AGWATER SOLUTIONS
Improved livelihoods for smallholder farmers

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This briefing note summarizes the preliminary pilot study findings for discussion and comment

MANUAL WELL DRILLING IN ETHIOPIA

Based on a report by Elizabeth Weight, Robert Yoder and Andrew Keller[1]

Establishing private manual well drilling enterprises to provide low-cost access to groundwater would greatly expand irrigated farm production area and offers the potential to improve the livelihoods of millions of small farmers in Ethiopia.

The Opportunity

Just over half of Ethiopia's 64 million rural population live in poverty. Less than 10 percent of the 3.7 to 4.3 million hectares of irrigable land is currently irrigated. Establishing a private sector industry for manual well drilling to access groundwater for irrigation would have the following benefits:

- **For low-income, smallholder farmers:** Improve their access to groundwater for irrigation, expand crop options to higher value crops, lengthen the crop growing season, and increase incomes.
- **For well drilling enterprises:** Provide a healthy return on investment and create employment for driller helpers.
- **For supply chain actors:** Increase profits along the supply chain.
- **For the financial services sector:** Stimulate demand for financial products and services throughout the value chain.

In the complex geological landscape of Ethiopia, manual drilling is feasible only in specific hydro-geologic conditions. In carefully selected test areas, International Development Enterprises' (IDE) pilot drilling program had an 80% success rate. There are, however, insufficiently detailed and accurate data, information, and maps regarding soil, hydrogeology, and water resources to determine suitable locations on a wide geographic scale.

Well drilling is done by teams using manual labor and simple technologies.

Therefore, investments in field-level data collection and mapping are necessary to determine areas suitable for manual drilling and then to estimate the number of smallholder farmers who could potentially benefit from manually drilled wells.

Developing an industry of private sector manual well drillers requires simultaneous investments in driller training and certification; creating supply chains for manual drilling supplies; generating awareness among farmers, the private sector and the government that low-cost drilling is possible; creating 'demand from farmers; supporting improved and sustainable smallholder agronomic production; and linking farmers to processing, storage and/or market opportunities for irrigated farm production.

Affordable Manual Well Drilling

Manual well drilling is typically done by teams using manual labor and simple technologies to access shallow groundwater. In many countries in Asia it is a well established business. Once a well is drilled, farmers have a range of pump options available for lifting water (e.g. treadle pumps, rope and washer pumps, motorized pumps); a range of water storage technologies; and a variety of application methods (e.g. drip or sprinkler) to apply water to crops.

In Africa, private sector manual drilling is prevalent in Sudan, Chad, Nigeria and Niger. In Nigeria, more than 100,000 wells have been manually drilled; and in Niger, 42 private sector drilling teams operate and have drilled more than 18,000 wells[2].

The Pilot

In 2009, IDE initiated a manual well drilling pilot program in three locations in Ethiopia to determine the technical and financial feasibility of establishing a private sector industry niche for manual well drillers. The goal is to catalyze widespread private-sector, low-cost manual drilling by creating an industry of private well drillers skilled in a variety of drilling techniques suitable for Ethiopia's challenging geologic conditions; mapping areas with potential for manual drilling; raising awareness among farmers and building their capacity for irrigating higher value crops; and establishing market chains that link equipment suppliers, drillers, farmers and consumers.

[1] *Manual Well Drilling Investment Opportunity in Ethiopia, 26 April 2011.*

[2] *"Best Practices in the Development of Small Scale Private Irrigation West Africa". Onimus, Francois; Abric, Moise Sonou; Benedicte, Augeard, 2010.*

Main Findings

The pilot drilling program in Lake Ziway, Betcho, and Lake Tana areas demonstrated a high potential demand among farmers for greater access to groundwater. During the pilot, for every well drilled, an additional three farmers expressed interest in a well. For smallholder farmers, the key constraints are difficulty obtaining investment capital and the lack of skilled drillers.

