

THE SOCIO ECONOMIC IMPACT OF SMALLHOLDER COMMUNAL IRRIGATION PROJECTS: A CASE STUDY OF TSHONGOKWE SMALLHOLDER IRRIGATION SCHEME IN LUPANE DISTRICT IN MATABELELAND NORTH PROVINCE, ZIMBABWE.

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ABSTRACT

The establishment of Tshongokwe small scale irrigation was meant to improve food self-sufficiency, security and the welfare of the people in the ward and district. The purpose of this study was to assess the socio economic impact of small scale irrigation scheme on the people's livelihoods in Tshongokwe and Sobendlewards. Quantitative and qualitative methodologies were used in the investigation of the impact of the scheme. All sixty one irrigators at Tshongokwe and thirty non irrigating respondents out of a total of one hundred and fifty dry land farmers in Gundwane Resettlement Area were interviewed. Data was collected using in-depth interviews, questionnaires and observations. Analyses were done using descriptive statistics. Tables and figures were employed in presentation and analysis. Results were that the irrigation scheme has made the participating farmers food secure, created employment, generated income, acquisition of agricultural productive assets such as scotch carts, cultivators and livestock by farmers. The type of housing has improved and school attendance is at 91.7%. The study recommends that governments, public and private institutions and non-governmental organisations work together in defining and implementing comprehensive strategies for small scale irrigation development, especially in the semi-arid areas so as to ensure increased food security, income and employment to the rural population.

Keywords: Socio-economic impact, Food Security, Diversification, Small Scale Irrigation

Background

Agriculture is the mainstay of the Zimbabwean economy with more than 75 per cent of the

population depending on it for livelihood and employment. Rain fed agriculture has become a gamble with uncertainty in rainfall and thus affecting production. Since, the arable land cannot be stretched, it becomes essential to increase the production to meet the increased demand for food due to growing population. Food production can be increased through various inputs like improved seeds, use of fertilisers, insecticides, pesticides and provision of sufficient moisture.

Irrigation farming is a way of improving agricultural production both in subsistence and commercial farming. Many Southern African governments began to embark on large and small scale irrigation schemes mainly in areas with little annual rainfall totals in order to supplement water shortages. In Zimbabwe, the agro-ecological zone IV and V are dominated by irrigation schemes. Kadzombe *et al*, (1973), argued that large scale irrigation schemes comparatively are more profitable and have socioeconomic advantages than small ones. However Chenje, *et al*, (1998), suggest that in terms of empowering the local communal people, small scale schemes are suitable as they occupy small land readily available in the rural areas. In Zimbabwe, irrigation schemes were established as a precaution against the inherent variability of rainfall as well as to ensure that cultivation is done all year round to boost and increase food production in the country so as to alleviate poverty. Moreso the government's attention to the development of small scale irrigation schemes was in a bid to meet its objectives towards decentralising irrigation schemes mainly in rural areas for empowerment. However, despite these efforts, the socioeconomic impact of these projects has not been evaluated.

Smallholder or community based irrigation schemes are demand driven and farmer managed irrigation schemes. A bottom-up or 'grass-roots' approach is used for development and the farmers are involved in the planning, decisions, contribute at least a part of the capital costs and accept full responsibility for operation and maintenance. The government facilitates development and may at times provide incentives, however the farmers drive the process through participation in the planning, financing, implementing, operating and maintaining the irrigation system. These farmers irrigate together and share the same water source that originates from an intake, mainly a weir or dam but there is individual control of irrigation and farming activities by each farmer in his/her plot. The individual plot sizes normally range between 0.2 and 2 ha, (FAO, 2000). The total acreage of a scheme may vary from 10ha to as large as 400ha and such irrigation schemes are considered as formal in the smallholder farming sector.

At each irrigation scheme, Irrigation Management Committees (IMCs) have been established with the help of the government agency in place. The main objectives of the IMCs are to enhance farmer's participation in management and decision making at scheme level, introduce a system of discipline among the farmers and to control infield water distribution. The IMC function in such a way as to prepare farmers for a complete takeover of the management functions after

withdrawal of government support. The government of Zimbabwe's objective, since 1980s has been to promote farmer managed schemes where possible.

Main characteristics of smallholder irrigation schemes

Farmers participate in or preferably drive all the project phases from planning, implementation and evaluation in order to create a sense of ownership and consequent commitment to the scheme. A bottom up approach is followed for irrigation development, treating farmers as "owners" rather than "beneficiaries" of the projects. Success and sustainability demand a careful holistic design that include capacity building in irrigation water management, general crop production and marketing. It might be important to help farmers with inputs for the first season so that they can build a cash flow base. Continuous monitoring of irrigation schemes is necessary to provide feedback information that helps in the planning, implementation and management of future schemes. An integrated rural development approach should be followed to maximise benefits from the intervention, meaning that rural physical infrastructure and markets should be developed alongside irrigation development. Developing the skills and broadening the experience of the farmers is key. Smallholder irrigation development has shown throughout the developing world that it can be used as a key drought mitigation measure and as a vehicle for the long term agricultural and macroeconomic development of a country. However socio-economic evaluations of smallholder irrigation schemes are needed at regular intervals in order to be able to derive lessons from past experiences and also help policy makers in formulating sound policies for future development.

