

# AgWater Solutions Project

## Case Study

### **Agricultural Water Management Technology Adoption in Zambia: An Inventory**

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**The AWM Project**

The AgWater Solutions project was implemented in five countries in Africa and two states in India between 2008 and 2012. The objective of the project was to identify investment options and opportunities in agricultural water management with the greatest potential to improve incomes and food security for poor farmers, and to develop tools and recommendations for stakeholders in the sector including policymakers, investors, NGOs and small-scale farmers.

The leading implementing institutions were the International Water Management Institute (IWMI), the Stockholm Environment Institute (SEI), the Food and Agriculture Organization of the United Nations (FAO), the International Food Policy Research Institute (IFPRI), International Development Enterprises (iDE) and CH2MHill.

For more information on the project or detailed reports please visit the project website <http://awm-solutions.iwmi.org/home-page.aspx>.

**Disclaimers**

This report is based on research funded by the Bill & Melinda Gates Foundation. The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of the project, its partners or the Bill & Melinda Gates Foundation.

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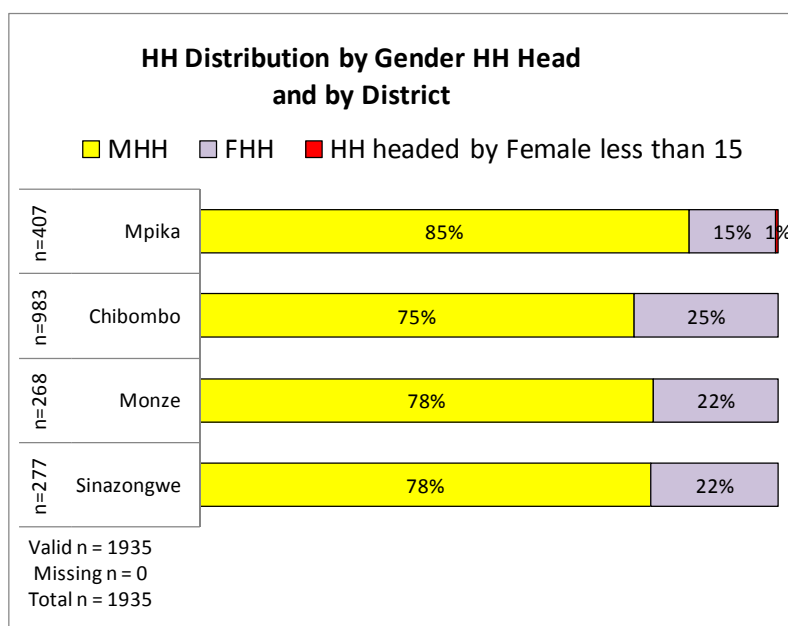
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## 1. INTRODUCTION

This report presents the results of an inventory of agricultural water management technology adoption in Zambia. The inventory concerned rainy season cropping and dry season irrigation in 2009-2010, with the aim to capture the range of important agricultural water management (AWM) technologies throughout Zambia, including buckets, dambos, river diversions, treadle pumps and motor pumps, conservation agriculture, and public irrigation schemes. To ensure sufficient frequencies of the last four AWM technologies, districts were selected where experts expected highest concentrations of those four technologies: Mpika (river diversions), Chibombo (treadle pumps and motor pumps), Monze (conservation agriculture) and Sinazongwe (public irrigation scheme). In these districts all households in a selected adjacent area were interviewed, both adopters and non- or dis-adopters. The field work was conducted by the Farming Systems Association of Zambia.

## 2. INVENTORY

### *Male and female headed households*



**Figure 1. Distribution of MHHs and FHHs by district**

There are 1,935 households (HHs) in the sample, with 983 HH in Chibombo alone, as this was the district surveyed first. When the other districts were identified it was decided to take a smaller sample for those (268, 277 and 407). In the total sample about 75% are male headed households (MHHs) while about 25% are female headed households (FHHs), with the exception of Mpika, where the ratio is 85% MHH to 15% FHH.

*Technology adoption by district*

**Table 1. AWM technology adoption by district**

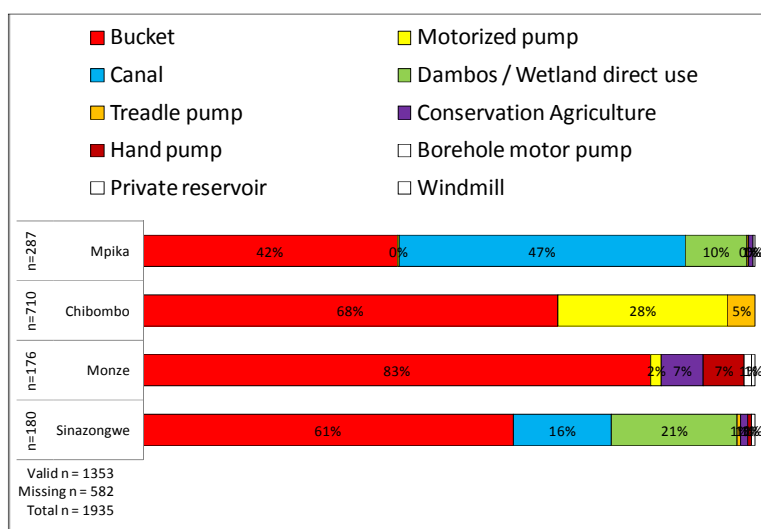
Districts	Adopters		Dis-adopters		Non-adopters		Total	
Mpika	242	59%	45	11%	120	29%	407	100%
Chibombo	710	72%	1	0%	272	28%	983	100%
Monze	138	51%	38	14%	92	34%	268	100%
Sinazongwe	140	51%	40	14%	97	35%	277	100%
Total	1230		124		581		1935	

