



Gender and water technologies: Water lifting for irrigation and multiple purposes in Ethiopia

Likimyelesh Nigussie, Nicole Lefore, Petra Schmitter and Alan Nicol

Produced by International Water Management Institute, East Africa and Nile Basin Office, Addis Ababa

Published by International Livestock Research Institute (ILRI)

February 2017

www.africa-rising.net



The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. <http://africa-rising.net/>



This document is licensed for use under a Creative Commons Attribution-Noncommercial-Share Alike 3.0 Unported License

This document was made possible with support from the American people delivered through the United States Agency for International Development (USAID) as part of the US Government's Feed the Future Initiative. The contents are the responsibility of the producing organization and do not necessarily reflect the opinion of USAID or the U.S. Government.

Acknowledgements

We would like to thank the Africa RISING team in Lemo and Bale and in particular Workneh Dubale, Fikadu Tesema, research assistants and data collectors for their support and dedication to this project. Without their commitment this report would not have been possible.

We further would like to thank the support of the Woreda, Omo Microfinance, the kebele leaders for their help with the project implementation and the participating households for their contribution and willingness to participate in the data collection.

Contents

Summary	4
1 Introduction	5
2 Methodology.....	6
3 Findings of the study.....	7
3.1 Historical background of water availability and use in study area	7
3.2 Source of finance for water lifting technologies.....	7
3.3 Use of water lifting technologies	8
3.4 Frequency of water lifting technology use (season, week, day).....	13
3.5 Access to resources.....	14
3.6 Control over technologies and participation in decision-making.....	19
3.7 Benefits of using the technology	23
3.8 Constraints of using technologies.....	29
3.9 Ideas to improve the technology.....	31
3.10 Preferred technologies	32
4 Conclusion and Recommendations.....	32
4.1. Perceived gender relations around technologies	32
4.2. Recommendations	34
4.3. Further research	34
5 References	35

Summary

This report outlines the results of a study on gender and individual irrigation technologies undertaken in two Africa RISING Project sites in Ethiopia, Bale (Illu Sambitu Kebele) and Lemo (Jawe and Upper Gana Kebeles). The study is based on a survey of 79 farmers (38 men and 41 women) across four types of water lifting technologies. The study explores the intra-household gender dynamics in Africa RISING pilots of water lifting technologies (rope and washer pump, tractor and drip and solar pumps). The technologies are installed near farmer households to produce irrigated fodder, vegetables (carrot and cabbage) and fruits (avocado) in the dry season, and to serve multiple purposes. Diesel pump users already producing dry season vegetables in the sites are included in the study.

The study focuses on domains of productive and reproductive uses, labor, access to resource, and benefits, including income. The survey questions include subjects on: i) use of technologies by men, women and children; ii) access to the technologies and other resources; iii) participation of men and women in decision making; iv) perceptions of men and women technology users about the technologies, including benefits and constraints.

The study findings show that users apply the technologies to lift water for multiple purposes across seasons with improved water quality enhancing use for domestic purposes. While the project targets women and men farmers, women still have lower access to most resources, particularly information. Women and men report that men mostly control the use of the technologies especially for irrigation, though women and men perceive the level of control over the technologies differently. Nearly all respondents indicate that the technologies ease work both on-farm for irrigation and for domestic and livestock watering roles. Women and men respondents ranked double cropping as the highest benefit of the technologies, followed by domestic uses and livestock watering, though men also considered social status improvement as a benefit. Most respondents said there is equal sharing of benefit within the household, though there is indication that men have more control over income from the technologies. Women primarily make decisions on use of the income from the technologies only for food and small household purchases. In addition to benefits at household level, respondents consider the technologies as beneficial to community, because they provide easy access to water for domestic purposes.

The study concludes with recommendations for future development investments in smallholder, individual irrigation technologies. It also proposes areas for further research on gender empowerment and equality in relation to such technologies.

Introduction

Most of the 82.9 per cent of the Ethiopian population living in rural areas depend on agriculture (O Sullivan, et al. 2014). The Government of Ethiopia places strong emphasis on agriculture in the Growth and Transformation Plan II (GTPII), including smallholder agriculture (Ministry of Finance and Economic Cooperation 2015). Investment in irrigation is a key strategic direction to accelerate economic structural transformation, as well as reduce poverty, in the GTPII. With the emphasis on strengthening agricultural production, it is important to note that women are responsible for about 40% of agricultural activities in Ethiopia (Frank 1999), but have 13.4% lower productivity than men caused by endowment and structural differences (Aguilar, et al. 2014).¹ Reducing these resource and structural differences through targeted measures for equitability has the potential to boost agricultural growth.

The Africa RISING project shares the approach of the Feed the Future initiative to gender by recognizing that women are important food producers and therefore addressing gender inequality is important to achieving food security.² Investments in irrigation should likewise target equity in productivity between men and women; irrigation provides opportunity for women's empowerment (Domenech and Ringler 2013). While past research and various tools suggest approaches to improve equitability in irrigation schemes, far less is known about how to ensure gender equitable investments in individual technologies that farmers are rapidly adopting in many African countries.

Against this background, the Africa RISING project designed an intervention to test individual water lifting technologies with men and women farmers in Bale (Illu Sambitu Kebele) in the Oromia Region and Lemo (Jawe and Upper Gana Kebeles) in the Southern Nations, Nationalities, and Peoples' Region in Ethiopia. The project sought to understand the potential of the water lifting technologies to contribute to sustainable intensification and improve livelihoods more broadly, but designed interventions to respond to the needs of both women and men farmers. The project chose the individual water lifting technologies to pilot in consultation with woreda and kebele officials, being rope and washer pumps, tractor with drip kits, and solar pumps. Research included diesel pump farmers in the area to add to the comparison of technologies. The project piloted these technologies and associated agriculture water management practices to produce fodder, vegetables (carrot and cabbage) and fruits (avocado and others) in the dry season for own-consumption and sale. The project also aimed to test technologies that could provide for multiple uses, reduce labor, and enable women farmers to earn cash income through horticultural crop cultivation in backyard gardens.³

This report outlines the results of research on gender dynamics across technologies. The purpose of this study is to understand the intra-household gender relations and power dynamics of households around the water lifting technologies. More specifically to understand: i) productive and reproductive use of technologies by men, women and children; ii) access to and control over these technologies and related resources; iii) participation of men and women in decision-making or

¹ Figures for productivity differences between men and women farmers in Ethiopia vary. See Aguilar et al 2014.

² <http://www.feedthefuture.gov/approach/Gender--Integration>

³ Different development and research initiatives use different terms for these farms, including backyard, homestead and kitchen gardens, as well as commercial gardens. This report uses the term backyard gardens. See Merrey, D. J.; Langan, S. (2014) for more on kitchen gardens in Africa.

control over the technologies; and iv) perceptions of men and women technology users about technologies including, benefits, constraints and preferences.

Methodology

This study interviewed 79 individuals: 38 male head of household and 41 females. Among the female respondents, 5 were head of household and 36 were female spouses of the male respondents. All were water lifting technology users in the study areas. The project collected data through survey questionnaires administered by enumerators trained to use the data collection tools.

Of the 79 respondents, over half use rope and washer, with the remaining respondents spread relatively evenly across diesel pump, tractor and drip, and solar pump. Of the diesel pump users, the study included 8 farmers (3 men and 5 women) in the Bale site that did not receive any technologies or other inputs from Africa RISING and were included to broaden the study. Table 1 below provides a breakdown of respondents per technology type and project site.

Table 1: Number of male and female respondents using the technologies per site

Location				Gender		Total
				Male respondents	Female respondents	
Lemo - Upper Gana	Type of technology	Water	Diesel Pump	2	0	2
			Tractor and drip	3	2	5
			Rope and Washer Pump	8	10	18
			Solar Pump	3	3	6
			Total	16	15	31
Lemo - Jawe	Type of technology	Water	Diesel Pump	1	1	2
			Tractor and drip	3	3	6
			Rope and Washer Pump	7	10	17
			Solar Pump	1	1	2
			Total	12	15	27
Bale - Illu Sambitu	Type of technology	Water	Diesel Pump	4	5	9
			Rope and Washer Pump	3	5	8
			Solar Pump	3	1	4
			Total	10	11	21
			Total	Type of technology	Water	Diesel Pump
Tractor and drip	6	5				11
Rope and Washer Pump	18	25				43
Solar Pump	7	5				12
Total	38	41				79

The study sought to analyze gender differences and intra-household gender relations related to the technologies. While much research has been done on gender and irrigation at scheme level, very little has been done on individual irrigation technologies. However, the existing evidence from irrigation scheme studies informed the approach to the study. More specifically, the survey was designed around domains that align with the Women's Empowerment in Agriculture Index⁴, which USAID employs to measure change in Feed the Future projects. In this case, the survey included questions related to production, access to resources, income and time. The survey omitted

⁴ <http://www.ifpri.org/publication/womens-empowerment-agriculture-index>

leadership because there are no related committees or organizations, as technologies are at individual or household level. Earlier research suggests the value of the WEAI domains in assessing the impact of irrigation investments and gender.

Findings of the study

Historical background of water availability and use in study area

The project collected data on the type of water source of respondents prior to the introduction of the new water lifting technology and the purpose of use for each source, including domestic, livestock watering and irrigation. In Bale, respondents had used tap water for domestic purposes, and ponds and rivers for livestock watering. In Lemo, farmers had used rivers, ponds and springs for domestic uses, and ponds and springs for livestock watering, in addition to shallow wells. In Lemo, most farmers indicated they did not practice irrigation before the project introduced the water lifting technologies. However, the few who practiced irrigation used water from river or wells.

Source of finance for water lifting technologies

The Africa RISING project provided rope and washer pumps and solar pumps on credit, and fully covered the cost the tractor and drip technology. As noted above, Africa RISING did not provide diesel pump to farmers; diesel pump users already had the technology from other sources when the research began. Figure 1 below indicates responses of farmers on source of finance for the water lifting technology.

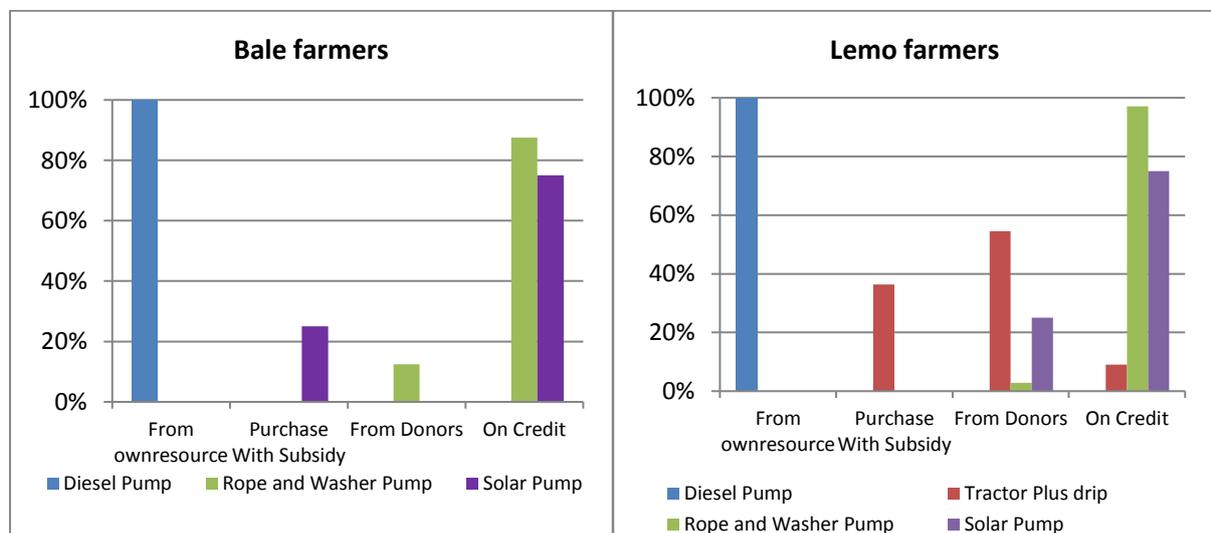


Figure 1: Source of financing for each technology, by users per site

In both sites, farmers either purchased diesel pumps with their own capital or were renting. In Bale, 67% of diesel pump users rented. However, in Lemo, half of farmers purchased the technology and half rented. There is also an arrangement where vulnerable groups such as women, the elderly and handicapped community members who have land, but do not have the capacity to buy or rent a pump, make arrangements with pump owners or renters to work together on the land and share the produce proportionally, in most cases equally.

Regarding rope and washer pumps in both sites, more than 80% of users indicated they get the technology on credit, while the remainder of users indicated they got the technology from donors. Similarly, the source of finance for about 80% of solar pump users in each site was credit. However, more than 20% of the users in Bale responded they purchased the technology through subsidy, while more than 20% of users in Lemo indicated donors granted them the technology. Tractor and drip users in Lemo indicated a donor provided the technology (Africa RISING) or they purchased with a subsidy.

The results of the survey questions related to credit suggest that farmers perceive credit arrangements associated with donor-funded projects differently. A few respondents indicated they were not aware of the credit arrangement, though field coordinators claimed each farmers did know the arrangement. The results suggest some farmers did not understand the terms of the credit when they signed the agreement to purchase the technologies. This could have implications for future projects.

Use of water lifting technologies

The Africa RISING project provided fodder, vegetable, and avocado seeds to farmers. Figure 2 shows varieties provided by the project. In addition, farmers purchased seeds and grew crops of their choice, as indicated in Figure 3, including tomato, onion, garlic, apple, pepper, enset, potato and others.

