



Gender-Sensitive Irrigation Design

**Gender considerations relating to
treadle pump adoption: experiences
from Zambia**

F Chancellor
D O'Neill

**Report OD 143 (Part 3)
December 1999**



HR Wallingford



DFID Department for
International
Development

Gender-Sensitive Irrigation Design

**Gender considerations relating to treadle pump
adoption: experiences from Zambia**

**F Chancellor
D O'Neill**

**Report OD 143 (Part 3)
December 1999**



**Address and Registered Office: HR Wallingford Ltd. Howbery Park, Wallingford, OXON OX10 8BA
Tel: +44 (0) 1491 835381 Fax: +44 (0) 1491 832233**

Registered in England No. 2562099. HR Wallingford is a wholly owned subsidiary of HR Wallingford Group Ltd.

Contract

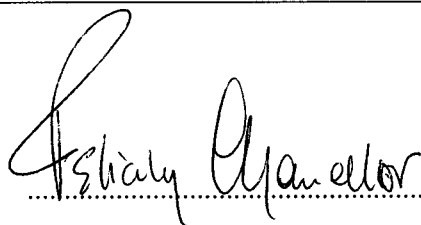
This report is an output from the Knowledge and Research Contract R6876 – Gender-sensitive Design for African Small-scale irrigation. The work was funded by the British Government’s Department for International Development (DFID). The project has been carried out by the Water Management Department of HR Wallingford in collaboration with Silsoe Research Institute.

The HR job number was MDS 0518

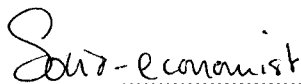
The DFID KAR project details are:

Theme	Water for food production
Theme No.	W5
Project	Gender-sensitive Design for African Small-scale Irrigation
Project	R6876

Prepared by

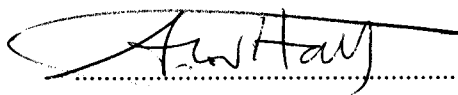


(name)

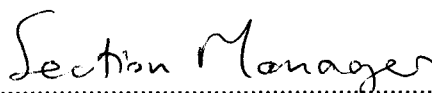


(Title)

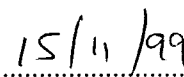
Approved by



(name)



(Title)

Date 

This document is an output from a project funded by the UK Department for International Development (DFID) for the benefit of developing countries. The views expressed are not necessarily those of DFID.

© HR Wallingford Group Limited 1999

Executive Summary

Gender-Sensitive Irrigation Design (GSID)

Gender considerations relating to treadle pump adoption: experiences from Zambia

F Chancellor
D O'Neill

Report OD 143 (Part 3)
December 1999

Future development of the smallholder irrigation sector in Zambia is likely to occur among individuals or small informal village-based groups sharing a water source or small associations of women such as garden clubs.

The relatively plentiful availability of land, surface water and shallow groundwater result in ideal conditions for promoting widespread use of low-lift pumps for irrigation. The relative poverty of small farmers suggests that low-cost design is essential to adoption. Already the treadle pump has been identified as an attractive option and promotion of treadle pump technology is supported by government, FAO and NGOs to assist in sustaining water use for improved agricultural production, improved nutrition and poverty alleviation.

The GSID project briefly reviewed the promotion and adoption of treadle pumps with particular reference to their impact on women and poor people. So far, the impact is generally positive but adoption is not yet widespread and is too recent to judge sustainability. The gender implications are not clear, but the research does suggest that further investigation is needed before widespread promotion is justified. Participation of women in the technology appears to be constrained by their access to land and water, their lack of access to technical knowledge and training, and by the purchase price. The problems associated with marketing and transport constrain men and women alike but are particularly likely to deter women in rural areas. Nonetheless women are generally relieved of the burden of watering gardens by bucket.

Training improvements are in progress and the potential for increasing the level of irrigation awareness and skill development is huge. Policy measures to reduce marketing difficulty would enable users to profit from treadle pumps more widely and, potentially, to progress to other, less labour intensive technologies and greater economic security.

The study recommends that:

- Farmers and their families are given sound information on which to base their technology choices.
- Women should be specifically targeted with information in local languages
- Marketing issues and workload issues should be given particular emphasis

Executive Summary continued

- Irrigation developers must recognise the importance of irrigator's livelihood strategies and gender-based needs.
- Men and women's preferences for crops must be accommodated.
- The current training must be used as an opportunity to bring user and other stakeholder needs to the forefront while determining management techniques.
- The expertise of local NGO's and existing women's groups in the agricultural and irrigation sectors should be tapped to increase women's participation in control of resources.
- Treadles are further developed through full-scale research.
- The coverage of training is expanded.
- Women's participation in training is monitored.

It is also suggested that government might foster links for:

- Identification of strategies to support farmers in developing sustainable irrigated enterprises. Such strategies should include access to land, credit and women's rights.
- Developing improved market structures for small-scale irrigators and strategies to link them with post-harvest processing, improved on-farm storage and catering industries.
- Developing self-determination and enterprise among irrigators, particularly women, through effective participation.

Contents

<i>Title page</i>	<i>i</i>
<i>Contract</i>	<i>iii</i>
<i>Executive Summary</i>	<i>v</i>
<i>Contents</i>	<i>vii</i>

1.	Introduction.....	1
1.1	Background.....	1
1.2	GSID issues.....	1
2.	Case studies.....	2
2.1	Methodology.....	2
2.2	Field visits.....	3
2.2.1	Individual irrigators.....	3
2.2.2	Informal groups.....	4
2.2.3	Training programme.....	4
3.	Results and discussion.....	5
3.1	Marketing.....	5
3.2	Access to resources.....	7
3.3	Equipment and land preparation.....	8
4.	Conclusions and recommendations.....	9
4.1	Participation.....	9
4.2	Design.....	10
4.3	Capacity building and training.....	10
4.4	Sustainable livelihoods.....	11
5.	References.....	12

Appendices

Appendix I	Workshop Summary
Appendix II	SIWUP Summary
Appendix III	Gender based constraint analysis issues and experiences from selected irrigation sites in Zambia
Appendix IV	Small-scale irrigation using appropriate water lifting devices
Appendix V	Zambian consultations
Appendix VI	Field visits Zambia April/May 1999

1. INTRODUCTION

1.1 Background

The 'Women in Irrigation' study highlighted women's labour as a key factor in the performance of smallholder irrigation. It is important therefore to ensure that women's effort is used in the best way to improve production and sustainability, while also guarding against exploitation of women. At present, women are among the poorest people in rural areas, largely as a result of their lack of control over productive assets and their heavy workload.

Suitability, of a system or individual item of equipment, depends on durability, dimensions and energy requirements, technical skill for operation and maintenance, availability of spares and servicing, access to training and the overall workload of the user. In these respects men and women have different requirements and different starting points.

In smallholder irrigation, jobs are traditionally allocated on a gender basis but the interdependence of one job on another means that there are seldom entirely male or female issues. *Gender-sensitive irrigation design (GSID)* refers to designs that recognise the different starting point, constraints and aspirations of men and women regarding the use of irrigation facilities. A good gender-sensitive design would be one that maximises the sustainability and production of the scheme while empowering both men and women to fulfil their objectives for a minimum input of effort.

1.2 GSID issues

Group-based smallholder irrigation is not widespread in Zambia, there are only about 70 hectares of formal smallholder irrigation in total, and it is not actively promoted by government or regarded as a growth area. However, the Ministry of Agriculture, Fisheries and Forests (MAFF) with the support of the Food and Agriculture Organisation (FAO) and have commissioned a vigorous programme to promote improved water use by individual farmers through extension. The extension programme focuses on upgrading the existing extension network through improved training for trainers and promoting interactive training programmes that demand the active participation of farmers in demonstration and group learning situations.

This programme promotes use of the suction (river) treadle pump and, in partnership with International development Enterprises (IDE), who manufacture and distribute the treadle pump through a network of partnerships with NGOs and agents, has facilitated the sale and installation of more than 1000 pumps nation-wide. The demand for treadle pumps is reckoned to be strong, cost only acting as a constraint to even greater effective demand.

The treadle pump is regarded as an affordable and manageable alternative to laborious watering using buckets filled from streams and springs near to the irrigated fields. It has potential to reduce labour requirements and to increase the areas that can be successfully watered. Land and water availability are not major constraints in Zambia, although in some of the drier regions irrigation in the dry season demands substantial inputs of labour and then water becomes scarce.

MAFF is concerned that the labour saving of the treadle pump should empower women. IDE believes that the pump is eminently suitable for women to use and has made conscious efforts to ensure that women are targeted, using women in their publicity material. The fact that few of the sales so far have been to women is thought to result from women's limited access to cash and irrigated land. There is general agreement that the treadle pumps can increase productivity, but it is not clear yet how additional production will benefit the individuals in irrigating households.

The Gender-sensitive Irrigation Design Project (GSID) is concerned to identify gender related problems and to assess the quality of participation achieved by men and women in choosing and using irrigation equipment. The brief study carried out by GSID in Zambia aims to:

- identify aspects of irrigation design that constrain men and women from using irrigation to the best advantage in terms of profitability and sustainability
- take into account the personal workloads of men and women with particular reference to the temporal and social constraints that apply to them
- identify practical strategies for ensuring effective participation of men and women in directing government policy in relation to support for irrigators

The research study will provide:

- general guidelines for taking gender considerations into account in design and rehabilitation of small-scale, smallholder irrigation
- publicity material aimed to farmers to encourage gender-awareness and appreciation of irrigation design issues

Phase I of the project, was carried out in Zimbabwe. It investigated gender roles through surveys and focus group methods to identify potential research issues and facilitated prioritisation of research issues by smallholder irrigation professionals from the region. Phase I culminated in a Workshop in Masvingo, Zimbabwe, in February 1998, to which representatives from South Africa and Zambia came to discuss issues and take part in the prioritisation exercise. The workshop based discussion on Phase I field work but did not limit the issues to those identified in this preliminary work. Priority areas for investigation in **Phase II** were identified. (*A summary of the prioritisation process can be found in Appendix 1 GSID Phase I Report to DFID*). The workshop identified three major issues for concern in relation to gender disparity on irrigation schemes:

- **Marketing**
- **Access to resources**
- **Equipment and land preparation (including indigenous technical knowledge)**

Other significant findings from the workshop that were relevant in Zambia included:

- Inappropriate design of early prototype equipment e.g. low-lift pumps
- Crop preferences e.g. men often prefer cash crops and women food crops
- Access to training and women's availability to attend training
- Access to information and the importance of language and illustration
- The success of women's clubs and their efficient use of money
- Effects of improved irrigation on women

Gender issues surrounding smallholder irrigation in Zambia are described in Deric Moono's paper, *Gender based constraint analysis issues and experiences from selected irrigation sites in Zambia* prepared for the Phase I Workshop (Appendix 3). Further investigation of how participatory design can incorporate the physical and social needs of men and women, as well as production needs, is recommended.

2. CASE STUDIES

2.1 Methodology

Zambia has few formal smallholder irrigation schemes. Individual smallholder irrigators are the backbone of the sector. Interviews were arranged with individual irrigators to develop an understanding of the issues facing irrigators in relation to marketing, access to resources, equipment choice and operation and maintenance. This approach was supported by in-depth consultation with key stakeholders in Ministries, NGOs and academic institutions.

Food security is a crucial issue in Zambia, where rural poverty is widespread, thus attention is already focussed on smallholder irrigation through the FAO Special Programme for Food Security (SPFS). This Programme promotes improved training for extension staff in irrigation development and interactive and participatory methods. The effectiveness of this initiative in improving access to advice and information about irrigation was briefly assessed through observation of the training programme in action.

In partnership with International Development Enterprises, the SPFS is promoting small-scale irrigation using treadle pumps to access water. Pump manufacture and distribution and a certain amount of training is managed by IDE and contributes to building capacity among local manufacturers and retailers to make the technology available and affordable for Zambian farmers.

CARE, Zambia are major participants in Food Security initiatives and CARE Livingstone participated in the Phase I, 1998, Masvingo Workshop. Florence Mubanga, of Livingstone Food Security Programme (LFSP), provided a paper outlining the objectives of the Food Security Programme in distributing treadle pumps on a loan basis to farmers in the region and a detailed case history of the changes in time and effort experienced by a family (Appendix 4).

2.2 Field visits

CARE, Livingstone, facilitated field visits, including structured interviews with individual irrigators and a review of a community-based garden development, using an artesian well for an irrigated garden. A full account of these visits can be found in Appendix 6.

An informal group, The Green Hill Community Women's Group in Chamba valley in the Lusaka, was studied in a focus group interview facilitated by Patrick Tembo, MAFF, Lusaka District. The group used treated effluent to grow vegetables for the urban market. The discussions included treadle pump use, access to resources and marketing. Although it was formally titled as a women's group men were heavily involved, particularly in managing the treadle pumps.

Visits were made also to on-going training sessions for extension staff and for farmers. This section summarises the main characteristics of individual irrigators, groups and training initiatives.

2.2.1 Individual irrigators

Visits to three individual irrigators in the Livingstone area confirmed that the suction-type, treadle pumps are popular with farmers and have a significant positive impact on vegetable production. Farmers use the pumps to improve quality in the vegetables they produce, increase yields and the range of crops they offer for sale and enlarge the area of land they irrigate.

All three interviewees were men and were the main users of the treadle pump. The pump was a major investment for them and extending their investment to cover the amount of pipe work they ideally would prefer was their next objective. The lack of expense to run the pump was a popular feature and one farmer felt he had a considerable edge over diesel pump users due to his low production costs.

The fact that the pump was portable was important and farmers had constructed pumping points to which the pump was moved to command a particular area of the garden. Pumping points often had a frame for support and sometimes a seat arrangement. One farmer claimed that a seat made pumping more comfortable, sustainable and less likely to damage the pump. They were all satisfied with the performance and durability of the pumps although the test period is short so far. Only one farmer had used the pump for more than a year.

