Research Summary

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Title: An Evaluation of the Limitations and Opportunities for out-scaling the small-holder irrigation sector. The Case of Gwanda District, Limpopo Basin Zimbabwe.

Project #: L 1 “Targeting and Scaling out”

Institution: University of Dar es Salaam Tanzania, College of Engineering and Technology

Degree Programme: Msc Integrated Water Resources Management

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Results and Key findings:

Demographic data

Gender - Makwe and Guyu have more females in the scheme (60.5% and 55% respectively). Masholomoshe has the highest number of males (53.3%). Discussion with the sampled households revealed that male headed families hardly face labour problems, and high percentages of female irrigators have a negative impact when it comes to operation and maintenance. In terms of gender distribution there are more women irrigating than males.

Age distribution – more than 70% of the plot holders are above the age of 51 - This is contrary to previous studies which emphasized that small-holder irrigation creates employment since the majority of the plot holders are elderly people. Rises concerns on the ability of these elderly farmers to provide labour for cultural activities. Perception on welfare trends – 89% acknowledged scheme contributes to household income, 11% said that irrigation enhances food security thus importance of irrigated agriculture for rural people cannot be over emphasized.

Irrigation water requirements and irrigation water use efficiencies

Table 1: Crop water requirements and Gross irrigation requirements

<table>
<thead>
<tr>
<th>Crop</th>
<th>Guyu irrigation scheme</th>
<th>Masholomoshe irrigation scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total CWR (mm)</td>
<td>Gross Irr Req TAW (mm)</td>
</tr>
<tr>
<td>Maize</td>
<td>768</td>
<td>1098</td>
</tr>
<tr>
<td>Beans</td>
<td>465</td>
<td>665</td>
</tr>
<tr>
<td>G/nuts</td>
<td>-</td>
<td>-</td>
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</table>
The results indicate that irrigation water applied at Masholomoshe irrigation scheme is more than double the total crop water requirement. At Guyu the irrigation water applied was lower than the crop water requirement and this could be the problem of power cuts and pump problems at the scheme unlike at Masholomoshe where they do not experience any power cuts or pump breakdown.

Seasonal irrigation water efficiencies were high at Guyu than Masholomoshe (57% and 45% respectively). This can be attributed to the simple fact that farmers at Guyu irrigate as when power is available and those at Masholomoshe are not limited to their irrigation water expect the times when they do not have water in the dam.

**The major limitations found in the irrigation schemes under study:**

The causes of poor performance of small-holder irrigation both in terms of productivity and economic impact are varied and they include socio-economic, institutional, technical, political, climatic, design factors as well as poor farmer participation.

i. Low fertilizer application – farmers are applying less than recommended fertilizer. For maize farmers are applying (26kg/ha Compound D and 18kg/ha for AN, against the recommended 250 kg/ha and 300kg/ha respectively). For beans and groundnuts, nothing is applied at all.

ii. Over application of water at Masholomoshe irrigation scheme and under application of crop water requirements at Guyu irrigation scheme, the is gross over-use of water at Masholomoshe irrigation scheme, leaching of nutrients as well as deep percolation due to too much water.

iii. Cropping intensity very low and not market oriented – farmers are only alternating summer and winter cropping without venturing into high value cash crops.

iv. Low income levels for farmers as compared to production costs - the highest number (more than 60%) is that of farmers earning between 0-10 US$ per month and for those earning more than 30US$ are less than 15%. Maize crop has the highest production cost (80US$) followed by beans then groundnuts has the least production costs of US$30 thus no profits realized.

v. Conflicts on non-payment of water and electricity bills – the three irrigation schemes have high debts to be paid for water and electricity. Makwe has a total of US$122 000, Masholomoshe US$ 4 370 and Guyu US$ 34 682.

vi. There is also poor water and land management as well as dilapidated irrigation infrastructure

**Opportunities for out-scaling**

i. Fertilizer applications - Soils are generally infertile hence need for the use of organic or inorganic fertilizers.

ii. Need for a defined irrigation scheduling - To avoid over applications which normally result in water logging and high water rates in terms of payment. To avoid over application which normally result in water logging and high water rates in terms of payment.

iii. Improvement of existing cropping pattern – farmers should be encouraged to grow cash crops which normally fetch high prices at the market. This will boost their income levels and hence able to pay for their water and power bills
iv. Strengthening market linkages - Farmers will grow crops after identifying the market and hence profit realization in the sector

v. Business management training - There is need to teach farmers that farming is a business and as such there are risks associated with every business and as such farmers should be prepared to handle situations as they come

Recommendations:

Based on the findings from this study, the following recommendations may contribute to the out-scaling of small-holder irrigation schemes:

i. Improving the existing irrigation infrastructure
   The infrastructure in all the three irrigation projects is falling apart due to old age and also lack of proper maintenance. Water is being wasted especially in the surface systems, hence there is need to introduce piped conveyance system instead of open canals. This improvement should be carried out with full participation of the farmers, the farmers should also contribute what they can afford and as such a sense of ownership will be cultured in farmers.

ii. Strengthening market linkages
   There is need for the establishment of input supply, output marketing and credit service to allow rapid progress in the introduction and adoption of productivity improving technologies and farming practices. The farmers should be linked to potential markets. Agricultural companies should be encouraged to do contract farming with small-holder farmers and government should also try to motivate this contract farming by introducing subsides.