Out of the 1,935 HHs, 1,230 have adopted an AWM technology (Adopters), while 581 HHs did not (Non-adopters) and 124 once adopted but have now abandoned (Dis-adopters). Adoption rates are different in Chibombo where there was only one Dis-adopter. As markets are good and as the main AWM technology in Chibombo is the bucket with some portable motorized 5HP pumps, it indicates that this is a popular technology which farmers don't abandon.

**Table 2. AWM (Dis/Non) Adoption by MHHs & FHHs**

Gender HH Head	Adopters		Dis-adopters		Non-adopters		Total	
MHH	1005	67%	99	7%	403	27%	1507	100%
FHH	225	53%	25	6%	178	42%	428	100%
Total	1230		124		581		1935	

FHHs have a lower adoption rate (53%) than MHHs (67%). There is not much difference between the MHHs and FHHs as far as dis-adoption is concerned.



**Figure 2. Adoption by district**

In the four districts the farmers are using different technologies. Where the bucket is the predominant technology in most districts, the next most important technology is different for each of the districts:

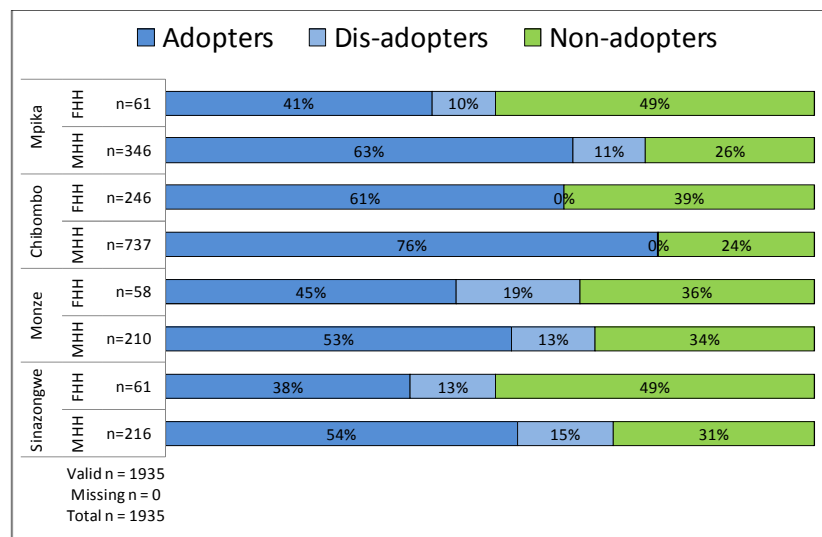
**Mpika:** Canal (i.e. river diversions) even more important than buckets.

**Chibombo:** Motorized pumps (mainly small 5HP portable petrol pumps).

**Monze:** Conservation Agriculture, but also hand pumps (the latter were installed some 25 years ago on farms in Kayuni Settlement, a scheme on an ex-state farm).

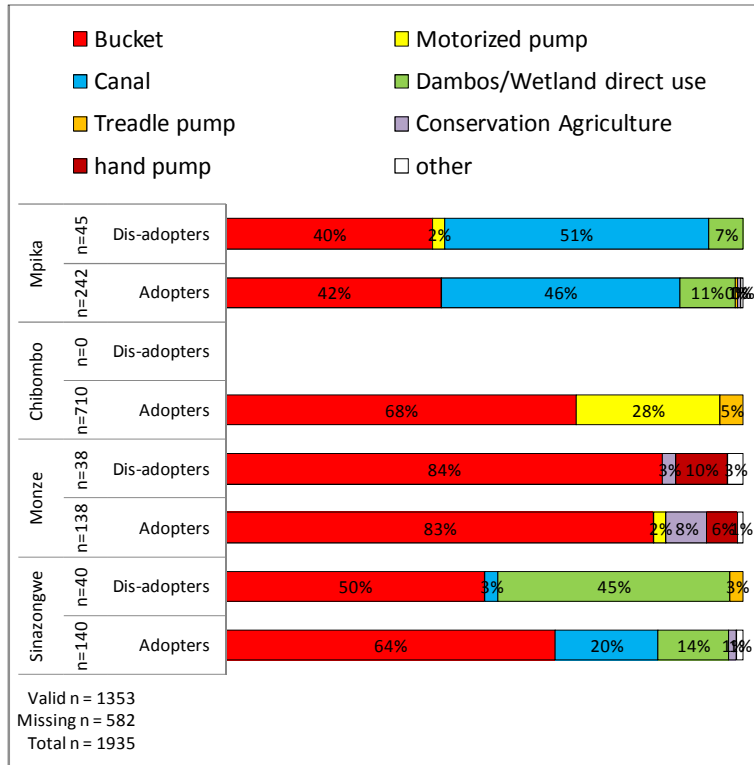
**Sinazongwe:** Canal (i.e. public irrigation scheme) is the focus of the survey but even more HHs use the dambos/wetlands. This highlights that the public scheme only benefits a small proportion of the people.

