International Water Management Institute

Water Policy Brief - 42

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Prices, loans or ambiguity? Factors influencing groundwater irrigation adoption in Ethiopia

Key messages

- Climate change projections call for significant expansion of irrigated areas to avoid production losses and increased hunger.
- Farmer-led private irrigation, especially the use of pumps to extract groundwater, offers demonstrated potential for increasing irrigation and reducing climate-related production risks. Despite this, progress in the adoption of these pumps across sub-Saharan Africa has generally been slow.
- The results of an IWMI study show that farmers' interest in pump ownership is high. However, according to over half of the respondents, the likelihood of them getting a loan to purchase a pump is low.
- If pump ownership is to increase, policy measures are needed to address access to loans and to reduce uncertainty around borehole drilling.

Agriculture in sub-Saharan Africa is dominated by rain-fed cultivation, with only 4-6% of the cultivated area under irrigation (Wiggins and Lankford 2019). This makes farming households particularly vulnerable to climate change. Some estimates suggest that without the expansion of irrigated areas, the number of people affected by hunger due to climate change will rise by 5% by 2030 and 12% by 2050 (Malabo Montpellier Panel 2018). Irrigation can reduce these risks by expanding cultivation during the dry season, enabling multi-cropping and reducing production losses caused by droughts (see, e.g., Burney and Naylor 2012; Buisson and Balasubramanya 2019).

In response to these challenges, countries in sub-Saharan Africa are promoting investments in smallholder, farmer-led private irrigation, especially the use of pumps to extract groundwater. Evidence suggests these pumps offer significant potential for increasing irrigation (Schmitter et al. 2018).

Farmers using solar power to pump water from a tank into irrigation tubes in Danghesta village, Amhara region, Ethiopia (*photo*: Mulugeta Ayene/WLE).

Supply and demand side factors

Yet, progress in the adoption of these pumps has generally been slow. In Ethiopia, the focus of this brief, imported pumps began appearing on the market in the 1990s. Thanks to government initiatives, manual treadle pumps and rope and washer pumps are now locally manufactured, a steady supply of diesel pumps is imported, and repair and maintenance services are generally available. In the past few years, the Ethiopian government has focused on solar pumps in an effort to expand smallholder irrigation (ibid.). However, only 6.7% of households currently irrigate, and less than 9% of irrigating households use groundwater (IWMI calculations from the 2015-2016 Living Standards Measurement Study – Integrated Surveys on Agriculture [World Bank 2021]).

On the demand side, two well-known constraints to expanding farmer-led irrigation in Ethiopia are high pump prices and the lack of loans for purchasing pumps. Diesel and solar pumps are expensive, in part because import tariffs account for approximately 30% of pump prices (ATA 2017). Prices for these pumps exceed the loan limits of most microcredit organizations. Consequently, farming households can mainly access informal credit sources that are risky or expensive. To date, the policy focus has been on offering public subsidies to reduce pump prices.

However, a demand-side constraint that has received less attention, but is potentially vital for expanding smallholder private irrigation, is the ambiguity (unquantifiable uncertainty) associated with drilling boreholes. Even in sites with high groundwater potential, 33% of the wells drilled required more than one attempt to reach the groundwater (Figure 1). Since the costs of drilling wells are high and the service is commonly provided by uncertified and untrained drillers (Figure 2), uncertainties around 'hitting water' are likely to discourage farmers from installing wells, limiting the demand for pumps regardless of their prices. Policies where, hypothetically, the state drills the boreholes and farmers only incur the drilling costs when boreholes are successfully installed may be equally or more important for increasing groundwater irrigation.

