Farmer Perceptions On The Impact Of Farmer Led-Irrigation Initiatives On Crop Production Under Redistributed Lands: A Case Study Of Mazowe District A1 Resettled Farmers, Zimbabwe.

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Abstract- This article acknowledges that land reform is critical in the development and transformation of economies especially in Sub Saharan Africa. (SSA). Land reform is a planned purposive change in the way land tenure is held or owned. It also includes the methods of cultivation that are employed and in a way, defines the relation of agriculture to the rest of the economy. Like most economies in Sub Saharan Africa (SSA), agriculture in Zimbabwe plays an important role in the country's economy and also on the livelihoods of the rural populace whose quest for food security and nutrition, income and expansion of their rural economies is embedded in agriculture. This is clearly spelt out in the Zimbabwe's economic blue print, the National Development Strategy One (NDS1) where agriculture forms the important enabler for the country's social and economic transformation by the second Republic of President Emmerson Mnangagwa. Farmers under the A1 model of Zimbabwe's Fast Track Land Reform Programme (FTLRP) have engaged in Farmer Led-Irrigation (FLI) initiatives to complement irrigation programmes by the Government of Zimbabwe. The main goal of these initiatives is to increase crop productivity that invariably enhances small holder farmers' livelihoods. Rainfall agriculture has proven to be unreliable in the face of climate change. However a rigorous assessment of its impact of farmer led irrigation on crop productivity is lacking. This study bridges the gap by assessing the perception of resettled farmers on the impact of farmer led irrigation on crop production 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 highly positive impact on crop production under the A1 resettlement schemes of Mazowe District of Mashonaland Central Province of Zimbabwe. The study, therefore, recommended Government subsidy interventions to help farmers acquire FLI hardware at affordable costs which is envisaged to increase crop productivity. to help stabilize household food security. The study also recommends further studies to establish other factors that might provide further insights into the effect of farmer led irrigation farming on crop production.

Index Terms- Farmer-led irrigation, land reform, livelihoods, Zimbabwe, crop productivity

I. INTRODUCTION

Zimbabwe's Fast Track Land Reform Programme (FTLRP) has been noted as an approach to redressing inequalities in access to productive resources including land ownership (Mandizadza, 2010). This land reform programme offers an interesting case study especially now that the world is grappling with rising food prices and food shortages as a result of climate change induced shocks, the COVID 19 global pandemic and the war between Ukraine and Russia. The FTLRP 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 crop 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 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 crop 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 iniatives 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 crop production and 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 et al., 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 crop productivity 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 crop productivity for resettled farmers in Mazowe District.

III. REVIEW OF RELATED LITERATURE

A Farmer led irrigation initiatives defined

Woodhouse et al. (2017: 13) define farmer led irrigation development as a process where smallholder farmers assume a driving role in improving their water use for agriculture by 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), mostly by individuals (de Fraiture and Giordano, 2014), but sometimes in small groups (Beekman et al., 2014). 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 high-value horticultural crops and staple crops (Otoo et al., 2018). In the Zimbabwean context, the 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. Land in Zimbabwe is no longer a limiting factor in the smallholder sector of Zimbabwe especially after the FTLRP. Smallholder farmers assume a driving role in improving their water-use for FLI (Scoones, et al., 2019).

B Extent of farmer led irrigation initiatives in Zimbabwe

After the FTLRP, farmer-led irrigation has been taking root in the new transformed agrarian landscape that is taking place in Zimbabwe. Scoones et al. (2019) in a study in Masvingo district in Zimbabwe, indicated that farmer-led irrigation is far more extensive than previously documented. Manzungu (2003) posits that informal irrigation (outside those schemes initiated by Government) accounts for only 9% of all the 154 000 hectares of irrigable land in Zimbabwe. (Mosella et al., 2017).

One of the important objectives of land reforms world over is to improve crop productivity and irrigation plays an important role in increasing crop productivity. Crop yield improvement in SSA increased by 141 to 195 percent in smallholder irrigation compared to rain fed (Domenech and Ringler, 2013). Crop yields of A1 model farmers of Zimbabwe under dry land farming fell in areas where no farmer led-irrigation was been practised (Scoones et al., 2019). There is little documented empirical evidence to support this and therefore this research is meant to provide such answers.