The more advanced AWM technologies beyond the bucket and dambos are most commonly used in: Mpika (58% of the adopters) and Sinazongwe (39%), followed by Chibombo (32%) and Monze (17%).



**Figure 3. Adoption, non-adoption and dis-adoption of AWM technologies by district and gender of household head**

Figure 3 is a graphic presentation of a combination of Table 1.1. (adoption by district) and Table 1.2. (adoption by gender of HH head). The same observations apply.



**Figure 4. Adoption of specific AWM technologies by adopters and dis-adopters.**

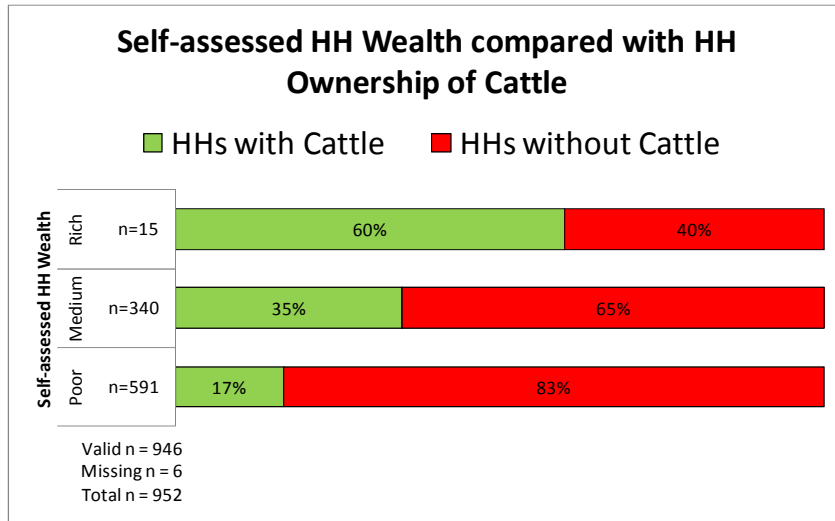
In **Mpika** the dis-adopters had the same pattern of AWM technology as the adopters: users of buckets and river diversions.

In **Chibombo** there was no dis-adoption of any technology.

In **Monze** there were few dis-adopters who had used conservation farming; there were more dis-adopters that had used hand pumps before, probably because the pumps could not be maintained anymore.

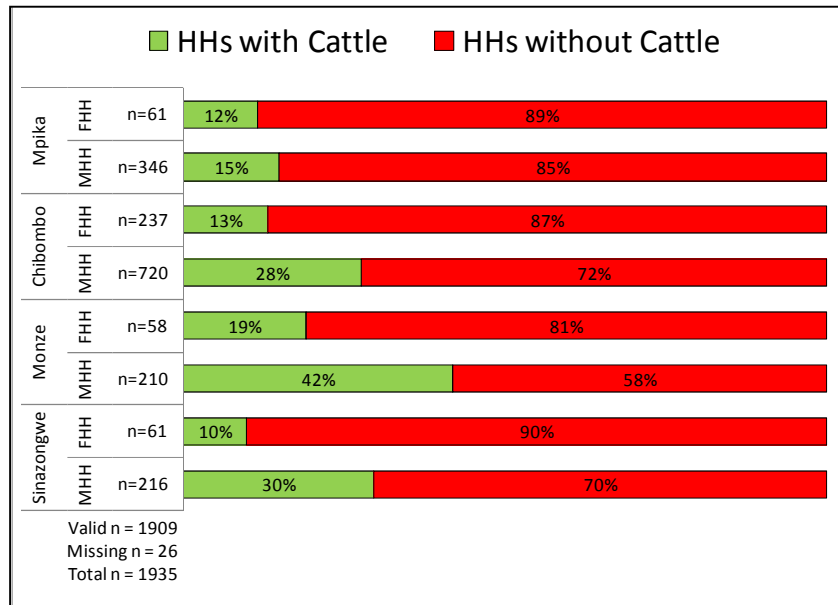
In **Sinazongwe** there was a larger proportion of dambo/wetland users among the dis-adopters than among the adopters, while few dis-adopters were users of the public irrigation scheme; this indicates a move away from the dambo.

*Adoption and household wealth*



**Figure 5. Household head wealth and use of AWM technology.**

There is a clear relationship between cattle ownership and self-assessed wealth. Self-assessed wealth was only recorded for three districts (not in Chibombo), while cattle ownership was recorded in all four districts. Cattle ownership, instead of self-assessed wealth, is therefore used as a wealth indicator for all four districts.