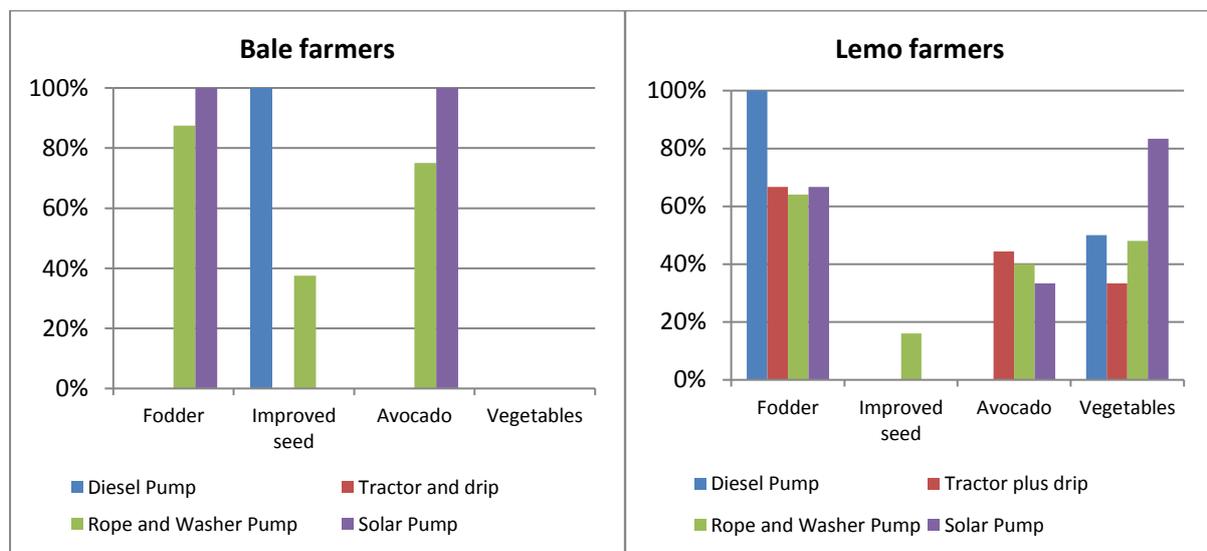


Figure 2: Types of crops grown with seeds provided by Africa RISING project

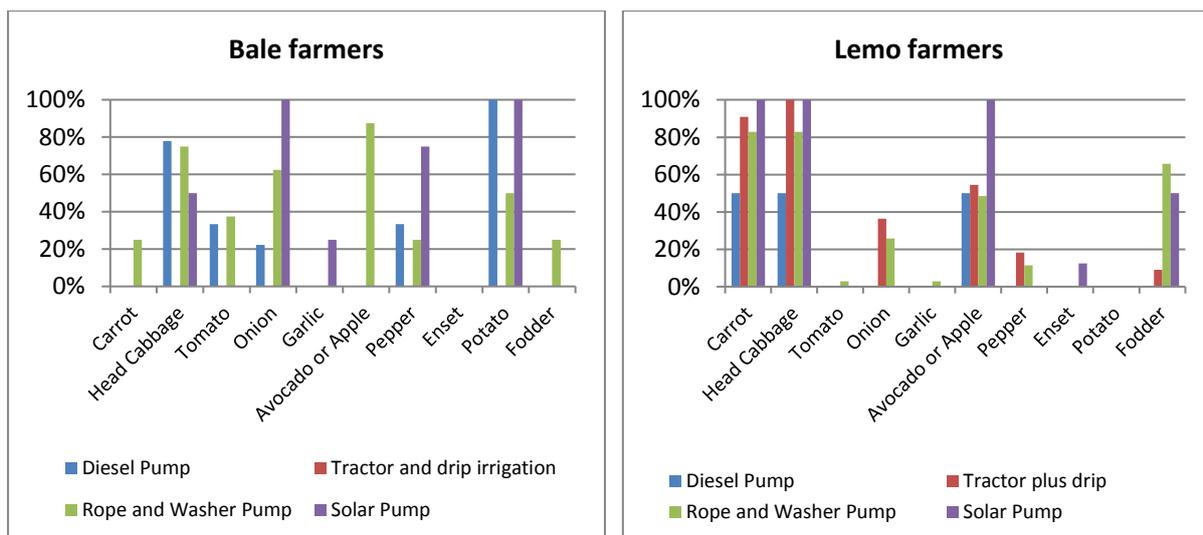


Figure 3: Type of crops grown by farmer choice and self-purchase

Study results in both sites indicate farmers use the water for domestic use and livestock watering, in addition to irrigation. The water lifting technologies enable multiple use by providing relatively easy access to water and improved water quality. Figure 4 shows the percentage of respondents in each site, indicating whether the water lifting technology is used for multiple purposes or not.

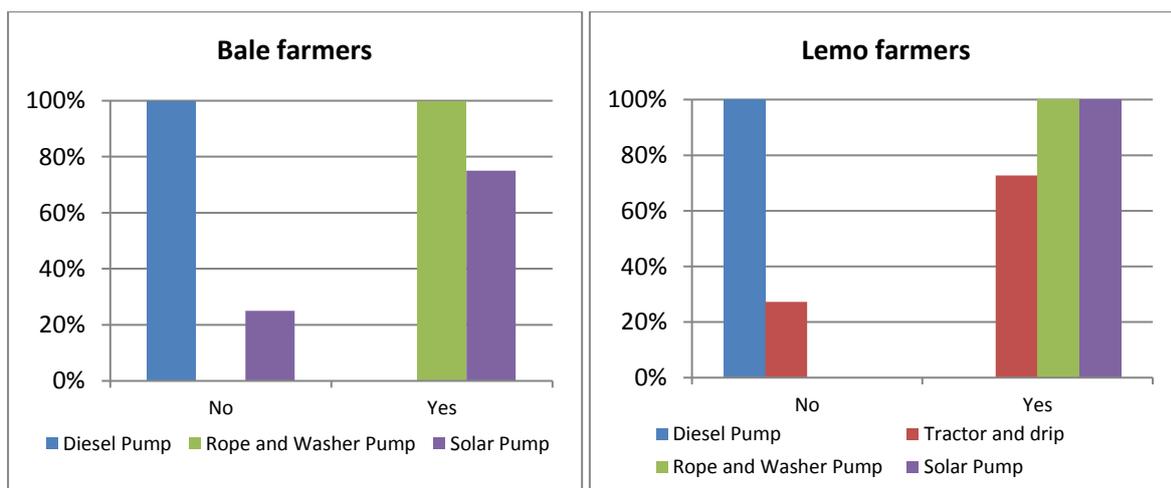


Figure 4: Percentage of respondents indicating whether the water lifting technology is used for multiple purposes

Results suggest that diesel pumps are only used for irrigation. A majority of tractor and drip farmers in Bale stated that they use the technologies to lift water for multiple purposes. The water brought by tractor from rivers, ponds, or harvested rainwater is stored in a tank, ostensibly for the drip irrigation purpose, but farmers use it for other purposes. Solar pump and rope and washer pump users in both sites clearly indicated they use the technologies to obtain water for multiple purposes (irrigation, livestock watering and domestic use). However, some farmers in Bale have access to piped water for domestic use and ponds for livestock, and therefore, 25% of solar pump users in Bale indicated they use solar pump water only for irrigation. All rope and washer farmers lift water for multiple purposes.

Perceptions of water quality may also influence how the technology is used. The study also assessed farmer perception on water quality accessed with these technologies. As shown in Figures 5 and 6, most of the technology users reported improved water quality for multiple purposes, except for diesel pump users and solar pump users in Bale.

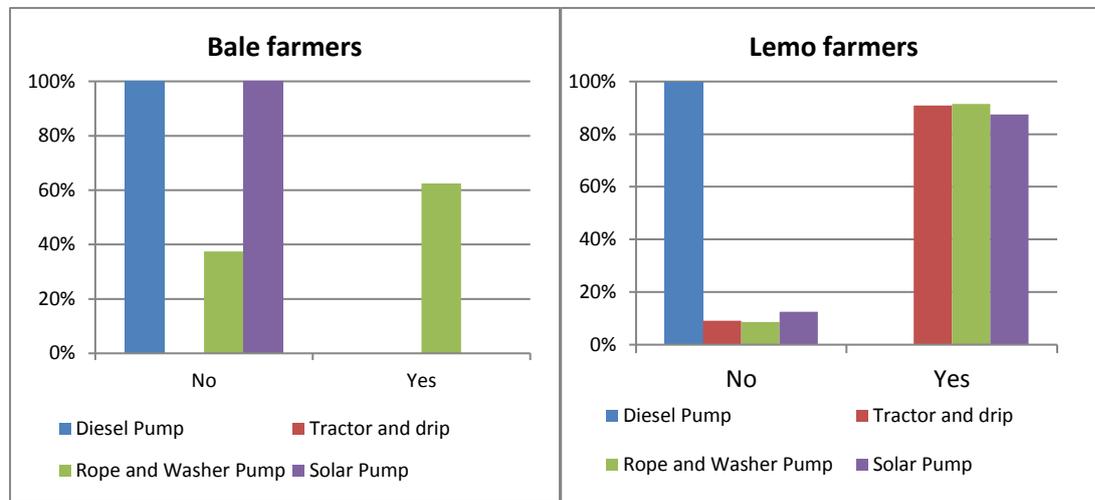


Figure 5: Percentage of respondents indicating that the technology has improved water quality

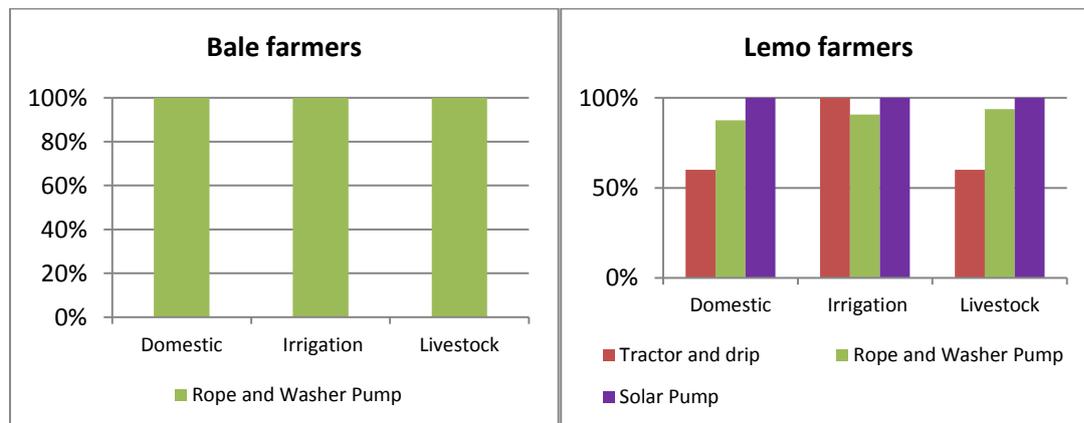


Figure 6: Percentage of respondents indicating the technology improved water quality for multiple purposes

Respondents explained how they perceived improved the water quality. Those with wells noted two improvements, being covered wells so water is protected from contamination and reduced disturbance of sediment and turbidity previously caused by throwing jerry cans into the well to draw water. Respondents in Lemo previously used open (unprotected) sources for domestic purposes so the technologies reduced likelihood of source contamination.

Not surprisingly, women and children use the water differently. Graphs (7a, 7b and 7c) show how men, women and children use water from these technologies for different purposes.

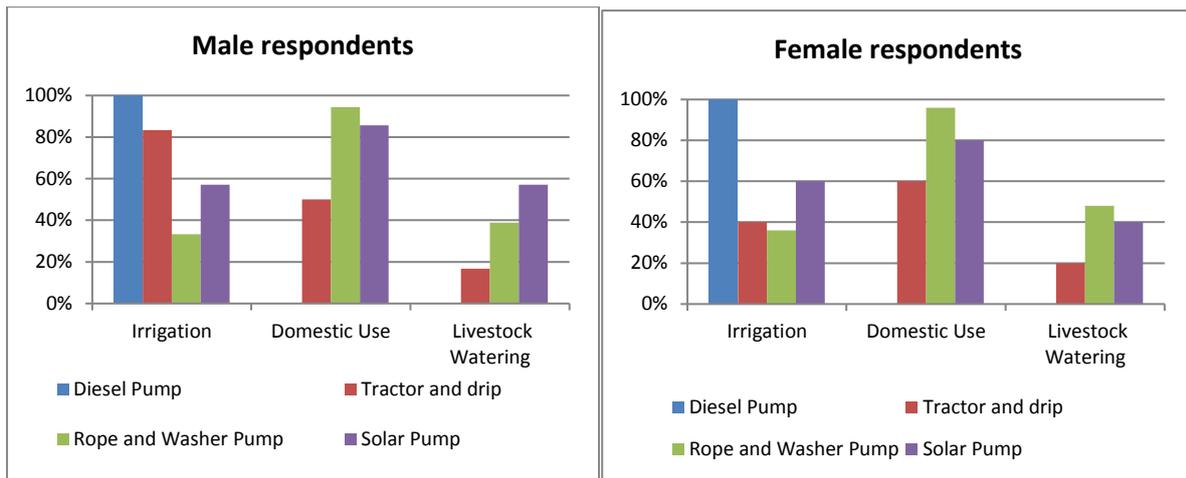


Figure 7a: Percentage of men and women respondents, indicating women's use of water

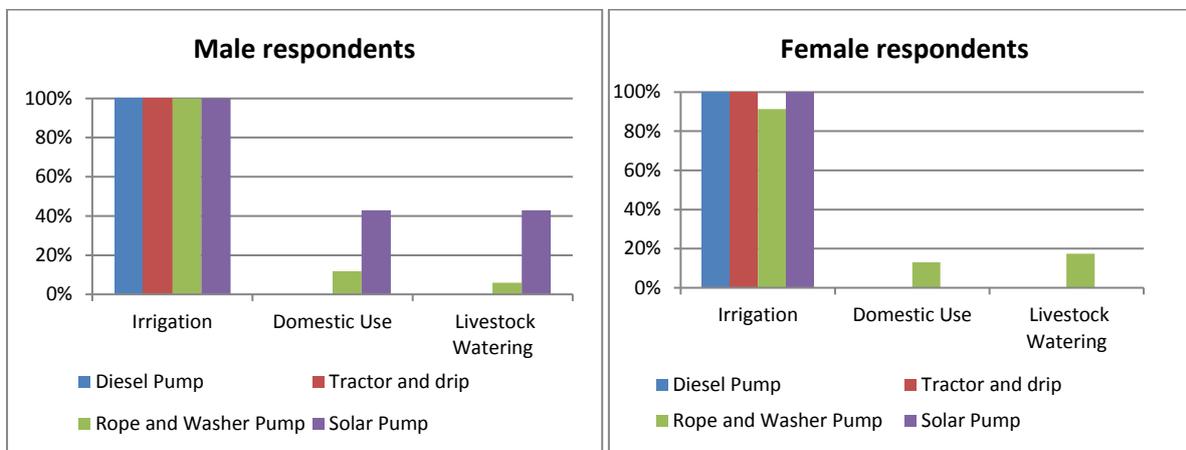


Figure 7b: Percentage of men and women respondents, indicating men's use of water

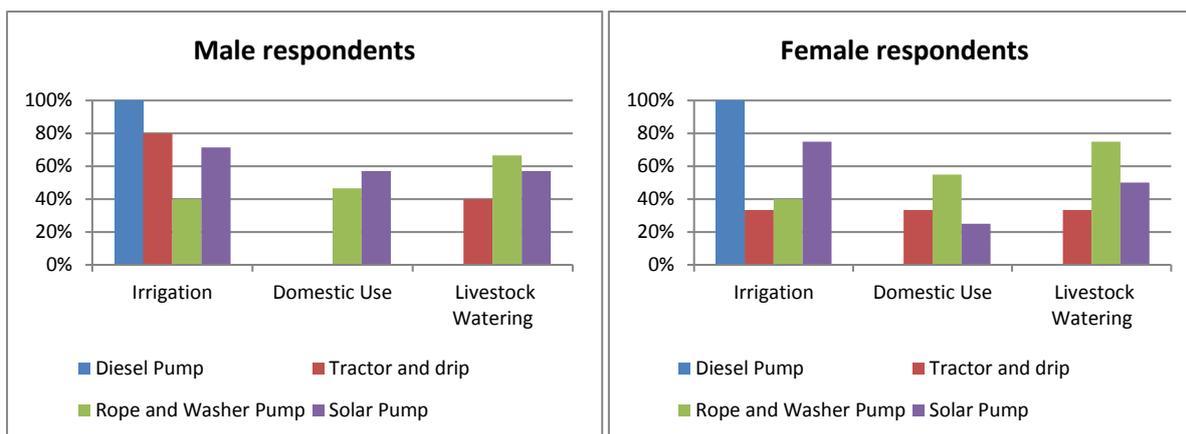


Figure 7c: Percentage of men and women respondents, indicating children's use of water

As shown in the three figures above, in most of the cases, men use water from these technologies for irrigation, while women and children use water from these technologies (except diesel pump) for multiple purposes. Men and women diesel pump users indicated that men, women and children all use the technology for irrigation. Men use water from tractor and drip, rope and washer and solar pumps only for irrigation, while children and women use it for livestock watering and domestic use.

Men and women technology users therefore indicated different benefits these technologies. The respondents' perceived benefits are represented below in figure 8.

