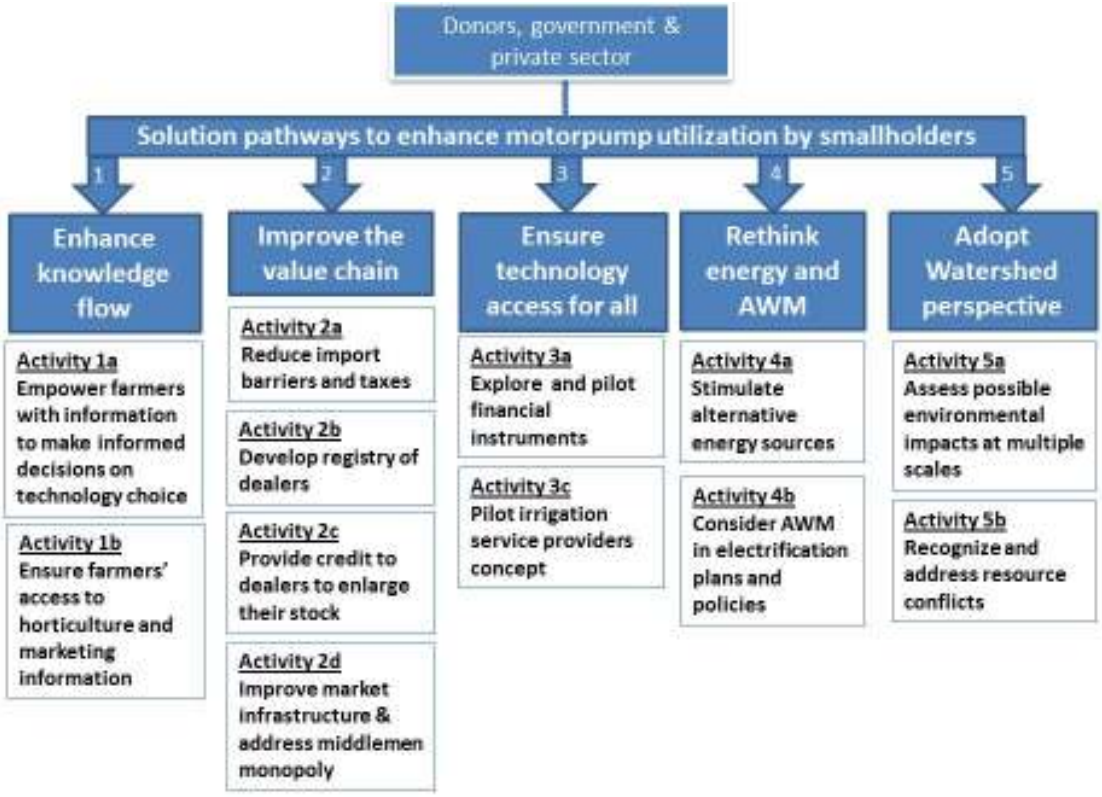
- Substantial increases in farm incomes will lead to poverty reduction for millions of smallholders in SSA
- Achieving the potential market of a few million motorized pumps in SSA will benefit those involved in the equipment supply chain: manufacturers, retailers and local dealers
- Technological innovation in motorized pumping—particularly in the area of alternative energy pumping—will benefit other smallholders in the future.

## Proposed solution pathways

To address the opportunity while addressing efficiency constraints and minimizing adverse social and environmental impacts, the project is exploring the following strategies:

1) Enhance knowledge flows
2) Improve the value chain
3) Ensure technology access for all
4) Rethink energy policies
5) Adopt a watershed approach

**Diagram 1: Supporting smallholder private pump irrigation in SSA: five possible solution pathways**




**1) Enhanced knowledge flow**

Awareness among smallholders about the use of motor pumps for private irrigation is high. But sources of technical information in rural areas are limited. NGO and government programs often promote a single technology. Dealers often carry limited stock and do not have the technical knowledge to advise farmers on the right choice. Extension workers only reach a small portion of the farmers and seldom have a background on irrigation and irrigation equipment. As a result, farmers are hesitant to take the investment risk for fear of failure. In other cases they take the equipment available in the nearest store and pay a price that exceeds the quality they get; they purchase pumps that are ill-suited to the size of their land and end up with high operation and maintenance costs.