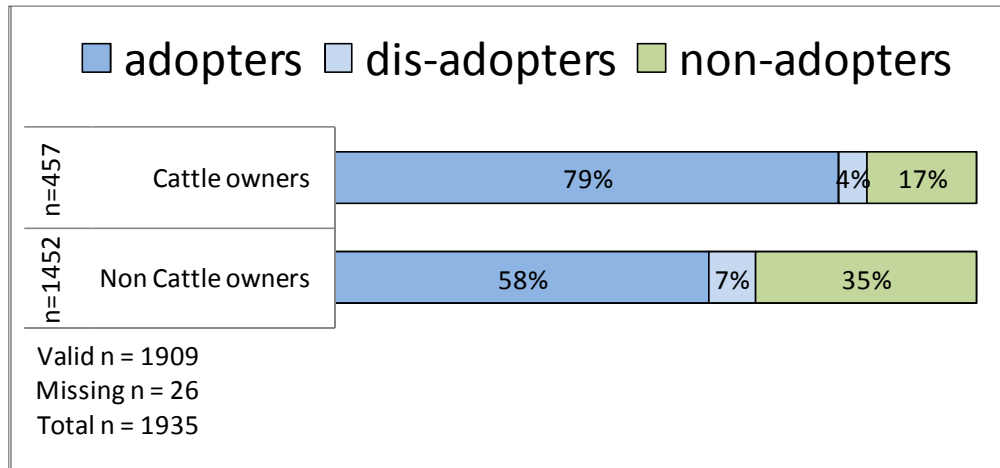


**Figure 6. Wealth (cattle ownership) by gender of HH head and by district**

In all districts there are more MHHs than FHHs who own cattle, which indicates that MHHs tend to be wealthier than FHHs. In all districts, the majority of HHs don't own cattle but



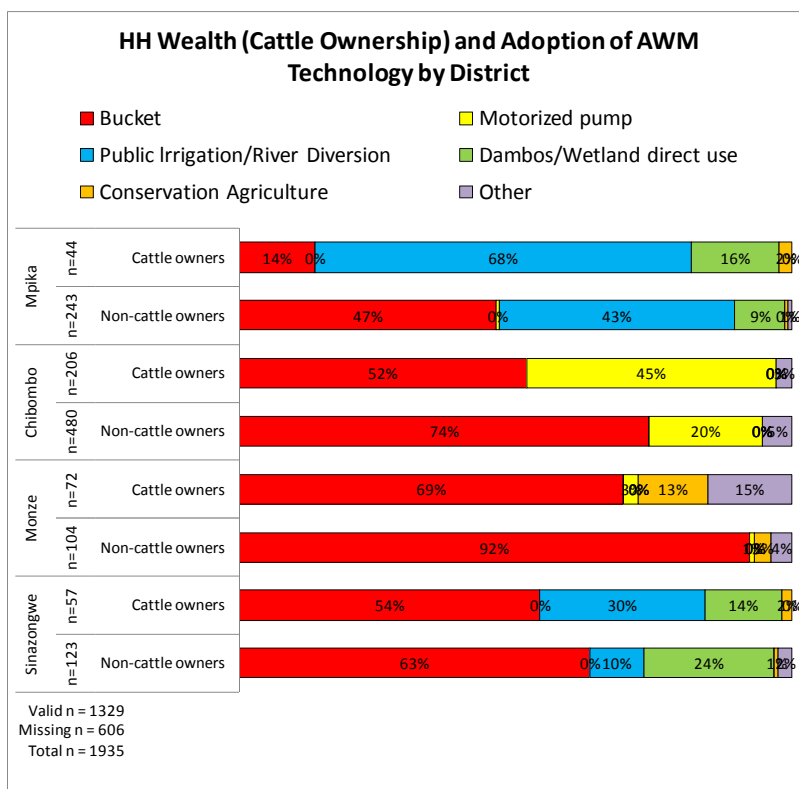
there are more HHs with cattle in Monze in Southern Province than in the other three districts.



**Figure 7. HH wealth (cattle ownership) in relation to AWM technology adoption**

More cattle owning HHs (79%) are adopters of AWM technology than non-cattle owners (58%), which means that there are more adopters among wealthier HHs either as the cause or result of adoption. Adoption could be easier when the HHs have the resources for investment, but adoption itself is also likely to improve the wealth of the HH.

There are almost an equal proportion of cattle owning HHs (4%) that dis-adopt as non-cattle owning HHs (7%) that dis-adopt, so wealth of the HH does not seem to have an influence on the decision to dis-adopt.



**Figure 8. Household head wealth (cattle ownership) and adoption of AWM technology by district**

In all districts, the wealthier HHs make less use of buckets and make more use of advanced technologies such as:

- River diversions in Mpika,
- Motorized pumps in Chibombo,
- Conservation agriculture (and other) in Monze, and
- Public irrigation scheme in Sinazongwe.

*Farm size of adopters and non-adopters in three districts*

**Table 3. Adopter and non-adopters by farm size**

District	Total area under irrigation Mean (Ha)	Total area under rain-fed Mean (Ha)
Mpika	0.47	1.32
Chibombo	No data	No data
Monze	0.16	2.17
Sinazongwe	0.38	0.94

The average farm size of all irrigated plots is smaller than the average farm size of all rain fed plots of the whole sample. In Mpika, the total area of all rainfed plots is bigger by a factor of 2.8 while for Sinazongwe it is a factor 2.5. This shows that irrigation is intensively