There was general agreement that women found the pump harder to operate than men, but young boys were easily able to operate the pump and showed considerable enthusiasm for pumping. Women's main role was in the cultivation of the vegetables, planting, weeding and harvesting. Women worked with the men on watering, controlling the water in the channels, furrows and basins as the men pumped. Women

did operate the pump in the absence of men, but complained of knee pain and found the work tiring if it had to be done over a long period. However it did reduce the hard work of carrying buckets to water plants that had previously been done by women. Also when women operated the pump it reduced their working hours which was a significant advantage. Men provided most of the information.

The farmers displayed good general knowledge about irrigation techniques and layout. Water was being applied reasonably efficiently in all the gardens. Farmers, however, felt they were limited in the amount of fertiliser and chemicals they could afford to apply. The main source of difficulty was the marketing of the irrigated produce. Transport and market saturation, are issues that seemed most difficult to cope with. Selling from the field is only an option for conveniently located farmers who have secured a good reputation for themselves as quality producers.

2.2.2 Informal groups

Group irrigation has not been pursued in Zambia largely because of the widespread ease of access for individuals to surface and shallow groundwater, but informal groups do exist where circumstances encourage them. The team visited two groups; the first had formed in a relatively dry area to make use of water from an artesian well while the second had formed in response to an opportunity to use treated effluent from a sewage treatment plant on the outskirts of Lusaka.

The first group was planning an irrigated garden using well water stored in an elevated tank to give sufficient head to allow them to pipe the water to the garden site. The community planned that about 40 families should benefit from the gardens. The existing garden at the site, run by a local widow, was an excellent example of diversification for nutrition and subsistence. It was not clear if the families would follow this pattern or grow for the commercial market. CARE experienced difficulty mobilising women facilitators and possibly this would result in male dominance on the irrigated garden. It appeared that the garden, when completed, would be managed and maintained by a community committee but families would grow and sell as individuals.

The second group irrigated to sell in the urban market. They used a suction treadle pump to lift water from the canal to the fields. Women here found they were able to provide more water to the vegetables using the pump but that treading was very exhausting. Rape formed 90% of their sales, although they were able to grow a wide range of vegetables. The popularity of rape arose from perceived steady demand although market-glut often led to farmers obtaining very low revenue. The group seemed to be very informal and acted together in the loosest way, women following their own growing and marketing strategy. There was some co-operation in raising the water to irrigate but there was also individual responsibility for acquiring water, inputs, labour and marketing. Their greatest problems arose from the difficulty of market access. Despite their proximity to Lusaka, this poor community had difficulty in competing with suppliers who could afford motor transport and reach market earlier despite longer distances. The time needed to transport produce to market reduced the time they had for field operations. There seemed to be potential for improving the situation through improved management of labour and equipment. However, lack of infrastructure and organisation remains a problem.

2.2.3 Training programme

Attention is being focussed on two main aspects: firstly, retraining trainers to increase their capacity to access information relating to irrigated farming and, secondly, to increase their capacity to use interactive training methods to maximise participation, facilitate farmers to reach their own decisions and encourage ownership of outcomes. Camp-officers face difficulty in achieving wide coverage (due to the dispersed population they are targeting) and in convincing farmers of the realities of the agricultural prospects and constraints they face. The gender balance among camp officers is biased towards men and the few women clearly have difficulty in asserting themselves in the training process. Man to man transfer of knowledge appeared to be common, even though most officers were aware that farmer to wife transfer was ineffective.

However, group training undertaken by retrained officers, with plenty of interactive elements, clearly provides excellent opportunity for officers to change their role to that of facilitator. The increased participation of women, particularly younger women was good and the general feeling was that the new technique which encouraged reinforcement of lessons learned by practice was effective in promoting greater confidence among farmers and greater participation of women.

3. RESULTS AND DISCUSSION

It has been possible to identify key issues that influence the development of the smallholder irrigation sector and that warrant future research. Findings indicate that the gender implications of the introduction of new techniques are not clear and not fully appreciated. Using the priorities agreed in the 1998 Workshop, findings from Zambia are grouped under the headings, marketing, access to resources and equipment and land preparation.

3.1 Marketing

Market problems that were consistently mentioned by irrigators in Zambia included:

1. Poor crop planning and lack of on-farm storage constrain farmers from avoiding the slumps in product prices brought about by market glut.
2. Marketing is challenging for remote farmers and tends to erode the profit to be made from irrigation. Vegetable irrigation using treadle pumps is relatively new and no one has yet assessed the financial gains after the pump loans, fertiliser, pesticides, additional labour and transport have been deducted. Despite the greater volume of produce grown, market conditions might, in the long-term, restrict profitability.
3. Marketing adds substantially to the workload. Where distance to market is long men often undertake journeys by bicycle and are away all day. This must have implications for on-farm work. This is not always the case and in some areas women carry (head-loading) produce up to ten kilometres away. It appears that this often involves the women being accompanied by a man further reducing the workforce for crop production.
4. Marketing even in the peri-urban areas is constrained by poor infrastructure and the general poverty of irrigators. Women entrepreneurs or 'marketeters' undertake most of the transport of produce from the field to the market.
5. If treadle pump technology is widely adopted, it will test both the strength of domestic demand for horticultural produce and the ability of the market to absorb widely dispersed small producers.
6. Although a wide variety of vegetables can be grown, the most popular by far is rape. It is attractive because demand is high and consistent, it is easy to grow, seeds are cheap, it matures quickly and provides regular income. However, glut and losses are becoming increasingly common.
7. There is potential for the use of policy instruments to promote rotational peri-urban markets to resolve the transport problems of scattered producers. This might involve licensing village markets around larger towns to operate on a specific day each week to facilitate marketing for farmers in the surrounding rural area. Co-operation of wholesalers would be required.

The transport infrastructure in Zambia is poor and where transport is available it is expensive for relatively poor smallholders. As a result, much of the transport to market is achieved on foot or by bicycle. Producers are restricted in terms of the amounts of produce that can be sent to market each day and the time needed to get it there. If they have to hire someone to transport their produce, profitability and their

capacity to expand is severely reduced. In addition, slow transportation in warm conditions deteriorates the quality of the produce, further reducing profit.

In rural areas, there is little opportunity for producers to co-operate in marketing due to the widely dispersed nature of individual irrigators and the lack of suitable collection points. Producers generally shoulder the whole risk and cost of marketing. Out-grower schemes have been tried with varying results. Problems arose because the promised inputs and advisory service did not materialise as expected and buying arrangements were not honoured. Farmers are now understandably cautious of attempting such arrangements a second time. Such negative experiences tend to have far reaching effects.

In the peri-urban area, professional market women buy from producers at the field edge or even pick produce themselves, negotiating, for rape particularly, on the basis of a bed for a fixed price, thus reducing both risk and labour for producers but also cutting significantly into potential profit. The peri-urban grower can thus predict income but does not benefit from market opportunities. The potential for value added activities, appears to be low in both rural and peri-urban areas due to low management skills and severe marketing difficulties.

The lack of bargaining power among producers keeps prices low, added to the low quality problem, exacerbated by poor storage and transport conditions. Thus, in glut conditions, prices are said to fall sometimes below production costs. Yet producers are slow to respond by switching to alternative crops. There appear to be several factors at work:

- Lack of market information (exacerbated by poverty, widely dispersed growers)
- Lack of confidence to try new crops (linked to lack of information about demand for the less common crops)
- Reluctance to use credit to grow high value crops in case of failure (in some cases reinforced by bad experiences)

Markets for irrigated vegetables are often remote from producers. CARE Zambia are keen to investigate options for market restructuring that have had some success in Malawi. This would assign one market day per week to areas around the centre of demand, thus focusing buyers into a different growing area each day. This would have the effect of evening out the opportunities for growers and transferring part of the cost and risk of transport to the buyer. The case for pilot interventions to test new market strategies is strong as marketing is a major constraint. It would be important that the strategies to be piloted resulted from a participatory process in which stakeholders, farmers and buyers, have the opportunity to assess issues that might arise from change and fully discuss and prioritise concerns before selecting the strategy package to be tested.

Gender disparity in crop choice was highlighted in the workshop paper given by D. Moono (Appendix 3). The field visits confirmed that among the individual irrigators and in the peri-urban garden, commercial varieties formed the greatest part of the crops grown. This appears to result in male dominance in smallholder irrigation marketing and thus in control of the profits. The exception was in the garden at the artesian well, run by a woman, that offered a wide range of subsistence crops.

Women, when asked about their preferred crops, insisted that rape provided small but regular amounts of cash which they needed to buy the essentials for family meals. There is undoubtedly a trade-off between growing subsistence or commercial crops and cash needs. Knowing more about the way in which women have changed their cultivation practice and crop choice is crucial to understanding the impact of increased irrigation on women's livelihood strategies.

It was clear that while introduction of the treadle pump enabled increased yield, it also increased the demand for weeding, harvesting and transport to market. The gender basis for allocation of these jobs

varies. Women appear to be almost universally responsible for weeding. Men and women share harvesting and transport to market. However, who transports to market also depends on the location, the distance to market, social acceptability of women leaving home for prolonged periods and the cost of transport.

3.2 Access to resources

There are gender disparities in access to resources, although the scale of the differences and the flexibility of society vary greatly from place to place. The resources important for irrigation include land, water, labour, equipment, money, advice and training. In general, women own less land than men and their access depends on user-rights, which are insecure. In turn, women's lack of land tenure restricts their access to other resources such as cash and equipment. Many women's only resources are their labour and indigenous knowledge passed down by their mothers. This is a significant constraint to women in taking the initiative in developing irrigated gardens of their own. Findings from the field included:

8. Women's poverty is such that the cash price of treadle pumps, or even loan terms offered by CARE, may be too much for them to deal with confidently. CARE offers farmers loans to buy pumps with an initial deposit of 10% of the cost. Loans run over six months. The farmers formulate their own repayment schedule and have to produce a business plan, for approval by CARE, before the loan is provided. So far, all takers are men. IDE recorded only four sales to women up to the end of May 1999.
9. The land tenure arrangements do not favour women if the husband dies. They often lose the right to use the land they are cultivating. Thus married women may be reluctant to invest in irrigation equipment even when it is financially possible.
10. Women may be further excluded from resource control by male interest in vegetable growing for sale. Vegetable growing has been widely associated with women in many parts of southern Africa. Recent development of horticultural markets and international trade in vegetables from the region has moved vegetables into the 'cash crop' category. Male ownership of treadle pumps and pipes may widen the gap between male and female access to resources. Women using buckets will find it hard to compete for a share of the market against men using treadle pumps.
11. Smallholders have more control over water by using treadle pumps and are able to more consistently meet the needs of the crops they have planted. They use more water both by providing more for each plant and by planting larger areas.
12. It is still too early to assess the impact on local water sources, of increased water use. Studies suggest that the recharge is more than adequate to compensate for the present rate of abstraction [IFAD Smallholder Irrigation and Water-use Programme (SIWUP), Design of an Environmental Monitoring programme for Dambos in Zambia, Mc Cartney, Daka and Phiri, FAO, Mission Report 28, 1998].
13. There is concern about change in the environment. It may be wise for farmers and communities to be encouraged to appoint a community member to record when water sources expire and recover to provide themselves with early warning of diminishing supply.

In common with Zimbabwe and South Africa, rights to own and use land commonly fall to male members of society and control of water is closely linked to control of land. Most smallholders have relatively little physical productive capital such as tools and equipment, but the sales information available for treadle pumps suggests that women were far behind men in acquiring and controlling equipment.

Women have poor access to training and advice, in part because of the restrictions placed on them by their role of mother and family provider of food and water, but also because of cultural attitudes to women

travelling away from home and entering a male domain. The institutions associated with irrigation are staffed predominantly by men and that can deter women from approaching with queries and requests.

Both men and women are restricted by lack of access to capital and infrastructure normally provided by government, such as roads and market places. The lack of these supports increases the costs faced by individuals in marketing produce. Similarly credit is scarce for everyone but men's rights to land increase their ability to secure credit.

3.3 Equipment and land preparation

14. Contrary to expectations, the users of the treadle pumps were mainly men and boys. Women users complained of fatigue
15. Men appreciate the advantages of treadle pumps and see a good future ahead in horticultural production. The low capital cost and the almost zero recurrent cost allows good profit when market conditions are right.
16. The introduction of treadle pumps has stimulated people to be inventive in their use of water for irrigation as they see the potential gains from reliable supply of good quality produce to market.
17. It appeared from discussion with farmers that they are used to shifting their gardens around to exploit changing water availability. Land is sufficiently plentiful that this does not cause problems. The portable nature of the treadle pump fits well into this system.
18. People normally supply farm-power. Among smallholders, tractors and draught animals are scarce and expensive.
19. The introduction of the treadle pump changes the way in which smallholders configure their plots. In general, more attention must be given to levels and to forming channels than for the relatively independent basins needed in bucket-irrigated gardens. It appears that land preparation is mainly a male job.
20. There is a serious lack of on-farm storage. High yielding maize is less resistant to storage pests than indigenous maize, thus traditional storage methods are less effective. This results in farmers selling maize soon after harvest when prices are low and buying back for consumption when prices are high. This contributes to the general lack of resources for irrigation enterprises.
21. Storage of irrigated vegetables is even more difficult than for maize. There is widespread lack of knowledge on simple cooling techniques for vegetable storage. Processing is limited and sale to processing industries is confined to the commercial sector.
22. Women benefit from the reduction in labour brought about by use of the treadle pump. Some people regard the labour reduction as minimal, although the benefit from reduction in work could be optimised if other changes, such as subdividing gardens to allow rotational watering, are adopted simultaneously.
23. Women may benefit considerably from reduction in workload if the introduction of the treadle pump means that men assume responsibility for watering vegetable crops.
24. As women exchange arduous watering for closer attention to weeding and transplanting, production is likely to increase.