***Case study example, Ethiopia:*** *Smallholder private irrigation is emerging throughout Ethiopia. The five year Growth and Transformation Plan highlights the use of Ethiopia's abundant surface and groundwater resources by individual smallholder farmers, but little is known about the factors behind households' adoption of water technologies such as small pumps. Based on data collected from 800 farm households in four regions, the main obstacles to adoption facing farmers are high upfront investment costs (and lack of access to finance),* ***absence of spare parts and maintenance services and lack of access to technical and market information*** *leading to high transaction costs. Improved access to information and affordable credit will boost small pump adoption and hence farmers' incomes.*

Action points:

- Train local dealers and farmers on technical aspects, brands and price ranges of pumps.
- Train dealers in better marketing and after-sales service provision. Support dealers in setting up demonstration plots where farmers can try out a variety of technologies before buying.
- Build on the existing NGO network and marketing skills to market a broader range of technologies.
- Develop illustrated, local language manuals on pump characteristics, irrigation use, maintenance, and repair.
- Support governments and national institutions in collecting and improving datasets and their dissemination.

**2) Improve the input value chain**

Import duties and taxes (both formal and informal) can substantially add to local pump prices, sometimes up to 40%. Where pumps are exempt from duties or taxes, exemption procedures are sometimes unknown, long and/or cumbersome. Spare parts are often not included in exemptions. In many countries pump markets are poorly developed and immature and many low quality pumps enter the market. There is no quality control, and price-quality configurations differ by an order of magnitude without obvious reasons other than the lack of competition between dealers.

***Case study example, Zambia:*** *One of the major obstacles to smallholder private irrigation is the high cost of equipment. Most irrigation equipment is imported because local manufacturing capacity is limited. Duties, taxes and high transport costs add to the price of small pumps putting them out of reach of small farmers.* ***High transaction costs*** *prevent new importers from entering the market. In 2009 the Zambian government exempted agricultural equipment from VAT and import duty. However, importers and dealers lack information on exemption procedures and pump prices vary by an order of magnitude depending on location and dealer.*

Action points:

- Review import duties and exempt small pumps from sales taxes. Simplify exemption procedures.
- Develop pump registries: a registry of pump dealers can help farmers locate nearest shops, get an idea of prices and available options in the market. It can be a tool to disseminate relevant information on innovations, new developments and technical events. A pump registry can also serve as a mechanism to establish warranty systems and after sales services.
- Provide credit to dealers, sometimes available from wholesalers and manufacturers as an incentive for dealers to keep larger and more varied stock.

**3) Ensure access to pump technology for all**

Awareness of and interest in motor pumps is high. However, for many smallholders the purchase price and running costs remain the biggest obstacles. Micro-credit facilities and financing options are absent or non-accessible. Nearly all pumps are financed from personal savings. Hence, only better-off farmers can afford to buy pumps, and female ownership of motor pumps is very low due to lack of access to appropriate credit facilities.

***Case study example, Tanzania:*** *Small private irrigation in Tanzania, primarily for horticulture and flowers, is growing. It provides a vital additional income to smallholders in the dry-season. Based on surveys among 335 farmers we estimate that watering by hand is the most common (88%) irrigation technology, followed by motor pumps (10%) and treadle pumps (2%). All smallholder farmers indicated their preference for motorized pumping but were* ***held back by the high upfront costs and lack of finance*** *at the beginning of the season. This constraint was particularly felt by women.*

Action points:

- Explore and pilot financial instruments specifically designed for the purchase of pumping equipment and other necessary inputs.
- Pilot an "irrigation service providers" concept where entrepreneurs (either pump owners or people without their own farmland) go from farm to farm with small motor pumps to provide the service of irrigating smallholders' lands for a fixed fee per hour, day or season.
- Explore and pilot different rental arrangements, based on existing pump sharing systems (e.g., around small reservoirs in Burkina Faso).

**4) Rethinking water and energy linkages**

Energy costs are already high and rising oil prices reduce the economic viability of motor pumps for smallholders. Small motor pumps tend to be energy inefficient.

Greenhouse gas emissions from motorized pumping in SSA are negligible now (see below), but this could change depending on the number of motor pumps, the type of energy used to run the pumps, as well as through increased use of fertilizers and market transport.