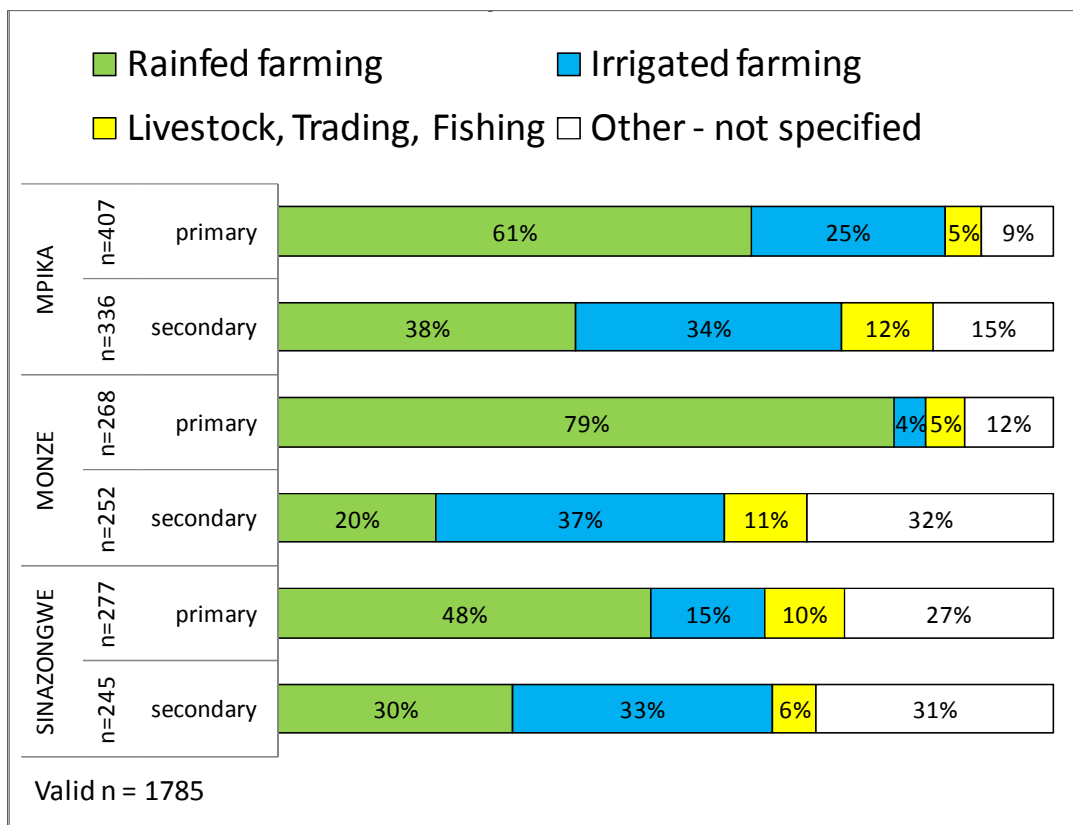
done on farms of less than 1 ha, while rainfed farming is done more extensively on farms of more than 1 ha. In Monze, the rain fed farms are bigger by a factor of 14 as compared to irrigated farms, probably because in Monze the use of buckets is much more common (83%) than in Mpika (42%) and Sinazongwe (61%).

*Primary and secondary livelihoods*

This factor was examined in Mpika, Monze and Sinazongwe only, as they were not included in the Chibombo survey. The total N for these three districts is 952, but the valid Ns for these questions are always more than 952 because these were multiple response questions. The figures therefore included only the valid Ns.

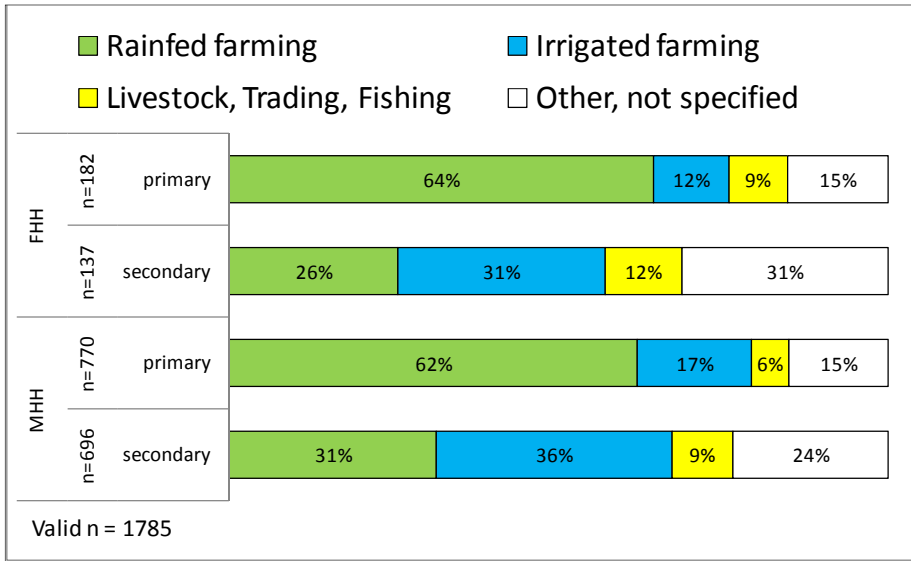
All the four figures in this section have the following in common:

The majority of respondents (50-70%) say that rainfed farming is their primary livelihood, while 30-50% say that irrigated farming is their secondary livelihood. The proportion for which irrigation is a primary livelihood varies between 4% in Monze and 25% in Mpika. This shows that rainfed farming is still of primary importance to the farmers, but irrigated farming is considered as second important farming activity.