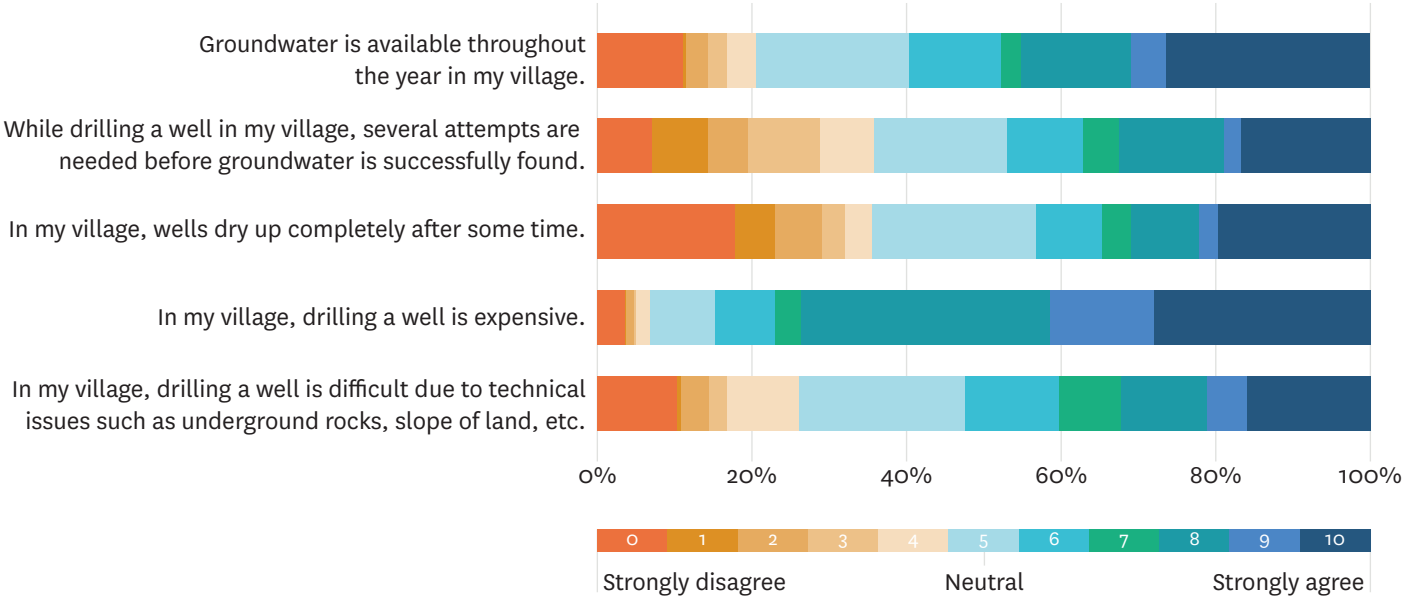

Figure 1. Perceptions of well drilling.
Source: IWMI survey among 400 households in sites with high potential for groundwater irrigation.

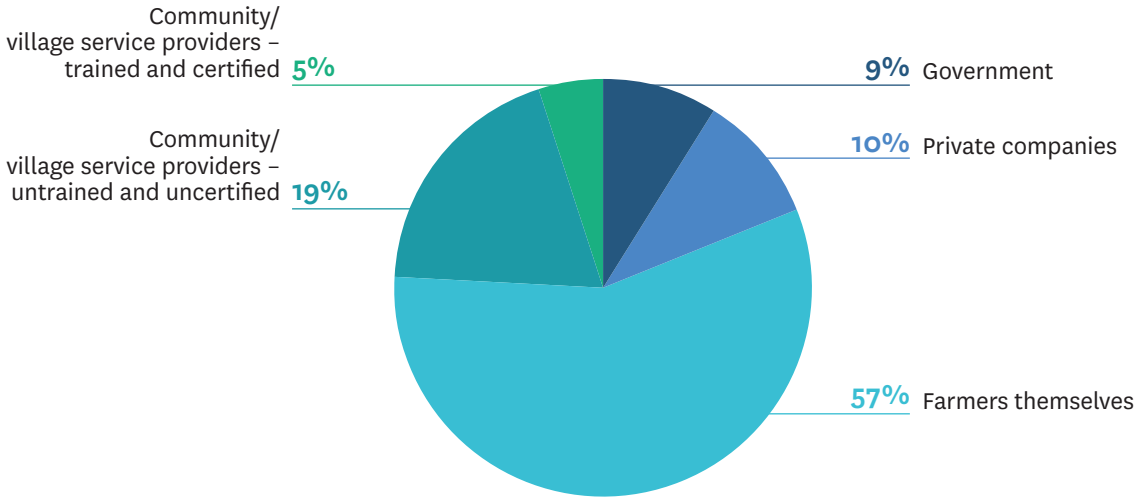

Figure 2. Well drilling service providers.
Source: IWMI survey based on 313 wells drilled in sites with high potential for groundwater irrigation.

IWMI conducted a study among 400 respondents from 16 villages in two districts: (i) Dera in Amhara region; and (ii) Lemo in Southern Nations, Nationalities, and People's Region (SNNPR). The selection of these sites was guided by the following three factors:

1. High potential for groundwater irrigation – so that investments in farmer-led irrigation are feasible for the households surveyed.
2. Access to shallow groundwater – pre-survey key informant interviews indicated that only suction and surface pumps are commonly available to farmers at reasonable prices. These types of pumps can only extract water from depths up to 7 meters. Therefore, the study was limited to areas where these types of pumps are useful.
3. Market access – this affects farmers' ability to market their surplus production and acquire modern inputs, such as irrigation equipment.

IWMI's study examined farmers' willingness to adopt groundwater irrigation packages in response to the following three factors:

1. Subsidies on pump prices through tax breaks.
2. Access to loans.
3. Reduction in the uncertainties related to well drilling, e.g., ambiguities associated with 'hitting water' in drilling boreholes.