According to Miller (1982), irrigation facilitated the growing of crops in the flood plains of the Nile Valley so that supplementary food could be accessed. An increase in crop production in almost every year as a result became the attracting feature for the country to increase irrigated lands. Recent years have seen an increase in the use of irrigation to facilitate cultivation in semi-arid and arid regions. According to Andrew and Jackson (1996), between 1970 and 1990 the total irrigated land in the world rose from one sixth of all cultivated land to one third. In Zimbabwe, irrigation was slow until in the 1950s when the then Rhodesian government saw it fit to stimulate development by an introduction of low interest loans in the commercial Triangle and Hippo Valley Estates. According to Kadzombe (1973), the development of large and small irrigation schemes in the communal areas of Zimbabwe flourished after independence. This saw the establishment of schemes like GacheGache in Mashonaland Province, Chikwalakwala in Matabeleland South, Manjinji and Mteyo in Masvingo Province and irrigation scheme development as late as the 1990s shows cases such as Tshongokwe, Lukosi, Nabusenga and Lungwalala irrigation schemes in Matabeleland North Province.

The Influence of Irrigation on Livelihoods

According to Burrow (1987), small holder irrigated horticulture had proved to be a viable and attractive option for poor farmers in developing countries. He further asserted that returns from intensive irrigated horticulture even on tiny plots could greatly exceed returns from rain fed cereal production. In many developing countries, small scale irrigation schemes were counted on to increase production, reduce unpredictable rainfall and provide food security and employment to poor farmers.

Cornish (1999), asserted that some of the small scale irrigation projects have been developed primarily for income generating such as the peri-urban areas in Kumasi and vegetable growing in Arusha, Ghana. Moreso irrigation farming is the source of income for the disadvantaged rural people that are mostly women, widows, orphans and people living with HIV and AIDS. According to Jackson *et al* (1997), a survey of horticultural production in Zimbabwe showed that irrigation farming enables the growing of green vegetables, wheat, tomatoes, cotton, maize and even sugar-cane among others.

According to the World Bank (2008), more than 70% of the poor people live in areas relying mostly on agricultural activities and sometimes mining and fishing for survival.

Irrigation farming contributes significantly at the household in terms of income in rural areas. Having most of the rural household unemployed, most families' income levels are relatively low and possibly not enough to acquire basic commodities and services. People in Mutambara, Masvingo confessed that their project enables members to earn an income which enables them to meet some of their basic needs, (Makumbe, 1996). Cash earned from the sale of crops is used to cover household needs of food and non food items. It also enables members to meet educational needs of their children such as exercise books and tuition fees. Data from previous case studies also revealed that irrigation farming has long term economic contribution on rural livelihoods. According to Kundl and *et al* (1994), food production from irrigated farms is a major source of wealth creation to the extent that it is the basis for economic growth in a number of localities.

According to Weinert *et al* (1997) in Moll (2004), a comparison of income earned from small scale irrigation and that earned from dry land farming or from non-skilled work in Zimbabwe industries revealed that small scale irrigation farmers earned more. In comparative analysis between irrigators at Nyanyadzi irrigation scheme in Zimbabwe and their dry land counterparts, irrigators' investment was estimated to be between \$150 and \$200 while dry land farmers' investment was estimated to be lower than \$100. This indicated that irrigators were in a better position to invest in capital items than non-irrigators because of higher incomes. Irrigation developments have made it possible for other rural infrastructure to be developed in areas which

could otherwise have remained without roads, telephones, schools and clinics. According to Webb (1991), in Chenjeetal (1998) in the study of irrigation schemes in Chakuda Village in Gambia, small irrigation schemes have resulted in increased income that was translated into increased expenditure, investment, construction and trade. At the village level, increased material wealth manifested in the form of construction of a large mosque built through farmers' donations and an improvement of the village clinic. Irrigated agriculture is an essential component of any strategy to increase global food supply. The benefits of irrigation have resulted in lower food prices, higher employment and a more rapid agricultural and economic development. The spread of irrigation has been a key factor behind the near tripling of global grain production since the 1950s. Chenjeet al, (1998) asserts that agriculture is the backbone of Zimbabwe's economy and as such irrigation is a very important agricultural practice to the country given that the country suffered periodic droughts in 1972, 1982/3; 1991/2 and 2002/4. Irrigation in Zimbabwe offers greater yields than dryland since more than one crop can be grown annually. Levels of output in terms of quantity are higher in irrigation schemes than dry land areas suggesting that there is more intensive crop production in irrigation schemes than in dry land agriculture (Chenjeet al, 1998).

Chitsiko (1999), also argue that small scale irrigation schemes are important in augmenting government policy of reducing rural to urban migration. He further stated that in his study of Hama Mavhaire irrigation schemes in Masvingo, Zimbabwe, the scheme provided a source of self reliance and income to some eighteen year olds who did not intend to move to town. Roder (1965), supports this assertion by saying that irrigation schemes helped in reducing rural to urban migration by offering rural population an alternative source of employment and income and irrigators' wealth was chiefly held in the form of farm implements and in better houses. Shopping and market centres can be created as a result of infrastructural development brought by irrigation. More so, they have generally been created with prospects of increasing employment opportunities.

Donahue *et al* (1993) cited that in Zimbabwe about three quarters of the population is employed in agricultural industries. However, Moyo (1991) in Manzungu (2004) argued that small scale irrigation schemes normally depend on self employment because farming is not highly mechanised hence much of the labour is manual. Wringley (1982), gave the view that large irrigation schemes such as Gezira scheme in Sudan employs about one million landless labourers and their families to help in the planting, cultivation as well as harvesting.