**Figure 9. Comparison of primary and secondary livelihoods by district**

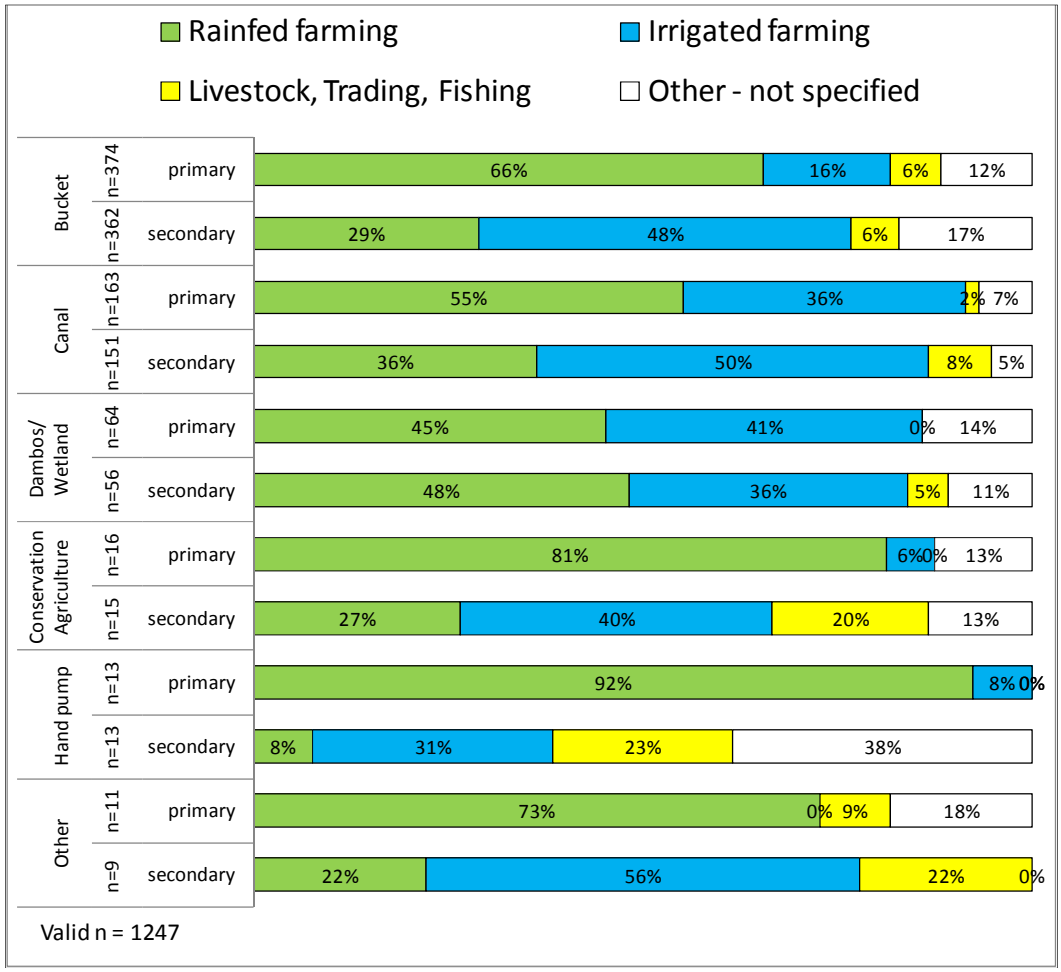
In Monze and Sinazongwe, about 30% of secondary livelihoods are outside farming (Other) as compared to Mpika (15%), which indicates that Mpika is more of a farming community.



**Figure 10. Primary and secondary livelihoods of FHH and MHH**

There is hardly a difference in primary and secondary livelihood patterns between FHHs and MHHs (none of the differences exceed 10%).

There is a slight trend for FHHs to go more outside crop farming for secondary livelihoods (12% + 31% = 43%) as compared to MHHs (9% + 24% = 33%).



**Figure 11. Primary and secondary livelihoods related to specific AWM technology use**

The AWM technology that is quite different from the other technologies in terms of livelihood is dambos/wetlands, which are relatively important both as a primary and secondary livelihood.