The findings

Pump ownership is low, but interest is high

Although 26% of households surveyed reported irrigating at least one plot, which is higher than the national average, only 12% actually owned a diesel pump, 5% owned a solar pump and nobody owned a rope and washer pump. Interest in acquiring pumps for groundwater irrigation appeared to be high. Approximately 53%, 51%, and 16% of the respondents indicated that they were likely to buy a diesel pump, solar pump, and rope and washer pump, respectively, in the next five years. However, according to over half of the respondents, the likelihood of them getting a loan to purchase a pump is low.

Access to loans and uncertainty in drilling are most important

Providing access to loans increased the probability of a farmer choosing an irrigation package by 12 percentage points on average, while the government providing drilling services increased the probability by 9 percentage points (Figure 3).

Subsidies on pump prices are less important

Subsidies had the smallest effect on the probability of a farmer choosing an irrigation package. A price reduction of 30%, which is equivalent to the current import tariff for pumps, increased the probability of a farmer choosing an irrigation package by only 4 percentage points (Figure 3).

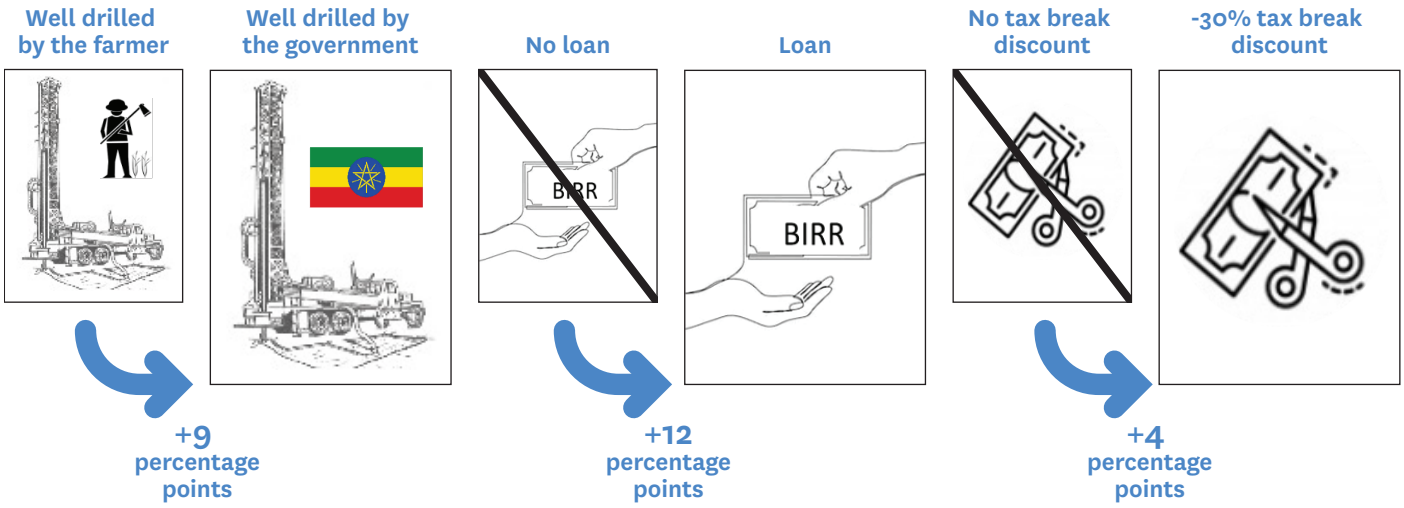

Figure 3. Probability of a farmer choosing an irrigation package based on specific factors.
Source: IWMI discrete choice experiment among 400 households in sites with high potential for groundwater irrigation.

Conclusion

The results of the research highlight that subsidizing pump prices may not be the best use of public funds to expand irrigation in Ethiopia. Instead, decreasing ambiguities around borehole drilling are likely to play a major role in increasing the adoption of pumps for small-scale farmer-led irrigation using groundwater. The government should help farmers to minimize the uncertainties and cost of unsuccessful drilling. This will require the government to study groundwater hydrogeology, use information on groundwater depth, seasonality and recharge to drill boreholes, and absorb the costs of unsuccessful drilling.

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Source

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Contacts

Soumya Balasubramanya, Research Group Leader – Economics and Impact Evaluation, IWMI, Colombo, Sri Lanka (s.balasubramanya@cgiar.org)
Marie-Charlotte Buisson, Senior Researcher – Development and Agricultural Economics, IWMI, Colombo, Sri Lanka (m.buisson@cgiar.org)
Thai Thi Minh, Senior Researcher – Innovation Scaling, IWMI, Accra, Ghana (t.minh@cgiar.org)

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International Water Management Institute (IWMI)

Headquarters
127 Sunil Mawatha, Pelawatte, Battaramulla, Sri Lanka

Mailing address:
P. O. Box 2075, Colombo, Sri Lanka
Tel: +94 11 2880000
Fax: +94 11 2786854
Email: iwmi@cgiar.org
www.iwmi.org