According to Mutsvangwa *et al* (2006), vegetables and other crops affect customer's diet, health not only rural households but also to those who buy them through local markets. Makumbe (1996), argues that more nutritious food is not only difficult but too expensive for them. Food

security is therefore likely to increase in households practising irrigation farming. Fresh foods and other food crops as noted by Jackson *et al* (1997), have a special role in supplementing the diet of small children at weaning age and lowering the lack of protective foods. Rural people are therefore likely to fend for themselves when it comes to food requirements and thus maintain a decent health condition.

According to Mamvura *et al* (2006), Mutsvangwa (2006), irrigation also empowers women and emancipates them socially. Women tend to play a leading role in irrigation farming and this ensures their participation in development initiatives and poverty alleviation in rural areas. Munina *et al* (2000), Manzungu (2004) argue that women in irrigation farming increase income at their disposal which changes the balance of power within the household. This resultantly increases women's confidence in debates and discussions for community decision making. Chenje *et al* (1998), state that the aim of irrigation is to increase crop production and grow crops in areas where such an activity would normally be impossible due to lack of water.

Irrigation farming is viewed as a cheap substitute for costly disaster relief by the governments. According to Kadzombe *et al* (1973), instead of importing food relief thereby wasting foreign currency, farmers are assured of a constant source of food and money by establishing irrigation schemes. This is supported by Meinzen-Dick *et al* (1994) who assert that the greatest food deficiencies in Zimbabwe appear in dry land areas of Natural Region IV and V. In their study they noted that fewer irrigation schemes ran out of food during the year than in dry land areas.

Sustainable Rural Livelihoods

Humanity has the ability to make development sustainable and to ensure that it meets the needs of the present without comprising the ability of future generations to meet their own needs. It must go hand in hand with improved lifestyles for the least fortunate. Ellis (2000), postulates that livelihoods comprise of assets, activities and access to these that together determine the living gained by households or individuals. Rural people move regularly between rural areas and towns or cities to seek work, market their produce and buy manufactured goods. Rural families through livelihood diversification construct a diverse portfolio of activities and social support capabilities in their struggle for survival and in order to improve their standard of living of which small scale irrigation schemes is one of the options (Ellis, 2000). The sustainable livelihoods framework is designed to help understand and analyse poor people's livelihoods. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future while not condemning the natural resource base.

For sustainable livelihoods to be achieved the future of irrigation farming in alleviating rural poverty lies not only in people but calls for intervention of interested stakeholders in rural development. These organisations are government and non-government organisations. Irrigation farming is possibly one of the key drivers to enhancing rural livelihoods if necessary support is given to it. Chambers (1983) points out that participation should not refer to mere involvement but should mean that beneficiaries of development initiatives actively take part at all levels of development projects. According to Hodder (2000), the active participation of women is critical to agricultural prosperity and policy designers should ensure that women are incorporated in all matters of life. According to Msingo (2007), Mujere, Chazovachii *et al* (2010), irrigation farming has become a source of income for disadvantaged people in rural areas. This means that participation is no longer limited to the well-up but also extended to vulnerable groups for example widows and orphans.

The research wanted to find out the impact that Tshongokwe Irrigation Scheme has had on the livelihoods of the community in the ward and beyond. Tshongokwe Irrigation Scheme was selected for the study because it is one of the better managed and performing smallholder irrigation schemes in the province and country and has been in operation for more than two decades.

Over the past few decades, there has been a growing interest in the assessment of the performance of irrigation projects in developing countries, but most of these have been on larger irrigation projects (>500ha). This interest is due to the awareness that many irrigation schemes in the developing world are not living up to their expectations.

This assessment would add to the growing wealth of knowledge on farmer managed irrigation schemes.

The objectives of the study were:

The study sought to provide micro evidence on the socioeconomic impact of irrigation development on the livelihoods of the people in Sobendle ward. Tshongokwe Irrigation Scheme was rehabilitated and expanded in 1992 with the primary objective of food security and income generation for the beneficiaries and the ward. The study investigated the socio-economic impact of the irrigation development on the programme beneficiaries.

The specific objectives were:

1. To identify the benefits derived from the irrigation scheme development.

2. To assess the contribution of the scheme in improving people's livelihoods.
3. To document the socio-economic impact the irrigation development has had in the ward.

METHODOLOGY

Site Description

The study was conducted in Tshongokwe Irrigation Scheme in Sobendle Ward of Lupane District during 2012/13. This scheme is 25 hectares and has 61 plot holders each irrigating an area of 0.4 hectares using border strip irrigation. The irrigation scheme is in Natural Region IV, which is characterised by low and erratic rainfall of 450 to 550 mm per annum. Rain fed agriculture results in low crop production. The scheme is run and managed by an irrigation management committee (IMCs), elected by the farmers. AGRITEX offers extension services on irrigated crop agronomy and irrigation water management. The scheme is situated 213 kilometres north of Bulawayo. The scheme is divided into four blocks, with each farmer having 0.1 hectare per block. All plot holders carry out the same agricultural activities in all the blocks at the same time.

Sample and sampling design

A questionnaire was designed and administered on all of the 61 farmers at Tshongokwe Irrigation Scheme. The farmers had been made aware of the survey and consent was sought. The same questionnaire was administered to 15 non irrigating farmers in Gundwane Village of Lupane District.