Adoption and gender

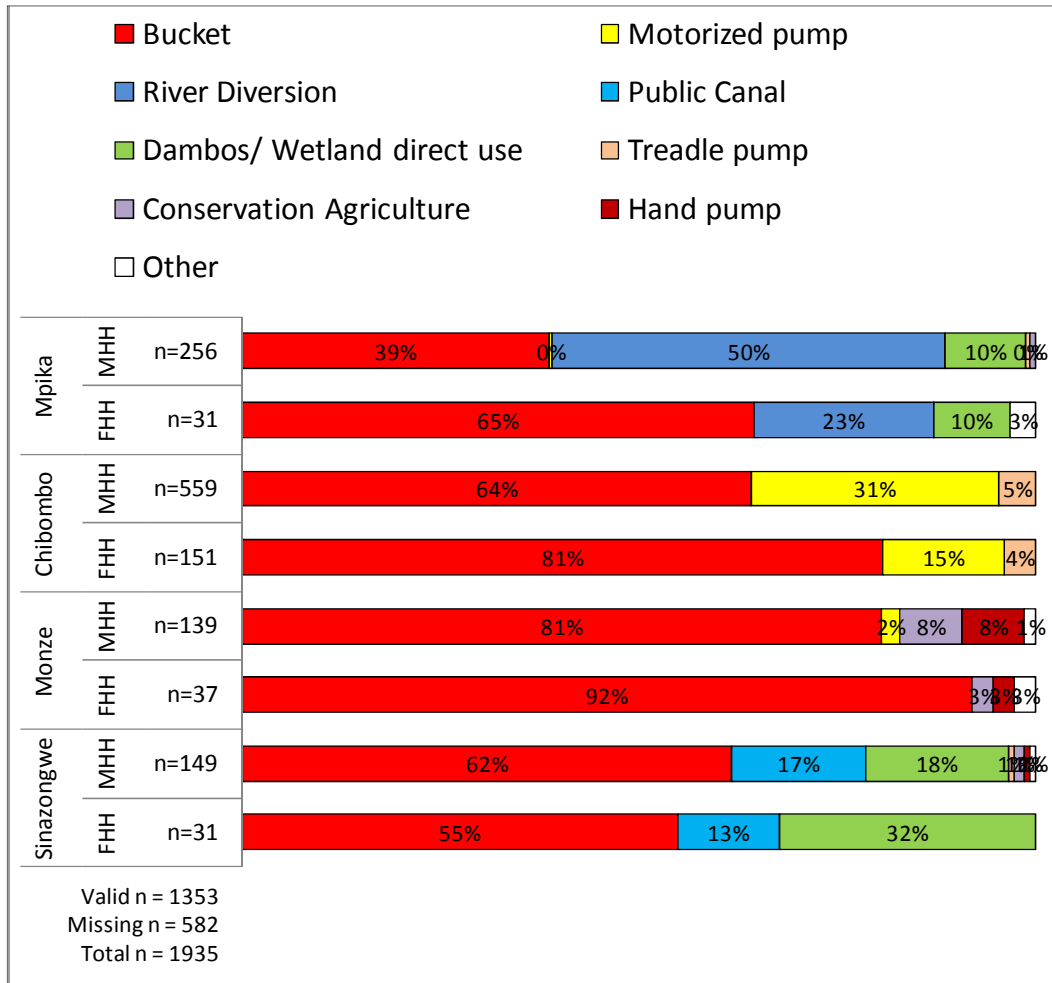
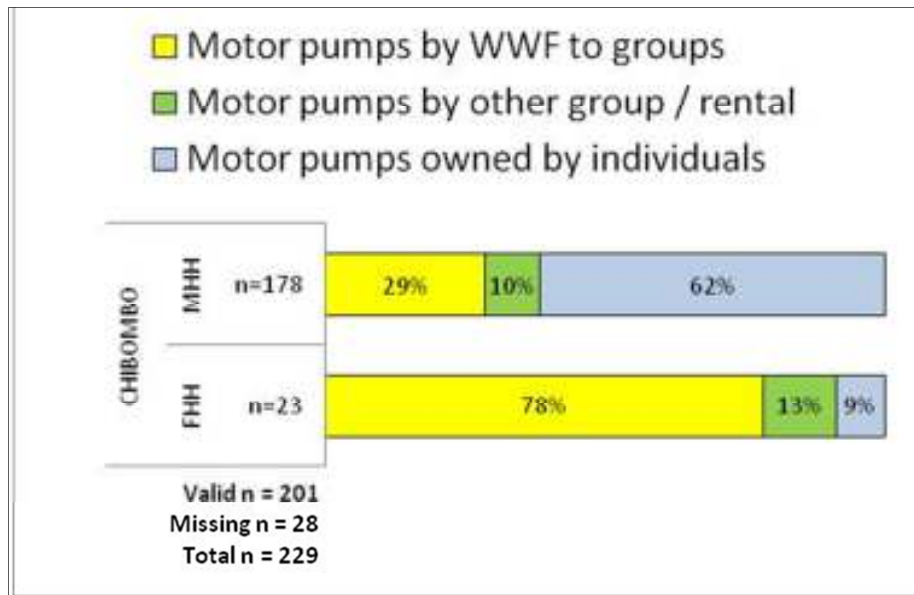


Figure 12. AWM Technology adoption by gender of household head and by district

- All districts have buckets as the main AWM technology except for **Mpika**, where river diversions are used by 50% of the MHHs while only 39% of those MHHs use buckets; for FHHs in Mpika, buckets are still more important but river diversions come at second place (23%). dambos/wetlands are used by 10% of both MHHs and FHHs.
- In **Chibombo**, motorized pumps are the most important after buckets, used by 31% of MHHs and 15% of the FHHs; the treadle pump is only used by a few HHs.
- In **Monze**, there is no dominant technology other than the bucket; conservation farming is only used by 8% of the MHHs and by 3% of the FHHs. This shows low adoption rates of conservation agriculture even in areas like Monze which are known for their relatively high adoption rates, and also selected for that reason in the districts.
- In **Sinazongwe**, dambos/wetlands are, after buckets, the second most important AWM technology and are used more by FHHs (32%) than MHHs (18%). Use of the irrigation scheme is almost as important as dambos/wetlands and is used by 17% of the MHHs and 13% of the FHHs.

