

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

**The use of motorized pumps has only recently been taken up by farmers in Tanzania where over 85% of irrigators still use just buckets and watering cans. Motor pumps are popular and would be adopted by many more farmers if they had access to technical information and affordable credit.**

### The Opportunity

There are many types of smallholder water lifting technologies (WLTs) used in Tanzania. These include manual irrigation methods such as buckets and watering cans, manual pumping methods (mainly treadle pumps), motorized pumps, wind and solar pumps, and hydram pumps<sup>1</sup>. The use of WLTs could improve farmers' control over their production systems by creating a reliable supply of irrigation water, especially where rainfall is erratic. However, their actual potential to improve water management, agricultural productivity and household incomes is not well quantified, and adoption rates and dynamics of WLTs are also not fully understood.

### The Research

In Phase 1, a countrywide reconnaissance survey was conducted. This was followed by in-depth studies in: Kipera in Morogoro Region; Mpunguzi and Bihawana in Dodoma Region; Lukozi in Tanga Region; Arumeru and Moshi in Arusha and Kilimanjaro Regions; and Kinondoni and Ilala in Dar es Salaam. The 335 respondents were all farmers who used motor pumps, treadle pumps, or buckets and watering cans in the year of the survey or the previous year. The questionnaire covered: socio-economic and demographic characteristics, water sources and WLTs, farming practices, decision making, productivity, and markets. Additional information was obtained from interviews with key players in the irrigation sector, including government officials, NGOs, and the private sector.

Table 1. Awareness of WLTs

Region	% of farmers		
	Treadle Pump	Motor Pump	Bucket
Tanga (n=1832)	93	98	100
Morogoro (n=1350)	96	100	100
Dodoma (n=2100)	91	100	100
Dar es Salaam (n=550)	100	100	100

<sup>1</sup> For more information on these see the Tanzania Situation Analysis Brief on the Project website.

# WATER LIFTING TECHNOLOGY IN TANZANIA

*Based on a report by Bernard Keraita and Charlotte de Fraiture*



*Farmers using pumps still use buckets for specific tasks or when water is scarce.*

### Main Findings

The three most commonly used WLTs in Tanzania were the focus of this study, namely buckets and watering cans, motor pumps and treadle pumps. There are generally very high awareness levels of all these WLTs (Table 1) but, despite knowing about the alternatives, the majority of farmers still use buckets (Table 2). This is because they are the traditional means of water lifting and are cheap (Table 3). In addition, buckets are portable, can be easily be used in conjunction with other WLTs and are suitable even where water resources are limited.

Table 2. Pump ownership

Region	% of farmers		
	Treadle Pump	Motor Pump	Bucket
Tanga (n=1832)	1	4	95
Morogoro (n=1350)	4	5	94
Dodoma (n=2100)	1	10	89
Dar es Salaam (n=550)	3	5	92

Table 3. Capital cost of WLTs

Average capital costs	WLT Method		
	Treadle Pump	Motor Pump	Bucket
Of pumps (US\$)	86.77	254.87	3.46
Of accessories (US\$)	48.5	137.04	0

All farmers using pumping systems such as treadle pumps or motor pumps, occasionally use manual systems, for example during certain phases of plant growth or when water supplies are limited.

Although the survey found that motor pump ownership is currently low (Table 2), their use is high in some parts of the country because farmers hire pumps from other farmers. For example, in Lukozi, Lushoto District, as many as 69% of the manual irrigators occasionally hire motor pumps. This indicates a clear potential for pump markets.

### The Gender Dimension

Across the country, more males are involved in irrigation using WLTs. On average, for every one female irrigator, there are 18 male irrigators. Further, male farmers are much more likely to use motorized pumps. In our survey, only 7% of the farmers utilizing motorized pumps were women. This shows clear gender differences in technology use overall with a specific bias against the use of motor pumps by women.



Treadle pumps are owned by farmers with comparatively smaller land sizes and investment potential.

### Pump Sales

Treadle pumps have been actively marketed in Tanzania in the last decade, principally by Kickstart International, with their MoneyMaker brand. Treadle pumps are owned by farmers with comparatively smaller land sizes and investment potential (both capital and operational investments) than those who own motor pumps.

As a way of supporting poor but agriculturally active communities, some NGOs, companies with out-grower schemes and district assemblies also help farmers or groups of farmers to acquire treadle pumps. However, our estimates show extensive use of buckets, with almost every farmer who uses a treadle or motor pump also using a bucket on occasion. In terms of overall sales, the study found an estimated 7000 motorized pumps sold annually to smallholder farmers. By contrast, annual treadle pump sales are estimated to be 4000 pumps, despite NGO support and subsidies.