Demand for the IDE treadle pumps indicates that farmers recognise the benefit of these pumps. The cost is currently US\$67, which is a major item in the smallholder household economy. Buyers must be confident

of success with the pump. The SIWUP report of December 1998, (Appendix 2) claims increased incomes in the range of six-fold to ten-fold depending on management ability, and yields of between 18 and 30 t/ha for cabbage, rape, tomato and okra. IDE supply farmers with booklets on pump care and maintenance also a simple irrigation manual including crop budgets.

None of the sites visited needed to raise water more than 2 metres. However, even at that depth, women seemed to find treadle pump operation difficult or tiring. Presumably at greater depth, operation requires more energy and there will be a limit to the area that can be irrigated in one day by one operator. This is likely to be a limiting factor to the drought alleviation function of the pump.

There is evidence also of treadle pump users expanding their existing gardens by double and up to fivefold. The combined effect of improved yield and expanded irrigated area may contribute to market glut problems.

However, it is not clear how the adoption of the treadle pump affects the distribution of labour and benefit within the family, nor is it clear if there is a gender issue arising from the changes. SIWUP state that there are no gender conflicts regarding specific roles that women perform in preparing land and growing vegetables in Dambos (Appendix 2). However, there is little data regarding men or women using treadle pumps, apart from IDE sales data indicating that men and not women buy pumps. The cost of the treadle pumps and access to land and resources potentially affects the way that men and women participate in irrigation. It appears to be accepted that women are more likely to adopt the technology as part of a group than as individuals. The basis for this view is firstly, the cost of the pump relative to women's resources and secondly, the greater propensity to work together found among the women.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Participation

Women's participation in decision making is lower than that of men. The low uptake of treadle pumps among women may also indicate low awareness, and hence low participation, as well as restricted access to cash. As in most countries in the region, women contribute significant amounts of labour to tending irrigated produce.

- Levels of participation are affected by institutions and arrangements that they impose; attitudes and people within the organisation; the confidence and ability of communities; incentives and the history of earlier attempts at participation.
- Participation can be superficial if it is limited to the plot owner and disregards the user.
- The need for participation is not readily acknowledged by institutions or among ordinary people.
- Women's participation must be arranged to avoid reinforcing existing gender bias.
- Effective gender-sensitive participation can result in positive transformation of projects (Appendix 5.).

It is recommended that:

- *Farmers and their families are given sound information on which to base their technology choices.*
- *Women should be specifically targeted with information in local languages*
- *Marketing issues and workload issues should be given particular emphasis*
- *Irrigation developers must recognise the importance of irrigator's livelihood strategies and gender-based needs.*

- *Men and women's preferences for crops must be accommodated.*
- *The current training must be used as an opportunity to bring user and other stakeholder needs needs to the forefront while determining management techniques.*
- *The expertise of local NGO's and existing women's groups in the agricultural and irrigation sectors should be tapped to increase women's participation in control of resources. (see Appendix 5)*

4.2 Design

Design of irrigation equipment in Zambia is likely to focus on individual smallholder systems. The treadle pump appears to be ideally suited to conditions in Zambia and offers a reasonably priced, robust, low operational cost alternative to bucket irrigation.

- Land preparation is a key issue for men. It is strongly affected by choice of application method and field layout.
- Attention to ergonomic aspects of equipment design can increase productivity , reduce fatigue and thereby ameliorate gender disparities
- Use of inappropriate technology can adversely affect the health and income of users

Women find the pump more strenuous than men and have difficulty in operating the pumps for more than 15 minutes at a time. Some users have added seat-type modifications.

It is recommended that:

- *Treadles are further developed through full-scale research:*
 - *research should be based on participatory and ergonomic methods to ensure design appropriate to men and women.*
 - *research teams should include men and women from socio-economic, health financial and engineering sectors..*

People are anxious to learn more about alternative ways of using water to increase crop production.

It is recommended that:

- *A selection of low cost technologies could be promoted through the enhanced training programme. Low cost micro-systems and other techniques need to be tested for Zambian conditions.*

4.3 Capacity building and training

Although the participation of women at village level in the SIWUP supported training initiative is impressive, and women make a significant contribution to group training sessions, nonetheless, women, in general, have less access to training and are less targeted by trainers. Only a small proportion of trainers are, themselves, women.

- Training coverage tends to be biased in favour of men
- Training could be more demand-led.
- Training needs gender-sensitivity in timing, venue and content
- Interactive training and farmers experiment promote adoption

It is recommended that SIWUP or MAFF:

- *Expand the coverage of improved training and monitor women's participation*
- *Focusing attention to bring user-needs to the forefront of design criteria*

Refocusing training on users would include:

- *Reviewing crop choices from a sustainable livelihood perspective rather than considering yield and cash returns only.*
- *Considering ways in which women might increase their access to resources in a culturally acceptable way, such as through women's groups.*
- *Assessing gender implications of adoption of treadle pump technology prior to countywide promotion of treadle pumps.*
- *Determining appropriate situations in which to promote the pumps among men and women.*
- *Developing appropriate, basic, record keeping and business management training for small producers.*

4.4 Sustainable livelihoods

Smallholder irrigation in Zambia is improving the income generation of rural farmers. Sustainability requires that all ingredients for successful irrigation are obtained to function without damaging the natural resources. When one or more aspect is neglected then the risk of failure increases. It is difficult for individuals to achieve reliable support without assistance from government. Provision of a framework that allows good advisory services, a robust legal framework, good infrastructure and financial services to develop is essential. This does not imply that free services should be provided. The principle that 'users pay' has been demonstrated to result in sustainable and responsive institutional development.

- Smallholder irrigation can provide sustainable improvements in livelihood.
- Sustainability is threatened if marketing is difficult or returns to work are too low.
- Women tend to be under-rewarded in relation to their contribution to labour.
- Adoption of 'modern technology' can increase poverty if the context is unsuited.
- Widespread support for a design is as important as technical perfection.

It is recommended that government retains and fosters linkages for:

- *Identification of strategies to support farmers in developing sustainable irrigated enterprises. Such strategies should include access to land, credit and women's rights.*
- *Developing improved market structures for small-scale irrigators and strategies to link them with post-harvest processing, improved on-farm storage and catering industries.*
- *Developing self-determination and enterprise among irrigators, particularly women, through effective participation.*

5. REFERENCES

Chancellor, F (1997)

Developing the skills and participation of women irrigators. Experiences from smallholder irrigation in Sub-Saharan Africa. HR Report, OD 135

Mc Cartney, Daka and Phiri,

IFAD Smallholder Irrigation and Water-use Programme (SIWUP), Design of an Environmental Monitoring programme for Dambos in Zambia, FAO, Mission Report 28, 1998.

UNFIP

Project Document, Empowerment of women in Irrigation and Water Resources Management for Improved Household Food Security, Nutrition and Health. FAO-INT-99-0461.

Appendices

Appendix I

Workshop summary

Gender-Sensitive Irrigation Design

Phase I Report

1 Introduction

The Gender Sensitive Irrigation Design project is organised in two phases. Phase I identifies and prioritises the design issues which have important gender implications in the region. Phase II will be devoted to testing hypotheses that address the prioritised research issues. The recent Workshop in Masvingo marked the close of Phase I, which began in October 1997.

The participants in Phase I were:

- HR Wallingford, UK
- Silsoe Research Institute, UK
- Institute of Development Studies, University of Zimbabwe
- AGRITEX (Ministry of Agriculture), Zimbabwe
- Support and assistance has been given by CARE, Zimbabwe

Phase I activities were:

1 Identifying a representative sample of smallholder irrigation projects

From nine irrigation schemes visited and evaluated, five were selected for further investigation. The selection was based on criteria such as identification of gender issues, identification of potential for changes to take place, typifying smallholder irrigation types found in the region, accessibility for researchers, being representative of socio-economic rural groups and willingness to participate.

The final selection included schemes under the auspices of AGRITEX, CARE and Ministry of Cooperatives. Schemes included those where water was delivered by gravity flow and by pump and where supply was dam backed and came from groundwater. Application methods included flood, sprinkler and bucket and the scale of individual holdings ranged between garden plots of less than 0.005ha and commercially viable units of 1.5 ha.

2 Investigating gender roles in the projects through surveys and focus groups to identify potential research issues.

A primary identification of issues was facilitated by a random sample questionnaire carried out at the five selected schemes. In-depth focus groups discussed the issues identified, expanding and augmenting where relevant, to produce an understanding of the different gender issues that emerged from different irrigation situations. Detailed reports from the investigation can be found in the folder (N. Matshalaga, Nov 1997; F. Chancellor & N. Hasnip, Jan. 1998). The main findings are summarised in Section 2 of this note.

3 Investigating potential pilot interventions

At three of the schemes the team, in conjunction with the irrigators, identified issues where specific investigation or information could be agreed to promote further understanding of the gender issues in particular aspects of irrigation work. At one scheme, it was agreed that a demonstration of the correct use of existing equipment would help men and women to assess their equipment needs to achieve the desired ploughing depth. The intervention has led to a greater appreciation of the possible uses of different tools and equipment. At another site, farmers experiments succeeded in stimulating women to consider their equipment needs more

critically. At the third site, an attempt was made to analyse and cost use of existing equipment. A detailed account of the interventions is in preparation.

4 Formulating and organising a workshop in which regional irrigation professionals participated in a prioritisation process

A Workshop was held in Masvingo, Zimbabwe from 10-12 February 1998. There were 20 participants including the research team, representatives from Zimbabwe, including AGRITEX, CARE and other DFID supported projects, and participants from South Africa, Zambia, Namibia and Tanzania. (A detailed list of participants and papers from the Workshop can be found in the folder).

The workshop aimed to:

- Identify issues from the Masvingo investigation
- Identify issues from the region
- Prioritise the issues identified
- Facilitate participation in region-wide research on the prioritised issues in Phase II

2 Findings from investigation and workshop

The issues that emerged from the preliminary investigation in Masvingo Province, Zimbabwe, illustrate the complexity of the gender disparities that occur in irrigated agriculture and the difficulty that arises in clearly identifying the impacts of these disparities on production or on the levels of poverty experienced by people of different gender. In all of the aspects mentioned below there were gender disparities evident.

- Irrigated agriculture is highly valued – men and women may place different values on it.
- The importance of land preparation and weeding and the associated benefits of deep ploughing on water use and weeding*
- Marketing difficulties – eg. access and transport is different for men and women*
- Use of unsatisfactory agricultural tools
- Lack of knowledge about hardware – such as pumps*
- Division of labour - often women do more than half the work but have less access to resources and to support services*
- Women are not often involved in decision-making*
- Importance of time scheduling (eg. water delivery, timing of training, information delivery and meeting times) and how irrigation planning influences the workload of women*

(* Subsequently confirmed at the workshop)

These findings formed that basis of discussion at the workshop alongside the contributions of the invited participants, which can be found in the workshop folder. These contributions were augmented by contributions from the participants, which will be circulated shortly.

The main findings from the workshop (in addition to the survey) are:

- Inappropriate design of equipment eg low-lift pumps
- Different crop preferences eg. men often prefer cash crops and women food crops
- Access to training and women's availability to attend training
- Access to information and the importance of having literature in local languages and use of pictures for illustrating important issues

- The success of women’s clubs and their efficient use of money
- Improved irrigation leads to marginalisation of women farmers

2.1 Workshop priorities

The Workshop participants were divided into three groups of balanced interests to discuss: **farming factors, equipment factors** and **human factors**. The participants then reconvened to receive the group reports and reach a consensus on the cross-cutting issues. The participants agreed on nine critical issues. These nine issues were prioritised using both pair-wise priority ranking and urgency priority ranking methods. The top three issues were taken from each list and combined to produce agreed areas for future activities.

Table 1 Results of the two methods of priority ranking

<i>Pair-wise priority ranking</i>	<i>Urgency priority ranking</i>
Gender disparities	Equipment and land preparation
Marketing	Gender disparities
Access to resources	Marketing
Participation	Access to resources
Support services	Management and Institutions
Equipment and land preparation	Training
Indigenous Technical Knowledge	Indigenous Technical Knowledge
Training	Participation
Management and Institutions	Support Services

In moving forward from the findings of the Workshop, it was decided that identification of “gender disparity” is relevant to every activity proposed in the project and is not an issue in its own right. Participants had emphasised the need to flag the issue at national level in the spirit of promoting gender awareness. It was therefore agreed that the three main areas for future activities should be:

- **Marketing**
- **Access to resources**
- **Equipment and land preparation (including indigenous technical knowledge)¹**

2.2 Marketing

Although there is much evidence showing that marketing is a widespread agricultural problem, the investigations carried out in Phase I confirm that there are gender disparities in marketing which need to be addressed.

Although transporting produce to potential markets can be a major problem for both women and men, women tend to find it more difficult. In many cases where vehicles are available, males tend to have greater access to them, leaving the women to carry produce on foot or to wait for infrequent buses.

Women have more problems with sourcing markets than men, partly because they tend to be responsible for marketing small quantities of vegetables, for which contracts are not usually sought and partly because they have more social difficulty in travelling away from the homestead. Many farmer committees (both men and women) stressed that they would appreciate training in marketing, especially how to source for potential markets.

¹ The participants agreed that Indigenous Technical Knowledge is very strongly linked with equipment and land preparation and thus should be treated as one issue

Competition when markets are flooded with produce reduces prices and leads to produce remaining unsold. Farmers, who have less access to extension advice, commonly bear more losses and these are often women.

The papers from South Africa (Oral presentation – Chris Stimie) and Tanzania (R. A. D. Kweka, 1997) also stressed that the lack of well-defined markets is a major problem for most small-scale farmers and that adequate crop marketing strategies are needed. One participant pinpointed a problem in that in the rural communities women are unaware of “marketing” as a concept and see only a problem in selling which limits their ability to address the problems they face.