C Smallholder Farmer led irrigation 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. Food security is defined by FAO (2020) 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 farmers led-irrigation initiatives is essential in the improvement in the livelihoods of 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.

Irrigation as a farming activity plays a major role in wealth creation especially in rural settings (Moyo, 2016). Smallholder irrigation is a key aspect when it comes to improving and enhancing lives of poor households as it determines key opportunities of uplifting societies from the clutches of poverty (Mutiro and Lautze, 2015). 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 benefit for A1 settlement schemes comes in the form of improved crop production and increased incomes for

farmers. Therefore, they contribute to improvements to the welfare of their households (Setboonsang and Gregorio, 2017). Regions such as North Africa, Middle East and East Asia having the largest proportion of irrigated land, have experienced remarkable improvement in livelihoods over the years compared to regions that depend on rain-fed farming (Gebrehiwot et al., 2015; Hussain and Hanjira, 2015; Muzerengi and Mapuranga, 2017). Beekman et al. (2014) further state that the prevalence and severity of poverty has been meaningfully lower in areas practicing irrigation. Asia and Latin America recorded significantly high production and incomes due to adoption of irrigation. Africa has a generally, low reduction in poverty because only three percent of farmland is under irrigation (Tshuma, 2015) and this seems to be the case in Zimbabwe's A1 settlement schemes.

D Smallholder farmer led irrigation and farmers' livelihoods

The paper as a result, explored the role that smallholder farmer led-irrigation farming plays on A1 resettled farmers' livelihoods. The FTLRP was implemented in an accelerated manner and radically transformed the county's land ownership and agrarian structure (Zikhali, 2008). 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, Agriculture, Fisheries, Water and Rural Development, 2021). 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, 2021). Under the A1 model a total of 180 000 households were resettled while 9600 households were allocated land under the A2 model (Government of Zimbabwe., 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; Masiiwa, 2004; Moyo, 2004; Mukodzongi, 2019; Richardson, 2004; Rukuni et al., 2006; Sachikonye, 2003; Scoones, et al., 2019; Zikhali, 2008). To its credit, FTLRP addressed the Zimbabwean land question, that is, the land ownership dispute between the white minority and the black majority (Richardson, 2004). The land ownership dispute as noted by Richardson (2004) centers on colonial policies (Land husbandry Act of 1930 and the Land apportionment Acts of 1951) that allocated most of agricultural prime land to the white minority while depriving land ownership to the black majority and in the process making them landless or crowding them in the less productive areas of the country. This has positioned a significant sector of the population of the indigenous Zimbabweans to contribute more meaningfully to the national growth agenda in pursuit of Zimbabwe's Vision 2030. The FTLRP has been associated with loss in agricultural productivity and economic collapse and violence in the manner in which it was implemented (Sadomba, 2008). 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; and What could then be new profiles of the resettled farmers practicing farmer led irrigation?

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 and livelihoods in communal areas of Zimbabwe (Kabongo, 2020; 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. The current study therefore, makes some contributions to fill such gaps in knowledge.

Impact of climate change

According to Mosello et al. (2017) climatic data indicate Zimbabwe as starting to experience the climate change effects as witnessed by high frequency of extreme weather events like cyclones and droughts (Mugabe et al., 2013). The occurrence of cyclone Idai in 2019 also adds to the list of extreme weather patterns affecting Zimbabwe and the sub region.

History of small-holder irrigation schemes in Zimbabwe

Studies of smallholder irrigation schemes have mainly been focused on communal areas where irrigation schemes were developed by either the pre-independence or post-independence governments (Chazovachii, 2012; Manzungu, 1999; Mombeshora, 2003; Rukuni and Eicher, 1994). In such schemes Makadho (2008) notes that , the land is state-owned but managed by groups of farmers who share water resources, infrastructure, and each family has an area of not more than 0.5 hectares. This is supported by other studies in smallholder irrigation schemes in Zimbabwe (Chazovachii, 2012; Manzungu, 1999; Mombeshora, 2003; Rukuni and Eicher, 1994). Historically, small-scale irrigation schemes were regarded as insurance against crop failure that leads to famine in the absence of other means to access food (Makadho, 1994).