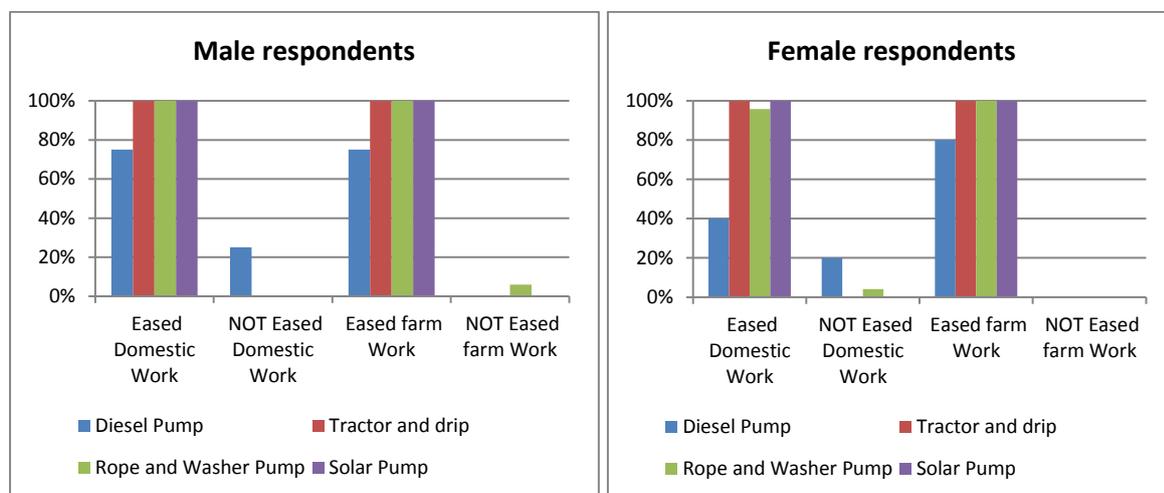


Figure 8: Percentage of men and women respondents, indicating whether using technology eased their work

Proximity of the technology, irrigated plots and home are important determinants in the purpose of the technology and the ways in which it may ease labor. Africa RISING installed technologies at the household for use on household plots and nearby gardens. Therefore, for majority of the respondents, the technology eased both domestic and farm work, because the technologies are simultaneously used for irrigation and domestic work. However, some diesel pump users indicated the pump does not ease their work, as they have to carry the pump from home to the plot for each use. Figure 9 below shows the time required to walk to the plot from the water lifting technology. Respondents using rope and washer, solar pumps and tractor with drip indicated irrigated plots are located in their compound or close by the water lifting technologies. In contrast, half of the diesel pump users indicated that irrigable plots are located a 20 minute walk from their homes, which can add to time and labor required for irrigating.

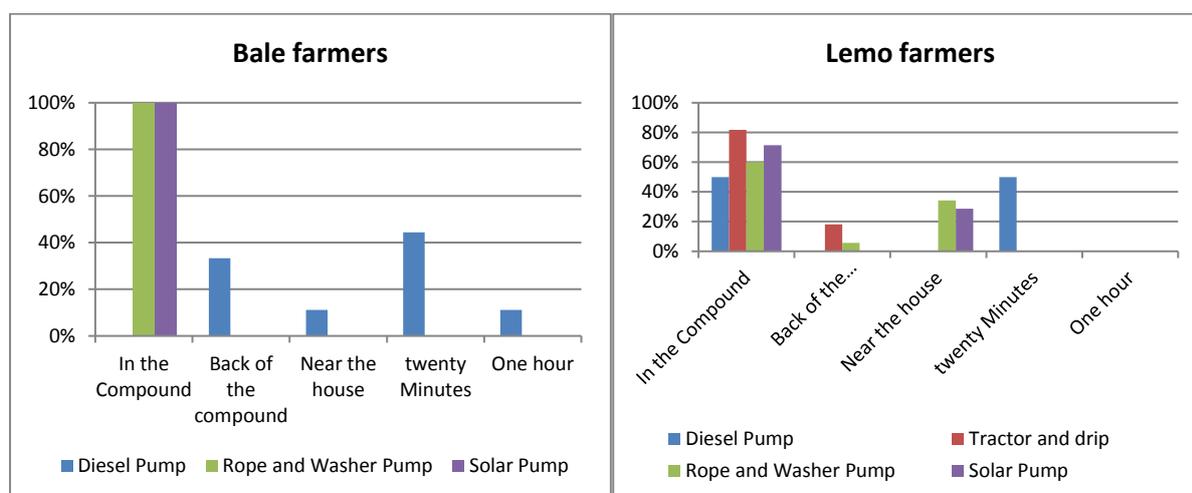


Figure 9: Percent of respondents, indicating the duration needed to travel from home to plots, per site

Frequency of water lifting technology use (season, week, day)

The study also assessed frequency of use water of the technologies: per season, per week and per day. The results are reported below.

As shown in Figure 10, diesel pumps and tractor and drip users reported use only in dry season, while other technology users reported use in dry and rainy seasons. In Bale, half of the rope and washer pump users use water from the technology only in dry season. This could be because of the availability of tap water and rainwater for domestic purposes and livestock watering in the rainy season. Information on solar pump across seasons was not collected, as the solar pumps were installed recently. However, in rainy season solar pump functionality might be constrained by solar intensity.

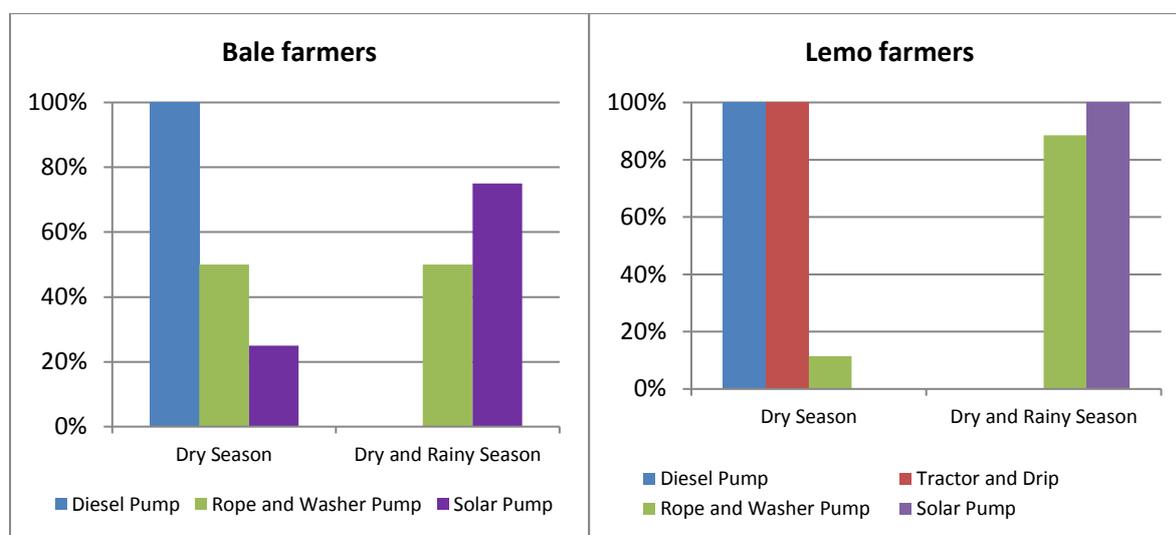


Figure 10: Percentage of men and women respondents, indicating seasons the technologies are used

The purpose for water use, the season and crop type influences the number of times water is lifted for use per week and day. Figures 11a and 11b show average frequencies per week and average duration per day across seasons and uses.

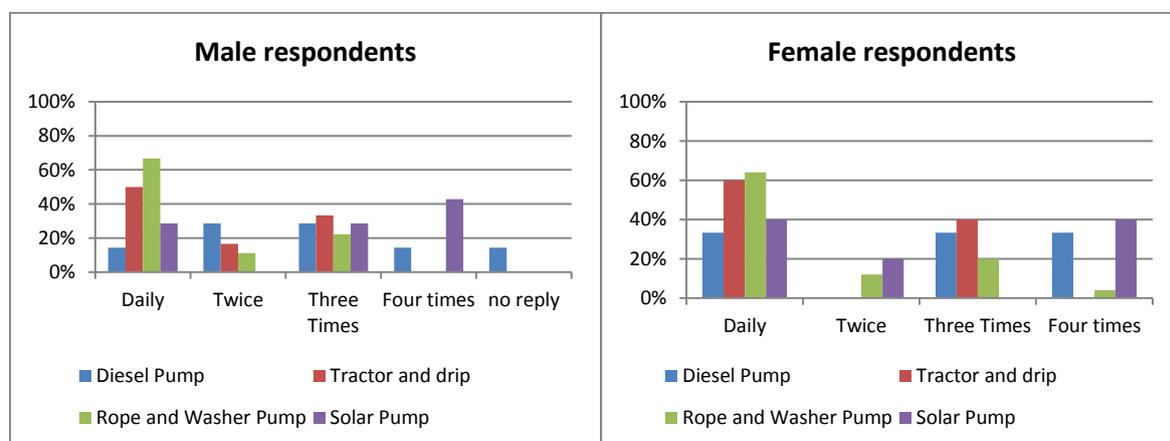


Figure 11a: Percentage of men and women respondents, indicating the number of times technologies are used to lift water per week

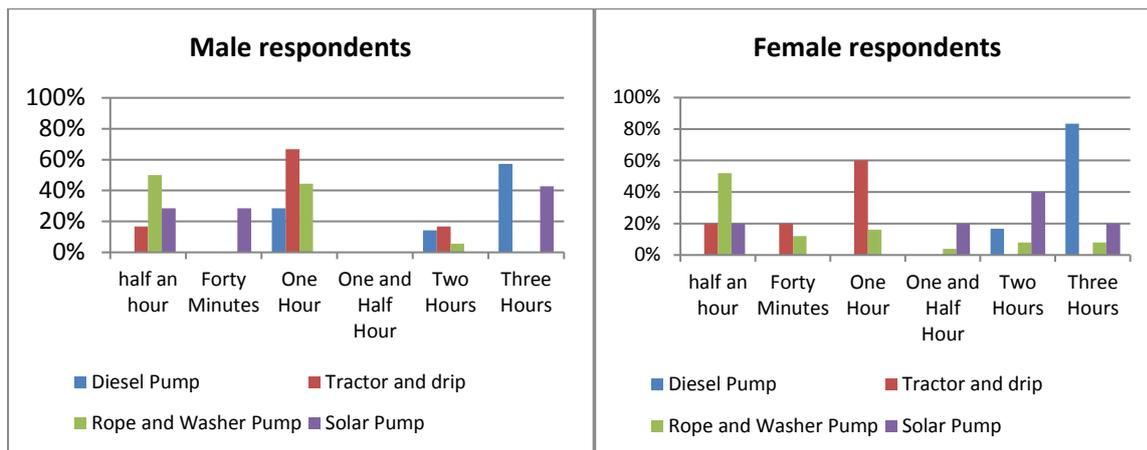


Figure 11b: Percentage of men and women respondents, indicating the number of times technologies are used to lift water per day

Access to resources

Access to resources such as land, credit, other inputs and information contributes to the likelihood of water lifting technologies improving the livelihoods farmers. The study found that male spouses of the household dominate access to resources, as indicated by men and women respondents, as seen in Figure 12. A higher number of respondents noted equal or shared access to technology, which could relate to the project targeting women for technology use and installing technologies in the home area so women would have access for domestic uses. Interestingly, female and male respondents' perceptions differed on access of female to resources and on joint access within the household. Women respondents perceived higher access to resources for women than the men respondents, but also, women perceived more joint access for technology and land; this suggests that women perceive their own access to be higher than men perceive it to be. Both women and men perceive men to have greater access to information, despite aims by the project to target women.

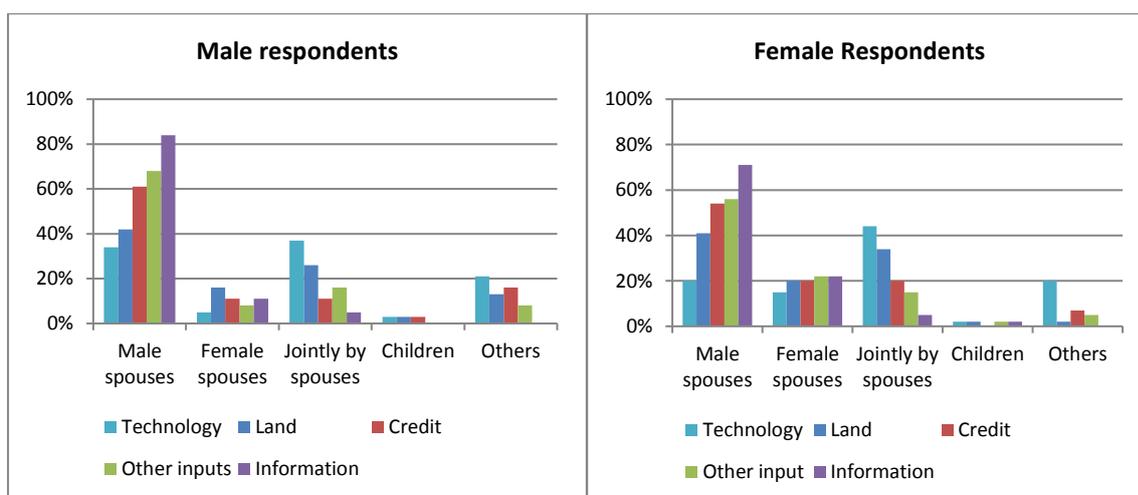


Figure 12: Percent of male and female respondents, indicating who has access to resources

Toward an understanding of the relationship between type of technology and access to resources by men and women, Figures 13a to 13d provide a breakdown on perceived access to resources by technology type.