2.3 Access to resources

Throughout the region land tenure arrangements favour men. Women landholders are often widows whose access to other resources is limited. However, for many irrigators in the region land ownership is not an option and access to user rights is the central issue.

In Zimbabwe in communal areas, user rights are commonly dispensed by the state through its agencies or departments or by traditional leaders or chiefs. In such systems the area of land controlled by women is generally less than that controlled by men, although barriers to women in obtaining user rights are not necessarily formal or even recognised as existing. Where women’s ownership is promoted there are positive impacts for productivity, also experienced in Tanzania (see contribution from R. A. D. Kweka, 1997).

Access to water is closely linked to land rights, but rights to land do not necessarily confer access to water. The geographic position of the plot influences water delivery (N. Matshalaga, 1997, page 27) as do social and cultural pressures, for example treadle pumps in Zambia (contribution from D. Moono, 1998) or physical restrictions such as individual strength (contribution from D O’Neill). Operational requirements of the system in terms of timing and duration also influence the individual irrigator’s access to water. For example, domestic obligations of women and stock-keeping activities of men, may restrict their access to water at certain times of the day. Clearly these factors should be taken into account to ensure that neither group suffers unduly.

The ability of the irrigators to pay for the inputs themselves, the transport costs and the logistics of field application are crucial. Women have restricted access where there are social and economic constraints to their reaching distribution points. Collateral links credit availability to land tenure. The attitude of banks to women borrowers is unsympathetic. Physical access to lending institutions (often in distant towns) is poor.

Energy has to be purchased, either as electricity or fossil fuel or as work by draught animals or hired labour. Use of purchased energy implies prior purchase of capital equipment such as pumps and ploughs. Women on their own and elderly men and women, due to weak finances and control of other assets, may have poor bargaining power and pay excessively for such services and equipment or receive a lower level of service.

2.4 Equipment and land preparation

The preliminary investigation and the Workshop raised several issues regarding the hardware and mechanical inputs used by small-scale irrigators. Most prominent in the investigation were the importance and difficulties of land preparation (Chancellor and Hasnip, 1998), particularly in achieving a good depth of ploughing (eg c 150 mm [N. Matshalaga, 1997], but depending on soil type). Shallow ploughing was believed to be responsible for less efficient

use of water and greater weeding demand. The main benefit of deep ploughing was the greater penetration of water and, thus, reduced run-off and less frequent demand in the scheduling cycle. The project was able to address this by organising a demonstration on the setting and operation of (animal-drawn) ploughs, which the recipient farmers (at Mushandike) found most helpful. They had been unaware of the significance of the design features on ploughs and they believed that the demonstration and practical experience gained would enable them to plough deeper, faster and with less strenuous demands on both themselves and their animals (field visit 6 Feb 1998). This was felt to be particularly helpful for women and farmers with donkeys.

The most prominent issue to emerge through the Workshop (also supported by the findings of the preliminary investigation) was the inappropriate design of pumps, be they human- or engine-powered. Other pieces of equipment and tools were also considered to be of unsatisfactory design, particularly for use by women. The problems of women operating low-lift pumps were described by D. Moono (1998) and, more generally, women's difficulties in dealing with minor breakdowns of engine-powered equipment were reported by Stimie (oral presentation, South Africa) and our investigation (N. Matshalaga, 1997). Many reasons (mainly cultural) were given, such as male dominance, lack of confidence, unavailability of training. Inappropriate selection of pumps, often in donor projects, because of unavailability of spares and technical knowledge were reported in 3 of the 5 of the participating schemes in Zimbabwe (Chinyamatumba, Longdale, Rufaro).

The generally unsatisfactory status of tools and equipment can be succinctly summarised by quoting from Kweka: "Access to improved technologies is a right for men and women. The problem of women's workload can be minimised by the introduction of appropriate technology which will reduce working hours on the farm as well as simplifying the work" (R. A. D. Kweka, 1997). An important aspect that emerged in the workshop discussions was that opportunities to build on indigenous technical knowledge were often missed because women who hold that knowledge lack confidence in the value of what they know.

3 Discussion and conclusions

Although it is well known that addressing gender disparities in agriculture contributes to reducing poverty, the differences between the needs of men and women are often ignored or wrongly identified by irrigation designers. It is important that these gender disparities are recognised so that they can be considered in the participatory design process. Phase I identified several issues including:

Participation

Throughout the region there are social and cultural constraints, which result in women participating less in formal consultation on irrigation development than men. Research to evaluate methods of increasing female participation is in progress in Tanzania, detailed in "Women in Smallholder Irrigation in Tanzania" (R. A. D. Kweka, 1997). Formulation of the new Water Law in South Africa acknowledges the need to formally recognise women's rights in relation to allocation and use of water. The Workshop confirmed the need for widespread evaluation of the impact of women's participation on productivity and sustainability.

Infrastructure

Participants agreed that care should be taken to select irrigation infrastructure that enables both men and women to develop their preferred irrigated agribusiness. This implies that flexibility is given a high priority. For example, design for long furrows determines the need

for engine or animal-powered land preparation, which may restrict women's opportunity to cultivate. In addition, long furrows do not readily permit different watering regimes for the different crops preferred by men and women. This constraint to diversification reduces sustainability (Experience of South Africa – Chris Stimie).

Organisations and Institutions

The links between organisations and irrigators are often heavily influenced by social and cultural conventions. The problems faced by men and women irrigators are therefore likely to be different. These differences must be taken into account in setting up crucial lines of communication, particularly those that relate to ensuring water delivery. The Chinyamatumwa case study illustrated that women's access to town restricted their ability to interact with the Ministry that controlled their water supply, with the result that their crop suffered and water use was ineffective (N. Matshalaga, 1997; Chancellor and Hasnip, 1997).

Tools and equipment

In Zambia the use of treadle pumps has been particularly targeted to women to promote their control of irrigation water. Men find the ungainly activity of their wives unacceptable while the wives find the physical strain unacceptable. The pumps are regarded to be unsuitable to meet the objective. Unreliable pumps cause problems where the operational skills of either men or women are poor and where repair services is restricted for financial or social reasons.

Hand tools used in rainfed cultivation may be inappropriate in the irrigation context either because the gender of the user is different or because the task is different. For example (1) available hoes are unsuitable for use in close planted vegetable gardens, (2) often more physical strength than women can provide is needed – such as for moving long sprinkler pipes. These mismatches reduce productivity and increase energy requirements.

Training

Training is often less accessible to women than to men for a variety of social and temporal reasons. The importance of providing training, at times and places suitable for the trainee, was agreed. Providing training in the local idiom and the provision of training materials, manuals etc accessible to all users is thought to have a potentially large positive impact. emphasise

Suggested hypotheses:

- I. The use of labour is of equal importance to the use of water.
- II. Purchased inputs such as herbicides when used as a substitute for labour can raise profitability.
- III. Alternative tillage techniques (eg ripping, mulching) can reduce or ameliorate (eg by reducing bottlenecks) overall labour demand.
- IV. Gender-based Associations can operate constructively to raise scheme productivity / profitability.
- V. Design factors to facilitate women's use of equipment can be identified.
- VI. Lack of Standards and effective guidelines limit system performance / productivity / profitability.
- VII. Taking into account age and gender variables influences sustainability.
- VIII. Adopting an ergonomics approach to design will increase the extent to which the needs of both men and women are met.
- IX. Participation based on work contribution can contribute to reduction of existing gender biases.
- X. Attention to gender aspects of marketing for small-scale producers can improve the profitability of schemes and the livelihoods of individuals (i.e. reduce poverty).

4 Phase II Activities

In assessing the feasibility of research to support or refute the hypotheses, it must be borne in mind that some changes will be technically feasible, whereas others may take time, for example if a change of policy or law is necessary.

Zimbabwe

The question of appropriate pumps is of particular interest in Zimbabwe where a number of existing schemes rely on pumps which the farmers have a limited capacity to maintain and repair. Selection of the pump has in the past been heavily influenced by donor policy and has resulted in long term difficulties. There are two issues to be addressed. What are the criteria farmers and professionals should apply when selecting hardware? How can both men and women farmers access information about available technology and training and how are they motivated to do so? Hypotheses i, v, vi, and vii would be addressed in this context.

A second major concern is the gender aspects of land preparation. The long-furrow system, common in many existing smallholder schemes, has gender implications, which may support either government or donor policy objectives for rural women. Hypotheses viii and ix could be investigated in this context. Although, individuals within AGRITEX show interest in these problems, in the team's estimation there is doubt about the level of commitment to gender issues at policy level. Before proceeding with a detailed proposal for Phase II in Zimbabwe, we therefore wish to take advice from DFID, Harare, as to how the research could be linked to other DFID funded work in progress in Zimbabwe, such as the Small Dams Rehabilitation Project, to produce the best use of resources and opportunity

South Africa

The Ministry of Agriculture in Northern Province is in the process of compiling an inventory of some 170 smallholder schemes. Mainly sited in the former homelands of Lebowa, Venda and Gazankulu remarkably little is known about the schemes, their design, operational status, agricultural performance and impact on local economies. Some eleven have been selected for more detailed appraisal and it is planned to select two or three of these for development/improvement. At the same time DFID are supporting a programme of improvement in rural support services in the province. Our research partners in the Institute of Agricultural Engineering (IL) have undertaken to link the Gender-sensitive Design Research with these on-going programmes. The intention is to use the current investigative work in the Province to identify sites that will allow us to use matched pairs of schemes, preferably one pair of "food plot or garden scheme" and one pair of smallholder, commercial schemes. Introduction of participation towards gender-sensitive design in one of each pair would be initiated to test hypotheses iv, vii and viii.

It is expected that research can begin in August/September of this year when the inventory and preliminary investigations should be complete.

Zambia/ Namibia

The issues surrounding the introduction of treadle-pumps were clearly brought out in Mr. Moono's paper (D. Moono, 1998). Further investigation of how participatory design can incorporate the physical and social needs of communities as well as production needs is recommended. The questions raised in hypotheses i, vii and viii should be answered. We await further details of proposals from Zambia and expect to be able to initiate work during the second quarter of 1998/9.

Regional

Hypotheses viii, ix and x will be addressed in all locations as these issues are fundamental to both irrigation scheme sustainability and profitability as well as impact on poverty alleviation.

5 Phase II Funding

The Workshop highlighted a greater range of issues than was envisaged in the original proposal and has clearly illustrated that professionals in the region accord high priority to dealing with the gender aspects in mainstream smallholder irrigation development. As detailed plans unfold it is increasingly evident that the amount of research time required to address the priority issues exceeds the original estimate. We would like to take the opportunity to flag the need for additional funds so that as detailed proposals become available in a few weeks time, adjustments can be made to the original estimate.

Appendix II

SIWUP summary

**Smallholder Irrigation and Water Use Programme
(SIWUP) / Special Programme for Food Security (SPFS)**

Consultancy Draft Report

**A Socio-Economic Impact of the Use Of Dambos, Their
Long-term Land Use Changes and Classification In the
SIWUP/SPFS Pilot Areas in Zambia**

by
A.E.DAKA
(02/11/98 to 02/12/98)

**Food and Agriculture Organization Of the
United Nations**

Summary Conclusions And Recommendations

SOCIO-ECONOMIC

- Farmers' livelihoods and lifestyles have positively changed. Some farmers are reported to now afford sending children to school, to own livestock purchased from Dambo income and bicycles, radio and television.
- Women do as much work as men in Dambo cultivation. Men have empowered their wives to keep their household income.
- The SIWUP/SPFS have impacted positively among smallholder farmers in irrigation in the pilot sites. Farmers have been able to increase their income by a range of sixfold to tenfold depending on their management levels.

AGRONOMIC PRACTICES

- The cropping calendar at Fikolwa should shift cabbage, rape and tomatoes towards the rain season. This has implications of planting on raised beds and ridges in order to cope with possible flooding hazard. More acid tolerant vegetables are suitable during the dry season in the seepage zone.
- The uppergrassland and transition zones would prove suitable for a wide range of crops in most Dambos. This however is possible only with use of treadle pumps in order to command reasonable areas.
- Yields have improved under SIWUP with some farmers obtaining 18t/ ha and 30 t/ ha for cabbage, rape, tomatoes and okra.

CAPACITY BUILDING

- There is need to strengthen Water Users Associations in all the pilot areas so as to give them capacity for water control, farm record keeping and operation and maintenance of the treadle pump.
- The program has also benefited non - treadle pump users through being taught better cropping methods and water management in the seepage zones of Dambos.

ENVIRONMENTAL IMPACT

- There is evidence of Dambo desiccating at an annual rate of about 2% which is not alarming. Poor rainfall is blamed for Dambo drying.

*"Fikolwa is a wet low non-utilized sour source Dambo"
and
" Mudobo is a dry medium grazed and cultivated intermediate
source Dambo"*

IRRIGATION EXPANSION

- Before SIWUP average garden sizes of 0.01 – 01 ha were characteristic. After SIWUP garden sizes average between 0.25 – 0.5 ha
- An increase of 200 ha of land under treadle pump small – scale irrigation has resulted from direct purchase of treadle pumps after SIWUP demonstrations. This does not include pumps installed for demonstration purposes. An adoption rate of 75.4% per month has been achieved.
- From demonstrations in pilot sites, a total of about 400 individual farmers have adopted the treadle pump irrigation resulting in an increase of 200 ha of land under irrigation by small-scale farmers countrywide.

MARKETING

- Marketing of produce is a major constraint to the majority of farmers. Low prices as a result of glut on the market are common.
- The range of marketing possibilities is more flexible, predictable and greater than rainfed crops in terms of the times of the year at which they could be sold.

GENDER ISSUES

- There were no conflicts regarding specific roles men and women perform in preparing land and growing vegetables in Dambos. It is however apparent that women are involved in most of the activities as compared to men. However, women appreciate the most laborious activities men have to perform.