The beginning of the FTLRP redefined the dynamics of smallholder irrigation. According to Scoones et al. (2019) the land reform of 2000 in Zimbabwe redistributed about 10 million hectares once owned by approximately 6 400 white commercial farmers. This, according to Ministry of Lands (2019), has resulted in establishment of around 146 000 A1 and 16 000 A2 scheme units. Land allocations to smallholder farmers under A1 scheme

were in the range of 3-6 hectares of arable land and the majority of these plots can be deemed to be having access to irrigation water from both old and new sources on the farms (Scoones et al., 2019). Some of the plots are located in areas where there exist irrigation infrastructure like water pipes, water reticulation and water pumps left by former commercial farmers. This land is mostly fertile land and in most cases there is access to water sources previously used for irrigation by the former white commercial farmers under the previous agricultural land dualistic set up before the onset of the FTLRP (Tshuma, 2015). This radical reconfiguration of the agrarian structure according to Scoones et al. (2019), has given rise to the need to re-establish different agricultural production scales particularly under irrigation. The resettlement models implemented to date are a useful starting point in understanding the present models of A1 and A2 under the FTLRP.

E Support to resettled farmers

According to Zikhali (2008), the Government of Zimbabwe from the onset of the FTLRP envisaged a scenario in which A2 farmers are supported with agricultural resources to participate in commercially viable agriculture (GOZ, 2000) and on the other hand there seem to be no clear path in terms of the effective way of supporting Zimbabwe's A1 settlement schemes. Because of this, Moyo (2019) argues that A1 farmers under the FTLRP receive minimal government support because of budgeting constraints and dwindling support from multilateral financial institutions and this is supported by Mukodzongi et al. (2019). According to Rukuni (2019), bank lending is influenced by two aspects of viability and trust. Trust is an element built over a number of years as was the case of the commercial banks and the former white commercial farmers. Prior to 1980 and until the 1990s commercial banks provided some agricultural finance to commercial farmers mainly through special credit lines to tobacco, cotton and horticultural industries as there were the major foreign exchange earning commodities. Loans were secured through title deeds and repaid through stop orders (Moyo, 2016).

After the onset of the land reform programme, commercial banks were not willing to provide credit to A1, A2 and even large scale commercial farmers because of lack of secure collateral and risks associated with insecure tenure and selective law enforcement (Sukume, 2009). Banks did not accept the 99 year leases given to the new occupants as they were not secure and transferrable (Moyo, 2016).

F Irrigation – a key factor in crop productivity

Access to irrigation is widely cited as one of the major factors that contribute to the high agricultural production reported for Asia in the 1960s and 1970s during the Green Revolution (Pingalli et al., 1997; Bhattarai et al., 2002). However, studies in India suggest that further investments in irrigation would only make moderate contribution to agricultural production and agricultural GDP (Faned et al., 2000). At the same time, other studies have shown that there is potential for further economic gain from further improvements in irrigation (Baker et al., 2004; Datt and Ravillion, 1994). Domenech and Ringler (2013) also posit that availability of irrigation affects the types of crops that farmers grow. Crop selection and diversity are influenced by the type of technology used in irrigation and the size of the land (Chazovachii, 2012). This scenario will influence whether the farmer engages in monoculture versus vegetables and fruits (Domenech and Ringler, 2013).

In Zimbabwe, studies by Zawe et al. (2015), in the Chitora area showed that irrigation increased yields by seven fold as compared to dry land yields in the same area. They further established that irrigation schemes in the Chitora area attained 5 tonnes per hectares for maize and 7.8 tonnes for groundnuts compared to 0.8t/ha under dry land for maize and 0.4t/ha groundnuts respectively. Furthermore, there are large numbers of reports and research papers (Chazovachii, 2012; Chazovachii, 2016; Chitsiko, 1999; Mombeshora, 2003; Mosello, et al., 2017; Moyo, et al., 2017; Zawe, 2006; Rukuni, 2006; Mhembwe and Dube, 2019; Scoones, et al., 2019) that report on the effect of irrigation on production of crops in the communal irrigation schemes. The current research focusses on the impact of irrigation on crop productivity under the FTLRP smallholder A1 schemes. Such similar studies noted above also confirmed increases in crop productivity under smallholder irrigation in other schemes in Zimbabwe (Chazovachii, 2012; Chitsiko, 1999; Mombeshora, 2003; Mosello, et al., 2017; Moyo, et al., 2017; Scoones, et al., 2019).