iii. Business management training
   Farmers should be trained that farming is a business and as such there is need to plan and keep records of inputs against outputs. Farmers should aim at producing high value crops which are marketable; they should identify their market first and then plan their cropping pattern. There is need for big investments in terms of inputs which will make farmers realize better yields. Farmers should be made aware that there is risk involved in running a business and as such they should be prepared for uncertainties which might rise. Farmers should find ways to better match the production plan with market demand and to compete with other producers to increase their bargaining power.

iv. Extension officers
   There is need to call for the government to deploy more experienced extension officers to irrigation schemes. These officers should have enough and necessary resources to execute their duties well.

v. Capacity building programmes for farmers to strengthen support and enlighten them as well as encouraging farmer participation in irrigation development.

vi. Crop diversification to improve the income and viability levels of farmers as well as for cost recovery from users to cater for the operation and maintenance costs.
Research site(s), setting

Description of the Study Area
This section gives a detailed description of the general characteristics of the area under study. It starts with the salient features of the Limpopo Basin and narrows down to Zimbabwe and then Gwanda District

Limpopo Basin

The Limpopo River rises in Central Southern Africa and flows to the Indian Ocean. It is the 2nd largest River in Africa that drains to the Indian Ocean after the Zambezi. The River Basin is shared by four SADC member states, Botswana, Mozambique, South Africa and Zimbabwe. Despite hosting some of the better developed countries in Africa, half of population in the Limpopo Basin still live under the poverty datum line (FAO, 2005).

Location and Physical Characteristics

Gwanda District is located in Matebeleland South Province of Zimbabwe. It is located at Latitude 21° 30' 0” S and Longitude 29° 30' 0” E. It is the provincial capital of Matabeleland South and has a total area of about 14 000 km². It has a population of over 150 000 people derived from over 25 000 households (Gwanda District Annual Development Plan January – December 2011). The district covers the South Western part of the country sharing the border with Botswana. The district shares the border with quite a number of districts in the province and beyond. Insiza to the East, Umzingwane to the North, Matobo to the West, Mberengwa and Mwenezi to the South East and Beitbridge Districts to the South. The District is located along the Beitbridge-Bulawayo road and has 24 wards divided into five communal lands.

The entire district lies in Agro - ecological zones IV and V which are characterized by very low and erratic rainfall and long dry seasons that makes crop production close to impossible. Agriculture is the principal economic activity for the majority of the rural households in the study area. Except for a few that are privileged to use irrigation, the majority of them depend on rain-fed agriculture with erratic and unevenly distributed rainfall pattern. The erratic, late onset and early withdrawal of the rains during the rainy season cause frequent crop failures.
Research question(s) addressed:

The following research questions were investigated

i. Is there any relationship between the social characteristics of the households and the irrigation scheme performance?

ii. Are the irrigation technologies used efficient enough to achieve the intended results from these irrigation schemes?

iii. What are the limitations and opportunities for irrigation development, and are there ways of out-scaling the small-holder irrigation farming sector?

Methodology:

Data collection and analysis
A study was conducted in three irrigation schemes, Guyu-Chelesa, Masholomoshe and Makwe in Gwanda District. The approach used was mainly qualitative, using both primary and secondary data from farmers, key informants and document reviewing. A total of 115 farmers were involved in the study.

Statistical Package for Social Scientists (SPSS version 16.0) and CROPWAT were used to run the data collected from farmers. The main descriptive indicators that were employed in the study are frequency and percentage values. To obtain the crop water requirements the CROPWAT 8.1 version developed by FAO was used. To determine the amount of water applied in the irrigation schemes various equations were employed.
Crop water use efficiency estimated using the following relationship:

\[
\text{WUE} \% = \frac{\text{CWR}(\text{mm})}{\text{TAW}(\text{mm})} \times 100
\]

Where WUE is the Water use efficiency (%)  
CWR is the Crop Water requirement (mm)  
TAW is the Total water applied to meet the CWR (mm)  [Equation 1]

Irrigation water applied under surface was obtained using the following equation:

Irrigation water applied (m\(^3\)) = \(\left(\text{D}_s \times \text{NS} \times \text{T}_{cd}\right)\]

Where \(\text{D}_s\) is the siphon discharge  
\(\text{NS}\) are the numbers of siphons per plot  
\(\text{T}_{cd}\) is the time taken to reach the cut off distance (hrs) [Equation 2]

Water applied under sprinkler was estimated using the following equation:

Volume of water applied = \(\left(\text{N}_{sp} \times \text{DSp} \times \text{T}_s \times \text{A}\right)\]

Where \(\text{N}_{sp}\) is the number of sprinklers on the lateral  
\(\text{DSp}\) is the average sprinkler nozzle discharge (m\(^3\))  
\(\text{T}_s\) is the duration (hrs)  
\(\text{A}\) is the total area covered by the sprinklers (m\(^2\))  [Equation 3]

Related outputs:

An Evaluation of the Limitations and Opportunities for out-scaling the small-holder irrigation sector.  
The Case of Gwanda District, Limpopo Basin Zimbabwe.