Appendix III

Gender based constraint analysis issues and experiences from selected irrigation sites in Zambia

**GENDER BASED CONSTRAINT ANALYSIS ISSUES AND
EXPERIENCES FROM SELECTED IRRIGATION SITES IN
ZAMBIA.**

**Prepared for the ODA/ODU- Agritex (Zimbabwe) Workshop On
Gender Sensitive Design for Smallholder Irrigation, 10 -12
February 1998, Masvingo, Zimbabwe.**

Prepared by:

Deric S. M. Moono REng, MEIZ, AMSAE

February 1998

Abstract

Constraint analysis of the irrigation programme in selected sites of Kalomo, Kafue and Mkushi districts reveal that women in the project sites still desire for the realisation of reduced workloads, reduced time schedules, improved living standards and traditional constraints women irrigation still prevail and dominate. Women have no defined ownership to land and water. Women have not reduced their workloads under irrigation, neither have their livelihoods improved significantly, except where women have been empowered to group and find strength in co-operation, the case of the Malende site, Kalom District.

Women need to be empowered directly with knowledge and skills. Representation by men has not had the desired and assumed trickle effect. Introduction of irrigation technology should have a holistic farming systems approach and avoid stereotype dogmas that are so enshrined in institutions and traditional perspectives. Women Must be given correct consultation at all levels of project or technological inception and there on. They are still the custodians of the all important triple rows of reproduction, production and management of work.

If women are not consulted the strategic and practical gender needs may be missed all together (Molyneux, 19985) ultimately the project suffers as the case was in the introduced lifting devices where women new the limitations of the water resource . Had women been consulted, the high volume Kasisi treadle pump would not have been selected for the dry Kalomo District. The concept of "Hand pumps designed by and for women and respective appropriate training by women" might sound an extreme quest ' but this might be the only alternative to bring effectiveness to delivery systems of technologies to the ultimate users, women.

In decisions concerning cropping and other technologies under irrigation, women have different preferences to men despite the fact that the may not have the right to decision making. Women are more concerned with household food security than direct commercial benefits as their ranking of crops showed in all the sites while men have a commercialised outlook to cropping decisions under irrigation.

Women demand that project design should be focused and targeted and identify, as soon as possible, to areas of highest potential with full participation of women Project must have in built flexibilities to fit in a holistic farming systems. A project involving women may require soliciting the cooperation of both sexes (Evans 1989). If women and men were able to cooperate we would have made successes of many irrigation schemes. Correct needs assessment should be carried out to determine the actual needs of all especially women. In a needs assessment in Kasama district (Milimo, 1994) a women's club ranked the seven most important items women wanted to acquire as a Hammer mill, sewing Machine, Knitting Machine, Cooking Oil Extractor improved Farming Methods, Timely Delivery of Fertilizers, Consumer shops. This shows that mobilized and empowered women can aspire for high technologies and irrigation should be no exception.

1.0 Background

Zambia is a participant to the FAO promoted Special Programme for Food Production for Food Security. In 1996 a mid-term programme constraints analysis (Moono et al 1996) conducted in 1996 covered among other aspects the impact and constraints of the irrigation component of the programme.

It was during this constraints analysis exercise that a lot of issues constraining the development of small scale small holder irrigation were discovered on the selected irrigation pilot sites.

2.0 Objectives

This paper therefore aims at revealing and discussing selected findings of a constraints analysis study carried out in Zambia under the auspices of the FAO Special Programme for Food Production giving special attention to small scale small holder irrigation and gender aspects. The study covered eight pilot irrigation sites in three districts.

3.0 FAO SPFPFSP Programme Setting

The programme involved households (Labour), land, water and irrigation technology as an input. Management was modelled on a Water User's Association. It was mandatory to involve at least 25 % women participation and women groups were especially encouraged. Before the introduction of irrigation technology to the 8 sites a phased comprehensive training programme involving three levels was introduced as follows.

- i) Training of Technical Staff
- ii) Training of Extension Staff by Technical Staff
- iii) Training of Farmers by Extension Staff

At all levels, training covered irrigation methods, aspects of irrigation agronomy, disease and pest control, water management, operation and maintenance of selected and introduced low lift pump!-.

4.0 Findings

The findings during this study reaffirms past research finds and theories about the role, participation, and involvement of women in community based projects.

4.1 Production

Even irrigated agriculture, women contribute most of the labour requirements (IMA, 1993) This was also true especially in a polygamous marriage situation predominant in Kalomo of Zambia.

Women priorities are those of increasing production and incomes under reduced energy input, manageable time schedules and reduced workloads (Chancellor, 1997, WRD,1993, ICNU 1981).

It was found in the study that the introduction of irrigation if not well planned added to the workload of women and disrupted the traditional time and job allocation schedules in the traditional triple role of women.

For example women waited idly for hours waiting for their turn on a rotational low lift pump because the plot design was individualised rather than networked by a canal.

The Irrigated plots grew bigger with the coming of the pump and women spent more time gardening in addition to other routine household activities. Women confessed that since this "New Gardening" came we have little time to rest.

The Kasisi Treadle pump was heavy and difficult to operate for women, children and the elderly. It was found therefore that women without elderly children and widowed had to spend many hard hours to irrigate their plots.

4.2 Resource Ownership

Historically, when gardening it was small scale in the tradition sense, it was regarded as a woman's activity. However when highly remunerative, organised irrigation under institutional support came in the men hijacked the programmes took over most all the decision making. This was clear with the pattern of inventorised ownership of irrigation sites in Kalomo, Kafue, and Mkuuhi Districts in Zambia. In Kalomo, out of 190 smallholder irrigators, 165 were registered as men and 35 as women owners. In Kafue out of 1,052 small scale irrigators, 729 male and 325 are female. While in Mkushi District, out of 3,037 irrigators 2,410 are male irrigators and only 627 are female. This gives the impression that men own, manage and work the irrigation plots.

The above reaffirms the male domination and the silence on women land resource ownership. This also brings into picture the need to eliminate the de-womanization of land rights with the realization that women in Africa are the traditional resource managers (ILO, 1988). Further, the African Women Assembly(ICUN 1998) did note that women suffer with the development of irrigation with the introduction of greater labour demand, pollution of clean water and loss of land in reallocation for titling in the name of resettlement.

4.3 Women Irrigation Project Priorities

If women were to be given a full voice on decision making in an irrigation project, experiences from the irrigation sites indicate that women's priorities would have been as follows:-

4.3.1 Crops

Women are more concerned with house hold food security indicating more inclination to family care and spend more incomes on health, nutrition and education (UNCED 1993, WFP 1996).

In the irrigation pilot sites under study Zambian women irrigators indicated a preference to crops that had more direct household value in terms health, nutrition and education.

In Kalomo District a groups of women, using pairwise ranking indicated that Groundnuts, Okra, Maize, Bambaranuts, Cabbage Tomato and chickens in order of importance brought them more household incomes while men using the same tool ranked their income resources as Maize, Cattle, Pumpkins, Watermelons, Tomato, Rape and Onion. The ranking reflected mens commercialised outlook to irrigation and marketing in general while, women's ranking is an indication of their concerns to food security, their limited market, usually at village community level and their limitation to decisions and control.

Further, by ranking the traditionally woman's crop groundnuts first, it indicates that women can be conservative in an effort to protect their long standing indigenous knowledge especially when a new technology is perceived as threatening their control over their livelihoods (WWN, 19986).

Table Ia, b, c, d at the Annex shows the crop and commodity preferences for income generation of women and men in Kafue and Kalomo District,

4.3.2 Low lift Devices

During the programme period three types of low lifting devices were introduced namely the Kasisi Treadle Pump, Bangladesh Treadle Pump and Rope and Washer all of which were well tested prototypes in their countries or places of manufacture. With the introduction of these devices the general traditional aims were to increase the area under irrigation and consequently incomes. However, as always, the manufacturer and programme Initiators are oblivious to the real needs of women, the end users, with the result that the introduced pumps did not answer women requirements and below are some of the selected comments

Kasis Treadle pump

The peddling of the pump is hard and as already mentioned requires men or young men. Women without this category of men and young adult males abandoned the pump and reverted to the bucket. Therefore the design fails to address a correct relationship between the energy inputs, despite the cardinal theory that higher inputs are required if yields are to be increased (Giles, 1975) especially in the context of women.

The Pump breaks down frequently and sometimes does not pump at all- It was later revealed that the need for priming and keeping the leather caps wet was demonstrated to only a group of men and young males with a view that the knowledge 'will trickle to the women. The past has shown that women have not benefited from this assumption (Boserup 1970, Rogers 1980)

For security reasons, the pump had to be transported to and from the village every day. The Karisi pump was bulky and heavy requiring transportation by a pair of oxen. This again quickly put the women at the mercy and grace of men for this daily task as tradition dictates that usually, only men handle animal traction.

This brings the question of realising early in the project inception whether the new technology will require supporting services eg, transport, workshops and spares. In this Kalomo site, the pump was disused for months because one plunger rod broke and was not available or fabricated in the community.

Bangladesh Treadle Pump

This type of treadle pump was more acceptable to women as it had the many advantages over the Kasisi Treadle pump in that it was easily portable, had good volume and simple to operate. However women quickly commented that because of the low delivery head, it required that a delivery canal from the source to the plot and a field network. These associated technological support arrangements were beyond women's expertise.

The training received from the extension officers did not go far enough to transform women bucket irrigation gardens to furrow or flood irrigation. It shows that there is requirement that an effective training and delivery system for developed technologies suitable for women should be put in place well before the introduction of a technology.

Rope and Washer Pump

Where the rope and washer was installed women found it to be very unsuitable in many aspects. Some of the reasons put forward were as follows:

The rope gets easily entangled and the limitation of delivery and lifting associated with low volumes made it a no better advantage to the dependable long tested bucket. It also falls in the technological quagmire of requiring canalising, gravitational water management.

Perhaps the argument could be that women could be taught to prepare and manage the field layouts to suit the pump. This possibility is further nullified by the fact that in most sites land was owned in random parcels not ideal for surface irrigation a decision to reallocate re-parcel to suit the technology meant land sacrifices in losses and gains. Additionally, as we have already seen, land ownership is vested in men and therefore any decisions on land do not belong to women.

From the reactions of women to the three low lifting devices, one .15 I ft to agree that technology should be viewed as a commodity which must be situation specific at affordable prices, possibly locally mass produced in consultation with women, with backup small scale workshops and artisanry. In a nutshell women demand portable inexpensive, multifunctional, ergonomically suitable, compatibility with other activities and sustainable.

Women must be trained, involved and organised and should not be mere shadows of men. This requires therefore that literature on the technology should be translated and simplified to the literacy and numeracy of the recipients, women.

Table II at the Annex shows the general rating of the low lifting devices at selected pilot sites in Kalomo district.

4.3.3 Irrigation Methods

While, according to the extension training programme, all the basics of irrigation methods were taught and demonstrated, field evaluations showed that adoption was very low and restricted only to a few enthusiastic participants who were usually men. The evaluators quickly realised that the following could have been the cause:-

Training sessions and demonstrations were attended mostly by husbands who "promised" to teach the wives, Wives were usually absent because they out for other household chores fulfilling the woman's double day.

Literature was not available in local languages. Training sessions became short-lived verbal encounters.

Land desegregation also played a significant part in the failure to adopt irrigation methods as already discussed above.

Irrigation methods required time consuming initial and regular land preparation an additional demand to the workload and tight time schedules of women.

4.3.4 Land Tenure

Women in all the irrigation sites do realise that they are disadvantaged on matters concerning land. In spite of their triple role of reproduction, production and managing work they also realise that their gender interests are more enshrined in the social positioning and cultural attributes.

The inventorisation of plot ownership already discussed above illustrates the grim picture.

"In a polygamous, marriage of four wives my husband gives the biggest and best part of "his" plot to his favoured wife, yet she is the laziest while I am left with this small rocky patchy with my many children, confessions of a woman irrigator in a polygamous marriage.

In three irrigation sites of Kalomo district the irrigators composed of women only, Choonga, Malende and Chiusa. The women, through the traditional land tenure system, managed to acquire land specifically for their irrigation club. These three women irrigation clubs showed a measurable amount of success because for a change, they said, were in control of the main resource land. With land under their control, they could "reshape" and reallocate land according to the dictates of the technology. It is out of this strength in land ownership that women were able to integrate irrigation in their traditional calendars and daily household chores such that the Malende irrigation boasts of a thriving bank account and growing membership.

Table III at the Annex gives the distribution of irrigators by gender in project sites of the three districts of Kalomo, Kafue and Mkushi in Zambia,

4.3.5 Water Resource

While water for irrigation in the high rainfall areas of Mkushi was abundant creating little demand conflicts between users, in many sites of drier low rainfall Kalomo district, the competition for limited water resource comes into play. In these areas there is already traditional competition between domestic animals and people for any water source. When high tech high volume and frequent irrigations on expanded gardens are introduced, this adds a new dimension to the competition for water. Here are some observations from the women of Kalomo;-

The new pumps suck too much water from the shallow wells and small streams, which have poor recharge rate.

- This forced women to reduce the household water requirements and puts women into hours of idling wasted time while waiting for the wells to recharge.
- The water quality suffers especially turbidity. The women demand that the pumps should be designed not to finish their water suddenly because they need it for household and domestic animals.

This demand and supply dilemma was even more compounded where there were upstream and down stream users.

It is clear from the example above that irrigation should not heavily compete with traditional farming and livelihood systems but rather enter into a holistic interdisciplinary approach using a step by step approach compatible with existing resource ceilings and management capabilities(Nornian, Collins 1995).

It may therefore almost possible to predict the acceptability of irrigation technologies by looking at the water resource inventories and the amount of "Gardening" being practised. The current status of gardening has evolved out of role of women and sometimes men responsibility as communal resource managers.

Table IV show sampled water resources inventories in Kaloomo and Kafue districts. The bigger the water resource the more active was traditional irrigation and vice versa.