### Productivity and Income

Irrigated agriculture using WLTs is mainly a commercial activity. The main crops grown with WLTs are vegetables including tomatoes, cabbage, leafy local vegetables, carrots, green peppers and potatoes. The average irrigated area in the study sites is 0.5 ha. Yields vary across study sites, but in general for a crop like tomatoes, motor pump yields are 13.3 tons/ha, which is 20% higher than for treadle pumps and buckets (10.6 tons/ha).

Potential profits for farmers using different WLTs vary widely by location due to different operational costs and market price structures. However, overall, farmers using motor pumps earn greater profits due mainly to higher crop yields, with the greatest marginal benefit in the relatively drier region of Dodoma (Table 4). In general, WLTs contribute 54-87% of household income depending on the region, compared to just 1-34% for rain-fed agriculture, which tends to provide staples for home consumption. An advantage of irrigated agriculture is that it mostly takes place in the dry season, supplementing rather than replacing wet season rain-fed agriculture.

Table 4. Average expenditure, revenue and profit

	Treadle Pump (US\$/ha)	Motor Pump (US\$/ha)	Bucket (US\$/ha)
<b>Morogoro</b>			
Expenditure	737	861	655
Revenue	1,584	1,809	1,504
Profit (loss)	847	948	790
<b>Dodoma</b>			
Expenditure	1,175	1,190	1,130
Revenue	2,661	3,464	2,810
Profit (loss)	1,486	2,256	1,680

## Adoption Constraints

The greatest limitation to motor pump adoption is investment cost (cited by 48% of farmers), although in recent years, cheaper motor pumps from countries like China and India have been introduced to the local markets. The operational costs (mainly fuel costs) are also limiting. For treadle pumps and buckets most farmers find them to be too labor intensive and tedious, and they can only irrigate small plots (Figure 1). Treadle pumps require two people, one to pump and one to hold the hose. Most farmers irrigating with treadle pumps or buckets would like to invest in motor pumps but lack the financial resources. Overall, motor pumps are the preferred WLT.

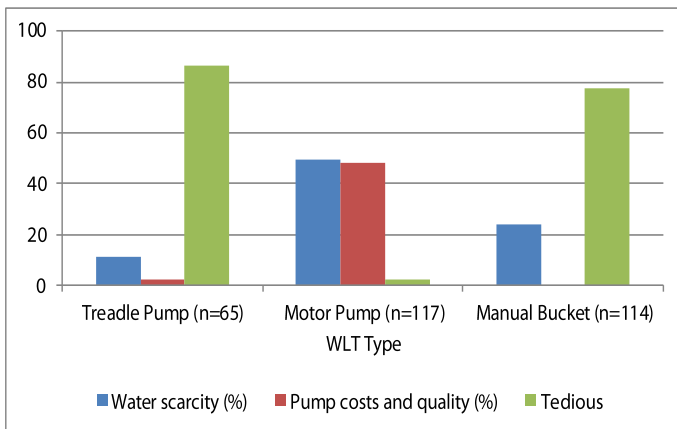


Figure 1. Farmer (%) perceptions of WLT limitations

With increasing numbers of cheap motor pumps on the market, quality control is becoming an issue. For example there are pumps available for as little as US\$ 150 but some farmers have found they only last a few months.



Pumps combined with manual methods of water lifting give farmers optimum control over irrigation.

Many farmers in Tanzania lack sufficient knowledge about pumps to make informed purchasing choices, (for example, the size of motor required,) and they do not know how to maintain them. This has repercussions as farmers learn from other farmers and will not purchase a pump if they see one failing on a neighbor's farm. The same applies to treadle pumps, which have improved over the years but perceptions from initial users (when designs were not so good) still affect potential new adopters.

## Solutions

- **Innovative training for all key actors:** for *extension service providers*, training should go beyond cereals and other traditional crops to those that are typically grown with WLTs, i.e. vegetables. It should include related water management practices and technologies. *Farmers* should be trained in appropriate selection, use and maintenance of pumps as well as production and marketing tactics for optimum returns. *Pump dealers* should be trained on how to offer advice to farmers in choice of pump, and maintenance and repair.
- **Credit facilities:** options should be explored for government provision of credit assurance to existing Savings and Credit Cooperative Organizations (SACCOs) so that they need not be funded by banks and could therefore give more flexible loans and collateral options.
- **Access to quality pumps:** by providing a registry of information on all models of small motorized pumps on the market.
- **Pump rental markets:** Support the development of pump rental markets (e.g., daily or seasonal leasing) for smallholders who cannot afford to own a pump.
- **Water application technologies:** Increase knowledge of more efficient water application technologies such as drip irrigation to reduce the quantity of water used in the fields.

## Questions for Discussion

- Which institutes/organizations are best placed to provide training and how could they be funded?
- Does a mechanism already exist through which the government could support SACCOs?
- Is there an appropriate government department or private sector organization that would be willing to create and update a pump registry?
- How could formal leasing markets be established and operated, or existing informal arrangements strengthened?

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](mailto:AWMSolutions@cgiar.org), please write "Tanzania" in the subject line.