The geology in Ethiopia makes drilling far more challenging than in many countries in Asia and a few African countries where manual well drilling is practised. However, there are numerous areas in Ethiopia with shallow water and permeable soil layers with high potential for manual drilling. To achieve an acceptable drilling success rate accurate groundwater maps and a database of geological conditions are the essential first step to establishing a manual well drilling industry sector.

A separate analysis by IWMI researchers showed that while there are alternatives (hand digging, machine drilling), manual well drilling is the most economic option. Women farmers with wells spend significantly less time walking long distances for water.

Solutions

One of the principal results of this study is a detailed model outlining how catalytic investments in water resource mapping, driller training, warehousing inputs, awareness and value chain linking would stimulate the market for input suppliers, well drilling enterprises, small farmers and markets (see Figure 1). Catalytic investments refer to initial financing by donor and/or governments to spur private sector industry. Initial feasibility assessment is estimated to cost approximately US$5 million. Once mobilized, it is expected that a private industry will operate and expand through commercial returns without further external investments.

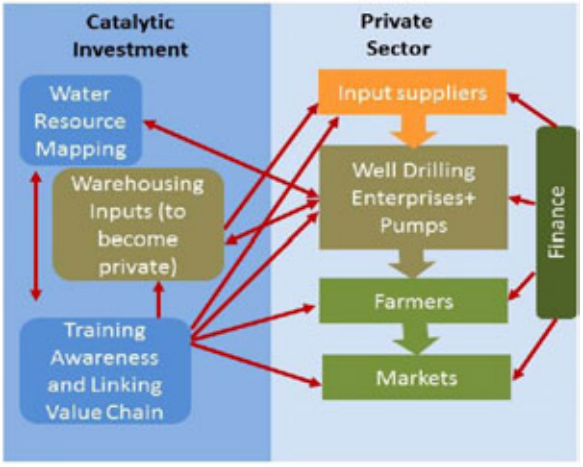

Figure 1. Private Sector Well Drilling Model

[3] *Calculated at an average of two apprentices at 60 and 80 birr per day for 200 days*

This investment model recommends simultaneous investments over a period of 3-5 years in driller training and certification, creating supply chains for drilling equipment and supplies, increasing demand among farmers, building farmers' capacity for irrigated agriculture, and linking farmers to processing, storage and market opportunities for higher value farm produce.

Specific steps towards establishing a manual well drilling industry will include the following:

- Produce maps showing where manual drilling is suitable and the potential number of farmers who could benefit;
- Set up a program to train and certify manual well drillers emphasizing establishment of driller enterprises;
- Raise awareness among smallholder farmers to create more demand for wells;
- Facilitate farmers' access to water lifting technologies;
- Train smallholder farmers in high-value irrigated crop production and marketing;
- Support private sector supply chains for spare parts, drilling equipment and pumps;
- Develop financial products and services to support the value chain;
- Monitor environmental risks associated with drilling and set up a national database on water resource availability, quality and well drilling conditions.

Potential Impact

A certified training program for well drillers graduating up to 200 drillers per year could result in nearly 400,000 wells over ten years. Initial investment required by farmers and well drillers are shown in Table 1.

Table 1. Summary Well Drilling Estimated Investment and Income Summary in US$

	Investment Cost	Additional Annual Income	Profit in Year 1
Farmer	$156	$490	$334
Well Driller	$1,247	$2,740	$1,493
Well Driller Helper[3]	$0	$667	$667

The estimated net annual additional income to farmers using a drilled well and treadle pump to irrigate a 700 m^2 plot is USD490 per year. In addition to his/her cash investment, farmers would need to participate in training or extension programs to build their capacity for irrigated crop production and marketing.

Certified drillers operating their own small business could expect to earn up to USD1500 per year. Suppliers of drilling equipment and materials benefit as the number of drillers multiplies and drillers scale up their operations.

These findings and recommendations are preliminary and are reproduced here for the purposes of discussion. The AgWater Solutions Project welcomes all comments and suggestions. These should be directed to AWMSolutions@cgiar.org, please write "Ethiopia" in the subject line.