5.0 Conclusion

In the selected irrigation sites for the irrigation constraints analysis, majority of women are still inadequately empowered with knowledge and skills. Women are not adequately consulted and they lack resource ownership.

References

1. Moono et al, 1996, FAO, SPFPFPS Irrigation component-Constraints Analysis, Lusaka, Zambia.
2. Chancellor F, Hide H, 1996, Smallholder Irrigation; Ways Forward, Guidelines for Achieving Appropriate Scheme Design Vol I and II. Report OD136, Wallingford.
3. Loudiyi D, IUCN, 19989, African Women Assembly: Women and Sustainable Development Workshop Proceedings, Harare.
4. FILMUP and UNIDO 1994, Proceeds of Seminar on Zambia's Lands Bill, Lusaka Zambia.
5. IMA Management Course, 1993, Women in Agricultural Systems, IMA.
6. Milimo, 1994, House Hold Food Security and Nutrition and Income Generation in Kasama and Serenje Districts Evaluation report, Lusaka, Zambia.
7. Chancellor F. 1997 Developing the Skills and Participation of Women Irrigators, Report OD 135, Wallingford.

ANNEX

Table Ia Income Sources as Scored by Women in a Pairwise Participatory Exercise at Choonga Irrigation Site, Kalomo District

Crop	Score
Groundnuts, Green Maize	4
Sweet Potatoes	3
Bambaranuts, Cabbage, Tomato	2
Rape, Cattle, Goats and Chickens	1

Source: (FAO, SPFPFSP, 1996)

Table Ib Income Sources as Scored by Men in a Pairwise Participatory Exercise at Choonga Irrigation Site, Kalomo District

Crop	Score
Green Maize	4
Cattle	3
Pumpkins, Water Melons, Tomato and Cabbage	2
Rape, Onion, Goats and Chickens	1

Source: (FAO, SPFPFSP, 1996)

Table Ic Income Sources as Scored by Women in a Pairwise Participatory Exercise at Mungu Irrigation Site, Kafue District

Crop	Score
Citrus	6
Rape	5
Cucumber	5
Maize	5
Pumpkins	4
Cotton	2
Cabbages	1
Tomato	1

Source: (FAO, SPFPFSP, 1996)

Table Id Income Sources as Scored by Men in a Pairwise Participatory Exercise at Mungu Irrigation Site, Kafue District

Crop	Score
Citrus	3
Rape	5
Cucumber	6
Maize	2
Pumpkins	4
Cotton	1
Cabbages	3
Tomato	3

Source: (FAO, SPFPSP, 1996)

The information in all the tables above reveal diversified preferences between men and women due to cultural, traditional and market forces.

Table II Evaluation of Lifting Devices at Selected Sites in Kalomo District of Zambia

Lifting Device	Labour Requirement (Energy Input)			Durability (Measure of Break Downs)			Efficiency (Area/Unit Time)		
	Mangawto	Choonga	Chibusya	Magwalo	Chonnga	Chibusya	Mangwato	Choonga	Chibusya
Bucket	1	1	1	1	1	1	3	2	2
Carcase Treadle Pump	2	2	2	3	2	2	1	1	1
Bangladesh Treadle Pump	3	N/A	N/A	2	N/A	N/A	2	N/A	N/A
Rope and Washer	NE	N/A		NE	N/A	N/A	N/A	N/A	N/A
Small Diesel/Petrol Pump	NE	N/A	N/A	NE	N/A	N/A	N/A	N/A	N/A

Source: (FAO, SPFPSP, Moono et al 1996)

NOTES: N/A - Pump not installed at site due to logistical and technical problems.
N/A* - Pump not provided to the site

Appendix IV

Small-scale irrigation using appropriate water lifting devices

SMALL SCALE IRRIGATION USING APPROPRIATE WATER LIFTING DEVICES

1.0 Background

Livingstone Food Security Program aims to improve the food security by addressing the underlying causes of food insecurity with the following objectives:-

- i. building the capacity of the community institutions
- ii. achieving sustainable farming systems, particularly in the areas of crop mix and varieties, soil fertility, soil moisture conservation and tillage practices.
- iii. Improving water harvesting, harnessing and utilization technologies and practices for domestic, livestock and cultivation purposes.
- iv. Raising incomes, developing market linkages and improving the distribution of income earning opportunities throughout the year.

This paper focuses on objective number iii and iv:-

1.1 Mandia Vegetable Scheme

Gardening came out as one of the needs for Mandia during the Participatory Rural Appraisal exercise (PRA) which was carried out prior to the project intervention.

Mandia, which is situated along the Zambezi bank, had adequate land for gardening hence thorny branches are used to fence their gardens to prevent cattle from grazing the vegetables. Kraal manure is used to improve the solid structure and increase the soil fertility of the sandy soils.

1.1.1 Irrigation methods

The gardens slope down to the river and the methods of lifting water to the fields by use of a bucket. Therefore, irrigation involves several up and down movements. This limits expansion. This is compounded by the fact that the underlying rocks makes digging of channels difficult, thus becoming hard for people to trap water for their gardens.

1.1.2 LFSP introduced 2 types of pumps namely:-

Pressure pump and suction pump. The aim of introducing these pumps was to help the farmers increase their vegetable gardens, which would enable them produce enough for consumption and sale. The pumps were tested for 6 months to ascertain their appropriateness. Water troughs were constructed to enable the 41 farmers pump water into the troughs from which they could lift to the beds.

Pressure Pumps

- ☐ Able to deliver water into the field from the river.

Suction Type

- ☐ Sucks water from the river after which water flows out of the outlet spout and flows into the field by gravity. (*This means that the pump has to be placed on elevated ground)
- ☐ It is not easy to design an irrigation system with this pump taking into consideration the topography along the river

1.1.3 Farmers reactions

- ☐ Troughs made the work more tedious in that water was first pumped into the troughs and later lifted to the beds
- ☐ Body pains due to fatigue
- ☐ Single women concluded after trying the pumps that the method required couples and not singles due to difficulties in operating it and also the pressure needed to lift water to the upland.
- ☐ It is not suitable for single women.

1.1.4 Constraints

- ☐ Due to too many handles, little care was given to the pump, this resulted in frequent breakdowns and wearing out of cylinder, check valves and pulley due to non alignment of plunger.
- ☐ Lack of training in pump utilization leading to frequent breakdowns.

1.1.5 Achievements

- Increased area of production due to bigger volume of water pumped per minute (i.e. 4-5, 15L buckets/bed/10mins previously, now 2-2.5L/min). Size of beds = 1.5m x 10m
- Accessibility of fresh vegetables, i.e. cutting down on labour for women in terms of looking for relish.
- Learnt to work as a team.
- Purchasing power increased as a result of vegetable sales. (buying chitenges for wives bought cattle, food etc).
- People spent their time on productive work than drinking – irrigation consumed most of their time, after knocking off they would be tired and decided to go home and rest.

The project tested the pumps in Katapazi, another area in the project. Katapazi has access to all year round sources of water such as springs, rivers and streams. The pumps have been accepted by both men and women. Four treadle pumps have been distributed to date. (See attached Case Study i.e. Effects of the treadle pump).

Other than treadle pumps, which have been introduced, for irrigation, spring capping is being done to stop water from running off. Water is drawn from these reservoirs by using a bucket and also canals will be constructed to allow water flow into the field by gravity.

1.1.6 Distribution System

In the same vein, the project is constructing a distribution system at the artesian well in Sinda. The community together with CARE agreed to utilize the water for livestock, fish farming and gardening. The irrigation system made up of a concrete tank has been constructed in such a way that water can easily be channeled to the gardens. Three methods of irrigation will be promoted i.e. flooding, furrow and spot.

The system is expected to benefit 40 farmers. The estimated hectareage to be irrigated is 2 hectares. The system has the following advantages:-

- a) Easy to operate
- b) Suitable for both men and women
- c) Leaves room for other activities

2.0 Recommendations

- Demonstrate on both types of pumps again.

- Water should be pumped directly into the gardens.
- Re design the troughs to allow water flow by gravity to the beds
- Introduce other types of pumps for suitability in different areas
- Distribute more treadle pumps to farmers who have applied

3.0 Conclusion

From the demos, which have been carried out, the pressure pump has been appreciated by the community, as such the project is considering supplying the same on loan.

ANNEX

Case Study

Effects of a treadle pump on activity profile of a household.

Mr. and Mrs. Sichonti have a vegetable garden where they grow rape and tomatoes for own consumption and sale. Last season Mr. Sichonti planted paprika in their garden. This change meant an increase in Mrs. Sichonti's labour requirements. This task of watering the gardens is primarily a role of the wife and other females in the household (LFSP, 1997).

In response to this increase in labour demands necessitated by the introduction of paprika, LFSP loaned Mr. Sichonti a treadle pump. The introduction of the treadle pump. The introduction of the treadle pump has achieved the following benefits;

◆ *Reduced Mrs. Sichonti's labour demand*

Mr. Sichonti has now started irrigating vegetables using the treadle pump, a task previously done by Mrs. Sichonti. This development gave chance to Mrs. Sichonti to concentrate on other family fields – e.g. harvesting groundnuts and millet, refer to box 1 on activity profile of Mr. And Mrs. Sichonti.

◆ *Reduction of irrigation frequency*

Irrigation using buckets would result in Mrs. Sichonti watering every after 2 days with the treadle pump. Mr. Sichonti irrigates every after 5 days because more water is irrigated at a time.

◆ *Reduction of workload*

Lifting the water from a shallow well using buckets, was quite strenuous for Mrs. Sichonti. As a results, irrigating the entire garden would take her 7 hours per week. Now irrigating the same garden takes Mr. Sichonti 4 hours per week.

1. Wife

DAILY ACTIVITIES WITHOUT TREADLE	DAILY ACTIVITIES WITH TREADLE PUMP
05.00 hrs: wake up to go to work in the main fields.	05.00 hrs: wake up go to work in the main fields.
12.00hrs: return home to prepare lunch, clean dishes and pots, draw water.	12.00 hrs: return home to prepare lunch, draw water, clean dishes and pots
14.00hrs: go to the garden, water vegetable using cans	14.00hrs: go to the gardens, prepare beds for paprika, transplant paprika (lasted 3 days). Return to main fields to harvest g/nuts.
16.00hrs: move to the main fields to start harvesting g/nuts and other crops	17.00hrs: return home, draw water and clean dishes and prepare dinner.
18.00 hrs: return home to prepare dinner for the family, draw water and clean dishes and pots	

2. Husband

DAILY ACTIVITIES WITHOUT TREADLE	DAILY ACTIVITIES WITH TREADLE PUMP
07.00 hrs: wake up, go and plough plant main fields.	08.00 hrs: join the wife at the main field or herd cattle.
11.00hrs: drive animals to the watering points.	12.00 hrs: have lunch, go to the main garden to make beds, fencing garden
12.00hrs: have lunch	14.00 hrs: prepare nursery to plant seeds. Water using the treadle pumps.
14.00hrs: go to check progress of work at the garden. Instruct wife what to do.	17.00 hrs: go home to wait for dinner.
15.00hrs: return home to rest and do some maintenance work on the structure e.g. kraals, houses	

Appendix V

Zambian consultations

1. Consultation with FAO

Andries Bosma (FAO) provided background information on smallholder irrigation in Zambia. Group-based irrigation is not widespread, there is only about 70 ha of formal smallholder irrigation in total, and it is not actively promoted or regarded as a growth area. FAO and MAFF have commissioned a vigorous programme to promote improved water use by individual farmers through extension. A series of workshops aimed at training the trainers is already in progress. The content of the workshops focuses on developing the skills of the extension staff to assist farmers in making informed choices about crops, fertilisers and chemicals, equipment and markets and strengthening their understanding of agricultural processes

The programme focuses on promoting use of the suction treadle pump and, in partnership with IDE, who manufacture and distribute the treadle pump, has facilitated the sale and installation of more than 1000 pumps nation-wide. The demand for treadle pumps is reckoned to be strong.

There is a proposed FAO programme, due to begin in June 1999, entitled, 'Empowerment of Women in Irrigation and Water Resources' to assist women and improve nutrition through irrigation development. The project will be implemented on the sites of the water control components of the FAO-supported Special Programme for Food Security (SPFS) in Zambia, Cambodia and Nepal and is expected to span three years of activity

Feedback meeting

After the field visits, it was agreed that there is an urgent need in Zambia for stimulus in the agricultural sector. Promotion of treadle pumps could be an effective strategy to address the poverty of rural families and the low nutritional status of children which is of prime concern. There is potential for increased use of water among poor rural people to grow food crops to improve livelihoods and income. Demand for research into development of small irrigation businesses is strong in Zambia and will be supported by MAFF. There are also clear linkages between the need for further research into appropriate irrigation design and the proposed FAO programme

2. Ministry of Agriculture (MAFF)

Mrs Tembo, Leader of the Women and Youth Department, MAFF, Lusaka was concerned that the labour saving of the treadle pump should empower women. It is not clear how that is to be achieved although there is general agreement that the pumps can increase productivity. The workload of women in bucket irrigation is recognised to be a constraint to women in fulfilling other obligations to the family. The impact of treadle pumps in reducing the time and effort involved in irrigation has potential importance for women in helping them increase income generation from irrigation or in increasing time for other activities. It was agreed that this would help women although it was not necessarily empowering. There are significant problems in

achieving women's participation in choosing technology. Mrs Tembo emphasised the importance of encouraging women's groups to register with the authorities to provide themselves with legal rights.

3. International Development Enterprises (IDE)

Peter Elkind and Angel Saka of IDE gave a full explanation of their pumps and the partnerships arrangements with various NGO's to ensure availability of the pumps and spares in the various regions of Zambia. They train members of the NGOs in the regions to advise farmers on the purchase of the correct pump and subsequently on its correct installation and maintenance with information about how to do minor repairs and replacements and how to get hold of, or manufacture, the parts. They agreed that the main users of the pumps are women, however the main purchasers, and presumably owners, are men. Out of 700 sales in the last year, only 4 were to women. A number of pumps have been distributed for demonstration purposes and farmers can subsequently buy those at the end of the demonstration period. They reckon the pumps to be pretty reliable and have had no failed models so far. IDE provide a guarantee with new pumps purchased and undertake to repair or replace models with manufacturing faults. They also provide operation and maintenance booklets with the pumps, irrigation manuals and examples of crop budgets bases on I hectare of the crop in question.