### Group and individual ownership of AWM technology in Chibombo



**Figure 13. Ownership of motor pumps by gender of household head in Chibombo**

In Chibombo, a SADC-Danida supported WWF project issued 30 motor pumps free of charge to male, mixed and women’s groups of farmers a few years ago. During a field visit in April in 2010, the farmers indicated that 33 people (22 men, 11 women) had started buying pumps after they had experienced the advantages of using small pumps for irrigation.

Relatively more FHHs than MHHs acquired pumps from WWF as a group. Absolute numbers of those acquiring pumps as a group are 18 (78%) out of the total 23 FHHs motor pump adopters; and 50 (29%) out of the total 178 MHH pump adopters. Although MHHs were still favoured by this project, the project’s targeting of women’s and mixed groups did ensure that more FHHs got access to motor pumps than FHHs would have had if they had to acquire them privately (Van Koppen and Akamandisa 2010).

Women-managed plots in MHHs and FHHs – in three districts

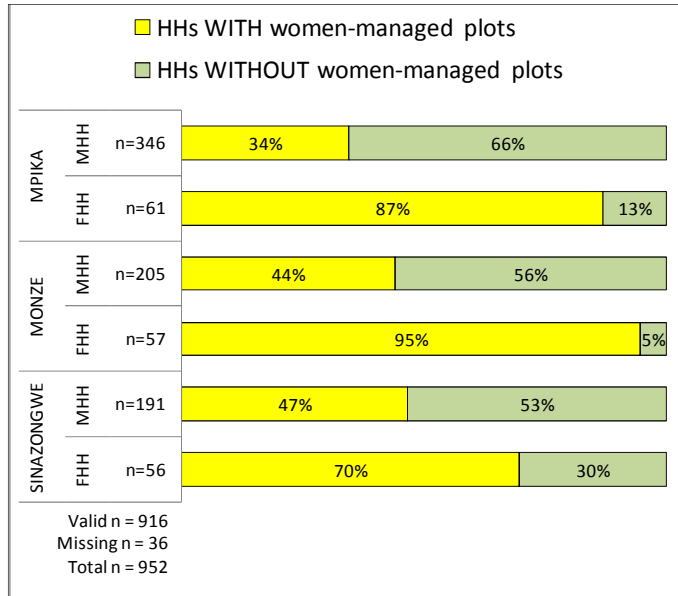


Figure 14. Gender of household head in relation to women-managed plots by district

In all three districts, women-managed plots were in the minority (34-47%) in MHHs and much in the majority (70-95%) in FHHs. This pattern is quite different when it comes to women-managed irrigated plots (see below).

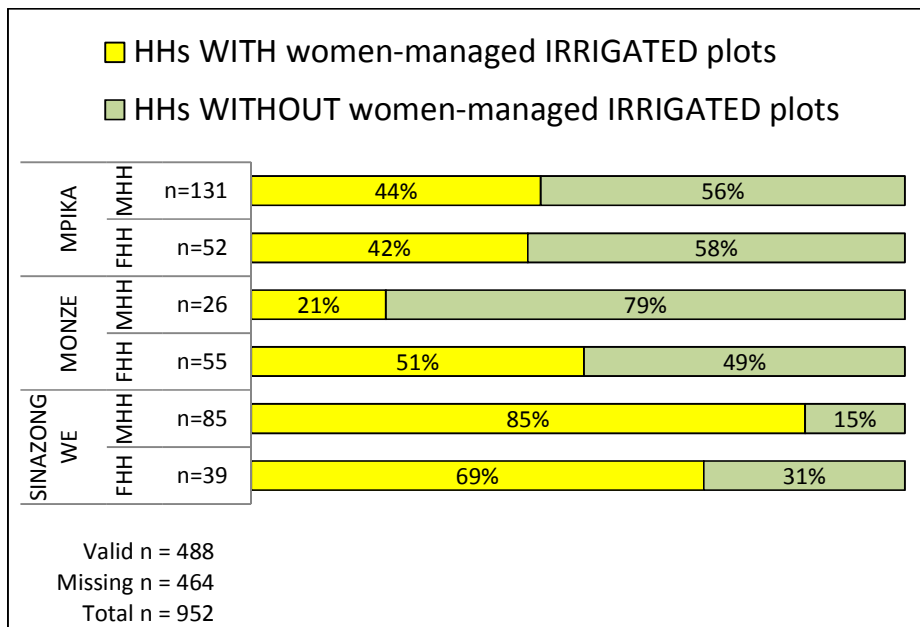


Figure 15. AWM adoption on women-managed plots by gender of household head by district



In Mpika, the proportion of women-managed irrigated plots in MHHs is similar to FHHs (42 and 44%). Wives with their own plots are as likely to adopt irrigation as women in FHHs with own plots.

In Monze, the proportion of women-managed irrigated plots is low in MHH (21%), but half of the FHHs with their own plots adopt AWM.

In Sinazongwe, the situation looks much different. Many plots are put under irrigation, especially in MHHs (85%). This is somewhat lower in FHHs (69%). This could be due to the availability of dambos where women have easy access.