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 OPINION OF THE SAMPLE ON ENGAGING IN CROP PRODUCTION UNDER FARMER LED IRRIGATION IN THE A1 RESETTLEMENT MODEL

Table 1. below presents the sample's views on crop production under farmer led-irrigation initiatives under the A1 Model and these results were used to answer the objective of this study. In this section a mean below 3 means in agreement with while a mean above 3 means in disagreement with.

Table 1: Numerical descriptive statistics of skewness and kurtosis for the range on 1 to 5 scale of opinions of individual A1 farmers sample from A1 resettled farmers in Mazowe District in respect to different crop production practices under farmer led irrigation

	N	Minimum [b]	Maximum [b]	Mean	Std. Deviation	Skewness	Kurtosis
Growing maize under irrigation	310	1	5	2.58	1.445	.430	-1.214
Growing tobacco under irrigation	310	1	5	2.57	1.405	.464	-1.124
Growing soya beans under irrigation	310	1	5	2.66	1.438	.334	-1.262
Growing potatoes under irrigation	310	1	5	2.67	1.448	.319	-1.307
Role of horticulture under irrigation	310	1	5	2.66	1.450	.362	-1.270
Irrigation farming on food security	310	1	5	2.67	1.464	.342	-1.303
Utilizing the plot through irrigation	310	1	5	2.56	1.446	.468	-1.181
Growing different crops all year round	310	1	5	2.63	1.435	.387	-1.230
Measurement tool[a]		1	5	3.00			
Valid N (listwise)	310						

a – This is the minimum score of the 5 point Likert scale of: Strongly agree (1), Agree (2), Neutral (3), Disagree (4), Strongly disagree (5)

b = This is the maximum score of the five point Likert scale of Strongly agree (1), Agree (2), Neutral (3), Disagree (4), Strongly disagree (5)

Normality test: Table 1 above confirm the existence of normality in the data set given the kurtosis and skewness scores for all the variables of crop production construct are within the normality range. According to Shukla (2008), the acceptable range of skewness in a normal distribution is -3 to + 3 while kurtosis should be within the range of -7 to +7 in all Structural Equation Models (SEM). This therefore calls for the use of a parametric test (Murairwa, 2019).

The view of A1 farmers on the position on growing maize under farmer led-irrigation in Mazowe district: As shown in Table 1: above the results lean toward agreeing and strongly agreeing. These results indicated that respondents felt that they would continue growing maize under farmer led -irrigation schemes.

Position on growing tobacco under irrigation: The results lean toward agreeing and strongly agreeing (Table 1). These results indicated that respondents felt that they would continue growing tobacco under farmer led-irrigation schemes.

Position on growing soya beans under irrigation: As shown in Table 1: above the results lean toward agreeing and strongly agreeing. These results indicated that respondents felt that they would continue growing soya beans under small holder farmer led-irrigation initiatives.

Position on growing potatoes under irrigation: The results lean toward agreeing and strongly agreeing (Table1). These results indicated that respondents felt that they would continue growing potatoes under farmer led irrigation initiatives.

Role of horticulture under irrigation: These results indicate that respondents felt that they would continue horticulture production under farmer led irrigation. In terms of the given mean, horticulture under irrigation had a mean of 2.66 and this showed that respondents had some positive attitude towards horticulture under irrigation in smallholder farmer led irrigation farming.

Role of irrigation farming on family food security: As shown in Table 1: above the results lean toward agreeing and strongly agreeing. These results indicated that respondents felt that farmer led irrigation farming has changed the family food security situation.

Utilizing the A1 plot through irrigation: The item scored an arithmetic mean of 2.56. As shown in Table 1: above, the results lean toward agreeing and strongly agreeing. These results indicated that respondents felt that they were fully utilizing the A1 plot through farmer led-irrigation.

Position on growing different crops all year round: As shown in Table 1: above the results lean toward agreeing and strongly agreeing. These results indicated that respondents felt that they could grow different crops on the plot all year round.

Hypotheses testing was conducted at a significance level of a=0.05 level and the results are presented in Table 2:

Table 2: SEM Output regarding hypothesized relationship between crop production and livelihoods under the A1 model of Mazowe District in 2021.