Ease of operation was discussed and it was thought that the suction pump was really easy for women although the pressure pump required more effort and was probably less suitable. The general suitability of the pumps for the Zambian situation in which water is commonly accessible within 7 meters of the surface seems to make them a feasible solution.

The current cost of the pump is 135,000 Kwacha (approx 60 US\$). Pipes must be bought separately and these are relatively expensive. In some cases where the water has to be conducted over a distance this may double the cost. The idea of watering a small area intensively to raise funds for more pipes might be acceptable to farmers and it was apparent this would depend on successful marketing.

Feedback meeting

Feedback on users, the way they were utilising the pumps and the gender composition of the buyers in the CARE project and the loan system used by CARE to promote the pumps was well received. IDE saw a great need for links with credit organisations, as they are unable to provide the capital required for credit schemes. They appreciate the serious need for training, both relating to use of their pumps, record keeping, and basic business management. They would like to offer more training but their company circumstances do not permit it. They recognised a need for improved on-farm storage, food processing skills and links with food-processing industries. IDE also believed that women's use of treadle pumps would reach significant proportions only when they were part of a women's group. He made the point that evaluation of the benefits of treadle pump use should not be limited to cash generation but should include the nutritional benefits, particularly from the growing of extra vegetables, to users' families. We indicated that CARE is interested in the availability of the bucket

drip systems and thought these might be appropriate for women as they are truly labour saving and very cheap.

The interest that had been shown by the Women for Change team and reservations they expressed were mentioned and it was recommended that IDE meet up with them and investigate the possibility of a gender analysis. However it is unlikely that IDE would be able to fund an investigation.

4. Programme Against Malnutrition (PAM)

Programme against Malnutrition focus on the need to reduce the number of cases of malnutrition. In Zambia it is thought that there are 3-4 child admissions due to malnutrition in each district each month. Vegetable growing in the dry season is seen to have a positive impact on malnutrition. The programme has distributed a small number of treadle pumps last year but, so far, there has been no formal evaluation of the impacts. It was agreed that the results of the current research may be of interest and would be forwarded in due course.

5. Department of Agricultural Engineering and Agricultural Economics, University of Zambia

Dr Kwendakwema, Head of the Agricultural Engineering Department, School of Engineering, University of Zambia (UNZA), feels that the Department has come along way from teaching the traditional design approach to favouring the farmer or user orientation. Recently gender has also been taken on board and is increasingly recognised as important in a sector where women are the main users of irrigation systems and equipment.

However, he emphasised the need to take a holistic approach with particular attention to the presence of market structures that allow farmers to reap the benefits of the improvements they make in their production systems and in the quality of their produce. There are several constraints in this aspect such as the general lack of on farm storage, particularly of hybrid varieties that are less resistant to storage pests than indigenous species. He favours promotion of appropriate maize decorticators as a simple and cheap way of improving on-farm storage. There is potential to promote women's ownership of such a machine as an effective income generation strategy. He suggested that many families who have a member working in town might be able to raise money for one. However, there is doubt that investment in a machine that would only be used at harvest time would bring in enough return to justify it as a priority investment for poor people.

Another major concern is the lack of grading in the current liberalised trading scenario, so that, farmers who make the effort to improve quality may not benefit in proportion. A third issue is that of transport, where costs are very high. The farmers are left with a slim margin and sometimes even a negative return after all costs are deducted. Fourthly, growing on credit often results in farmers selling soon after harvest at relatively low prices to repay credit; by the end of the season they have to buy back at higher prices. Coupled with storage problems this has a negative impact on farmer success.

It appears that no data collection has been done in the university on the economics of irrigation or forecasts of the effect of increased supply of vegetables from irrigation on the market price of vegetables

6. Women for Change

Women for Change is a Zambian NGO that works towards the empowerment of women in remote rural areas through gender analysis and popular education methodologies to achieve social change (1997 annual report).

They are keen to work closely with IDE in future as IDE are moving to an adjacent site. Gertrude Nkunta offers a gender analysis consultancy service. The WFC staff team and chairman provided a wide discussion on the gender issues surrounding treadle pumps covering health issues for pregnant and post natal users, control of resources and profits and potential for poverty alleviation. The overall view was that there was a need to look more closely and objectively at the issues and to monitor the impacts where pumps had been in use for some time before it would be clear what the impacts for men and women were. They had considerable reservations about the ability of the technology to reach the poorest section of the rural communities. The unit cost was too high.

They also pointed out the fact that many poor women do not operate in the cash economy and much of their commercial activity is achieved through barter, a disadvantage that precludes pump purchase. There is a danger when the pump is a man's property that he will exact more work from family women as he extends the irrigated area.

7. Ministry of Agriculture, Lusaka District Extension Office , MAFF, Kwatcha House.

Grace Kancheya-Nkhuwa, Acting Senior Agricultural Officer, Lusaka District Office, MAFF explained the structure of the Agricultural Extension Service in Zambia, giving us a understanding of the information flows from National government policy level to the farmers and back. She had worked with women's groups in Choma and was of the opinion that women's groups were more successful than mixed, predominantly male farmer groups. In her experience, mixed or male farmer groups had difficulty sharing equipment. She was of the opinion that women's groups offered a way forward for empowering women in agriculture.

It was often difficult for women's groups to access land, it was sometimes done through use of a man's title but this is open to reclaim and so of limited security. This is a constraint on women investing money to improve irrigation on the land. There is currently a move afoot by the Women and Youth department to address this as a legal problem.

We asked about the gender split among Camp Officers in Zambia and she said that in Lusaka there was a relatively high proportion of women, in fact they outnumbered men, but in rural areas men predominated. She said the reason behind this was that women did not see agriculture as a career opportunity for them. Women were

attracted to qualifications in health and hygiene, teaching and secretarial work. Those who do take up agriculture find the Camp Officer posts difficult due to the amount of travelling and field work involved.

8. Women in Agriculture, President Cecilia Makote

Mrs Makote who heads the NGO was well aware that irrigating with buckets is hard but she clearly felt that the alternative of treadle-pumping was only a minor improvement and was not really the answer for women. In fact, none of her women were using treadle pumps. (This may, however, be largely explained by the fact that their water sources were at least 15 m deep.) CM appeared to be more in favour of motorised pumping systems and cheap drip systems. Largely on the basis of effort.

We discussed at length the problem of women's lack of control over productive resources and lack of control over a fair share of the profits. Issues surrounding land tenure arrangements in the urban and rural areas are different and she felt that women have more ability to acquire land in the urban setting, although they have to demonstrate their ability to use the land productively before they are granted any rights. It was not clear if they could then sell that land.

CM believes that marketing is crucial to the success of schemes such as her women in agriculture farms. Associated with that is the problem of storage to avoid selling produce cheaply because of the need for cash, and then having to buy it back later at a much higher price. (already mentioned as a major issue at UNZA)

Her NGO has support from MAFF but the relationship was not quite clear. She has four women's groups at different sites that undertake farming for the profit of women and their families, ploughing back profits to the women and also to fund the expanding activity of the organisation. They appear to attract money from other sources and are clearly vociferous on the needs of women in agriculture.

8. CARE International, Lusaka.

Evaluations of the early treadle pump pilot scheme was undertaken by Highland Hamdudu. That report may be obtainable from Florence Mubanga at Livingstone. Current evaluations are unlikely to deal with treadle pumps specifically. The use of treadle pumps by women was in his experience mainly in women's groups.

Discussion with Godfrey Mitti revealed that transport is a big constraint to marketing vegetables around Livingstone and a number of strategies have been suggested. He favoured the organisation of rural markets 30 to 50 Kilometres out of town arranged in a weekly rota so that farmers in each district had a day on which to present their produce for sale at a well advertised spot. The organisation would be such that each district had a market monopoly on that day. He understands that the system works well in Malawi. He said that there was widespread awareness of the importance of

marketing. It is important that market demand can be forecast to enable farmers to plant appropriate crops in advance.

He mentioned that DFID is now funding the water component of the CARE project and that IOH has involvement with the introduction of collector wells in Zambia. CARE is also involved in dam rehabilitation. He reckons the use of treadle pumps will increase in the South to avoid drought and in the North for clean domestic water.

Appendix VI

Field visits Zambia April/May 1999

Individual Irrigators

Southern Province, CARE facilitated treadle pumps

Interviews were held with three farmers who were using treadle pumps to irrigate vegetable gardens to develop an understanding of the farmers' situations, their constraints and opportunities. The farmers in the Southern area who have acquired treadle pumps have done so only relatively recently so conclusions can only be tentative at this stage. CARE facilitated 18 farmers to buy treadle pumps through loans, and support the farmers with advice on technical, agricultural and marketing matters. The farmers who took up the loans were men. Affordable bucket drip equipment was thought to be a very suitable technology for relatively poor irrigators and the possibility of promoting this technology among women was discussed.

Farmer 1 (Siandazyia village)

Tobias got his treadle pump six weeks ago and had previously watered his garden using buckets. Watering took him and his two wives a great deal of time and effort and had to be done frequently. His garden was approximately 0.25 of an acre. The layout and levelling was well thought out and the garden was well fenced. It sloped towards the stream from which he pumped water; so he had not needed to put in drainage. He was growing successive plantings of kale (rape) on most of the garden but had also small areas of onion, tomato and cabbage.

Since he has had the treadle pump, he has been able to water more thoroughly. He still requires his wives or children to help as, while one person treads, the others conduct the water along the channels he has constructed to the furrows and beds where the plants are. However, they no longer need to carry buckets. Each watering still takes time but, it is much less exhausting and, because more water is applied, the frequency of watering is less and so time is saved in that way. Furthermore, the reduced frequency of watering creates time for more substantial alternative activities.

Transplanted seedlings need water once in three days while now he need only water the mature vegetables once a week (previously every four days).

He had to lift water about 1.75 metres. His water source is a seasonal stream that is expected to provide water until September. He also has another garden, where the stream is perennial, to which he will move the pump later. He had three installation sites for the pump in order to be able to command the whole garden. He found the treadle easy and had had no problems with the pump, although priming it seemed a little difficult, possibly due to the length of the pipe he was using at that particular installation site. He had constructed a home made settling pond at the intake to reduce sediment entering the pumped water. Although he was clearly the main user, his wives could use it and also youngsters of ten or upwards could, but found it tiring and complained of sore knees.

Because he was anxious about durability of the pump if it had to carry his full weight, he had constructed a small beam on which he could sit, above the pump, and which took most of his weight whilst he operated the treadles.

This farmer was very knowledgeable about the cultivation of vegetables and used both fertiliser and pesticide to ensure good timely crops. He reported that he had no trouble selling all his produce and buyers come to the garden to collect, helping to reduce his marketing costs. Clearly, he was already confident of his market before investing in the pump. He was very pleased with the added capacity it gave him and felt that it gave him an edge over other producers, even those with small diesel pumps because they had to face higher capital and running costs.

Now that less time and effort were needed for watering, he and his wives had more time for thorough weeding and doing other things. He made some interesting observations on how rape could not be grown successfully when it received both irrigation and rainfall, unless root pruning was undertaken. After discussion it was agreed that this was more likely to be related to root formation in response to the wetting pattern in the soil profile rather than to the quality of rainwater or irrigation water as he initially suggested. Nonetheless, the farmer seemed well able to provide the necessary solutions.

He also knew the market well and was able to consider planting to achieve a good flow of vegetables that would fetch good prices when they were ready to harvest and sell. He pointed out that there were already 120 vegetable growers in the area and as most grew a similar range of vegetables, he realised diversification was a good strategy. He is considering carrots and Irish potatoes.

Farmer 2 (near Siandazya village)

Fred Mukokeli and his younger brother Victor Siampondo have adjacent gardens. Mr Mukokeli has had a pump for four months. He needs to lift a little more than 2 metres to grow kale, onion, tomato, and bananas on his plot. The garden was well laid out and he is gradually converting from basins to short furrows that are more convenient for watering from the pump outlet. Shortage of pipes is a problem as pipes are not readily available in the area and when they can be bought, they are costly. Meanwhile he has improvised by lining the head of the channel with polythene bags.

All the pump-users at this garden at the time of our visit were men and boys. In contrast, everyone (ten people in all) took part in weeding. He reported that he had plenty of labour although he had expanded the garden since he bought the pump and planned to extend further. There were no problems in operating the pump and quite small boys could work it. Here a frame was used to hold to keep balance while operating the treadles.

This farmer did have problems with pests despite using “Fenicure”. He normally used manure from his kraal to fertilise the crops, as he had plenty livestock and found chemical fertiliser too costly. His main problem was the glut of kale, which has reduced the price he obtained for a bunch from 200Kw to 50Kw, reducing profit almost to zero. He saw several advantages of the pump in that it reduces labour, allows expansion of the irrigated area and encourages diversification. He plans to grow cabbages next.

Victor showed us the new garden he had constructed in a month. He had prepared it using oxen and a plough then levelled it and constructed beds and furrows by hand.

He had bought a pump but was unable to use it until he could get the pipes. CARE had ordered pipes but increased demand has made them scarce. Meanwhile he borrows his brother's pump and pipes. He picked up the ideas on how to lay out the water channels, furrows and basins from his brother and other local farmers. Some of the furrows were a little steep but, overall, the garden was well thought out.