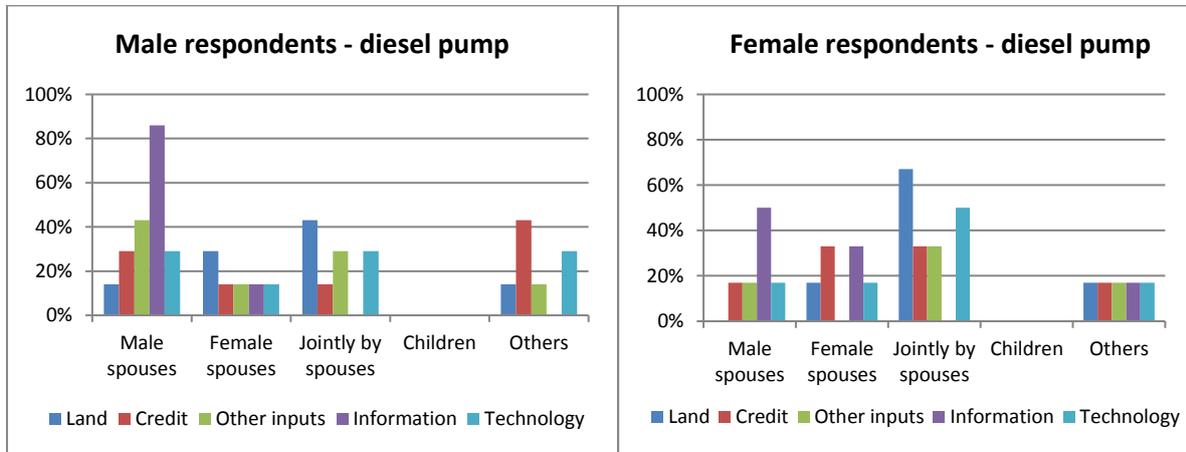


Figure 13a: Percent of male and female respondents using diesel pump, indicating access to resources

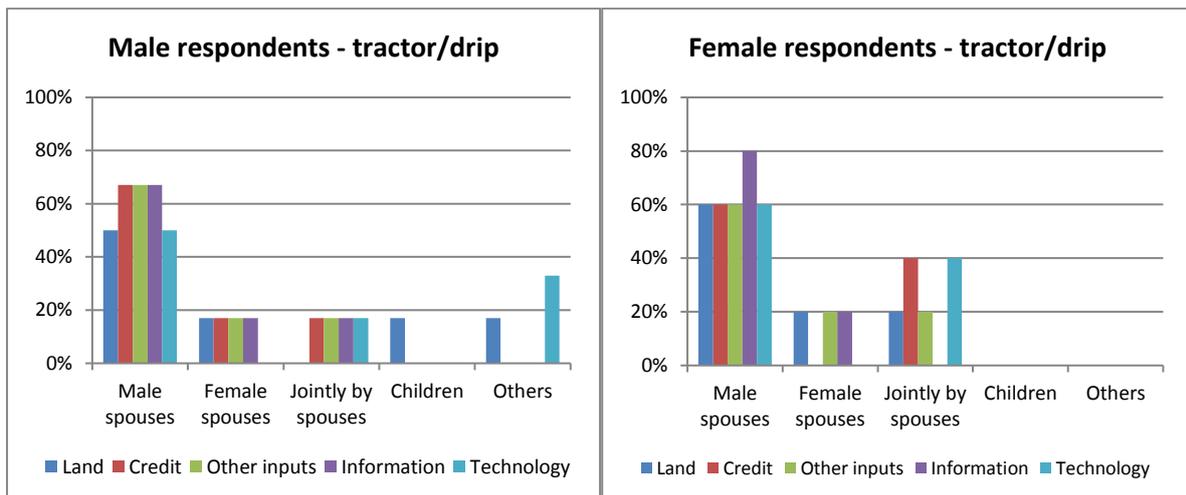


Figure 13b: Percent of male and female respondents using tractor and drip, indicating access to resources

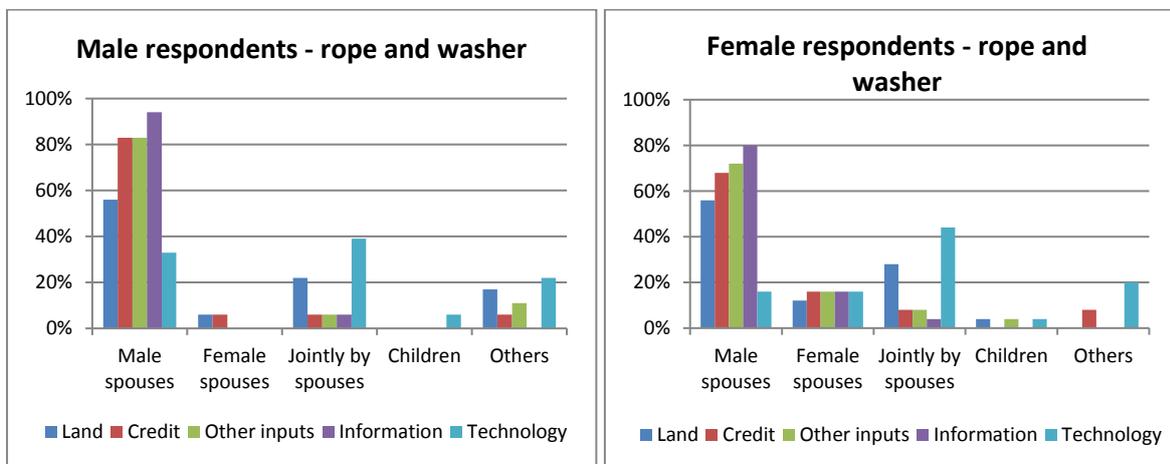


Figure 13c: Percent of male and female respondents using rope and washer pump, indicating access to resources

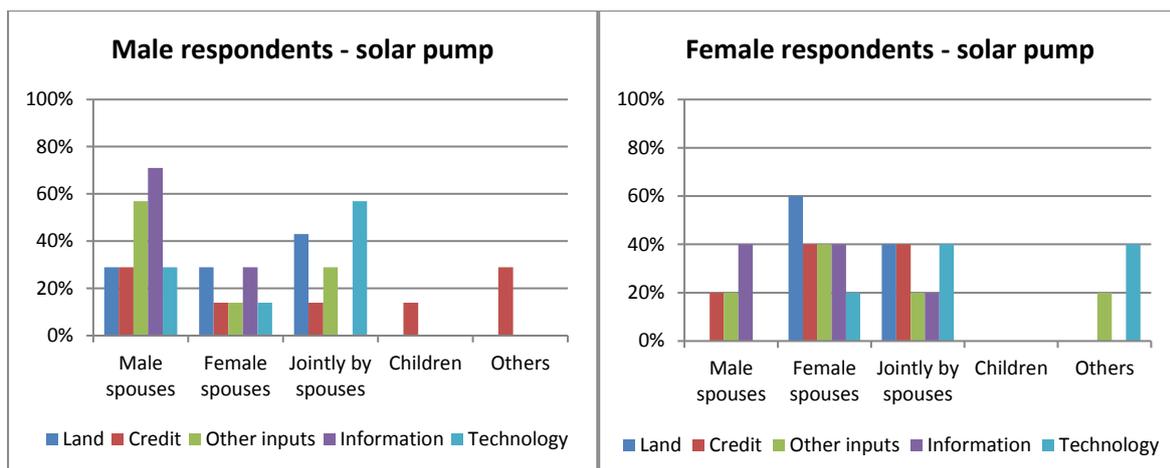


Figure 13d: Percent of male and female respondents using solar pump, indicating access to resources

Africa RISING targeted women in the provision of rope and washer, solar and tractor and drip, along with inputs and support services, yet women and men diesel pump users perceived lower domination of men in access to resources than for most of the Africa RISING supplied technologies. Women diesel pump users do not perceive male access to be as high as male respondents, though women do perceive men as having more access to information than women. Women diesel pump users also perceive their access to credit to be higher than men.

For tractor and drip users, men and women respondents saw relatively higher access for men to resources than for women. Again, women perceive joint access differently than men, stating higher joint access to credit and technology. Women tractor and drip users also believed men had far greater access to information.

Men and women rope and washer users see more joint access to this technology, and a bit less access domination by men than other technologies. This technology is fixed at the homestead and used for domestic purposes, but men and women still do not perceive women as having equal access to that or other resources. Notably, both women and men see that men have much greater access to information.

Solar pump users perceived the most equitability in resource access and more joint access to resources. Information access for women users of solar pumps was notably higher than other technologies, though respondents still perceive men to have greater access to information.

All respondents noted higher access to information for men. Information sources noted by respondents are seen in Figure 14. The sources of information about irrigation mentioned by respondents including the local agriculture office, the Africa RISING project, Farmers' Training Centers (FTC), and kebele meetings. According to all respondents except diesel pump users, Africa RISING is the major source of information for irrigation, followed by kebele agriculture offices.

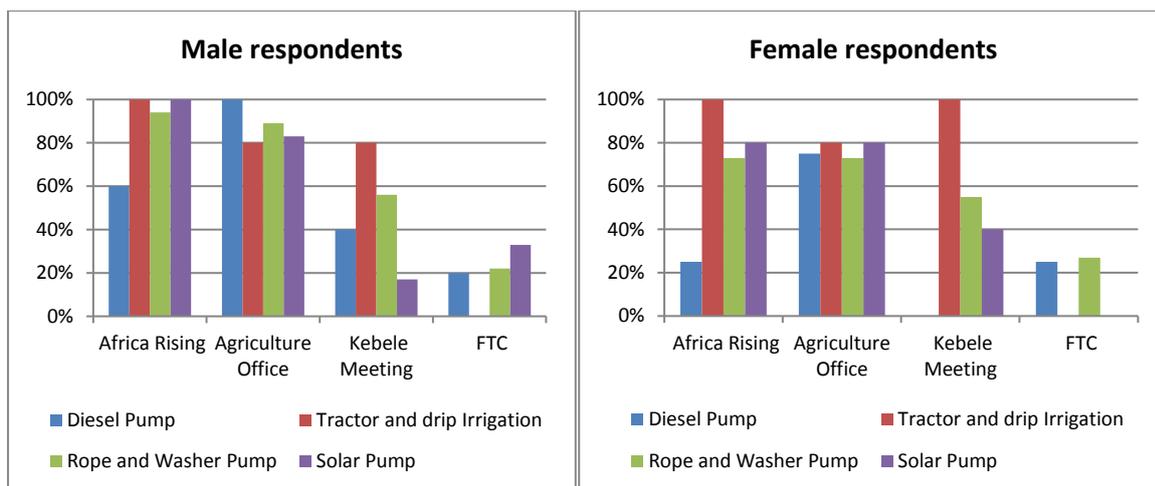


Figure 14: Percent of male and female respondents using technologies, indicating source of information on technology and irrigation

Regarding the constraints to access to information for women, as in Figure 15, the main factors were mentioned as: male dominance, cultural influence, women not being invited to meetings, and women’s domestic work load. Cultural factors, male dominance and lack of invitation to meetings may all be inter-related. Responses also varied across technologies, with male solar pump users seemingly having the highest awareness of potential factors that would affect lower access to information for women. Men and women respondents both recognized cultural influence as an important factor for lower access to information for women, though men saw women’s domestic workload as more important than women in terms of accessing information. Interestingly, diesel pump women and men users perceived domestic workload as a constraint to women accessing information; diesel pumps are used less for domestic water lifting than the other technologies and women may be spending more time fetching water. Also noteworthy, few respondents felt there were no problems with women’s access to information.

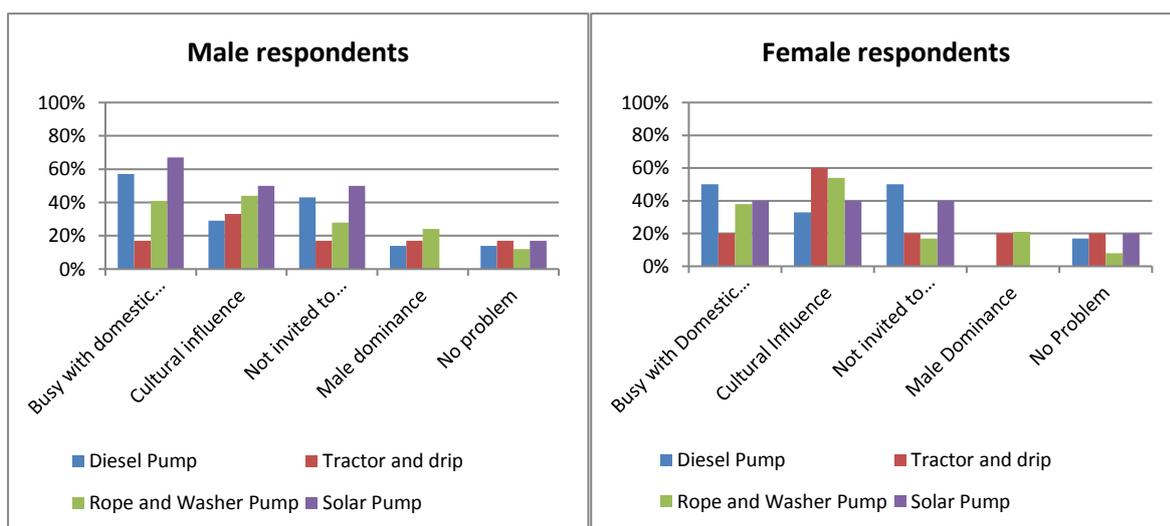


Figure 15: Percent of male and female respondents using technologies, indicating constraints for women to access to information

The study also looked into barriers for youth to access information on technology and irrigation, as respondents reported limited access to information about irrigated farming for youth, in Figure 16.

Respondents noted that youth are in school or helping with livestock domestic work, which leaves them little or no time to spend to access information.

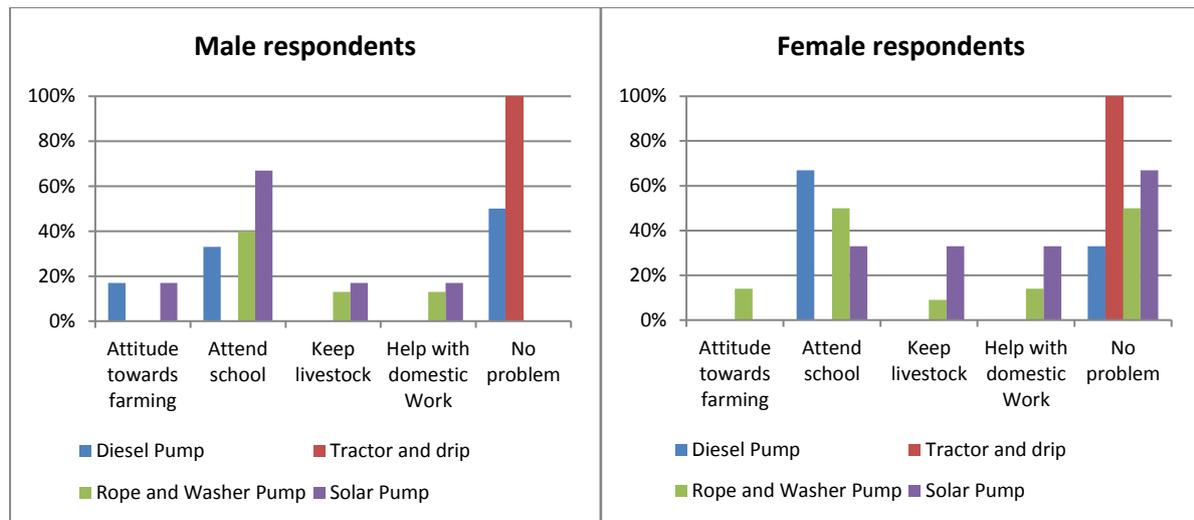


Figure 16: Percent of male and female respondents using technologies, indicating constraints for youth to access to information

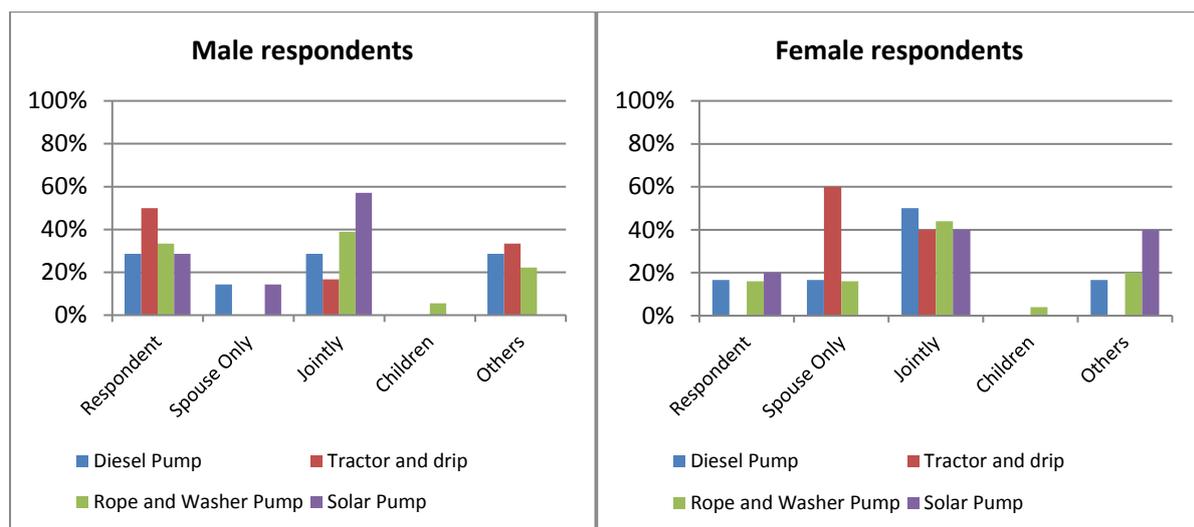


Figure 17: Percent of male and female respondents using technologies, indicating who has access to technology

When technology is explored independent of other resources, the trends in access to technologies becomes clearer. Women respondents perceive mostly joint access across the technologies, with low access for women and high access to tractor and drip for men. Men respondents see men as having more access to the technologies than the women, with joint access mostly for rope and washer and solar pump. Men may be perceived to have more access to tractor and drip irrigation technology because of the roles of women and men. Men are responsible to fill the tank and in most cases irrigate the plots, while women and children primarily fetch water from rivers and ponds to fill the tanks, and not actual use the technology. Roles for use of the technology may influence understanding of access to a technology, particularly if the role is supporting and not directly in irrigating or water lifting for domestic uses.