Hypotheses	Path	SEM Output			Results *
		Estimate	S.E.	P	
Ha 1	Farmer led irrigation has a positive impact on crop production under	Farmer led-irrigation to crop production → livelihoods	.530	.035	.000	Supported

	the A1 model Scheme	

*Supported at significance level p ≤0 .001. (SEM = Structural Equation Model)

Farmer led irrigation (Irrigation) estimated coefficient of the path β value .530 with p < .001, in the model, has a significant and positive influence on Crop Production (Production)

Further to the qualitative analysis, the study further went on to a qualitative analysis on how farmer led irrigation affected crop production and livelihoods of A1 farmers in Mazowe district in 2021.

CROP PRODUCTION AND LIVELIHOODS OF A1 MODEL FARMERS

A question was posed to the participants on how crop production contributed to livelihoods of A1 model farmers and the codes and themes are shown in Table 3 below

Table 3: Summary of codes and theme outcomes on factors on how crop production affected livelihoods of A1 model farmers in Mazowe District in 2021.

OPEN CODES	AXIAL CODES	SELECTIVE THEMES
1) Growing maize under irrigation		
2) Growing tobacco under irrigation		
3) Growing soya beans under irrigation		
4) Growing potatoes under irrigation		
5) Role of horticulture under irrigation	1. Cash crop production	
6) Irrigation farming on food security	2. Irrigation	1.Crop yield
7) Utilizing the plot through irrigation	3. Plot utilization	2.Livelihoods
8) Growing different crops all year round	4. Maximizing output	
9) Growing maize under irrigation	5. Income from sales	
10) Growing tobacco under irrigation		.
11) Growing soya beans under irrigation		
12) Growing potatoes under irrigation		
13) Role of horticulture under irrigation		

The analysis of key informant interviews reports on crop production contribution to livelihoods of A1 model farmers through open coding had thirteen, axial coding five and finally two main themes. Participants view the major crop production contribution to livelihoods of A1 model farmers in their contexts as through results on maximizing output increased income from sales. This further confirmed the qualitative analysis which showed that crop production had a positive impact on the livelihoods of A1 resettled farmers. 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 scheme. The percentage increase ranged from 70% in tomatoes to a high of 300 % in tobacco. Tobacco is a high value crop to both A1 farmers and the country. This crop has drastically transformed the livelihoods of those A1 farmers growing the crop as a result of increased incomes realised. The income is both on forex and local currency. This is also true for soya beans which is also a high value crop. Increase in maize yields has also resulted in both increased incomes and secure food security situations for the a1 farmers and their neighbours who were afforded a nearer source for food sources in the event of the need to purchase food.

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 1: Crops under farmer led-irrigation farming in Mazowe District during 2020/21 farming season.

During the tour of the farms, a number of farms were observed to be under irrigation cultivation during the 2020/2021 season (Figure 1) A1 farmers as a result of farmer led irrigation initiatives have ventured into high value horticultural crops like tobacco, soya beans, potatoes, tomatoes and cabbages which from the key informant interviews were sold to Mbare Musika in the Capital City of Harare and closer farming towns of Glendale, Mvurwi and Bindura town. Income realised from the sale of these crops was noted to subsequently improve the livelihoods of the A1 resettled farmers in Mazowe District. This improved income status for farmers practising farmer led irrigation was cited by respondents as a critical factor in influencing the adoption of farmer led irrigation for resettled A1 farmers under the FTLRP in Mazowe District. This is also supported by findings in figure 1 in this study. The registered outcomes from farmer led irrigation farming in this study showed that the ability to influence crop productivity was one of the important factors in the adoption of farmer led irrigation initiatives by A1 farmer in Mazowe District.

VI. RECOMMENDATIONS

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 resettlement areas, there is need for the introduction of gender-friendly irrigation schemes to accommodate the case 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 resettlement programs and move on to support smallholder farmer-led

irrigation with the aim of improving the livelihoods of the resettled farmers.

