

AGRICULTURE AS A SOCIAL SECURITY MODEL: IMPLICATIONS FOR FOOD SECURITY AND LIVELIHOODS IN ZIMBABWE'S CHIVI DISTRICT OF MASVINGO PROVINCE

L'AGRICULTURE IRRIGUÉE COMME MODÈLE DE SÉCURITÉ SOCIALE : IMPLICATIONS POUR LA SÉCURITÉ ALIMENTAIRE ET LES MOYENS DE SUBSISTANCE DANS LE PERIMETRE DE CHIVI (PROVINCE DE MASVINGO), AU ZIMBABWE

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ABSTRACT

Food insecurity is still a serious development challenge across semi-arid rural Zimbabwe, compounded by repeated droughts, precarious livelihoods, and weak formal social protection. This study investigates if smallholder irrigated agriculture is an informal social security mechanism in Chivi District, Masvingo Province. Applying a convergent parallel mixed-methods case study design, this paper takes the shape of questionnaires of 230 purposively selected households (150 irrigator and 80 non-irrigator households) along with the interviews of 19 key informants. The data are descriptive rather than statistically generalisable. Within these constraints, irrigation access was linked with enhanced results for the 4 pillars of food security, availability, access, utilisation, and stability. Irrigating households presented safer year-round food provisioning, varied diets, and reported income received from produce sales, which were used towards food purchases, healthcare, and education, as well as lower reliance on food aid. The study argues that smallholder irrigation functioned as a type of "agriculturally embedded social security" in this context in terms of smoothing income and buffering climatic risk. It therefore aims to promote better inclusion of irrigation as part of Zimbabwe's social protection framework with specific policy, credit, and institutional support. The results are topical to Zimbabwe's aspirations for SDG 2 and Agenda 2063. Keywords: Irrigated agriculture; Social Security; Food Security; Livelihoods; Chivi District; Zimbabwe; Smallholder Irrigation; Dryland Agriculture; Adaptation to Climate.

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RESUME

L'insécurité alimentaire reste un sérieux problème en ce qui concerne le développement des zones rurales semi-arides au Zimbabwe, aggravé par des sécheresses répétées, des moyens de subsistance précaires et une protection sociale formelle faible. Cette étude examine si la petite exploitation agricole irriguée est un mécanisme informel de sécurité sociale dans le périmètre de Chivi, province de Masvingo. En appliquant une conception du plan d'étude de cas parallèle et convergent à méthodes mixtes, cet article prend la forme de questionnaires auprès de 230 ménages sélectionnés à dessein (150 ménages irrigants et 80 ménages non irrigants) ainsi que d'entretiens avec 19 informateurs clés. Les données sont descriptives plutôt que statistiquement généralisables. Dans le cadre de ces contraintes, l'accès à l'irrigation a été associé à des résultats améliorés des quatre piliers notamment, la sécurité alimentaire, la disponibilité, l'accès, l'utilisation et la stabilité. Les ménages irrigués ont bénéficié d'un approvisionnement alimentaire plus sûr tout au long de l'année, des régimes alimentaires variés et des revenus déclarés provenant de la vente de produits agricoles, qui ont été utilisés pour l'achat de nourriture, les soins de santé et l'éducation, ainsi qu'une dépendance limitée sur l'aide

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alimentaire. L'étude constate que l'irrigation pratiquée par les petits exploitants fonctionnait comme un type de «sécurité sociale intégrée à l'agriculture» dans ce contexte en termes de lissage des revenus et d'atténuation du risque climatique. Elle vise donc à promouvoir une meilleure intégration de l'irrigation dans le cadre de la protection sociale du Zimbabwe grâce à un soutien politique, financier et institutionnel spécifique. Les résultats concernent les aspirations du Zimbabwe pour l'ODD 2 et l'Agenda 2063.

Mots-clés : Agriculture irriguée; Sécurité sociale; Sécurité alimentaire; Moyens de subsistance; Périmètre de Chivi; Zimbabwe; Irrigation par les petits exploitants; Agriculture en zone aride; Adaptation au climat.