Farmer 3 (at Lebunda, Katapezi)

Mr Sichonti had used a treadle pump for a year and was very pleased with the performance. It has needed only one repair in that time, when the pulley rope broke. However, that was easily replaced. He used the pump to water two gardens, moving it between them and moving to different locations within each garden. He also used the same pump to water his mother's vegetable garden. He, too, had had difficulty getting pipes and had borrowed some in the meantime. His problem was the cost of the pipes (4100 Kw/m) rather than availability, as he wanted a long length. He was now expanding by digging a small dam around a spring and using a flexible pipe outlet to water another garden by gravity flow. He had many sources of water on his land and had plenty opportunity to move the pump around to exploit the most convenient source. Before he had the treadle pump he watered a riverside garden with buckets but it suffered periodic floods, so he moved to his present place and greater security. He seemed knowledgeable about fruit and vegetable crops having first started irrigating in 1987, and grew a variety of tree crops and vegetables including orange, lemon, guava, also the more common tomato, cabbage and kale. His main problem was in transporting produce to market and in marketing at good prices. He recognised the need to diversify and was considering Irish potatoes and okra. Both, he thought, were in demand but he was less confident about the cultivation of potatoes and was put off by the cost of the seed (potatoes). He had had a bad experience last season when the paprika out-grower scheme he joined failed to keep the promises made to the farmers, resulting in substantial disappointment and some losses. Nevertheless, he feels he is overall better off since the pump and since expanding his irrigated area.

He hoped to grow Neem trees to provide pest control but they had died and it was difficult to get replacements. He used the manure from his six cows, which had so far escaped Corridor disease, a major problem for cattle owners in the area.

There were also, nearby, a capped well to provide clean drinking water (that was maintained by the community) and a weir over a stream that backed up water so he could use the treadle pump for his mother's garden.

His wife works in the gardens too. He does not expect her to do the heavy jobs but she helps in watering, weeding and preparing the seedbeds. She does use the treadle pump but tires easily, as "women are not as strong as men". He also fears the pump will not be robust enough to hold his full weight and has constructed support frames at the installation points.

Informal Group Projects

Community project at Chilyabukowa (Sindi area)

The Chilyabukowa artesian well, opened by CARE in 1996, is said to be approximately 58 m deep and delivers water consistently at the rate of 3 l/s. It serves the village with drinking water and cattle watering and, hopefully, with fish in the

future. It is also planned that 40 families will have plots in an irrigated garden adjacent to the well. They intend to start with one hectare of vegetable beds, one for each family and later expand to two hectares. The tank, which the community has built from materials provided by CARE, will feed six hoses conducting the water through ½-inch pipes to the beds. It is expected that this will allow water to be taken about 90 m from the tank. The widow land-owner of the proposed site will be compensated for her land by being allocated new land that has been cleared by the community. In the meantime, until the proposed tank and pipe connections are made, she uses buckets to water her garden. The garden has a very diverse selection of vegetables fruit and nuts. Her plants included: cassava, banana, sugar cane, citrus, pawpaw, three varieties of chilli, guava, rumanda, tomato, beans, mungongo nuts for oil, bush coffee, kale and cabbage. The garden was surrounded by a live fence, which would provide other useful materials such as kindling and herbal remedies. The level of diversification implies extensive plant knowledge and illustrated the high level of indigenous agricultural knowledge among older women.

Downstream of the well, the community and CARE had constructed a weir across an existing stream to dam excess water from the well and provide a cattle-watering point. This is a simple but substantial structure over two metres high in the centre and about 20m. across, with a sluice pipe to allow releases to other downstream gardens (outside the community). Fish have been introduced to the reservoir thus created to provide the community with an additional source of protein. There will be rules to govern who is allowed to fish, when and how much they can take. The livestock watering facility at this reservoir will also save the community considerable time and effort, as the nearest watering point otherwise is over 4 km away.

CARE has helped the community organise and has facilitated the setting up of committees and basic rules of operation. Both men and women participate and one local person has been trained by CARE as a facilitator within the community for when CARE pull out. However, CARE feel that although they try to involve women, women are less enthusiastic about becoming facilitators. At present women comprise only about 30% of the total. The time that is needed by a facilitator to move about among people away from home, at inconvenient times acts as a deterrent for women. Where women have become facilitators, they are less active and often fail to get into the field to interact with the farmers. Lack of knowledge, lack of confidence and lack of leadership skill, also contribute to women's generally poorer performance and, reluctance to become facilitators.

Visit to Women's Group, Green Hill Community, Chamba Valley.

The chairperson of the group Mrs Steriah Tembo welcomed us and described the activities of the group, which included sewing, baking, carpentry for boys and youths as well as agriculture. The group has also started a school (Grade 1) and a pre-school day centre, but are short of funds to operate effectively.

Most of the group's income is derived from selling the vegetables they grow using treated sewage effluent for irrigation. The group has been using a suction type treadle pump since it became part of the joint MAFF/IDE pilot scheme to introduce treadle pumps just over a year ago. Before this, irrigation depended entirely on the use of buckets and similar home-made containers.

In discussion, the women identified their main problems as watering, marketing, transport, crop pests and theft. When asked to prioritise, the women agreed that the most important problem was watering, followed by transport and then marketing. However, it was acknowledged that there was a strong interaction between the last two.

In further discussion the following points emerged:

- Watering with buckets is tiring and causes women back and shoulder pain
- Using the treadle pump is hard work and women can operate for only about 15 minutes without a break to rest. (Men also found the treadle pump tiring to use; nobody at this site had thought of constructing a seat arrangement.)
- Women were not critical of the pump and felt that being tired was their problem
- Using buckets, the women spent every second day watering the garden; using the treadle pump they are able to water at longer intervals and spend every third day pumping. However day three was clearly very stressful.
- The watering days typically consist of watering from 06am until 12 noon, then again from 14⁰⁰ until 16⁰⁰.
- We tried to discuss alternative arrangements for pumping such as dividing the plot into smaller segments and watering a segment each day in order to even out the effort of pumping to a few hours/day instead of one long exhausting day, every third day. However, it proved very difficult to make this concept understood.
- A large variety of crops can be grown (Rape, Chinese leaf, cabbage, tomatoes, onion, spinach, green beans, green peppers, okra, eggplants, groundnuts, carrots, cucumber and Irish potatoes), but by far the commonest is rape which is grown on 70-95 % of the area cultivated, depending on the season.
- The favourite crops are rape and cabbage. This is mainly because they mature quickly and so provide income more frequently and also the seeds are relatively cheap.
- Marketing activities vary between head-loading the harvested crop 13 to 15 km to town and inviting marketeers to come on-site harvest a bed of rape for 900- 1500 Kwacha per 2m². The marketeers then sell in town for around 3000 Kwacha, thereby earning 1000 to 2000 for their journey and labour. Variation in price arises from seasonal differences in the general availability of rape.
- Most families grow enough vegetables and maize (non-irrigated) for their own needs and sell the surplus. In years of poor maize yield, they aim to sell more vegetables and purchase maize meal
- When the market suffers a glut (particularly for their favourite crop, rape) the crop may waste in the ground or sell below production cost, causing overall losses.
- They have no on-farm storage and yet they feel that with technological help and funding (from a donor) they can be successful in cold-storing crops, to arrive at market in better condition.
- They have no livestock. The cost of donkeys (250000 Kwacha), which are scarce, was anyway considered prohibitive. Bicycles are similar in cost to donkeys, so they could not readily see a solution to their transport problem
- They feel aggrieved that despite good production conditions they cannot compete in the Lusaka markets against more distant producers who have access to main road transport.

The community was struggling and it was evident that, despite hard work and good production, they were not making much money. It was not clear what they planned to do. The women's leader focussed on donor assistance and was leading the community towards solutions that would be provided from outside. It was not possible to assess the extent of the group's support for her view. Women identified water as their main constraint, thus the treadle pump appeared to have helped on the water delivery side in that the volume of water that could be applied increased. Women used the treadle pump regularly and were agreed that it was an improvement on watering with buckets. However, they agreed with the elderly man who said they had not the energy to sustain this pumping. He had been given a diesel pump, which met his needs well, apart from the running costs. Clearly, that was neither affordable nor sustainable on the present financial turnover.

Women were stressed by the amount of work that had to be done. They appeared to be responsible for watering the vegetables, weeding and transport to market in addition to their household and reproductive duties. One man recounted helping his wife carry rape to market. She faltered after walking for more than two hours. He took the load but the weight was too much for him so he gave her the load back after a few yards.

Most of the discussion centred on marketing and transport which now they had the treadle pump was probably the prime constraint. Improved marketing would create profit and allow the women choice in either buying a less labour intensive pump or hiring labour. The community appeared, during discussion, to reject small, useful suggestions for change because they were being encouraged to hope for grander external solutions. The general understanding of sustainability was low.

Training Courses

Kalomo, Camp Officers training course

The workshop is an annual event aiming to refresh the extension or camp officers of the region with information, new recommendations and answers to problems they commonly meet in the field. This year, considerable effort is being made to developing a more interactive approach that encourages camp officers to facilitate decision making among the farmers. The course was attended by around 40 participants of whom 4 were women. The women made minimal contribution to discussion.

The sessions addressed questions such as the issues to be taken into account before deciding on irrigation layout, issues to consider in deciding if a pump is an appropriate option, selecting suitable pumps and placing them effectively in relation to the water source and the area to be irrigated. Issues such as cultivation methods and fertiliser application were also on the agenda. A main focus was the characteristics of effective facilitators and the methods they used. This type of training is expected to stimulate a more consultative approach among the camp officers to encourage them to work with farmers to determine solutions to their problems.

The camp officers complained of difficulties in alerting farmers to the advantages of accurate use of the resources at hand. Farmers do not generally accept careful measurement as helpful. The officers also complain of the difficulty of maintaining status with the farmers in an environment where political promises run contrary to agreed ministry advice. The blame often falls on the extension worker as he/she is seen as the deliverer (or non-deliverer) of government promises. This situation lowers the credibility of the camp offices and makes their job difficult.

The camp officers don't feel there is a realistic prospect of introducing pumps on a group basis except perhaps among women's groups where co-operation is better and where shared responsibilities seem to work out satisfactorily. They feel that individual ownership is more likely to be sustainable in Zambia for a number of reasons, a major one being the control of land. The cost of the pumps was not the only consideration for individual purchasers, the issue of locating reasonably priced piping needs to be addressed. The forward planning needed to set up successful treadle pump irrigation seems to be a substantial step from the current bucket-by-bucket application methods. The need for developing drainage in conjunction with irrigation layout is likely to complicate the process further for the farmers. It is hoped to use these workshops to assist the camp officers to participate with the farmers in achieving a holistic planning approach.

Mungu (Kafue District): Farmer training course.

Patrick Tembo of the District office in Lusaka arranged for us to attend a training session led by the Block officer, Knox Kalubi. Block Officer was dealing with the siting, preparation and use of plant nurseries. Training was delivered in a settlement where almost 30 farmers had gathered; more or less equal numbers of men and women came. When we arrived, the group was discussing the question of what they wanted from good seed. After discussion the farmers came up with a list of requirements. The Block officer acted as facilitator and skillfully led the farmers to define their needs as follows:

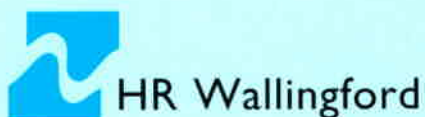
1. Seeds were an appropriate variety for the climate and season
2. Seeds (packets) are clearly labelled
3. The market demand for the vegetable to be grown is strong
4. High yielding variety
5. Knowledge of crop management available
6. Disease and pest resistant

The question of why a nursery was needed was discussed and there was some debate about the pros and cons of direct planting. Direct planting is considered to mature the crop faster although using a nursery and transplanting, which ensured a more even

crop, was slower and required some extra effort. The method of watering seedlings in the nursery, using a container with small holes punched in the bottom to create an effect like a watering-can rose, was demonstrated to us. Aspects of water and fertiliser wastage on seed that failed to germinate were discussed. After brainstorming, the leader asked farmers to produce a list of desirable attributes for a nursery site and then they went on to nursery management. All recommendations that the leader was writing on the flip chart came from the farmers, out of the discussion, and incorporated the discussions that had gone before. The farmers were very involved and attentive and many took notes. Women did not appear to take notes but many of them had infants to deal with while they listened. The group was mainly young, except one elderly man and woman who clearly had standing and experience in the community. The elderly man was supportive of the facilitator. The facilitator was careful to target questions to different areas of the farmer audience to maintain involvement of the group as a whole. He appeared to be careful to keep the women answering and offering views. The women sat to one side and although they were less vociferous than the men, they did contribute when asked and were attentive. The last discussion was on the need for good land preparation and the problems that result from poor land preparation. The meeting then split into three smaller groups, who went out to look at three nursery plots and judge three statements about each. This gave group members the opportunity to use the new knowledge, to discuss the issues presented by the three situations and to gain confidence in their judgements. The experience was wholly enjoyable for all the participants and the result showed the trainer and the farmers that they had understood the results of the brainstorming and could tell a good nursery plot from a poor one.

The enthusiasm and commitment of both the farmers and the officials were impressive. The level of participation was high and the practical element of the training session allowed immediate reinforcement of the information that had been discussed.

HR Wallingford is an independent company that carries out research and consultancy in civil engineering hydraulics and the water environment. Predictive physical and computational model studies, desk studies and field data collection are backed by large scale laboratory facilities and long term programmes of advanced research. Established in 1947 as a Government research centre, the Company now employs more than 200 engineers, scientists, mathematicians and support staff, many of whom are recognised international experts. Based on a 36 hectare site near Oxford, HR Wallingford has extensive national and international experience, with offices and agents around the world.



Address and Registered Office: **HR Wallingford Ltd**, Howbery Park, Wallingford, Oxon OX10 8BA, UK
Tel: +44 (0) 1491 835381 Fax: +44 (0) 1491 832233 Internet Server: <http://www.hrwallingford.co.uk>

Registered in England No. 2562099. HR Wallingford Ltd is a wholly owned subsidiary of HR Wallingford Group Ltd