Strengthening of extension services

The present agricultural extension services available to those farmers engaged in A1 smallholder irrigation is limited and ineffective regarding staff and quality of advice. According to Mhembwe et al. (2019) small-scale rural irrigation schemes can meaningfully change rural farmers' lives through reliable income. Key informant interviews, in the current study, with Agritex and irrigation officers confirmed that extension agents are not well equipped to undertake their tasks effectively. To make A1 smallholder irrigation more successful, it is therefore recommended that special attention should be given to increasing the number of extension officers per ward in order to reduce the current extension officer to farmer ratio to below 1: 600 from the current 1: 1000. The smaller the ratio the more the contact that the extension officer has with the farmers. The same farmers need more training in best agronomic practices to enable them to increase their current productivity.

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.

Improving access to irrigation water

Access to water by A1 smallholder households helps them realize most benefits from smallholder irrigation farming. Improved irrigation water access is part of the strategy that enhances irrigation farming access in the NDS 1 in pursuit of Zimbabwe Vision 2030 which aims to improve the status of its citizens to the level of upper middle class status. This also suits well in the attainment of SDG (*No one is left behind*). Investment in agriculture water will also allow intensification and diversification of crop production by A1 farmers under farmer led irrigation farming and small scale gardens thus increasing farm output and household incomes.

Provision of security of tenure

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 crop productivity and subsequently the livelihoods of smallholder resettled 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. In fact there could be exaggerated positions given that secondary data was lacking for cross validation. Therefore, future researches could put together the views of other major farming stakeholders with the results of farmers' self-assessment in order to get more valid conclusions.

VIII. CONCLUSION

The study findings contributed to limited academic literature available pertaining to smallholder farmer led irrigation farming, crop production 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 crop productivity 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 income status for its citizenry.

REFERENCES

[1] Bhattarai, M., Sakthivedivel, R. and Hussein, I. (2002). Impact of irrigation on Agricultural Growth and poverty alleviation. Macro level Analysis in India. Research Report 12. IWMI

[2] Beekman, W, Veldwisch, G.J. and Biding, A (2014). Identifying the potential for irrigation development in Mozambique: Capitalizing on the drivers behind farmer led irrigation expansion. *Physics and Chemistry of the Earth*, Parts A/B/C 76:56-63.

[3] Chazovachii, B. (2016). The impact of small-scale irrigation schemes on rural livelihoods: The case of Panganai irrigation scheme, Bikita district, Zimbabwe. *Journal of Sustainable Development in Africa, 14*(4), 217–231.

[4] Chimhowu, A. and Hume, D. (2006). Livelihood dynamics in planned and spontaneous resettlement in Zimbabwe: converging and vulnerable. World Development, 34:728-50.

[5] Chitsiko, R. (1999). Hama Mavhaire, an innovative and highly successful scheme. *Grid Network Magazine, FAO*

[6] Cousin, B. and Scoones, I. (2010). Contested paradigms of 'viability in redistributive land reform perspectives from South Africa. The Journal of Peasant Studies, 37:31-66.

[7] Cousins, B, (2013). Small holder irrigation schemes, agrarian reform and accumulation from above and below in South Africa. Journal of Agrarian Change 13 (1)116-138.

[8] de Fraiture, C. and Giordano, M. (2014). Small private irrigation: A thriving but overlooked sector. Agricultural Water Management 131: 167-74.

[9] Gebrehiwot, N. T., Mesfin, K. A. &Nyseen, J. (2015). Small scale irrigation. The driver for promoting agricultural production and food security, The case of Tigray Region State Northern Ethiopia. *Irrigation and Drainage System Engineering 4 (2), 141-150.*

[10] Lefore, N., Giordano, M., Ringler, C., & Barron, J. (2019). Viewpoint–Sustainable and Equitable Growth in Farmer-led Irrigation in Sub-Saharan Africa: What Will it Take? *Water Alternatives*, *12*(1), 156-168.

[11] Makadho, J., Mutondi, P. B., and Munyuki:-Hungwe , M.W (2001). irrigation development and water resource management. In Rukuni, M, Tawonezvi, P and Eicher, C. (Eds). Zimbabwe Agricultural Revolution revisited, PP 255-275, UZ, Mt Pleasant, Harare. UZ Publications.

[12] Mandizadza, S. (2011). The livelihoods after land reform in Zimbabwe. Working paper 2 Project PLAAS, Cape Town.