Semi structured interviews were also held with key informants such as the irrigation extension worker, supervisor, village headman, ward councillor and the AGRITEX District Officer.

Secondary data were also collected from published and unpublished documents from AGRITEX and the Department of Irrigation.

The data was analysed using descriptive statistics using Scientific Package for Social Sciences, Version 16 and Ms Excel.

FINDINGS

Socio-demographic profile

The study revealed that 28% of the respondents were male and 72% were female. Of these respondents 62%, 30%, 5% and 3% were married, widowed, single and divorced respectively (Table 1).

Table 1: Socio demographic information

Variable	Irrigators (%)	Non irrigators (%)
Household size	6.43	5.15
Males	28	80
Females	72	20
Level of education		
Primary	46.7	30
Secondary	48.3	40
More than 12 years	3.3	30
Male headed households	58.3	20
Female headed households	41.7	80

Source: Survey data

Age of plot holders

The majority of the irrigators are in the age range 41 to 70 years (72%), whilst the 31-40, 20 to 30 and 71 to 80 age range were reported at 13.3%, 1.7% and 11.7% respectively (Figure 1).

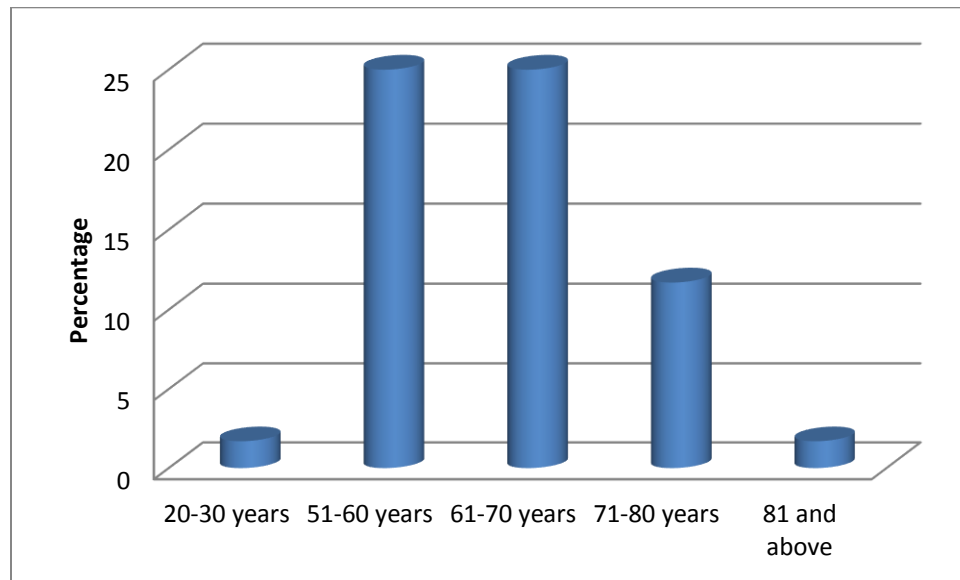


Figure 1: Age group of respondents

The majority of the irrigators (65%) joined the scheme after its expansion and rehabilitation in 1992, whilst 16.7% and 15% joined between 1996-2000 and 2000- 2005 respectively. Only 3.3% have joined after 2006.

Livestock ownership of irrigators and non-irrigators

The mean cattle ownership for irrigators in 1992 was 2.0 and it was currently at 2.65. The total number of animals among the respondent has increased from 120 to 159 animals from 1992 to 2012. The trend is not the same for the non irrigators (Table 2).

Table 2 Livestock ownership

Livestock Type	Irrigators		Non Irrigators	
	On joining	Current	On joining	Current
Cattle	2.0±1.3	2.65±1.4	1.7±1.8	2.2±1.10
Oxen	1.35±0.52	1.58±0.61	1.4±0.52	1.5±1.26
Goats	2.0±1.2	2.13±1.4	1.6±1.26	1.0±0.0
Donkeys	1.5±0.77	1.57±0.67	1.8±1.62	1.7±0.95
Chickens	3.72±1.43	4.90±1.49	1.4±1.26	2.7±1.57
Guinea fowls	1.1±0.66	1.15±0.52	0.0	1.0

Source: Survey data

On joining irrigation project the mean number of chickens per household was 3.72 and the study showed that it has risen to 4.90, with the total numbers rising from 223 to 294.

The other emerging livestock are guinea fowls. There were no guinea fowls in 1992 but the mean numbers was now 1.15. The mean of cattle on settling at Gundwane was 1.7 and it has risen to 2.2, whilst the goats, donkeys and chickens are 1.0, 1.8 to 1.7 and 1.4 to 2.7 respectively.

Agricultural productive assets

The mean ox drawn plough ownership is 1.27 with 73.3% and 26.7% reported having one and more than two ploughs. Only 40% of non irrigators had ox drawn ploughs.

The main source of transportation was found to be scotchcarts. The study found that 70% and 60% of irrigators and non irrigators had scotchcarts respectively. No one owned a tractor in the two groups of farmers in the study. The study found that 91.7% of the irrigators owned cultivators with 60%, 25% and 6.7% reported having one, two and more than two and 40% of the non irrigators had cultivators (Table 3).

Table 3 Agricultural equipment endowment

Type of Implement	Irrigators		Non Irrigators	
	Sample mean	%Owners	Sample mean	%Owners
Ox drawn plough	1.27±0.45	100	1.9±1.29	40
Scotch cart	1.37±0.50	70	1.6±0.52	60
Cultivator	2.30±0.72	91.7	1.4±0.52	40
Tractor	0.0	0	0	0

Source: Survey data

Condition of housing and quality of main house

The condition and materials used for the construction of the main house is an indicator of the investment from proceeds realised from irrigated and dry land agriculture. The study revealed that 46.7% of the irrigators had brick under driven thatch houses, whilst 13.3% had brick under asbestos, 10% have brick under corrugated iron whilst 30% have pole and dagga under thatch. All non irrigators had pole and dagga under thatch housing (Table 4).

Table 4: Type of household main housing

Type of main house	Irrigators	Non Irrigators
	% Owners	% Owners
Brick under driven thatch	46.7	0
Brick under asbestos	13.3	0
Brick under corrugated iron	10.0	0
Pole and dagga under thatch	30.0	100

Source: Survey data

All households (both irrigators and non irrigators) reported having no electricity at their homes. Power for lightening is provided by solar panels and generator sets. The study showed that the 68.3% of the farmers have solar panels for use for lightening purposes. Of those with solar panels, 10% have more than two panels, whilst 25% of respondents reported having generator sets. Sixty per cent and 20% percent of non irrigators reported using solar panels and generator sets for lightening respectively.

Non Agricultural equipment endowment

Table 5 below shows ownership of some non productive assets by the households who are participating in Tshongokwe Irrigation scheme and those not participating in the irrigation scheme (Table 5).

Table 5: Non Agricultural equipment endowment

Type of implement	Irrigators		Non Irrigators	
	Sample mean	% Owners	Sample mean	% Owners
Radio	1.85	68	2	80
Solar panels	1.8	68	1.8	60
Generator sets	1.25	25	1.2	20
Television set	1.45	42	0.1	10
Mobile phones	2.37	83	2.9	100
Bicycle	1.65	52	0.8	60
Set of sofas	1.40	42	0.4	40
Beds	2.75	95	2.6	100
Kitchen units	1.75	72	1.6	50
Ward robe units	2.27	90	2.0	70

Source: Survey data

The ownership of non-agriculturally assets such as radios, solar panels, generator sets, television sets, mobile phones was variable as shown in Table 5 above though the irrigators have slightly higher sample means and per cent ownership. Only one respondent has a car, but the ownership of bicycles is quite high with 51.5% reported having at least one bicycle (Table 6).

Table 6: Non Agricultural equipment endowment

Type of food item	Irrigators		Non Irrigators	
	Sample mean	% Owners	Sample mean	% Owners
Beans	2.23	93.3	2.1	60
Fresh vegetables	4.5	100	2.8	60
Chicken meat	2.0	68.3	1.7	30
Beef	1.37	35	1.9	40
Milk and milk products	1.9	38	2.1	60
Eggs	2.22	77	2.0	70
Potatoes	1.10	10	2.0	60
Dried vegetables	3.00	90	2.8	50

Source: Survey data

Consumption of legumes and vegetables

The study found out that sugar beans, fresh vegetables, dried vegetables, chicken meat, eggs were readily available and consumed by the irrigators than the non irrigators. The consumption of each food item per week was higher for the irrigators. Dry beans were consumed at least 2 to 4 times a week among the irrigators. Fresh vegetables were reported to be consumed 4 to 7 times a week and this was reported by all the respondents in the irrigation scheme. Fresh produce is readily available for the irrigators.

The irrigators reported that they dried the surplus vegetables during the glut periods. These dried vegetables were consumed during the times when there was no fresh vegetables in the irrigation scheme. It was found that 90% of the farmers ate dried vegetables twice to thrice a week.

Education of children

The study revealed that 91.7% of all school going age children at Tshongokwe was in school and only 8.3% were not attending school. The majority (88.3%) are in day schools of Tshongokwe Primary School, Nhlanhla and Jotsholo Secondary Schools. The 11.7% attending boarding school are either at Fatima High School, Mabhikwa High School or at Regina Mundi Mission. Sixty per cent of the children of non-irrigators are at school, whilst 40% are not at school. The percentage at boarding school is almost the same like the irrigators (10%).

Casual labour

The study found that beside family labour, the irrigators rely and engage casual labourers to assist with the leveling of border strips, planting and transplanting, weeding, harvesting and processing of maize, wheat and dry beans. The available family labour could not cope with both the dry land and irrigation labour requirements. The irrigators have to engage both permanent and casual labour to assist in their household and agricultural activities (Table 7).

Table 7: Employment of casual and permanent workers

Type of worker	Irrigators		Non Irrigators	
	Sample mean Male	Sample mean Female	Sample mean Male	Sample mean Female
Permanent	1.1	1.08	0.0	0.0
Casual	1.75	2.17	0.0	0.0

Source: Survey data

The study found that besides coming from the nearby villages of Jotsholo, Ngombane, Mtshekwa, some casual workers come from as far afield as Lusulu in Binga, Dandanda, Menyezwa and Gomoza. These areas are 80, 60, 40 and 25kilometres away from the irrigation project.

The majority of these casual workers preferred to be paid in-kind instead of cash payment. This was reported by 72% of the respondents, whilst 20% and 8% preferred cash and both in cash and in kind respectively (Figure 2).

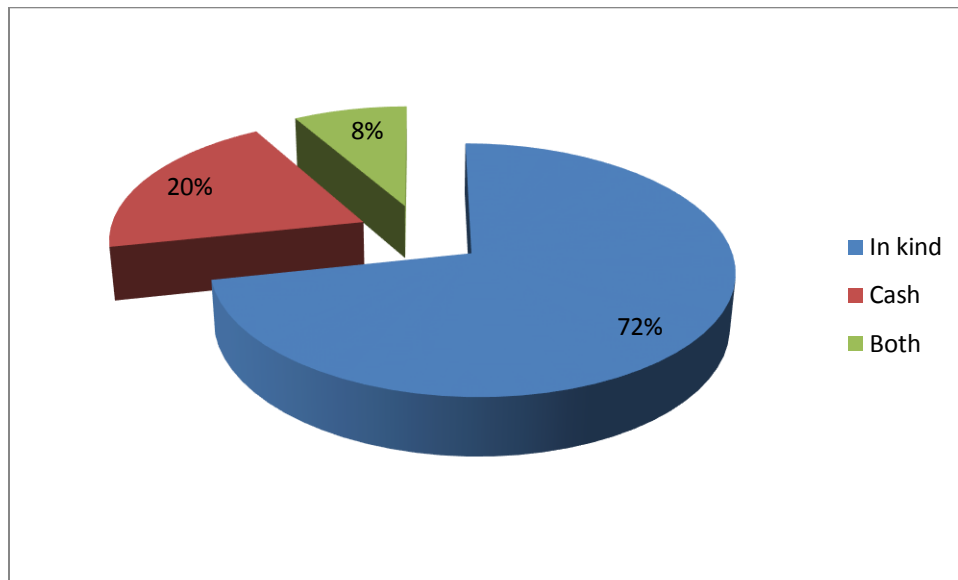


Figure 2: Payment of casual workers.

The payment in kind depended on the crop in season at the irrigation scheme. The payment rates that were found was that a worker is paid a dozen green maize cobs for borderstrip land levelled or weeded or two, 5 litre tin of tomatoes. It was found were also paid using grain maize, wheat, green vegetables, onions and dry beans. It was reported that the payment in-kind was preferred because the casual workers would keep some of the produce and resale some of the produce that they would have been given as payment. In this way their families are assured of food and also cash. these casual workers also resale portions of their payment for cash or barter with either grain or other non food items.

Development of Mabhunu Rural Service Centre

The study revealed that a thriving rural service centre has been established about a kilometre from the irrigation project. The centre boosts services such as grinding mills, grocery, furniture and welding shops, beer outlets and agro dealers. The irrigators do not have to travel to Jotsholo Business Centre for their provisions. The sprouting up of this rural service centre has however seen the slow down in development in Jotsholo Business Centre

Electrification of the schools around the scheme

The establishment of the business centre has seen the electrification of this centre and the two schools in the village.

Negative impacts

The sprouting of a rural service centre close to the irrigation scheme was reported to have brought in some negative impact. Thefts had been prevalent in the irrigation scheme. The proceeds from these thefts were reported to have been spent at the service centre. The irrigators had reported having to spend up to US\$20.00 a month to hire security guards to guard the irrigation scheme. These security guards work in collaboration with the Zimbabwe Republic Police.

Reckless spending of money realized from the sales of irrigation produce on beer was also reported as one of the main problems encountered due to the proximity of the rural service centre to the irrigation project.

Leadership and irrigation management

All the respondents were aware of the leadership structure of the irrigation project with 89.1% of the opinion that the irrigation management committee was relevant in the running of Tshongokwe irrigation scheme, whilst 10.9% did not think it was relevant. The study revealed that 62.5% of the officer bearers in the IMC were women.

DISCUSSION

Gender of the household heads regardless of the age group is an important variable influencing the participation decision in irrigation. The total sample of the study is composed of 41.7% female headed households. Discussion with households revealed that maleheaded households hardly faced labour shortage for irrigation as well as rainfed farming due to physical, technological, socio-cultural and psychological fitness of farm instrument to males than females. Similarly, education plays a key role for household decision in technology adoption. It creates awareness and helps for better innovation and invention. The average household size for the irrigators and non irrigators was found to be 6.43 and 5.15, respectively. This result is significant suggesting labour availability is an important factor influencing households' decision to participate in irrigation schemes.

The socio economic impact is better illustrated from the point of view of the benefits that accrue to the participants, the surrounding areas and the national economy in general. The socio-economic impact of the scheme has been found to be in the following areas.

Crop diversification

The Tshongokwe farmers are now able to grow high value crops both for the local markets and outside, thus effectively participating in the main stream economy. Their dry land counterparts in Gundwane concentrate on grain maize, small grain, groundnuts and Bambara nuts which are low value crops. The largescale production of high value horticultural crops is not possible under dry land conditions due to climatic limitations. Due to the irrigation development crop production has been diversified to high value horticultural crops such as tomato, cabbage, onion, green maize, wheat, rape, butternut, garlic and spinach. Three crop cycles are grown in a year compared to the single cropping that is possible and done under rain fed agricultural production.

High yields

Irrigated agriculture produces substantially higher yields than dry land agriculture. Based on the monitoring and evaluation data for Tshongokwe Irrigation Scheme from AGRITEX, the crop yields for maize which is grown under irrigation ranges from 6-9 tons/ha as compared to maize yields of 1-2 tons/ha under dryland. The scheme has been producing an average of 6 tonnes of wheat per hectare. This yield is higher than the current national average wheat yield of 3 tonnes per hectare. The groundnuts and dry beans yields are also higher than the dry land figures. This shows that yields have gone up with the introduction of irrigation at Tshongokwe.

Human development

The Tshongokwe Irrigation farmers have developed a commercial mentality. This is indicated by the use of high levels of inputs such as fertilisers and hybrid seeds by irrigators in comparison with the non-irrigators. The amount of fertiliser used by irrigators is up to 300 kg/ha per hectare Ammonium Nitrate top dressing fertiliser for maize where as dryland farmers use on average 50kg/ha. This difference reflects that irrigators are operating on commercial lines. The record books which are kept by each irrigator also explained how business minded these irrigators have become. Before joining the irrigation scheme none of the farmers reported keeping records of their daily farming activities. Now they record all activities and financial transactions which they carry out on the scheme. The hiring of both casual and permanent workers as shown in Table 7 above is also a characteristic of business minded people.

Employment creation

The scheme provides employment throughout the year for people from the surrounding villages, wards and neighbouring Binga District. Hired labour is paid mostly in-kind, cash or both.

Payment depends on the crop being harvested at that particular time. The payment in-kind is used for home consumption or for resale. The standard payment for weeding and leveling a border strip is US\$1.00. The hired workers thus prefer being paid a 5 litre tin of tomatoes, beans or a bundle of onions or green vegetables. When these are re-sold in their respective villages and communal areas, they get much more than US\$ 1.00. People prefer to work on Tshongokwe irrigation scheme than at ARDA Jotsholo Estates. This is because at Tshongokwe the payment is negotiable, promptly paid and there are flexible working conditions. The creation of employment has helped in the food security of the areas that provide these permanent and casual workers.

The irrigation scheme also acts as an employer to the irrigators. The majority of the young males and other male household heads have not bothered to look for work in towns such as Bulawayo, Hwange and Victoria Falls. This is an indication that the scheme is providing gainful employment. Some males interviewed on the scheme revealed that it is better to work on the scheme than to work in towns.

The scheme employs workers from as far afield as 80km. From a broader perspective, the irrigation scheme is vital in curbing the rural to urban drift.

Food security

Tshongokwe irrigation scheme is located in a semi arid and low rainfall area of Natural Region IV and acts as a source of food security during times of drought. In times of drought, non-irrigators come as far as Lusulu in Binga District and Hwange Communal area to buy grain maize, wheat and sugar beans from the scheme. The irrigators have not experienced any grain shortage like their dryland counterparts since the inception of the scheme. The non-irrigators confirmed that they encounter food problems at least once in every three years. They have to rely on food aid. The scheme has been thus a source of food security for the participating households, ward and surrounding districts. The all year round food and vegetable production has resulted in the irrigators eating more nutritious food for most parts of the year. This has a great role in improving health condition of farm households through the supply of nutritional balanced diet.

Drought relief savings

The Tshongokwe irrigation farmers are food self-sufficient. While their dryland counterparts often rely on food handouts from government this is not the case with the 61 irrigation farmers on the scheme. By not providing drought relief to the irrigators and their families the government is making a financial saving. The government saving only captures the cost of purchasing maize without even taking into account transportation costs, manpower costs and other logistical

support required in the distribution of this relief packages. Obviously the saving would be higher if these costs are incorporated. In addition a complete drought relief package includes other commodities like beans which, if included, would double the drought relief requirement.

Assets endowment

The irrigators have managed to acquire assets using incomes from the scheme. Tables 2, 3 and 5 show that the irrigators have more livestock, agricultural and non agricultural assets than the non-irrigators. Only one out of the 61 farmers has no cattle and the average number of cattle per farmer on the scheme has increased.

Livestock such as oxen serve a dual purpose. They are a source of income after sale and provide draught power. Livestock also serves as a source of wealth and reducing vulnerability to risk of drought and crop failure. Although the study area in specific and the country in general is endowed with different quantity and breeds of livestock, the quality and productivity of livestock is very low due to veterinary and health related problems.

Housing condition

Type and quantity of houses owned by households determine their level of wealth and livelihood. Brick under driven thatch houses, brick under asbestos, brick under corrugated iron and pole and dagga under thatch are the main types. Although with four of the house types in severance are similar, all the non irrigators had pole and dagga houses only. The study found that 70% of the Tshongokwe farmers had constructed improved housing, whilst all of the non-irrigators had pole and dagga houses

The irrigators invest the additional income gained from irrigation in different activities. Some of them invest in community service while others are in educating their children. Findings from this research showed that irrigation have positive effect on education. Nhlanha Secondary School near the irrigation scheme has seen it being accorded A' level status due to the increased enrolment. The results show that 91.7% of the irrigators' children are in school. The money realised from the irrigation scheme is being invested in their children's education. The increased income from irrigation has made the irrigators access materials for their children's school requirements and they have replaced the labour of their children engaged on farm by hired casual or permanent workers. This has decreased the number of children dropping out of school.

Entrepreneurial skills

The Tshongokwe farmers have developed entrepreneurial skills over the years that they have been members of the irrigation scheme. The farmers can work out and come up with a proper cropping programme. They now can budget for their cropping activities, manage their own affairs and borrow and repay debts. This indicates that they have acquired useful skills by participating in the irrigation scheme. This is not the case with the non-irrigators.

Social participation and access to infrastructural facilities

Among the constraints of smallholder farmers for technology adoption, shortage of working capital is the prime mover. Utilisation of credit may enable farmers to purchase inputs or acquire physical capital, thus contributing to technology adoption. However, some farmers have access and utilisation to credit while others may not have due to problems related to repayment and down payment in order to get input from formal sources. The survey result indicated irrigators had access to credit from Agribank and none of the non irrigators had ever had access to loans. This implies that irrigators have better access to credit compared to non-irrigators.

Support to other industries

The scheme has enhanced business activities for the local dealers who supply the scheme with inputs. The high value crops grown at Tshongokwe require high levels of fertiliser and chemicals and these are mainly purchased from the local agro dealer. The local dealers at Mabhunu Business Centre confirmed that the greatest demand for inputs comes from the Tshongokwe irrigation scheme more than from anywhere else. The Mabhunu Business centre was only established after 1995, after the rehabilitation and expansion of the irrigation scheme. The centre boasts of agro dealer shops, general dealers, bottle stores, grinding mills. The centre has electricity and farmers do not have to travel to Jotsholo Centre for their shopping. The growth of this centre has had negative effects on Jotsholo Centre. The centre has declined due to lack of business since the farmers are no longer going to Jotsholo Business Centre.

Transporters using both trucks and scotch carts also benefit from the Tshongokwe Irrigation Scheme farmers and vendors. The vendors hire the scotch carts to carry the purchased produce from the scheme to the Bulawayo – Victoria Falls road. The farmers also hire trucks to carry produce to the markets in Lupane, Bulawayo, Hwange and Victoria Falls.

Backward and forward linkages

The irrigation farming at Tshongokwe has created economic backward and forward linkages. Backward linkages have been in the form of the creation and enhancing business activities for

those dealing in farm inputs. This is due to the fact that high value crops, which are grown under irrigation, rely heavily on recommendations for improved purchased agricultural inputs. This has positive employment implications for agricultural input industries, which is particularly important in the seed industry because most seed is produced locally. Seed companies such as Pioneer Seeds and Prime Seed have set bases near the scheme through some agro dealership. Even though the impact on the fertiliser and pesticides industries is not yet fully realised locally, such expenditures contribute to increased labour use in the marketing and distribution sectors(FAO, 2000).

Forward linkages have been established since Tshongokwe Irrigation Scheme has led to cash cropping in an area that is semi arid and was dependent on rain fed agriculture. This has justified the cost of setting up the irrigation scheme by producing cash crops for the market. This production of crops for sell has promoted agro-industries and led to increased rural employment opportunities and increased standards of living in the ward.

Food insecurity at the household level in most communal areas is usually caused by lack of purchasing power. Tshongokwe Irrigation Scheme brings extra income to the farmers, thus enabling them to access food.

Impact on the management of natural resources

Soil erosion has been recognised in Zimbabwe as a long-term problem that needs to be addressed. Elwell and Stocking (1988) estimated that the country is losing Z\$ 1.5 billion worth of nitrogen and phosphorus each year from arable lands and 2.5 million tons of organic matter essential for soil fertility. This loss of nutrients, accompanied by environmental deterioration, poses tremendous implications for agricultural development in Zimbabwe. With the average demographic rate of 3.2% per year against an average agricultural output of about 2.5% per year, the area for dryland cropping is expected to increase. This will further aggravate the existing situation where large tracts of land are without vegetation cover. Consequently more land will be exposed to soil erosion leading to losses in arable and grazing lands, siltation of rivers and reservoirs, dissected landforms and gullies. This form of degradation severely reduces productivity (FAO, 2000).

The development of Tshongokwe irrigation scheme was properly planned, implemented and managed with community participation. The vegetation and area around the scheme has been well conserved.

Contribution of small-scale irrigation

Tshongokwe Irrigation scheme has both positive consequences on food security, asset ownership and income of households. Increased agricultural production through diversification and intensification of crops grown, increased household income because of on-irrigation employment, source of animal feed, improving human health due to balanced diet and easy access and utilisation for medication, soil and ecology degradation prevention and asset ownership are contributions of irrigation.

Moreover, irrigation utilisation greatly supports the livelihood of the non-users through employment opportunity. Tshongokwe irrigation was employing people from a radius of up to 80 kilometres. Irrigation development has created job opportunity for dwellers from other villages and their livelihood is dependent of the employment created by the activities in the scheme.

CONCLUSION

Participation in irrigation by households increases the household income on one hand and the improvement and availability of households' total income. This is due to that irrigation allows households to use farm resource in a more productive way. Firstly, irrigation enables the production of vegetables and cereal crops thrice a year. Secondly, it helps improve livestock productivity by providing feed during the dry seasons and minimising the cost of paying for fodder. Participation in small-scale irrigation, therefore, enables irrigators to improve their well-being by not only allowing higher income but also minimising risk and smoothening household consumption.

The study shows that smallholder irrigation can make a significant contribution towards poverty alleviation, increased incomes and food security. As such the government and donor NGOs should continue and been couraged to support smallholder irrigation scheme investments in the semi arid areas. This will ensure food security, increased incomes, improved standards of living and employment creation for the rural population. Governments, public and private institutions and non-governmental organisations are recommended to work together defining and implementing comprehensive strategies for smallholder irrigation development especially in the smallholder communal areas so as to ensure food security and employment to the rural population.

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