***Case study example: Environmental impacts of motor pump adoption in SSA:*** *A study on the potential impacts of motor pump adoption in Burkina Faso, Ethiopia, Ghana, Tanzania and Zambia suggests that in contrast to India the emissions from irrigation pumps are not likely to become a significant proportion of carbon dioxide emissions in each of the five countries. The emissions from pumps in 2010 were significantly less than 1% of each country's current agricultural sector emissions. Even with the development of a hypothetical scenario in which every smallholder uses a pump, the resulting carbon dioxide emissions are still less than 1% of current agricultural sector emissions. Although the impact on carbon dioxide emissions is small, cross checking the water abstraction rates for these pump numbers suggests that the limited amount of water resources (using the renewable national water resources as an indicator) is more likely to become a problem, especially at the local level. Suggestions to improve these estimates are to ensure better monitoring of pump adoption rates, and consideration of ways to improve pump efficiency and affordable alternative energy solutions (e.g., solar, wind). This would benefit both the farmer and the environment. A shift to other energy sources, such as electricity derived by coal or hydropower, could change (up or down) the estimated carbon dioxide emissions.*

Action points:

- Stimulate development and use of alternative energy sources: pilot and evaluate affordable solar voltaic and solar thermal systems in farmers' fields. Evaluate cost aspects and test financing options.
- Develop energy efficient pumps suitable for small landholdings.
- Stimulate innovation by competitions among local inventors, or local universities.
- Assess broader rural development benefits when considering electrification of pumps in electrification plans.

**5) Adopt a watershed approach**

Taking water from its natural course for irrigation nearly always has impacts on downstream users and the environment. But many small dispersed points of water extraction are more difficult to control and regulate than a few large users. The risks of conflicts over resources and environmental problems are aggravated by the individualistic nature in which smallholder private irrigation spreads. Regulation is often absent or difficult to enforce.

***Case study example: Balancing development and environmental impacts***

*In a study of four watersheds, improved access to pumps was associated with positive livelihood impacts (equity, gender and poverty reduction). However, these issues need to be balanced with environmental concerns related to water quality, quantity and the natural resource base. In all cases, understanding and strengthening existing formal and informal institutional networks to manage the positive and negative externalities could present real opportunities to safeguard resources and ensure local mechanisms to balance benefits and manage trade-offs.*

***Mkindo Watershed, Tanzania:*** *The watershed is already affected by poor water quality from agricultural intensification with local, periodic water scarcity which reduces people's livelihood and income opportunities. Thus, more pumps and extractions must be balanced with institutional space to negotiate trade-offs.*

***Mwembeshi Watershed, Zambia:*** *Abundant land and water in relation to population, with only a fraction of agricultural land currently used for crops. Downstream watershed streams feed into Kafue wetlands with unique ecosystem values, but some areas of the watershed are already affected by poor water quality. Commercial farmers withdraw substantial amounts of deep groundwater with little/no control, and the 'tenure' of water resource access is embedded in complex institutional arrangements.*

***Nariarle Watershed, Burkina Faso:*** *73% of the watershed is already farmed, but only 0.4% is irrigated. Annual rainfall is 700 mm, where 83% is used as evapotranspiration from crops, vegetation and small reservoirs. Water is limited, and access to irrigation is universal. Water quality is a concern in parts of the watershed, especially around reservoirs. Smaller commercial/agro-business farmers withdraw substantial amounts of reservoir water with little or no control. To ensure the sustainability and cost-effectiveness of agricultural water management interventions, adequate institutional arrangements should complement them.*

Action points:

- Consider multiple- versus single-AWM interventions (e.g., combining water management measures with changes in cropping patterns, fertilizer use and/or marketing and infrastructural support).
- Examine the existing formal and informal institutional networks active in the watershed and opportunities to bridge institutional gaps.
- Assess water resources availability, address possible environmental impacts and its consequences on incomes and livelihoods of agricultural and non-agricultural communities.
- Recognize and support social structures that can address potential emerging resource conflicts.

Within this solution pathway, an important opportunity for investors lies in supporting functioning stakeholder management forums that are established and managed in coordination with relevant national policies and private enterprise developments. The project has identified a local demand for such forums, with many informal structures upon which to build, and existing national policies to support the process. The challenge is to appropriately synergize the demand with the existing formal and inform al institutions.