1. INTRODUCTION

There is a considerable food insecurity in sub-Saharan Africa, Zimbabwe is one of the affected countries by drought, heavy reliance on rain-fed agriculture and lax formal social protection (FAO, 2022; Scoones et al., 2010; Moyo, 2011). Chivi District of Masvingo Province is a relevant instance in this regard it lies in Agro-ecological Regions IV and V, receives a paltry 400-600 mm of rainfall per annum without regular days of rain and has very low employment. But it also has perennial water sources that enable smallholder irrigation. The investigation examines the role of smallholder irrigation as a social security mechanism of rural households in Chivi District. While irrigation is associated with increased food security, it is comparatively under-researched as an informal social safety net through which income is smoothed, risk is reduced and protection of well-being in seasons is preserved. The central research question driving this study is: To what extent does smallholder irrigated agriculture function as a social security mechanism for rural households in Chivi District? This question emanates from a major lacuna in both the scientific literature and empirical research. The relationship between irrigation and food security has received extensive academic attention (Hussain, 2011; Awulachew et al., 2010). But the presentation of irrigated agriculture as social security --a means for a smooth transmission of income from one generation to the next, income smoothing (formal or informal), reduction in risk etc.--has received much criticism. Even if it's also underappreciated by existing thought. The majority of current studies regard irrigation as an agricultural productivity intervention rather than social protection tool. The study has three specific aims: to determine the impact of irrigation on the four pillars of food security; to assess its income-smoothing and food-aid-buffering roles in comparison with rainfed farming practices; and to observe organizational and policy contexts for improved use of irrigation as an appropriate social security instrument.

2. LITERATURE REVIEW

2.1 *Developing a conceptual framework of irrigation as safety net.*

In the majority of low-income, semi-agricultural contexts formal social protection tends to be weak, where informal social protection is vital for livelihood security (Devereux 2016, Holzmänn and Jorgensen 2000). In the current study, irrigation is conceptualised as a productive resource that mitigates seasonal vulnerability, stabilizes income and facilitates food access. The Sustainable Livelihoods Framework is useful here because irrigation expands access to natural, physical, financial, and social capital, thereby strengthening livelihood outcomes such as income and food security (DFID, 1999; Scoones, 2009). Devereux and Sabates-Wheeler's (2004) typology further indicates that irrigation can carry out both preventative and promotional functions (i.e., if accessing water is available universally) and possibly catalytic.

2.2 *Global Evidence on Irrigation and Food Security*

The extensive literature strongly supports the inter-relation between access to irrigation and household income and food security. Hussain and Hanjra (2004) found that generally water inflow enhances households' income and food production, often for the poor. Irrigation from Ethiopia and Nigeria has proven to augment higher-output and crop diversification in agriculture and thus enhance dietary

diversity and nutrition (Awulachew et al., 2010; Barau et al., 1999). Awulachew et al. (2010) investigating smallholder irrigation in Ethiopia find that irrigating households had yield levels four to six times higher versus rainfed households, as well as significantly greater levels of crop diversification, a key pathway to dietary diversity and nutritional food security in food. Similar findings are reported for East Africa by Burrow (1987) and Barau et al. (1999), irrigation development was significantly associated not only with increased food production but also with enhanced raw material production and accelerated rural development outcomes in Northern Nigeria. In Southern Africa, irrigating households are found to have higher incomes and have experienced less seasonal food shortfalls when compared to rain-fed households, further bolstering the feasibility of irrigation as a livelihood-stabilising intervention (Sithole, 1995; Rukuni et al., 2006).

2.3 Irrigation, Gender and Social Equity

The distributional aspect of irrigation is also key. Previous literature has shown that irrigation is an important tool in improving women's economic roles and in protecting vulnerable household formations through access shaped at both an inequality-centered level and privilege-based level (Mamvura et al., 2006; Meinzen-Dick et al., 2019; Lautze and Giordano, 2005). Furthermore, it is known that irrigation is extremely significant for among the most vulnerable household groups: widows, female-headed households, elderly farming households and households affected by HIV/AIDS (World Bank, 2008). In those contexts, irrigation serves, in part, not simply as an economic resource, but as a social anchor — an instrument of dignity, subsistence and participation in communities in which formal social protection systems do not exist. Nevertheless, the literature also documents the risk of elite capture in irrigation schemes, whereby powerful people in a particular community win appropriation rights to water at the expense of the most marginalised (Lautze and Giordano, 2005).

2.4 Climate Change, Dryland Agriculture, and the Case for Irrigation

The need for irrigation in dryland Zimbabwe is strengthened alongside climate change. Higher temperatures, variable rainfall, and more frequent drought make rain-fed production fragile, and irrigation an important adaptation strategy for sustaining food production and livelihood stability (IPCC, 2021, 2022; MAMID, 2020).