[13] Manzungu, E. (1999). Strategies of small holder irrigation management in Zimbabwe. Phd Thesis, Wageningen University, Netherlands.

[14] Mhembwe, S., and Dube, E. (2017). The role of cooperatives in sustaining the livelihoods of rural communities: The case of rural cooperatives in Shurugwi District, Zimbabwe. *Jamba Journal of Disaster Risk Studies*, *9*(1), 1–9.

[15] Moyo, M., Van Rooyen, A., Moyo, M., Chivenge, P. and Bjornlund, H. (2017). Irrigation development in Zimbabwe: Understanding productivity barriers and opportunities at Mkoba and Silalatshani Irrigation schemes. *International Journal of Water Resources Development*, *33*(5), 740–754.

[16] Ministry of Lands, Agriculture, Fisheries, Water and Rural Development. (2021). National Audit Report. Government Printers, Harare.

[17] Munyoro, G.,Ropafodza, B., Kaseke, T., Kandewo, G. (2015). An Examination of significance of Land Reform programme. A case study of mashonaland East province. *ADRRI Journal of Art and Social Sciences Volume 15 No 8 (3).*

[18] Mukodzongi, G. (2017). Fast Track Land Reform and Rural livelihoods in Mashonaland West Province of Zimbabwe Unpublished PHD thesis, University of Edinburgh.

[19] Muzerengi, T., and Mapuranga, D. (2017). Impact of small-scale irrigation schemes in addressing food shortages in semi-arid areas: A case of Ingwizi Irrigation scheme in Mangwe District, Zimbabwe. *International Journal of Humanities and Social Studies 5(7).*

[20] Nhundu K.; Mushunje, A; Zhou, L and Afhdasi, R. (2015). Institutional determinants of farmer participation in irrigation development post fast track land reform program in Zimbabwe.Journal of Agricultural Development 7 (2):9-18.

[21] Njava, T. (2015). Transforming People's Livelihoods through Land reform in A1 Resettlement Areas in Goromonzi District in Zimbabwe. *Journal of Humanities and Social Sciences. Volume 20 (2).*

[22] Otoo, M., Lefore, N.; Schmitter, P., Barron, J. and Gebregziabher, G. (2018). Business model scenarios and suitability: smallholder solar pump-based irrigation in Ethiopia. Agricultural water management – Making a business case for smallholders. IWMI Research Report 172. Colombo, Sri Lanka: International Water Management Institute (IWMI).

[23] Osewe, F., and Njangi, T. (2020). Farmer led irrigation and its impacts on smallholder Farmers: Crop Income: Evidence from Southern Tanzania. *International Journal of Environmental Research and Public Health (17), 1512.*

[24] Rukuni, M., Eicher, C. K. and Blackie (Eds) (2006), *Zimbabwe Agricultural Revolution revisited.* University of Zimbabwe Publications: Harare.

[25] Scoones, I., Murimbarimba, F., &Mahenehene, J. (2019). Irrigating Zimbabwe after land reform: The potential of farmer-led systems. *Water Alternatives* 12(1). 88-106.

[26] Tshuma, R. (2015). Investigating the contribution of the Gwanda Community Share Ownership Trust to Educational Development in Gwanda District of Matabeleland South Region in Zimbabwe. *Research Journal of Education*, *1*(3), 27–34.

[27] Woodhouse, P., Veldwisch, G. J., Venot, J. P., Brockington, D., Komakech, H., and Manjichi, A. (2017). African farmer led irrigation development: Reframing agricultural policy and investment? *The Journal of Peasant studies* 44(1): 213-233.

[28] World Bank. (2010). World Development Report. Agriculture for development. Washington, DC.

[29] Xie, H., You, L., WieLgosz, B., and Ringler, C. (2014). Estimating the potential for expanding small holder irrigation in Sub Saharan Africa. *Agriculture Water Management (131), 183-193.*

[30] Zawe, C. (2006). Reforms in turbulent times: A study on the three irrigation management policy reform models in Mashonaland, Zimbabwe. Wageningen: Wageningen University.

[31] Zikhali, P. (2010). Fast Track Land Reform Programme, tenure security and investments in soil conversation. Micro-evidence from Mazowe District in Zimbabwe. In Natural Resources Forum, 124-39.

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