Control over technologies and participation in decision-making

Control over technology in this context is the ability to make decisions regarding use of technology. This differs from access to use a technology. Decision-making related to specifically who decides, and therefore who controls, the user, the timing, and the purpose for a technology. Figure 18, shows responses of male and female technology users on who has control over the water lifting technology.

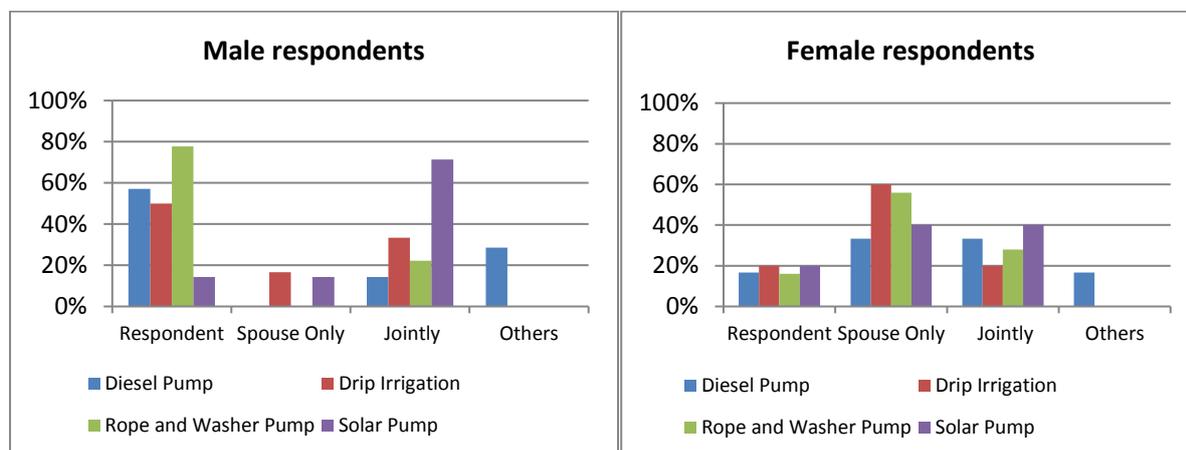


Figure 18: Percent of male and female respondents using technologies, indicating who has control over technology

The majority male and female respondents indicated men have more control over technologies, except in the case of solar pumps. Men and women perceive more joint decision-making for solar pumps, though about 70% of men and only 40% of women say decisions are jointly made. Notably, men perceive their control over technologies to be greater than how it is perceived by women. Higher control by men could be related to higher access to other resources, particularly information, but may also relate to roles and uses. For example, more than 50% of male respondents and 33% of female respondents indicated men have better control over diesel pump technology, which is used primarily by men on distant plots for irrigating and less by women on backyard gardens or domestic uses. Pump owners are noted to control diesel pump technology in rental arrangement.

One way to understand control in terms of purpose of the technology is to explore if control changes by season. Farmers do not use technologies or use them very little for supplemental irrigation in the rainy season. Accordingly, the survey asked if control over technology changes across seasons. As shown in Figure 19a, the majority of the respondents indicated the person that controls the technology does not change across seasons. Men respondents (33% of tractor and drip irrigation technology users, 11% of rope and washer pump users and 14% of solar pump users) indicated minor change across the seasons. Among the women, only 8% of the rope and washer pump users indicated that the person that controls the technology varies across the seasons.

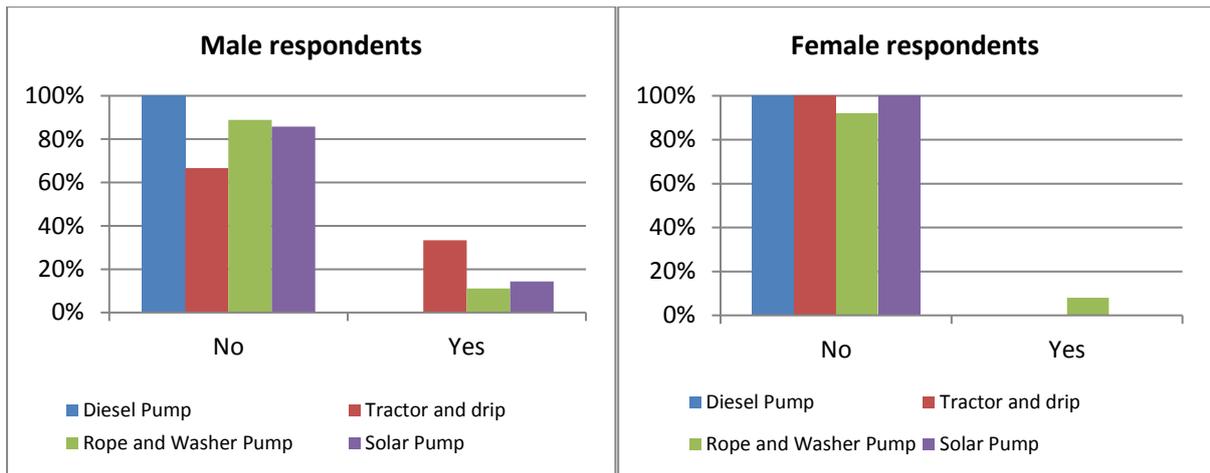


Figure 19a: Percent of male and female technology users, indicating if there is a change in who controls technology across seasons

The study then explored who makes decisions specifically on use of water and supplementary irrigation in rainy and dry seasons. Survey respondents indicated decisions are largely made by spouses jointly, as seen in Figure 19b. However, in the case of diesel pumps, half of the men reported women make such decisions in rainy season, when farmers generally do not use diesel pumps to irrigate and women may decide on other uses for the pump. For tractor and drip irrigation users, decisions are made by men in the dry season for drip irrigation, and may be used for domestic purposes in the rainy season.

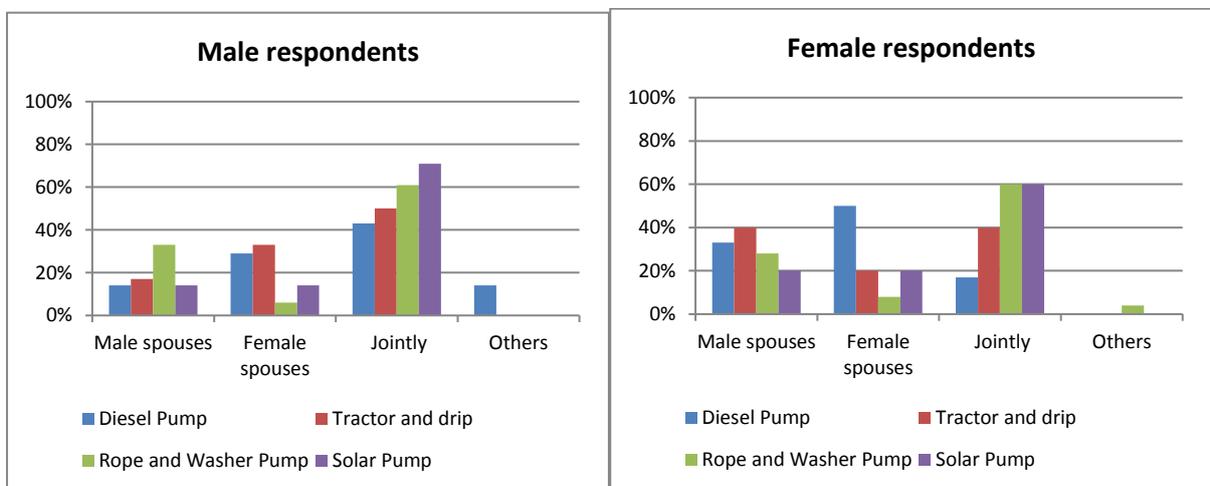


Figure 19b: Percent of male and female technology users, indicating who makes decision regarding water lifting technology in rainy season

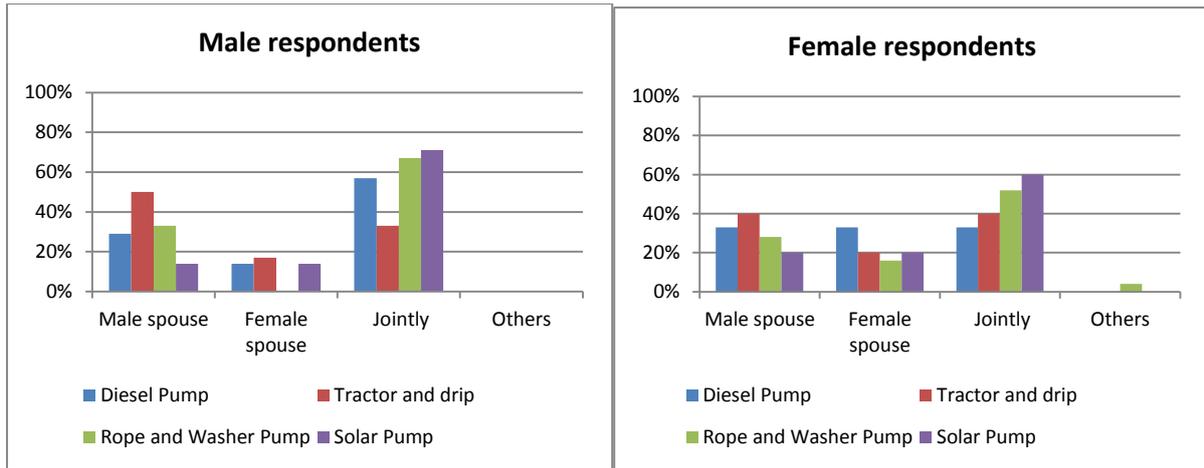


Figure 19c: Percent of male and female technology users, indicating who makes decision regarding water lifting technology in dry season

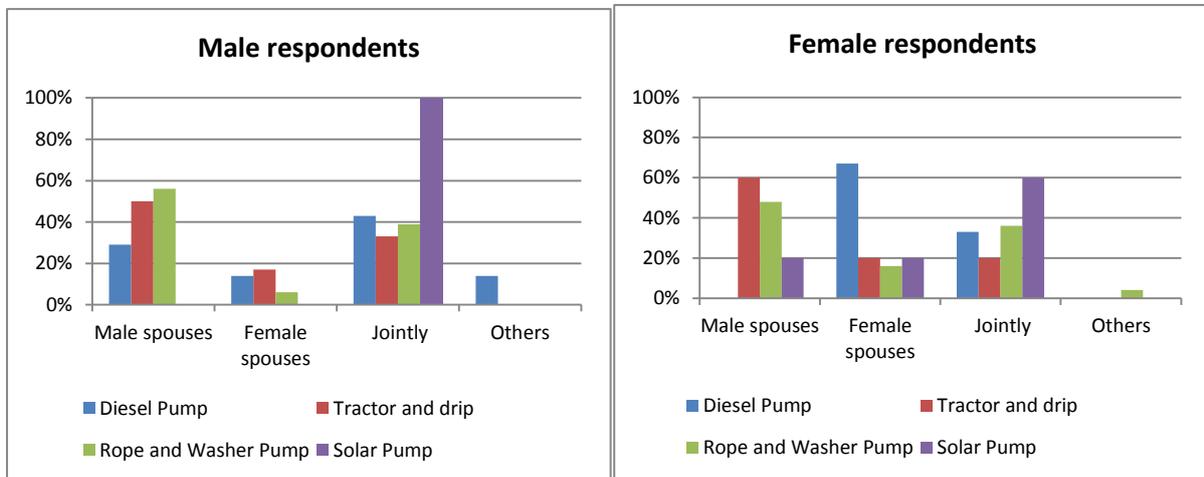


Figure 19d: Percent of male and female technology users, indicating who makes decision regarding supplementary irrigation in rainy season

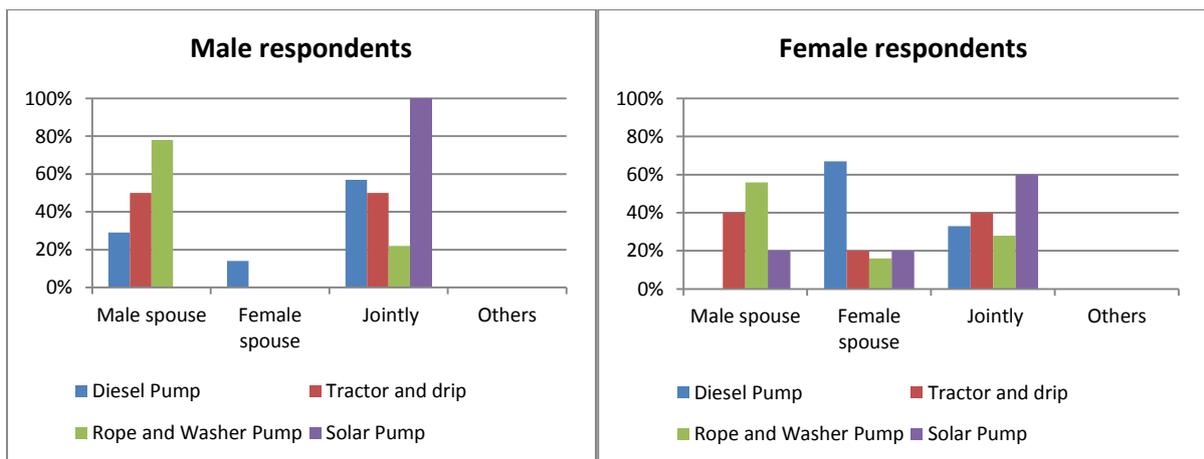


Figure 19e: Percent of male and female technology users, indicating who makes decision regarding supplementary irrigation in dry season

The responses regarding control over technology across seasons shows some difference between men and women about decisions on technologies within the household across seasons. Women's

perceptions about control varies little across seasons, consistently seeing men as having more control or joint control. However, men perceived more of a shift in control over the technologies and viewed women as having moderately more control in the rainy season than in the dry season. This could suggest that women perceive control differently, that control does not actually change much across seasons, or change in control is imperceptible to women in how it is expressed within the household.

Decisions over income are another reflection of control in terms of benefits from a technology. The study asked respondents whether using the technology increased their ability to make decisions over the income earned from the technology. Most of the men and women technology users replied that the introduction of the technology improved their decision-making capability over income earned, though it varied by technology. More women perceived an increase in control over income than men for tractor with drip and rope and washer, but half of the women that use diesel pump did not perceive any change in their participation in decision-making on the income. Interestingly, farmers use diesel pumps only to irrigate main plots for cash crops, whereas respondents use the other technologies around the home where women have better access. This does not indicate who in the household has control, but perceptions that the user of the technology has more control over income since the technology was introduced. It is also worth noting that men likely had control over income from rainfed crops prior to the introduction of the water lifting technology.

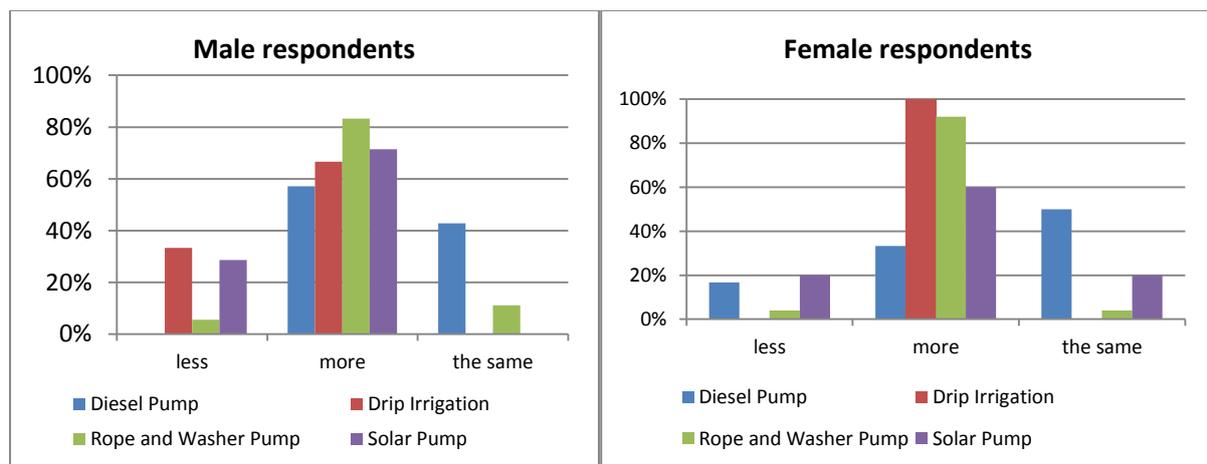


Figure 20: Percent of male and female technology users, indicating changes in control over income using technologies

The study sought to understand control over income earned through the water lifting technologies with questions regarding how money is used and who makes decisions for each use. Categories of expenditure included health care, major household purchases, daily household purchases and food purchases. As seen in Figure 21a, respondents indicated that men make most decisions requiring relatively larger expenditure, whereas women make more decisions requiring relatively less investment, such as daily household and food purchases. Men perceived more joint decision-making on expenditures than women did.

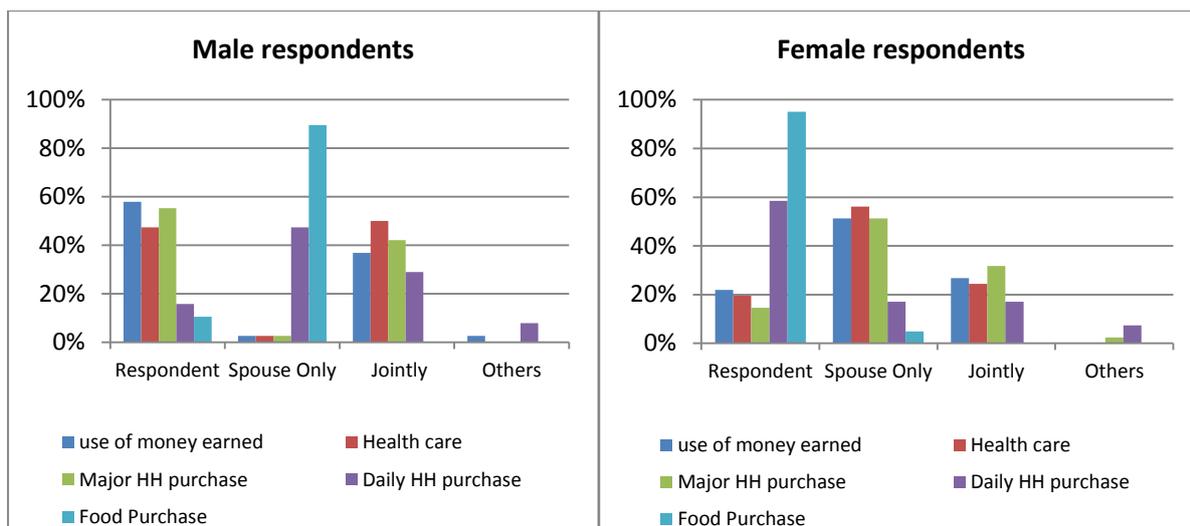


Figure 21a: Percent of male and female technology users, indicating who makes decision on various expenses at household level

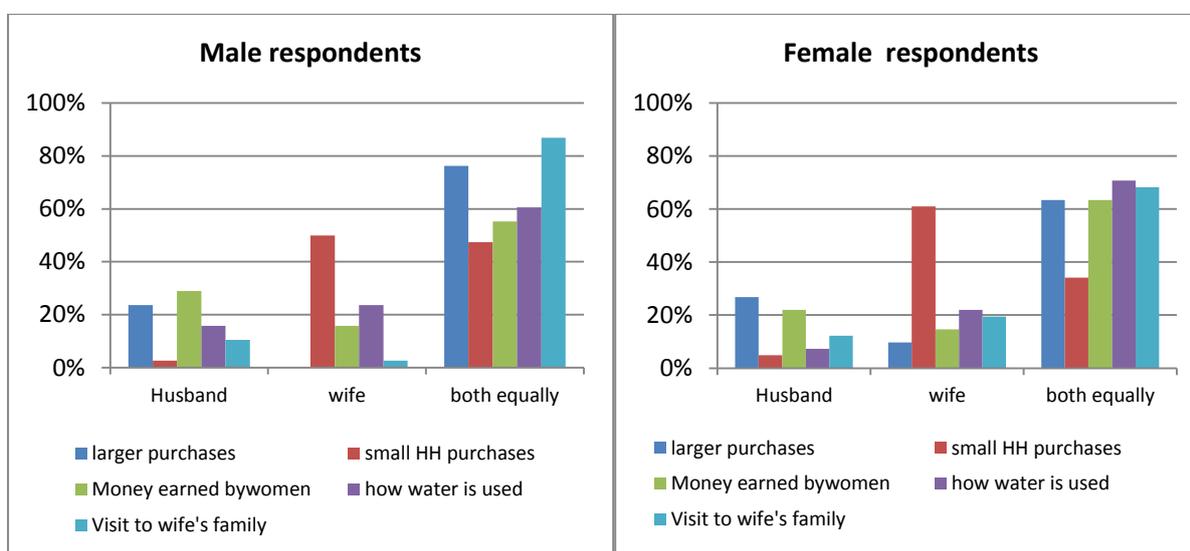


Figure 21b: Percent of male and female technology users, indicating who they prefer to make decisions on various aspects at household level

The study then asked respondents about their preference for decisions related to the following: larger purchases, money earned by women, visit to wife's family, small purchases and water use. According to the responses, shown in 21b, the only decision area where women are the preferred decision-makers is on small household purchases. Some men and women indicated they prefer husbands to take the lead regarding decisions on large purchases and on expenditure of income earned by women, but in both cases that represented roughly around 20-30% of men and women respondents. With the exception of small household purchases, most respondents claimed to prefer joint decision-making.

Benefits of using the technology

Africa RISING sought to improve livelihoods of farmers through introducing dry season, irrigated production of fruits and vegetables. The study therefore looked at perceptions of men and women

farmers on the benefits of using water lifting technologies. As shown in Figure 22, respondents indicated the benefits include: double cropping, increased income, easy access to water for domestic use and livestock watering, easing the work burden of women and children, saving time and labor, improved social status and others.

The majority of men and all women respondents mentioned increased production through double cropping as a benefit. Men and women tractor and drip irrigation technology users and solar pump users indicated that the technology saves time and can be used for other purposes. Additionally, most respondents using rope and washer pump and solar pump technologies mentioned that the technologies eased their domestic work (for cooking, washing, bathing and others) and livestock watering, as it saves them labor and time required to bring water from other sources. A few respondents that use solar pump, rope and washer pump and tractor and drip irrigation indicated that the technologies provided access to improved drinking water, particularly respondents from Lemo that previously used unprotected water sources.

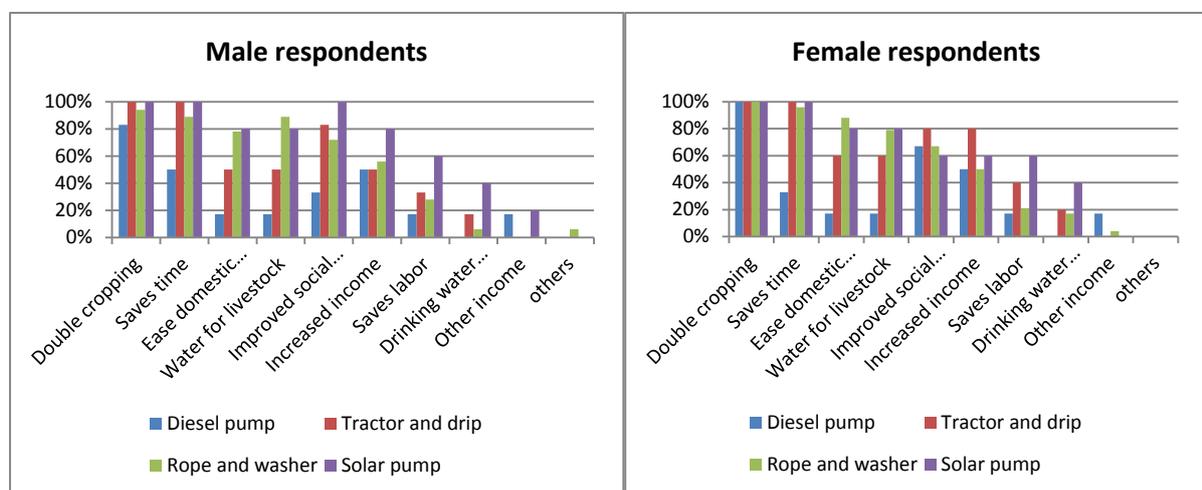


Figure 22: Percent of male and female technology users, indicating benefits of using technologies

Some technologies provide opportunity for cash income not directly earned from produce. Solar pump users indicated the technology enables income from small fees collected for charging mobile phone batteries. Diesel pump owners indicated they get income from renting out the pump to others.

Respondents then ranked the top three ranked benefits, shown in Figure 23 and Table 2. The top ranked benefit varies primary by technology and less so across women and men farmers. Men and women respondents across all technologies ranked double cropping as the top benefit.

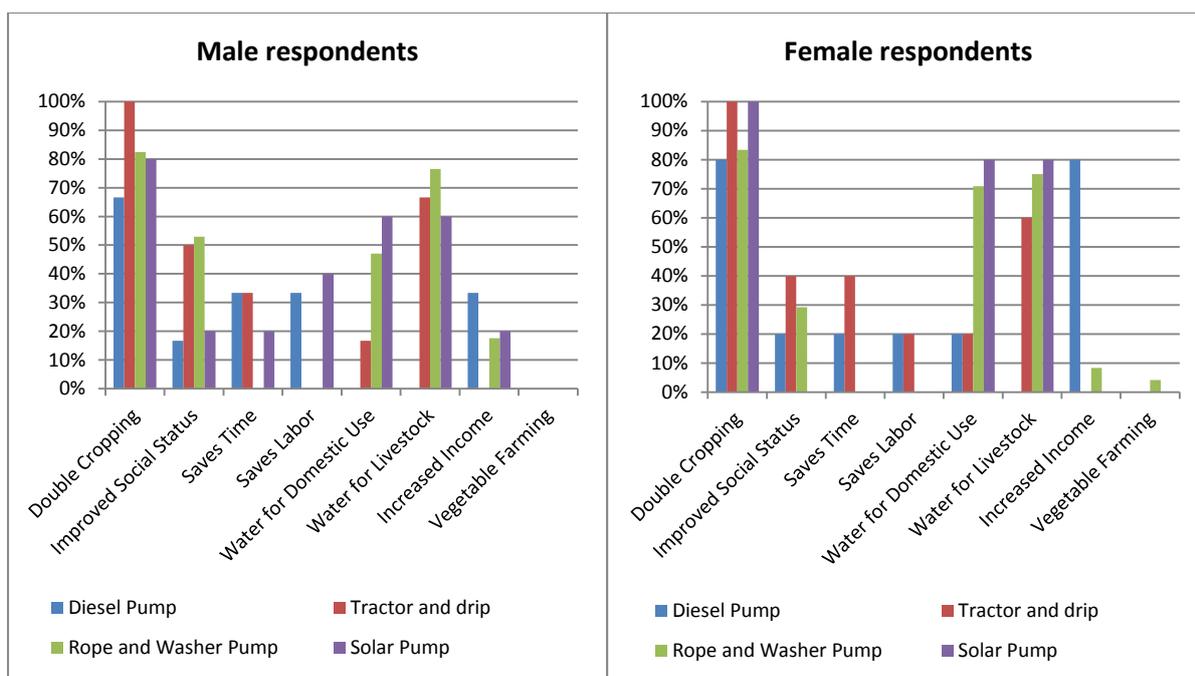


Figure 23: Percent of male and female technology users, indicating top three benefits of using technologies

Table 2. Ranking of benefit by technology according to male and female technology users

Technology and sex	Ranking of benefit ⁵		
	1	2	3
Diesel pump – men	Double cropping	Time/Labor/Increased income	Social status
Diesel pump – women	Double cropping/Increased income	Social status/Time/Labor/Domestic	-
Tractor and drip – men	Double cropping	Livestock	Social status
Tractor and drip – women	Double cropping	Livestock	Social status/Time
Rope and Washer - men	Double cropping	Livestock	Social status
Rope and Washer - women	Double cropping	Livestock	Domestic
Solar pump - men	Double cropping	Domestic/Livestock	Labor
Solar pump - women	Double cropping	Domestic/Livestock	-

Time saving and reduced labor did not feature as the primary benefit, but the project sought to further understand possible impact of the technologies on labor and time. Figure 23 shows impacts of technologies on work according to men and women farmers. Women respondents noted improvement in workload related to water for multiple purposes, increased work efficiency, and

⁵ In some cases, perceived benefits had equal numbers for ranks and are depicted as 'tied' for that rank.

time saving. Men respondents also noted the same benefits for their workload with more emphasis on increased work efficiency.