2.5 Identified Research Gap

The key gap is the fact that smallholder irrigation in Zimbabwe has seldom been studied specifically as a social security mechanism. The article responds to this void by taking in Chivi District from a social protection perspective that extends beyond food production only.

3. METHODOLOGY

3.1 Philosophy and Paradigm of the Study

A pragmatic mixed-methods design was adopted for the study, blending quantitative description of household food-security outputs with qualitative understanding of how irrigation is understood and applied in livelihood practice (Creswell and Creswell, 2017; Tashakkori and Teddlie, 2003).

3.2 Methods and Method of Research

An integrative parallel mixed techniques case study was employed. Quantitative and qualitative data were gathered over the 2023 dry season, analyzed independently, and integrated into interpretation to triangulate results (Creswell, 2014; Yin, 2018). In this study, a case study research strategy was utilized based on Chivi District, as a bounded analytical unit. This approach was deemed suitable as the study emphasized what, how, and why a certain phenomenon happened within a target context (Yin, 2018).

A cross-sectional design was used, with data collected across a single time period (2023 dry season) allowing comparison between irrigating and non-irrigating households in a similar climatic and socio-economic context. 3.3 Study Area: Chivi District, Masvingo Province

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Chivi District is located in southern Masvingo Province and predominantly located in Agro-ecological Regions IV and V characterised by poor and erratic rainfall patterns, unstable terrains, and sustained drought. These conditions render irrigation particularly important for agriculture as well as food security for the households. The district is fed by perennial water sources and a mix of large and smallholder farming irrigation projects that support wheat, maize, vegetables, beans and potatoes. Few, well-resourced formal jobs are available to all households who work to earn a living as agriculture operators and with it for the majority of these households, farming is the main means to survive; hence, Chivi is a natural site of investigation of irrigation as a form of social security mechanism. 3.4 Target Population and Sampling

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The study's target population comprised smallholder farming households in Chivi District together with institutional stakeholders possessing direct knowledge of irrigated agriculture in the district. According to the 2022 census, Chivi District has a total population of 172,979 people. Assuming an average household size of six persons, this equates to approximately 28,830 households. Within this population, the sampling frame for irrigating households was the register of approximately 1,200 households affiliated with the district's smallholder irrigation schemes, while the rain-fed comparison group comprised non-irrigating farming households resident in the same wards, identified through ward records and local leadership. Three wards and six irrigation schemes were purposively selected on the basis of agro-ecological location within Regions IV and V, scheme size, and water-source type in order to capture the range of scheme conditions present in the district. Consistent with the case study design, a purposive sampling strategy was adopted to enable analytical depth and bounded comparison rather than statistical generalisation. From the selected schemes, 150 active irrigating households were included, while 80 non-irrigating households were drawn from the same wards to permit a like-for-like comparison of food security outcomes. Households were identified with the assistance of scheme committees and ward officials, with selection across the six schemes reflecting variation in household size, headship, and scheme membership. The sample size justification was guided by the Yamane formula (Yamane, 1967): $n = N / (1 + N(e^2))$, where n = required sample size, N = population size, and e = margin of error (set at 0.08 for this study). Substituting the relevant values produced a minimum household sample of 155. The achieved household sample of 230 therefore exceeded this threshold, strengthening the reliability of the descriptive comparisons while remaining feasible within resource constraints. A further 19 key informants were selected purposively for their institutional roles and subject expertise: 2 Chivi Rural District Council officials, 4 AGRITEX extension officers, and 13 chairpersons of active farmers' cooperatives. These informants were included to triangulate household-level findings with governance, extension, and cooperative perspectives. The achieved sample therefore comprised 249 participants in total (Table 1).

Table 1: Sample Composition by Participant Category

No.	Participant Category	Selection Approach	Number
1	Active irrigating farmers	Purposive selection	150
2	Non-irrigating rain-fed farmers	Purposive selection	80
3	Rural District Council officials	Purposive selection	2
4	AGRITEX extension officers	Purposive selection	4
5	Farmers' cooperative chairpersons	Purposive selection	13
	TOTAL		249

Source: Research design based on the study sampling framework.

3.5 Data Collection Instruments

Data were collected through a household questionnaire, semi-structured key-informant interviews, and field observation. The questionnaire covered socio-demographics, irrigation participation, food security, income and expenditure, and key challenges. It was expert-reviewed and pilot-tested before the main survey.

Nineteen key informant interviews explored food security governance, institutional support, equity, sustainability, and policy issues. Observation checklists were used to record infrastructure condition, cropping patterns, and water management practices across the sampled schemes.

3.6 Data Analysis

Questionnaire data were summarised using descriptive statistics, including counts, percentages, and means. Because the sample was purposive, no inferential tests were applied. The World Food Programme Food Consumption Score was used to compare dietary patterns across the two household groups.

Interview and field-note data were analysed thematically following Braun and Clarke (2006), with themes refined iteratively during coding.

Triangulation occurred through integration of the quantitative and qualitative findings during interpretation.

3.7 Validity, Reliability, and Trustworthiness

Validity was supported through expert review, piloting, and alignment of the measures with established food-security and social-protection frameworks. Trustworthiness of the qualitative component was strengthened through triangulation, member-checking, and an audit trail.

3.8 Ethical Considerations

Ethical clearance was obtained from the relevant ministry and district authorities. Participants gave informed consent, anonymity was protected through coding, and data were stored securely.

4. RESULTS

4.1 Socio-demographic Profile of Respondents

The household sample was dominated by middle-aged and older adults, with men forming a modest majority. Most respondents had primary or secondary education, and large households were common. These characteristics are typical of the sampled rural communities, while remaining part of a purposive rather than representative sample.

Table 2: Socio-demographic Characteristics of Household Respondents (n = 230)

Variable	Category	Frequency (n)	Percentage (%)
Age	30–40 years	35	15.2
	41–50 years	69	30.0
	51 years and above	126	54.8
Gender	Female	98	42.6
	Male	132	57.4

Variable	Category	Frequency (n)	Percentage (%)
Household Head	Female-headed	64	27.8
	Male-headed	166	72.2
Educational Level	Primary	76	33.0
	Secondary	112	48.7
	Tertiary	42	18.3
Marital Status	Married	181	78.7
	Widowed/other	49	21.3
Household Size	3–7 members	88	38.3
	More than 7 members	142	61.7

Source: Field Survey, 2023. Percentages are based on the 230 household questionnaire respondents. Secondary education was the most common attainment level, followed by primary education, while tertiary education was less common. Large households were prevalent across both irrigating and non-irrigating respondents.

4.2 Food Security Situation in Chivi District

Food security outcomes differed sharply by irrigation status. Irrigating households were more likely to report year-round food availability, acceptable food consumption, and lower seasonal food shortfalls, while non-irrigating households were more exposed during the October–January lean season. These results are descriptive rather than population-level estimates.

Key informants confirmed that households with functioning irrigation were less dependent on food aid because they could produce food year-round and generate cash for purchases.

Table 3: Food Security Status by Irrigation Access (descriptive comparison; household respondents n = 230)

Indicator	Irrigating HHs (n = 150)	Non-irrigating HHs (n = 80)
Year-round food availability	113 of 150 (75.3%)	21 of 80 (26.3%)
Received food aid in past 5 years	7 of 150 (4.7%)	61 of 80 (76.3%)
Acceptable Food Consumption Score (FCS)	131 of 150 (87.3%)	31 of 80 (38.8%)
Reported seasonal food shortfall	18 of 150 (12.0%)	57 of 80 (71.3%)
Mean dietary diversity score (0–9)	6.3	3.9
Mean monthly food purchase (USD)	49	95

Source: Field Survey, 2023; WFP Food Consumption Score methodology applied. Percentages are rounded and reported as descriptive patterns within the purposively selected sample.

4.3 Crops Grown under Irrigation and Estimated Productivity

Seven main crop groups were identified under irrigation, including wheat, tomatoes, maize, beans, onions, leafy vegetables, and cabbage/potatoes. Because plot sizes were not standardised, Table 4 presents indicative self-reported seasonal output rather than precise yield estimates.

Table 4: Irrigated Crops, Indicative Seasonal Output, and Primary Use (irrigating households, n = 150)

Crop	Primary Use	Indicative output per household per season (kg)	Indicative market price
Wheat	Food (bread/staple) + sale (GMB)	~3,000	~USD 0.45/kg
Tomatoes	Food + sale (local markets)	~2,500	USD 4–6 per 20 L bucket (vs. USD 20–30 when scarce)
Maize	Food (sadza/green cobs) + livestock feed	~1,000	USD 0.30–0.40/kg
Beans	Food (relish/mutakura) + sale	~700	USD 1.20–1.80/kg
Rape/leafy veg.	Food + sale (growing demand)	~500	USD 1.50–2.00/bundle
Cabbage/potatoes	Institutional sale + food	~600	USD 0.80–1.20 per head or kg
Onions	Food + sale	~400	USD 0.70–1.00/kg

Source: Field Survey and Key Informant Interviews, 2023. Figures are indicative self-reported estimates drawn from the irrigating household sample and are presented to illustrate cropping patterns rather than precise area-normalised yields. GMB = Grain Marketing Board.

Wheat ranked as the top irrigated crop by output and tomatoes the most commercially important horticultural crop. Irrigated households themselves saw water availability and the competitiveness of farmers as well, as respondents reported irrigation increased production of dry-season tomatoes, driving down local market prices and increasing access to foods.

4.4 Research on Irrigation as a Mechanism of Social Security

4.4.1 Income Smoothing: Financial Resilience

One of the core social security activities with irrigation was income smoothing. Unlike rain-fed agricultural systems, which generate a concentrated income per annum, irrigation allowed for income to be earned more consistently, with staggered vegetable-cycles and winter wheat. Most respondents reported that irrigation income is spent on school fees, medical care, inputs and basic household needs. Key informants indicated a sharp increase in food-aid dependence could occur soon if irrigation income was lost, emphasizing irrigation's contribution to social risk management.

4.4.2 Decline in The Dependence on The Food Aid

Grants for irrigation access had a significantly lower dependence on food aid. During 2018–2023, only a small percentage of irrigating households reported receiving food aid while food aid receipt was high among non-irrigating households. Indicating irrigation acted as a net shield for households from repeated climatic forces. This is consistent with the notion that irrigation investment may augment and in some cases even decrease recurring humanitarian food assistance requirements.

4.4.3 Varying dietary patterns and dietary security

Dietary diversity was much higher in irrigating families (mean 6.3, 3.9 in non-irrigators). In this case study, irrigation in turn seems to facilitate not simply the better direct diet of vegetables and legumes, but also the income for the buying of complementary foods. Higher diets were associated with improved access to vegetables and legumes and staple crops and with increased amounts bought from irrigation revenue, the survey participants said.

4.4.4 *Equity Aspects: Vulnerability and Inclusion*

Field observations and interviews revealed some schemes included female-dominated households, elderly farmers and other at-risk individuals. However, the study didn't obtain detailed, intra-scheme distributional data, i.e. these equity results are suggestive and not final conclusions. This might suggest a transformative social protection role, but it has to be balanced against the documented risk of elite capture. For some future research that concerns testing scheme-level inclusion.

5. DISCUSSION

5.1 *Evidence and Implications: Irrigation as Social Security*

The results provide support to the claim that smallholder irrigation could be a social security in Chivi District. The irrigating households were consistently higher in food availability, access, utilisation and stability, and with more consistent incomes and lower food dependency. Collectively, these aspects uphold the logic of “agriculturally embedded social security.”

One warning is that households were not randomly allocated for irrigation. Differences in wealth, labour, or social capital as a result of previous experiences may be partially behind the observed advantages. The results are therefore associative rather than causal. Still, the study builds on the literature by demonstrating that irrigation revenue was employed not just for feeding but also for education, health and other welfare services, thus making productive agriculture more directly associated with social protection. The diet diversity gap between irrigating and non-irrigating households also points to a potential possible nutritional pathway in which irrigation could address food insecurity in dryland.

5.2 *Comparison to Previous Studies*

These findings support broader literature evidencing the fact that irrigation reduces income loss, crop selection, and food security in rural smallholders in Africa (Hussain and Hanjra, 2004; Awulachew et al., 2010). The primary contribution of the paper is conceptual: it understands irrigation not merely as a productivity intervention but also as a livelihood-based social protection mechanism.

5.3 *Limitations*

Due to the purposive sampling and cross-sectional design, the study is restricted to a certain extent by generalisability and causal inference. Thus the quantitative findings need to be construed as descriptive patterns for the sampled wards and the schemes. It also depended on self-reported output and income data without collecting in-scheme equity or hydrological sustainability data on detailed basis. Longitudinal designs and inclusion of livelihood, governance and environmental work should be included in subsequent work.

6. CONCLUSION AND POLICY SOLUTIONS

It gives some evidence that smallholder irrigation could play a social security role for rural households in Chivi District. Of these purposively sampled households, irrigating households had better food security outcomes, had lower food-aid dependence, and more stable livelihood support than rain-fed households. These findings support acknowledging the importance of the concept of irrigation as a form of livelihood-based social protection— although the study's conclusions have limited implications for causal inference and generalisation. