

Farmer Led Irrigation Initiatives And Its Impact On The Livelihoods Of Smallholder Farmers Under Redistributed Lands: A Case Study Of Mazowe District A1 Resettled Farmers, Zimbabwe

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Abstract: Farmer led irrigation farming (FLI) is a vital strategy in the livelihoods of smallholder farmers especially the A1 model resettled farmers in Zimbabwe who now operate in an unpredictable natural and economic environment which has become more and more volatile especially under the prevailing climate changing environment and more recently global epidemics like COVID 19. FLI is now a revolutionary agricultural intensification approach which is already in progress and has the magnitude to significantly transform the living standards of smallholder farmers. However a rigorous assessment of its impact of A1 resettled under its Fast Track Land Reform (FTLRP) is lacking. This study bridges the gap by assessing role of FLI farming initiatives on the livelihoods of resettled farmers under redistributed lands in Mazowe District in Mashonaland Central Province in Zimbabwe. The sample size for the study for quantitative data was 310 A1 farmers practicing FLI in Mazowe District while 5 public officers were for qualitative data. A questionnaire was used to collect household data. Processing of data was done using the Structural Equation Model (STEM). This study found out that smallholder farmer led irrigation had a positive impact on the socio economic aspects of the livelihoods of A1 resettled farmers under Mazowe District of Mashonaland Central Province of Zimbabwe. The study, therefore, recommended ICT development for extension officers who in turn are expected to assist A1 farmers as they embark on FLI farming while improving level of education will help farmers acquire the necessary information needed for decision making under the FLI. Government subsidy interventions will help farmers acquire FLI hardware at affordable costs while enhanced female participation is also envisaged to help stabilize household food security situations. The study also recommends further studies to establish other factors that might provide further insights into the effect of farmer led irrigation farming on livelihoods of farmers.

Key Words: Farmer-Led Irrigation, Livelihoods, A1 Resettled Farmers, Fast Track land Reform,

I INTRODUCTION

Land reforms world over have been noted as an approach to redressing inequalities in access to productive resources including land ownership (Mandizadza, 2010). Zimbabwe's land reform programme offers an interesting case study. At independence in 1980, Zimbabwe had inherited a skewed land ownership structure where 80 percent of all the arable land was owned by only a minority of white commercial farmers who only constituted less than 2 percent of the population (Munyoro et al., 2015). As a result, the new government of President Robert Mugabe embarked on the first land reform programme to re allocate land rights from the few minority white farmers to the majority previously marginalized black indigenous settlers in Zimbabwe. Land reform in Zimbabwe has been seen as a very powerful strategy in the promotion and transformation of the economy and livelihoods of smallholder farmers (Mukodzongi et al., 2017). This is also supported by Munyoro et al. (2015) who also posit that land reform has an important bearing upon livelihoods of people when used as a vehicle to address issues of equity and productivity.

Zimbabwe's Fast track Land reform Program (FTLRP) of 2000 generated intense debate that has polarized views between those in favour of redressing the colonial land imbalance in favour of black farmers and those against the purpose and the approach to land reform (Mukodzongi et al., 2017). In Zimbabwe in the past two decades before the FTLRP, debates focused on the contribution of agriculture to overall economic development (Njaya, 2015). Studies of the impact of irrigation especially by smallholder farmers in Zimbabwe was mainly in the communal areas where the block scheme type was dominant (Manzungu, 1999; Rukuni et al., 2006; Zawe, 2006). In the new agrarian context, in Zimbabwe, the strategy of adoption of farmer led irrigation by smallholder farmers describes

strategies and initiatives by the farmers to improve productivity and profitability where agriculture is the bedrock of livelihoods and incomes (Gebrehiwot, et al., 2015). Thus, the impact of farmer led irrigation initiatives has not been highly researched on, with most researchers concentrating on land reform outcomes from land redistribution and ignoring the impact of farmer initiatives in the area of farmer led irrigation and crop productivity (Mukodzongi et al., 2017; Scoones et al., 2010). This is regardless of the existence of vast global empirical indications of achievements in small-scale irrigation agriculture in countries like Japan, China, Taiwan, Mexico and Colombia and Kenya (Woodhouse et al., 2017). This study investigated the impact of farmer led irrigation on the livelihoods of smallholder farmers focusing on model A1 farmers in Mazowe District of Zimbabwe.

II PROBLEM STATEMENT

Zimbabwe's Fast Track Land Reform Programme (FTLRP) of 2000 has been noted to have had varied progress in terms of outcomes (Njaya, 2015). The programme is widely credited with addressing the colonial land imbalances and widened the base of economic participation of indigenous farmers (Mukodzongi, 2017). Despite being credited with the overhauling the skewed nature in inequalities in land ownership in Zimbabwe, the programme is associated with a decline in agriculture production and economic collapse (Richardson, 2004). The negative impacts often highlighted create a negative picture of the FTLRP. However, there has been lack of solid empirical research on how such an extensive land redistributive programme has impacted on the livelihoods of smallholder farmers especially those that have gone on to engage in farmer-led irrigation (FLI) farming (Njaya, 2016). To date, not much is known, in the context of Zimbabwe, about the nature of the relationship that exists between smallholder farmer led irrigation and crop production in the country, and how such practices impact on A1 settlement farmers' efforts towards improving their rural livelihoods (Scoones et al., 2019).. Therefore, this study sought to investigate the role of smallholder farmer led farmer led irrigation on the livelihoods of A1 resettled farmers in Mazowe District.

III REVIEW OF RELATED LITERATURE

A Farmer led irrigation initiatives defined

Farmer led irrigation development is defined by Woodhouse et al. (2017) as a process where smallholder farmers assume a driving role in improving their water use for their agriculture in the process bringing about changes in knowledge production, technology use, investment patterns, market linkages and governance over land and water resources. The development of smallholder farmer led irrigation has been noted across developing nations as being of highly significant value in mitigating the effects of drought and being a catalyst to sustainable long term agricultural and national development (Chisango and Maphosa, 2016). Farmer-led irrigation is also defined as an irrigation practice initiated, managed and financed by farmers themselves (Lefore, et al., 2019). The irrigated areas are typically small (less than 2 ha), the technologies are generally low-cost (Lefore, et al., 2019), and the farmers produce both horticultural crops and staple crops (Otoo et al., 2018). In the Zimbabwean context, the FTLRP resettled programme has availed more land to smallholder farmers. A1 farmers under the FTLRP command up to 6 hectares of arable land compared to their counterparts in SSA who have small plots usually less than 2 hectares.

B Smallholder Farmer led irrigation initiatives and productivity

According to Nhundu and Mushunje (2013), successful smallholder farmer led irrigation schemes the world over have resulted in increased productivity. They further note that increased productivity results in better incomes, employment creation, food security, nutrition, and reduced food imports to cover food deficits by government and aim to attain food security. Food security as defined by FAO (2020) is seen as a situation that exists when all people, at all times have physical, social and economic access to sufficient, safe and nutritious food that meet their dietary needs and food preferences for an active and healthy life. This definition gives a comprehensive narrative of food security which comprises five dimensions of food security which are food availability, economic, physical access to food, food utilization, and food stability over time and food safety (FAO, 2020).

The strategy of adopting these farmer led irrigation initiatives is essential in the improvement in livelihoods rural communities where agriculture remains the foundation of livelihoods and incomes (Gebrehiwot, et al., 2015). Despite such evidence the world over and persistent recurrence of mid-season dry spells and droughts in A1 settlement schemes in Zimbabwe, farmer led irrigation seems to be challenged and thus fails to be a source of sustainable livelihoods. As noted by Moyo (2016), access to irrigation would allow smallholder farmers in this case A1 model farmers to improve their crop production and simultaneously increasing their incomes and diversify opportunities to generate more income.

The fact that large numbers of the world's poor depend directly or indirectly on agriculture for their livelihoods reflects the significance of farming (INMI, 2016). In Zimbabwe, approximately 10 million people are directly or indirectly dependent on agriculture as a source of income and employment (ZIMVAC, 2021). The blueprint of the Government of Zimbabwean (GoZ), the National Development Strategy 1 (NDS 1), identified the agricultural sector as one of the major sectors with substantial potential of creating jobs (Government of Zimbabwe, 2020). The complexities in rural livelihoods and the levels of poverty in less developed nations has resulted in the need for in-depth research on the role of smallholder farmer led irrigation farming on the lives of the poor (Moyo, 2016). An understanding of the role of farmer led irrigation farming on livelihoods in Zimbabwe's A1 settlement schemes is important to enable interventions at policy, financing and programmatic levels in order to improve agricultural productivity and transform livelihoods.

C Smallholder farmer led irrigation under A1 schemes and farmers' livelihoods

This paper as a result, explored the role that smallholder farmer led initiatives plays on A1 resettled farmers' livelihoods. The FTLRP drastically reduced the land within the white dominated large-scale commercial sector and expanded the black dominated small-scale farming sector (Njaya, 2015). The Government of Zimbabwe adopted two model variants. These were the A1 variant and the A2 variant (Ministry of Lands, 2020). Regarding the A1 variant, it was mainly for the generality of landless people meant to decongest the communal areas of Zimbabwe while the A2 variant was meant for the commercial settlement schemes (Ministry of Lands, Agriculture, Fisheries, Water and Rural Development, 2020). Under the A1 model a total of 180 000 households were resettled while 9600 households were allocated land under the A2 model (GoZ, 2020).

In general, there has been progress of the FTLRP from 2000 to date in terms improving farming methods, decongestion of rural areas and redressing of land inequality. The causes and the subsequent consequences of the FTLRP have been widely debated and there is a significant contribution to academic literature regarding this program (Deininger et al., 2002; Matondi, 2012; Masiwa, 2004; Moyo, 2004; Mukodzongi, 2017) To its credit, FTLRP addressed the Zimbabwean land question, that is, the land ownership dispute between the white minority and the black majority (Munyoro et al. 2015). The FTLRP has been associated with loss in agricultural productivity and economic collapse and violence in the manner in which it was implemented (Munyoro et al., 2015). These narratives have created a picture of pessimism about the FTLRP. These negative impacts, often overly highlighted, overlook the positives that such a massive programme can have on the livelihoods of the resettled small-scale farmers. Some pertinent questions that arise are: Have there been any welfare and income gains for smallholder farmers under the A1 scheme of the FTLRP?; What are the perceptions of A1 farmers with regards to productivity under the FTLRP?; How have smallholder farmer livelihoods changed under A1 scheme when there are farmer led irrigation initiatives?

Previous studies on smallholder irrigation in Zimbabwe focused on examining the association between smallholder irrigation and livelihoods but did not quantify the farmer led irrigation farming contribution to household livelihoods of settlers in Zimbabwe's A1 settlement schemes. The previous studies went on to establish some positive association between smallholder irrigation farming in communal areas of Zimbabwe (Mhembwe and Dube, 2017; Tshuma, 2015). The level of farmer led irrigation is not documented, ii) the contribution of farmer led irrigation to productivity and consequently their livelihoods is poorly understood, iii) their level of technical knowledge on farmer led irrigation is not documented, iv) what are their major sources of income, how does their knowledge affect their ability to engage in farmer led irrigation, v) how does their knowledge affect their ability to derive income from farmer led irrigation practice. This paper therefore, makes some contributions to fill such gaps in knowledge.

D Support to resettled farmers under FTLRP

After the onset of the land reform programme, commercial banks in Zimbabwe were not willing to provide credit to A1, A2 and even to large scale commercial farmers because of lack of secure collateral and risks associated with insecure tenure and selective law enforcement (Chazovachii, 2016). Banks did not accept the 99 year leases given to the new occupants as they were not secure and transferrable (Moyo, 2016). The same applied to the A1 settlement permits issued by the Government of Zimbabwe.

IV. METHODOLOGY

This study utilized a mixed method research design with a target population of 3441 Smallholder A1 irrigation farmers in Mazowe District. The sample size for the study for quantitative data was 310 smallholder farmer practicing farmer led irrigation while 5 public officers were for qualitative data. For purposes of quantitative data stratified random sampling and convenience sampling were used while purposive sampling was employed for the 5 key informants (qualitative data). Data collection instruments used were a questionnaire for quantitative data, interview guide for key informant interviews and focus group discussions while observation was applied on transect walks. Processing of data was done using iNvivo version 12, SPSS version 20 before being analyzed by the researcher in line with the research objective.

V RESULTS

The study utilized the opinion of the A1 farmers on how they viewed the improvements in their livelihoods as a result of the engaged in farmer led irrigation initiatives. Table 1 below presents the sample’s views on livelihoods of A1 model farmers in Mazowe District.

Table 1 Summary of numerical descriptive statistics of opinions of eight key characteristics on a five point Likert scale for A1 smallholder farmers sampled from Mazowe District in Mazowe District in 2021.

Improvements on:		Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Lifestyle	310	1	5	2.85	1.487	.168	-1.415
Housing	310	1	5	2.85	1.494	.144	-1.444
Education for kids	310	1	5	2.84	1.469	.159	-1.390
Health status	310	1	5	2.76	1.489	.255	-1.391
Food security	310	1	5	2.89	1.483	.124	-1.412
Infrastructure	310	1	5	2.79	1.478	.178	-1.410
Assets	310	1	5	2.89	1.480	.117	-1.414
Sustainable use of natural resources	310	1	6	2.83	1.460	.186	-1.330
Measurement tool ^a		1	5	3.00			
Valid N (listwise)	310						

a – This is the mean of the 5 point Likert scale

b = The five point Likert scale: Strongly agree (1), Agree (2), Neutral (3), Disagree (4), Strongly disagree (5)

Normality test: Table 1 above confirms the existence of normality in data set given the kurtosis and skewness scores for all the variables of crop production construct are within the normality range Shukla (2008).

Improvements on lifestyle: The item scored an arithmetic mean of 2.85 (Table 1). The results lean toward agreeing and strongly agreeing indicating that respondents felt that there were major improvements on their lifestyles after they had engaged in farmer led irrigation initiatives. The majority of the respondents had some positive attitude towards improvements on lifestyle in smallholder farmer led irrigation farming in the A1 resettlement areas of Mazowe District.

Improvements on housing: The item scored an arithmetic mean of 2.85 (Table 1). The results lean toward agreeing and strongly agreeing indicating that respondents felt that there were major improvements on their housing.

Improvements on education for kids: The item scored an arithmetic mean of 2.84 (Table 1). The results lean toward agreeing and strongly agreeing and indicate that respondents felt that there were major improvements on education for kids. These results indicate that respondents had some positive attitude towards improvements on education for their children where smallholder farmer led irrigation farming was practised under the A1 schemes in Mazowe District.

Improvements on health status: The item scored an arithmetic mean of 2.76 (Table 1) above the results lean toward agreeing and strongly agreeing. These results indicated that respondents felt that there were major improvements on their health status since the adoption of farmer led irrigation initiatives.

Improvements on food security: The item scored an arithmetic mean of 2.89 (Table 1) The results lean toward agreeing and strongly agreeing and this showed that respondents felt that there were major improvements on their food security situation since they adopted farmer led irrigation.

Improvements on infrastructure: This item scored an arithmetic mean of 2.79 (Table 1). The results lean toward agreeing and strongly agreeing indicating that respondents felt that there were major improvements on their farm infrastructure as well as residential infrastructure under the A1 scheme of Mazowe District where farmer led irrigation was been practised.

Improvements on household assets: The item scored an arithmetic mean of 2.89 (Table 1). The results lean toward agreeing and strongly agreeing showing that respondents felt that there were major improvements on their household assets from the time they started practising farmer led irrigation under the A1 scheme model in Mazowe District.

Improvements on sustainable use of natural resources: The item scored an arithmetic mean of 2.83 (Table 1) The results lean toward agreeing and strongly agreeing and this showed that respondents felt that there were major improvements on sustainable use of natural resources in areas practising farmer led irrigation.

Hypotheses testing was also conducted at a significance level of $\alpha=0.05$ level and the results are presented in Table 2.

Table 2 Structural Equation Model (STEM) Output regarding hypothesized relationships between farmer led irrigation, crop production and livelihoods under the A1 model of Mazowe District in 2021.

Hypotheses	Path	SEM Output			Results*
		Estimate	S.E.	P	
Ha1 Smallholder irrigation has a positive and significant impact on the livelihoods of A1 model farmers	Irrigation →Livelihoods	.870	.036	.000	Supported

*Supported at significance level $p \leq 0.001$. (SEM = Structural Equation Model)

Irrigation refers to Farmer led irrigation.

Farmer led irrigation farming (Irrigation) estimated coefficient of the path β value .870 with $p < .001$, in the model, therefore has a significant and positive influence on livelihoods of A1 model farmers (Livelihoods). This infers that the Ha1 is concluded.

Data from quantitative analysis was triangulated with qualitative data. The following is the qualitative data analysis outcomes.

Farmer led irrigation farming and livelihoods of A1 model farmers-Qualitative analysis

A question was posed to the participants on how farmer led irrigation farming contributed to livelihoods of A1 model farmers and the themes are shown Table 3 below.

Table 3 Summary of emerging codes and resultant themes in response to how farmer led irrigation farming affected livelihoods of A1 model farmers in Mazowe District in 2021.

OPEN CODES	AXIAL CODES	SELECTIVE THEMES
1. Procurement of TV		
2. Car		
3. Bicycle		
4. Scotch cart		
5. Housing	1. Lifestyle	
6. Education for kids	2. social status	1. Livelihoods outcomes
7. Health status	3. farm implements	2. Livelihood assets
8. Food security	4. Other assets	
9. Infrastructure	5. Land use	
10. Household assets		

11. Natural resources
 12. High sales
 13. Cash liquidity
-

The analysis of key informant interviews reports on farmer led irrigation farming contribution to livelihoods of A1 model farmers through open coding had thirteen, axial coding five and finally two main themes. Participants (irrigating A1 farmers) view the major farmer led irrigation farming contribution to livelihoods of A1 model farmers in their contexts as through results on increased livelihoods outcomes and livelihood assets.

Results from the qualitative analysis confirmed quantitative results that farmer led irrigation had a positive impact on the livelihoods of A1 resettled farmers,

Presentation and analysis of the qualitative data – transect walks

Two types of household were observed which included the household beneficiaries of the FTLRP and farm worker households. Some former farm workers left behind by former commercial white farmers had been allocated A1 plots although of smaller sizes compared to their counter parts who had invaded the farmers. Some farm workers had small horticultural gardens where they grew horticultural crops from water drawn from rivers and wells constructed in the farm compound areas. This has resulted in sustained source of livelihoods in the absence of bigger pieces of land (Figure 1).



Figure 1 Former farm workers horticultural gardens

The same trend to marginalize former farm workers has also been observed in Namibia and South Africa where former farm workers were side lined in the allocation of acquired state land (Marongwe, 2008). This subsequently affected their livelihoods.

During Focus Group Discussions, crop production figures from farmer led irrigation farming compared to dry land farming were recorded and the following figures were noted.

Table 4. Potential Yield improvement from investments in farmer led irrigation in Mazowe District in 2021

Crop	Rain –fed yield (t/ha)	Smallholder farmer led irrigation yield increase (%)
Maize	0.8	140 – 200
Soya beans	1.5	100 – 175
Potatoes	4.0	190 – 210
Tomato	20	70 – 75
Tobacco	1.5	250 – 300
Groundnuts	0.5	138 – 151
Cabbages	10	210-250

Farmer led irrigation had led to an increase in yields in all crops grown under the A1 schemes. The percentage increase ranged from 70% in tomatoes to a high of 300 % in tobacco.

The transect walks further sought to investigate the impacts of crop production and the resultant changes in the livelihoods of the resettled smallholder A1 farmers in Mazowe District in 2021. The observation results therefore showed that crop production under farmer led irrigation farming had a high positive influence on the livelihoods of A1 resettled farmers under study (Figure 2)



Figure 2 Crop production under farmer led irrigation farming

The next section deals with the discussion of results

DISCUSSION

Sample opinion on Improvements in livelihoods of A1 model farmers as a result of farmer led irrigation

Summary results on improvements in livelihoods of A1 model farmers are shown in Tables 1. As shown in Table 1 the results lean towards agreeing and strongly agreeing. The means (2.76 – 2.89) and standard deviations (1.460 -1.494) revealed significant improvements in livelihoods of A1 model farmers. The following gives a discussion on livelihood variables that were enhanced by farmer led irrigation farming initiatives.

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Improvement of life styles

The respondents of this study indicated that there had a positive attitude towards the improvements in their life styles. Most respondents had changed their diets to include regular drinking of tea and regular meat consumption. Observations during field visits indicated that most families practising farmer led irrigation had acquired assets and built new houses. These results confirm to results by Moyo (2016) where irrigating farmers in Polokwane, South Africa had tremendously changed their life styles compared to non-irrigators in the same area. This is also supported by studies in Mutambara area of Manicaland, Zimbabwe (Makombe. 1996) which found out that smallholder irrigation enabled irrigators to earn an income which enabled them to meet most of their basic needs. In so doing this improved the irrigators' life style and livelihoods.

Improvement in Housing

Results from this research further indicated that the respondents had a positive attitude towards improvements on housing in smallholder farmer led irrigation. Transect walks and questionnaire analysis revealed that most of the respondents had built new houses which were bricks under asbestos or metal roofing sheets. The study by Chenje et al. (1998) supported the findings of this study. Chenje et al. (1998) in their study in Chakuda village in Gambia small irrigation schemes resulted in increased income which translated into wealth which manifested in the construction of farmers houses, a village clinic and a mosque. Farmer led irrigation is a strategy that can improve crop productivity in resettlement schemes and subsequent increase in wealth creation.

Improvements on education for kids

Findings of this study indicated that the respondents had a positive attitude towards improvements on education for kids in farmer led irrigation. This study found out that respondents with their income from farming especially from farmer led irrigation farming had built primary and secondary schools and teachers houses under the A1 model scheme in Mazowe District. Observations indicated that more blocks were built to accommodate more children under the new Covid-19 protocols which required children to practise social distancing while in class. Respondents also indicated that they had sent their children to boarding schools, colleges and universities from income gained from farmer led irrigation initiatives under the A1 scheme model in Mazowe District. Mpala (2016) findings in his study in Tshongokwe irrigation scheme in Lupane District, Zimbabwe support the findings of this study. Mpala found out that 60% of children of irrigators were in school while 40% of children of non-irrigators were out of school. 11% of children of irrigators were in boarding schools such as Fatima and Mabhikwa high schools.

Improvement of Health Status

Results of this study indicated that respondents had a positive attitude towards improvements on health status in smallholder farmer led irrigation. The respondents from this study indicated that income from farmer led irrigation enabled them to seek treatment from nearby district hospitals in Mvurwi and Concession. They were also able to seek specialist treatments in Harare. In farms like Gregen Gower and Glendale farms which are irrigating farms, farmers had built clinics to serve them and the surrounding farms. These results also concur with the studies from Chokuda village, Gambia where Chenje et al. (1998) found out that smallholder irrigators had built a clinic from proceeds of their irrigation farming enterprises. Scoones et al. (2019) from their studies on farmer led irrigation initiatives in Masvingo Province, Zimbabwe under the A1 model found out that irrigators were able to seek specialist treatment in the nearby town of Masvingo town and as far as the capital city, Harare.

Improvement on food security status

Most respondents had some positive attitude towards improved food security in farmer led irrigation. Farmer led irrigation farming was found to increase crop productivity in the crops that were grown in the resettlement areas of Mazowe District. Respondents indicated increases in maize yields, soya beans yields, wheat yields and tobacco yields for the field crops. The same also applied for the horticultural crops. On transect walks during field visits, it was observed that the crop stand was different between farmer led irrigation plots and those under dry land farming. Farmers under farmer led irrigation indicated that since they started farmer led irrigation they had enough food for home consumption and sold excess produce to Grain Marketing Board (GMB) and to other farmers. Tobacco and horticulture were sold for income.

The findings in this research are also supported by Mhembwe et al. (2019) on smallholder farmers in Zimbabwe. Mhembwe et al. (2019) found that small-scale rural irrigation schemes could meaningfully change rural farmers' lives by improving the sustainability of earnings from farming. Furthermore, they established that small-scale irrigation schemes could remedy food security challenges in rural households.

Improvements on infrastructure

The outcome of this study showed that the respondents had a positive attitude towards improvement on infrastructure in smallholder farmer led irrigation farming. The respondents in this study engaged in dam maintenance works, installation of electricity and road maintenance on their farms. This concurs with farmer led irrigation studies in Masvingo Province, Zimbabwe where A1 resettled farmers engaged in farmer led irrigation especially the aspiring irrigators and the commercial irrigators using the typology developed by Scoones et al. (2019), had developed substantial infrastructure on their plots and farms.

Improvement of household assets

The results that were found from this study indicated that respondents had a positive attitude towards improvements on household assets in smallholder farmer led irrigation farming. The quantitative analysis found out that irrigating farmers under the A1 model scheme had acquired livestock, cars, Lorries, tractors and bicycles. The irrigating farmers had also acquired scotch carts, cultivators and ox drawn ploughs. The respondents had also acquired household assets like chairs, beds, TV sets, radios and sofa seats. These findings are also supported by Woodhouse et al. (2017) in their studies on farmer led irrigation in Ghana. The smallholder farmers indicated that they did not have these assets before they started engaging in farmer led irrigation farming under the A1 resettlement model of Mazowe District.

Improvements on sustainable use of natural resources

Findings from this study indicate that respondents had some positive attitude towards improvements on sustainable use natural resources in farmer led irrigation farming in Mazowe District A1 model. The respondents indicated that the farmers were using water transmission pipes which were secure and buckets for watering to conserve water. Fields which were on slopes of more than 2% were protected using infield conservational works to reduce soil erosion. This study also found out that due to farm level irrigation constitutions, control of stream bank cultivation has been reinforced where farmers were practising farmer led irrigation.

The outcomes of this research are also supported by studies on dambo farming on different sites in Zimbabwe by Nyamadzawo et al. (2013) which showed that farmers practising farmer led irrigation in Dambo areas were using motorized pumps to minimize water losses and conservational works had been constructed in their dambo plots. Discussion on the hypothesis informing this study was also done.

Ha1: Farmer-led irrigation positively and significantly impacted on A1 model farmers' livelihoods.

The direct path shown in Table 2 between farmer led irrigation farming and livelihoods of A1 model farmers is validated. The estimated standardised β value .870 with $p = .000$ in the proposed model, reveal support to hypothesis Ha1. The results support the argument that farmer led irrigation farming is the root of success in livelihoods of A1 model farmers. This means farmer led irrigation farming is one of the significant factors in livelihoods of A1 model farmers. Thus, the finding regarding the effect of farmer led irrigation farming on livelihoods of A1 model farmers increased the generalizability from a different and seldom context.

The results of the model estimates for farmer led irrigation farming and livelihoods of A1 model farmers in Table 2 indicate a positive and significant association between farmer led irrigation farming and livelihoods of A1 model farmers.

The above findings are supported by Mhembwe et al. (2019) on smallholder farmers in Zimbabwe. They established that small-scale irrigation schemes were a panacea to food security challenges in rural households.

VI RECOMMENDATIONS

Information Communication Technology (ICT) development

Information is critical in the adoption of smallholder farmer led irrigation initiatives. In this regard the Government of Zimbabwe will need to develop well-equipped agricultural resource centers in all provinces of the country in order to demonstrate new technologies which assist smallholder farmers improve their crop productivity especially for those resettled under the A1 model of the FTLRP. The research findings of this study indicate this need for new information centres for A1 smallholder farmers in the areas of farmer led irrigation farmers as the study pointed out the need for new innovation, the ability to organize resources and sourcing for information at a cost.

ICT could accelerate productivity of Zimbabwean smallholder farmer led irrigation farming especially under the A1 scheme of the FTLRP in the areas of weather forecasting and irrigation scheduling.

Enhanced female participation in irrigation farming

It is generally acceptable that empowerment of women is empowering a nation. In terms of study findings, female headed families constituted 39.0% which is a big percentage in terms of number of households under the support of this female headed households. In smallholder farming especially under the A1 resettlement areas, there is need for the introduction of gender-friendly irrigation initiatives to accommodate the cases of female headed households which ultimately expand irrigated areas under the FTLRP. There is also need for policy priority to sustain the economic benefit of smallholder farmer led irrigation which is inclusive to all gender parties. The enhancement of rural livelihoods is achieved through focusing on policies aimed at female participation in A1 farmer led irrigation farming. Government should be focused on equal allocation of land between females and males under the Government programs and move on to support smallholder farmer-led irrigation with the aim of improving the livelihoods of the resettled farmers.

Government support to A1 smallholder farmers

According to Mutero et al. (2016), access to funding, markets, information and technology impact feasibility in terms of smallholder farming and this is supported by the current findings that established access to funding as one of the major challenges in smallholder farmer led irrigation farming ventures. Mobilizing and increasing rural credit lines to smallholder farmers including A1 irrigating farmers in Zimbabwe should be prioritized during policy formulation. As a result, the land bank (Agricultural Finance Cooperation) needs to be quickly operationalized to offer medium to long term capital borrowing to allow farmers to borrow for irrigation development. Irrigation accessories such as water pumps and engines, solar panels and piping should be exempt from paying duty on being imported into the country. These irrigation accessories form an important driver in the attainment of a viable smallholder farmer led irrigation development in the resettlement and the communal areas of Zimbabwe.

Provision of security of tenure for resettlement land

In this study, security of tenure documents for A1 farmers is varied and a segment of A1 resettled farmers do not have land tenure documents. This process of land tenure documentation is slow thereby curtailing the will by A1 irrigating farmers to invest sustainably. Studies elsewhere show that smallholder farmers invest even in the absence of tenure documents but the Zimbabwe situation is different in that farmer evictions happen regularly especially after elections. Banks have also been reluctant to offer funding where there are no tenure documents.

VII SUGGESTIONS FOR FURTHER RESEARCH

Even though the study has meaningful results, there are other areas requiring further researches. Firstly, selection of irrigation practices was not exhaustive. Consequently, other factors might offer insights on effect of smallholder farmer led irrigation farming on livelihoods of farmers. The major underlying issues at the front of the study variables as identified through factor analysis might be vital. Thus there could be need to include other construct items and statistical tools besides those used here to improve robustness of validity of results.

Secondly, it is widely understood that in empirical research, the results are always based on self-reported data of the respondents. As much as it was assumed that the respondents were adequate for reliable and valid data. It could be useful to put together farmers' responses to questionnaires with views held by their customers, competitors and distributors.

VIII CONCLUSION

The study findings contributed to limited land reform academic literature available pertaining to smallholder farmer led irrigation farming and the livelihoods of A1 model farmers settled under the FTLRP in Mazowe district, Zimbabwe. This study concluded that farmer led irrigation had a positive impact in the livelihoods of resettled A1 model farmers under the FTLRP. In this regard this paper proposed a model using the Structural Equation Model (STEM) that represents an important tool for predicting livelihoods of farmers across a range of smallholder farmer led irrigation farming categories in the Zimbabwean context. Furthermore, the recommendations discussed in this paper could help government to include farmer led irrigation in its National Irrigation Policy together with the viable financing models for financial institutions. Farmer led irrigation initiatives can complement government irrigation projects in pursuit of its target of irrigating 250 000 hectares by 2025 and attaining Zimbabwe's Vision 2030 whose aim is to achieve an upper middle class status for its citizenry. NGO and other interest groups targeting the smallholder farmer led farming within the smallholder farming sector will be able to make informed decisions in their pursuit in assisting smallholder farmers engage in farmer led irrigation initiatives which have been shown in this study to positively enhance livelihoods of resettled farmers under redistributed lands under the FTLRP in Zimbabwe.

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