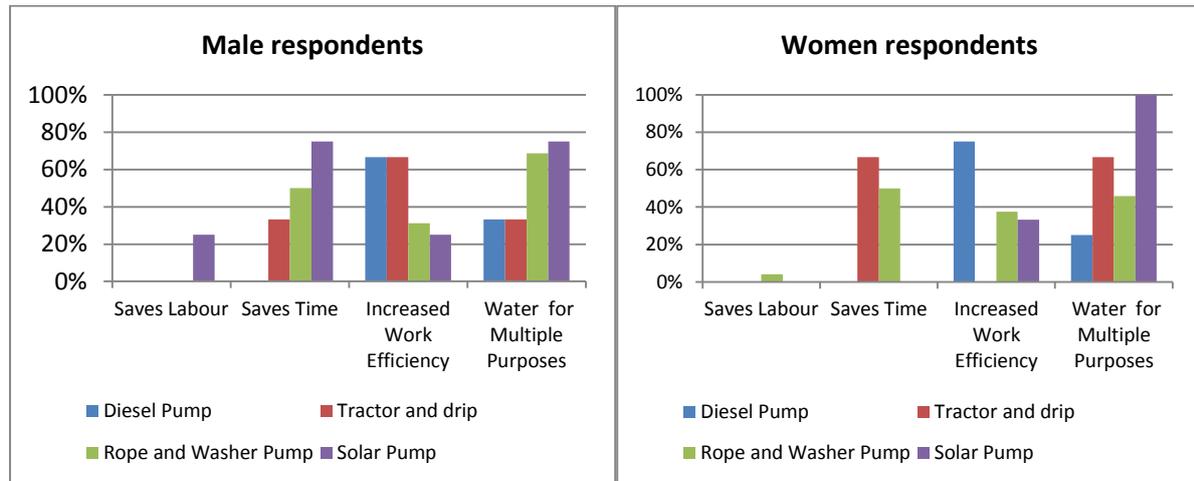


Figure 24: Percent of male and female technology users, indicating benefits of using technologies to households in relation to workload, labor and time use

All men and women respondents stated that the community benefits from the technologies through increased access to water for multiple purposes. Notably, diesel pump users indicated the community benefits through learning, as the community views those with diesel pumps as role models.

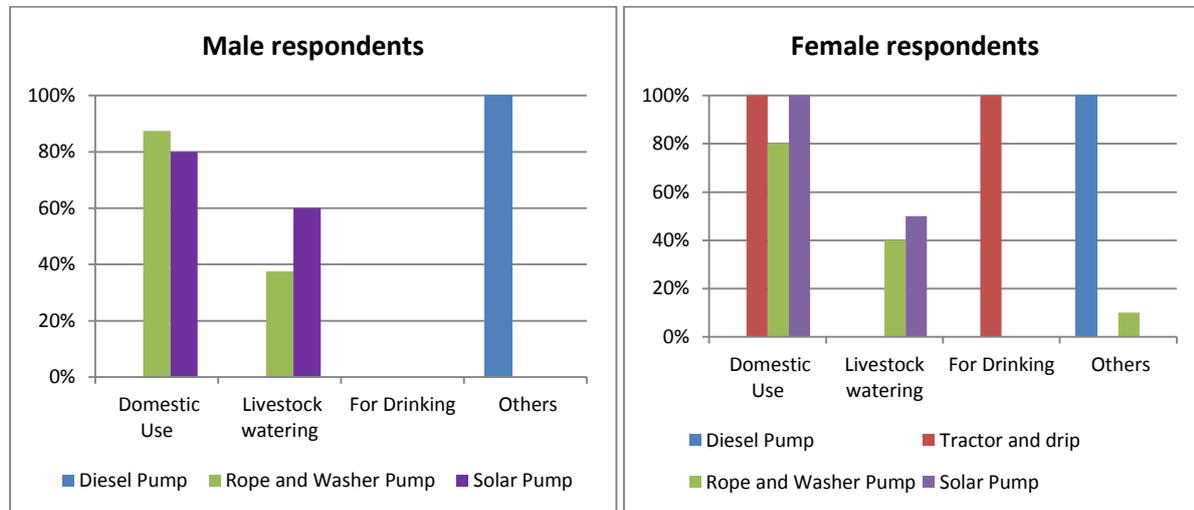


Figure 25: Percent of male and female technology users, indicating benefits of using technologies to community

The study sought to understand gender relations around the water lifting technologies, and therefore looked at perceived distribution of benefits within the household, as shown in Figure 26. Many respondents indicate joint benefit, though men see more joint benefit than women. The response also varies by technology. Most men using tractor and drip irrigation think male spouses benefit most from using the technology, as it enables irrigation that is perceived to be a man’s responsibility. Most of the women who use rope and washer pumps indicate that women benefit most from the technology, as it eases domestic work and livestock watering perceived to be a

woman's responsibility. Most of the men that use solar pump irrigation indicated men benefit through irrigation and income from charging mobile phone batteries. In sum, the perception of beneficiary appears to relate to the household gendered roles and responsibilities, and is understood to be mutually beneficial particularly by men. These trends in perception are also seen in Figure 27.

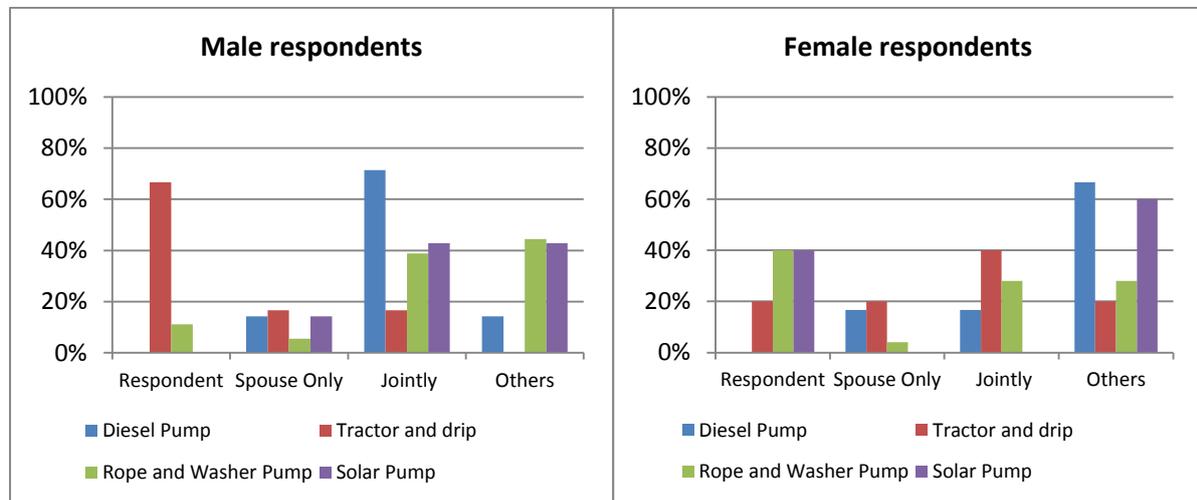


Figure 26: Percent of male and female technology users, indicating who benefits most from using technologies

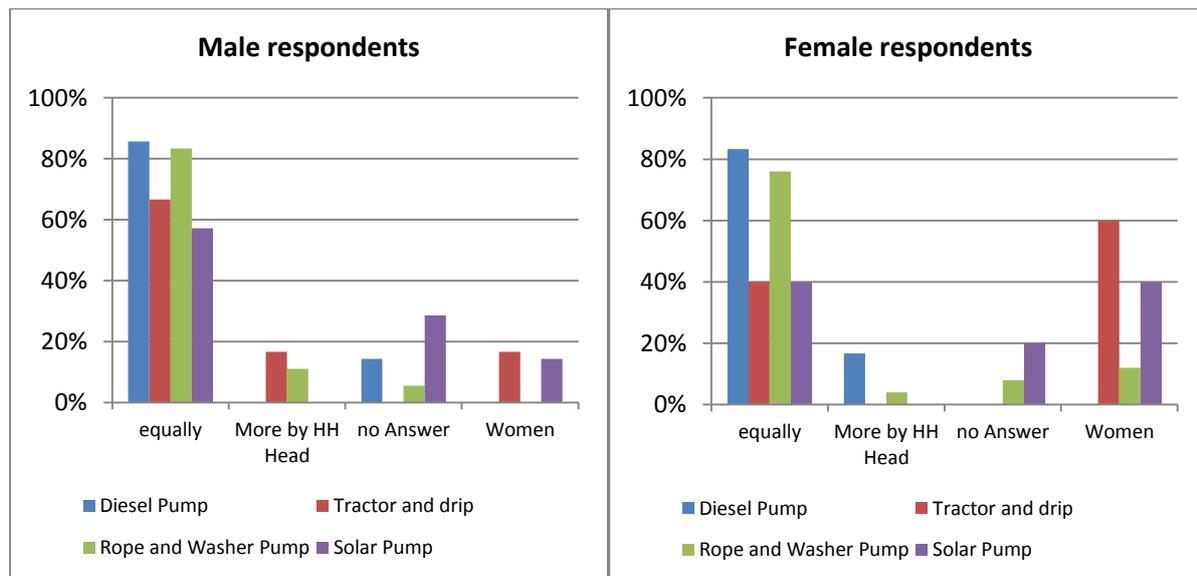


Figure 27: Percent of male and female technology users, indicating benefit sharing (mainly income) from using technology

The study deepened the analysis of benefit through breaking down the roles of men and women in marketing surplus produce. Figure 28a shows particularly the role of women in marketing irrigated produce, including carrying produce to market and collecting money, especially for produce from backyard gardens. A few diesel pump users indicated women have no role in marketing, which is not surprising as farmers use diesel pumps mainly to irrigate commercial plots and not backyard gardens.

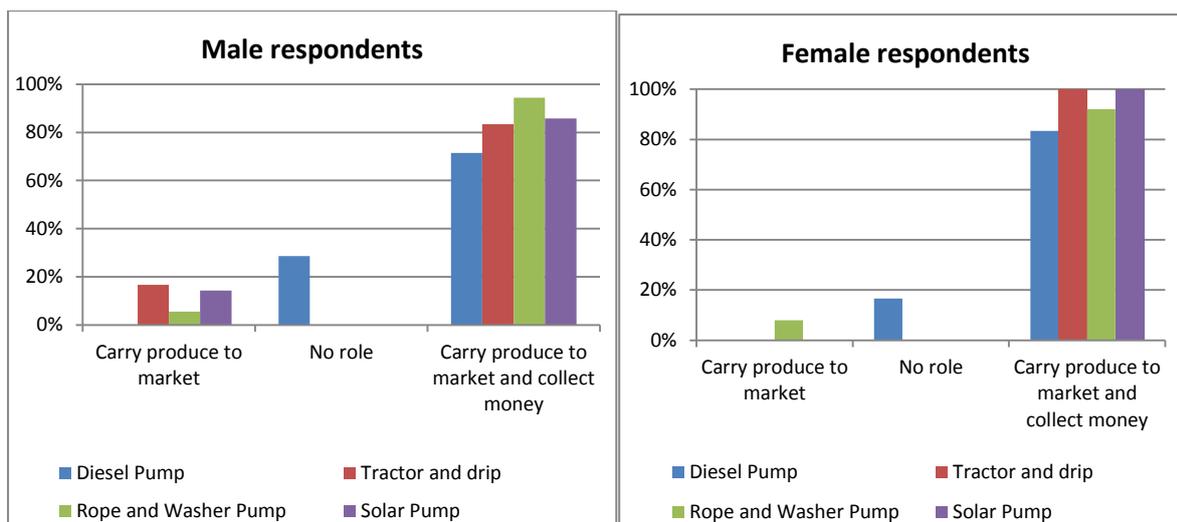


Figure 28a: Percent of male and female respondents, indicating role of women in marketing

While many respondents stated that men have no role in marketing directly, they also noted that their main roles are supporting women in marketing (e.g. men are viewed as considerate for helping carry produce to market) and fixing prices for produce and collecting cash. In other words, women carry the produce to market to sell for the prices set by men and men collect the revenue.

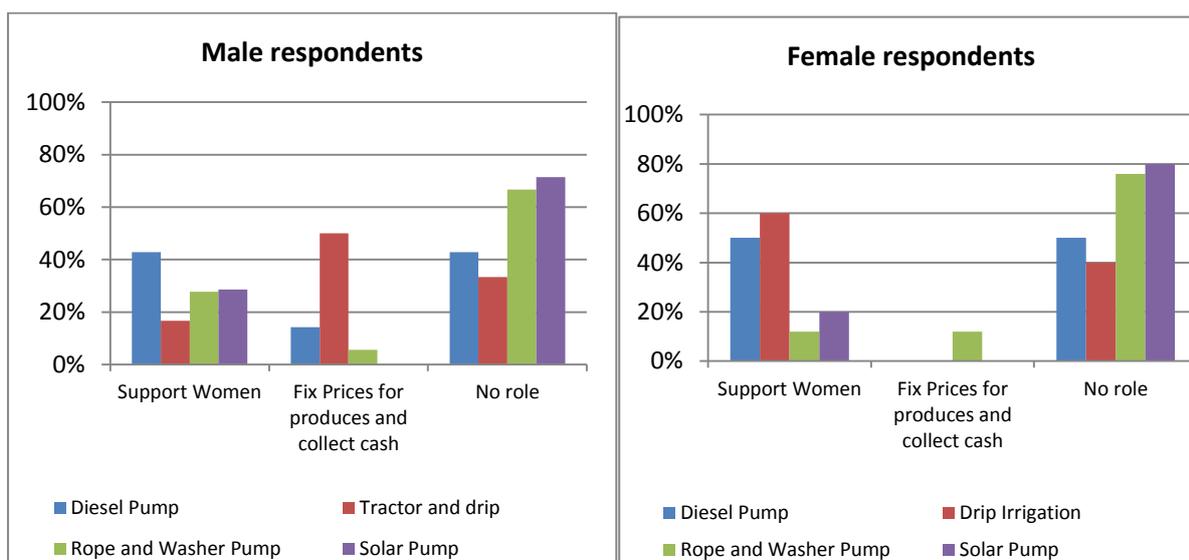


Figure 28b: Percent of male and female respondents, indicating role of men in marketing

More specifically, 43% of male diesel pump users indicated the role of men in marketing is supporting women in marketing. The majority of women (60%) agreed that the role of men in marketing is supporting women. Half of the men using tractor and drip irrigation technology specified that the role of men in marketing is fixing prices and collecting cash. Most respondents stated that men have no role in marketing: 67% of men and 76% of women rope and washer pump users, and 77% of men and 80% of women using solar pumps, and 43% of male diesel pump users. In cases where men stated no role in marketing, it is often because the technologies are used mainly for backyard cultivation. Most of the produce from these backyard gardens is consumed by the household and there is insignificant surplus produce to sell. For the most part, respondents stated that men have no role in the marketing process or in collecting the income from the sale of surplus

produce from backyard cultivation. However, follow up discussions with women suggested that men usually collect the income from produce sales.

Constraints of using technologies

Farmers also note that the water lifting technologies have some limitations, which could affect the use of these technologies and adoption by other farmers. Figure 29a shows constraints for men, women and children based on responses from users.

According to most of the male diesel pump users, the constraints of using the technology for men is that parts of the pump break easily and spare parts are not widely available in the market. For women, pumps are labor intensive and time consuming, as using the technology requires carrying the pumps from home to the plot. Additionally, the technology is expensive which makes it less accessible for women especially, who have less resources to rent or buy the diesel pumps.

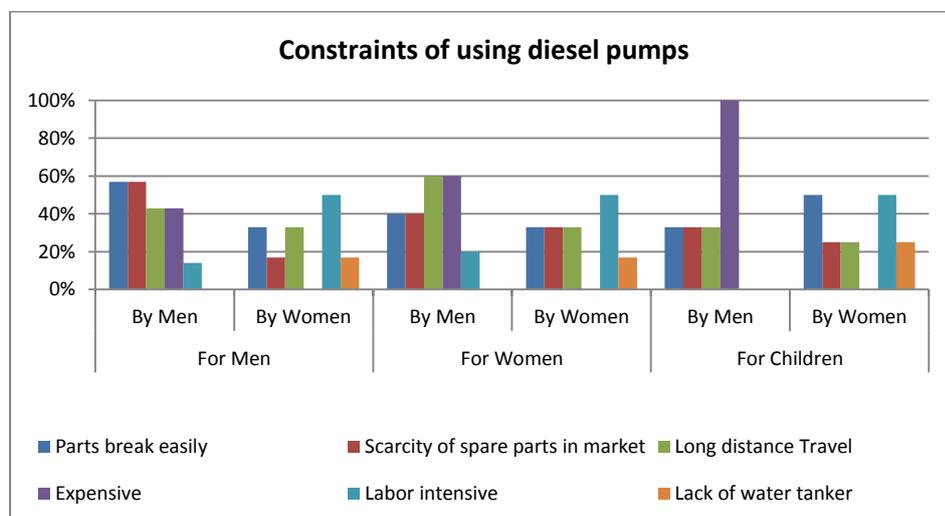


Figure 29a: Percent of male and female diesel pump users, indicating constraints of using the technology

Constraints of using tractor and drip irrigation technology for men, women and children include: labor intensiveness (main reason for all), evaporation, water scarcity and the risk of using the technology. Respondents report the technology to be dangerous to use because a farmer must use a ladder to fill water tanks mounted on a roof. Most of the women are also concerned that water scarcity is a barrier to use the technology. For men, evaporation is a limitation, while women do not consider it as a barrier.

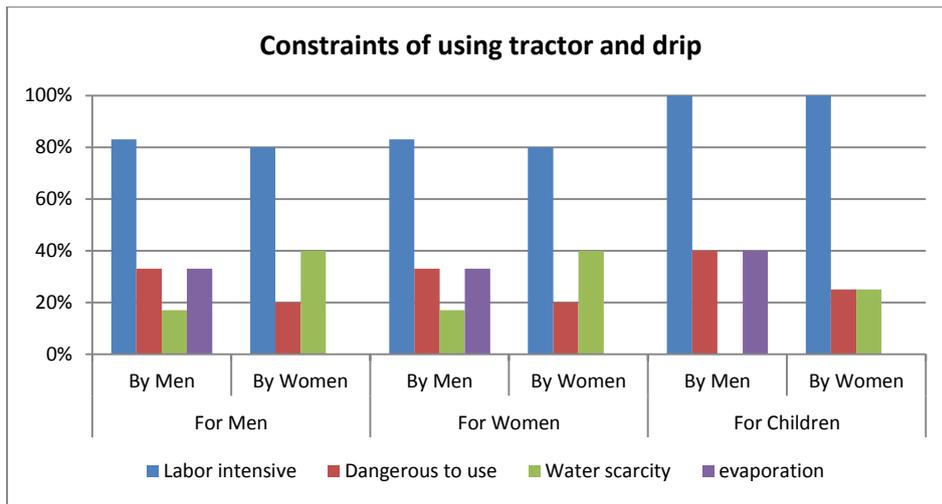


Figure 29b: Percent of male and female tractor and drip users, indicating constraints of using the technology

According to male and female rope and washer pump technology respondents, the major constraint to using the technology is that is labor intensive. The other constraints include parts that break easily, low water supply from wells, no water tank for storage and the price.

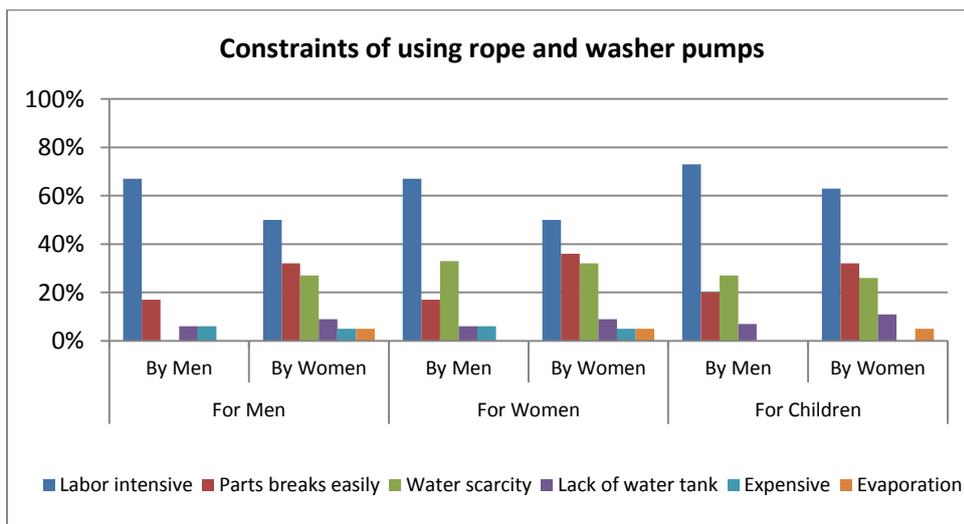


Figure 29c: Percent of male and female rope and washer pump users, indicating constraints of using the technology

For solar pump users the absence of a mechanism to store energy that would enable longer use when there is less sun is a major constraint. Half of the women and 17% of the men also think that the technology is labor intensive, because farmers who do not have hoses have to carry water with buckets to irrigate their plots. Men respondents also note the lack of water and lack of storage (tank) as constraints, though women do not.

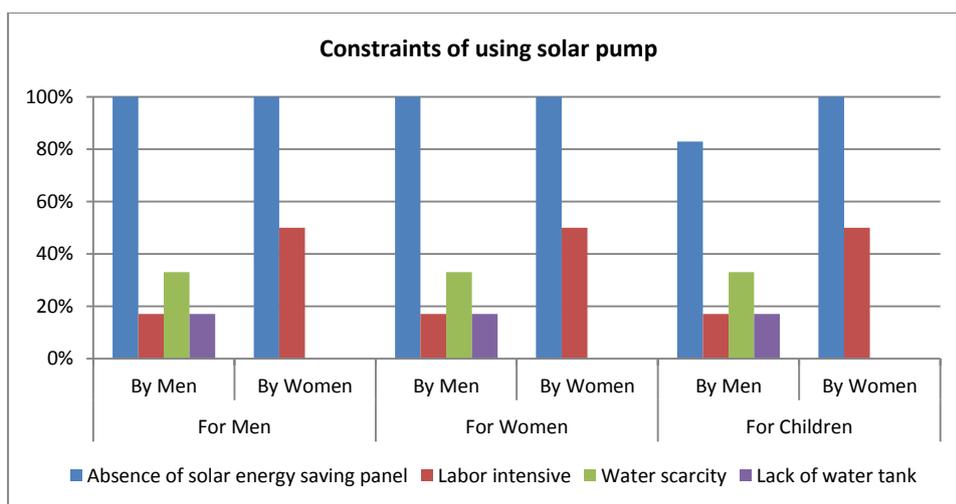


Figure 29d: Percent of male and female solar pump users, indicating constraints of using the technology

Ideas to improve the technology

The study asked users their views on how to improve technologies toward increased adoption and sustainable use. Table 3 provides a summary of responses from men and women technology users.

Table 3. Percentage of male and female technology users indicating ideas to improve technologies, per technology type

	Diesel pump technology users		Tractor and drip technology users		Rope and washer pump users		Solar pump users	
	Men	Women	Men	Women	Men	Women	Men	Women
Prefer different technology	57	83						
Prefer solar technology			33	20	6	-		
Prefer pump technology			67	60	41	29		
Add water tank	14	33	17	-	12	13		
Make more affordable	29	-			12	4		
Improve supply of parts and services	29	17			12	25		
Cover wells			33	20				
Add water conservation			17	20	24	17		
Make more labor saving					18	29	20	-
Add energy saving							60	50

The majority of diesel pump, tractor and drip irrigation and rope and washer pump (men and women users) indicated the improvement would be a different technology, particularly one that is affordable and saves more labor. Aside from that, diesel pump users and rope and washer pump

users indicate the need to improve the supply and availability of spare parts and maintenance services in the area, and adding tanks for storing water. Respondents also mentioned soil and water conservation works and well covers to improve the use of the technologies.

Preferred technologies

Most women and men respondents state that they prefer solar pump. Following solar pump, rain water harvesting is a preferred technology. Almost all tractor and drip irrigation and rope and washer users want to change technologies. Across respondents, most prefer solar pump with added energy storage.

Table 4: Number of male and female technology users indicating their preference to technology

Preferred Technology	Diesel pump users		Tractor and drip irrigation users		Rope and washer pump user		Solar pump users	
	Men	Women	Men	Women	Men	Women	Men	Women
Solar pump	75%	0%	60%	80%	88%	80%	50%	0%
Rain water harvesting technology	50%	0%	20%	20%	31%	20%	0%	0%
Does not want to change the technology	25%	33%	0%	0%	0%	5%	25%	25%
Solar energy saving technology	0%	0%	0%	0%	0%	0%	25%	50%
Drip Irrigation	0%	33%	20%	0%	6%	0%	0%	0%
No reply	0%	33%	20%	20%	6%	15%	0%	25%

Conclusion and Recommendations

The Africa RISING project provided women and men farmers with water lifting technologies, including tractor with drip, rope and washer and solar pumps in three sites in Ethiopia to support irrigation in the dry season. The project installed the technologies near the farmers' household to enable multiple uses in addition to irrigation. The farmers did not participate in larger irrigation schemes or establish user groups, but operated individual technologies on own plots. The project facilitated credit arrangements between men and women farmers and local, existing financial organizations so that each farmer would purchase and own the technology. Ultimately, the project aimed to increase income and to improve access to diverse foods produced in the dry season, and thereby improve farmer livelihoods. The project targeted women and men farmers and sought to understand the gender relations around the water lifting technologies, particularly on use, access, control and benefit.

Indeed, results of the study indicate differences in use of water and in perceptions regarding benefits, for men and women and across technology types.

4.1. Perceived gender relations around technologies

Productive and reproductive uses: Not surprisingly, men primarily use water from these technologies for irrigation, while women and children use the water also for domestic purposes and livestock watering (except diesel pump). Perceived improvement in water quality using the technologies was linked to domestic uses.

Labor: Women and men both find that the water lifting technologies ease their work, whether directly in farm roles or domestic roles. Locating the technologies near the home enables multiple uses and further reduces the workload for women and children. Improvements to work related to use of water for domestic purposes and to increased work efficiency. Time savings was noted as a benefit of rope and washer, tractor and drip, and for men only, solar pump. Diesel pump users reported the least saving in labor, notably women stated the labor required to carry pumps to more distant plots to irrigate.

Access to resources: Women and men across the technologies generally perceive women to have lower access to resources, including land, technology, credit, other inputs and information. Notably, women and men both noted that women and youth have significantly lower access to information. For the youth, respondents attributed this to youth being in school and unable to attend meetings. For women, respondents suggested that lack of access to information relates to women engaged in domestic duties, cultural barriers and not being invited to meetings. Of note, women perceived their own access to resources more positively than men saw women's access to resources. Joint access to resources was not particularly high, except for joint access to technologies that were provided under the project. Technology type did not appear to matter in terms of access to resources, though solar pump users reported more joint access across some resources.

Decision-making and control over technologies: The project attempted to understand control over actual use, in terms of who could use the technology, when and for what purpose. Men perceived men having the most control, and women agreed, but to a lesser extent. Men reported more control over technologies during the dry season when in use for irrigation, and slightly more control for women in the rainy season. And in some cases, men reported that women had control over the technology in the rainy season when it was not used at all. However, women did not perceive much difference in their control over the technologies across seasons. Respondents indicated that men had more control over use for irrigation than women. More joint control was noted for solar and rope and washer, both technologies located near the household with relatively significant domestic use.

Benefits: One perceived benefit of the technology was improved water quality, as most of the technology users had relied on unprotected water sources for domestic use, including drinking, prior to getting the water lifting technologies. Moreover, both men and women indicated that the number one benefit from technologies is double cropping. This has potential benefits for increased income and food consumption. However, who benefits the most in the household is less clear. Women's role in marketing surplus produce in the dry season is primarily carrying the produce to market and collecting money from the buyers. Respondents that said men had a role, and many said men did not have a role, stated that men supported women (sometimes assisting carrying produce to market) and fixed prices. During follow up discussions, women stated that men usually collect the cash from them after they take the produce to market. It is worth noting that much of the crop produced in the backyard garden is consumed, and therefore there is little surplus to sell at the market.

Following the benefit of double cropping, men and women agreed that livestock watering and domestic uses ranked highly among benefits, usually ranking these second. Men were more likely

than women to rank improved social status in the top three benefits of having the water lifting technologies.

Ultimately, most respondents stated that there was equal benefit to members of the household from the technology. The only exception was that women using tractor and drip and solar pumps felt women benefited the most.

Respondents also stated that the community also benefits from these technologies because of the increased access to water and also because of the opportunity for learning from peer farmers using these technologies.

4.2. Recommendations

- Investment in individual smallholder irrigation technologies can be a viable means to sustainable intensification that benefits women and men smallholder farmers through double cropping of fruits and vegetables.
- Interventions that aim to increase incomes and improve food security should consider technologies suitable for multiple purposes installed near the household. When close to the household, these technologies provide access to water for domestic use and livestock watering that eases the work burden of women and children, and also enables backyard garden production for consumption and surplus sale.
- Technology suitability criteria should include multipurpose uses, labor requirements for men, women and children across roles, affordability, and ability to use over extended hours to enable a range of uses.
- Labor saving varies by user and role, so projects must engage with each group in a project to understand the roles and potential for reducing labor inputs.
- Projects must invest more effort to reach women with information and ensure women, including understanding the time and location convenient for women. Projects need to extend invitation to women directly for information sharing events and meetings, and not rely on spouses or men in the community to inform women. In Ethiopia, the government structure - one to five women groupings - established at kebele level to reach women and disseminate information about irrigation and technologies should be supported.

4.3. Further research

The results of the study appear to align with earlier research on gender and irrigation schemes, however, there is still a knowledge gap on gender and individual irrigation technologies. Investments in which a farmer or household owns (or rents) a water lifting technology provide fewer points of entry for development investors to engage around gender issues and contribute to gender equitable outcomes, because there is often no water user group coordinating or facilitating. Therefore, better understanding is needed on how gender shapes and conditions suitability, affordability and both economic and environmental sustainability. At the same time, it is important to understand the potential for the smallholder technologies to empower women farmers and the best pathways to achieve that. In this regard, this study provides indications for future research on individual irrigation technologies with regard to gender and equity.

References

Aguilar, A.; Carranza, E.; Goldstein, M.; Kilic, T.; Oseni, G. (2014) Decomposition of Gender Differentials in Agricultural Productivity in Ethiopia. Policy Research Working Paper 6764. The World Bank Africa Region Poverty Reduction and Economic Management Unit.

Domenech, L.; Ringler, C. (2013) The impact of irrigation on nutrition, health, and gender: A review paper with insights for Africa south of the Sahara. IFPRI Discussion Paper 1259. Washington, D.C.: International Food Policy Research Institute.

Frank, E. (1999) Gender, Agricultural Development and Food Security in Amhara, Ethiopia: The Contested Identity of Women Farmers in Ethiopia. Ethiopia: United States Agency for International Development.

Merrey, D. J.; Langan, S. (2014) Review paper on 'Garden Kits' in Africa: lessons learned and the potential of improved water management. IWMI Working Paper 162. Colombo, Sri Lanka: International Water Management Institute.

Ministry of Finance and Economic Cooperation (2015). Growth and Transformation Plan II (2015/16-2019/20).

O'Sullivan, M.; Rao, A.; Banerjee, R.; Gulati, K.; Vinez, M. (2014) Levelling the field: Improving opportunities for women farmers in Africa. Washington DC: World Bank Group.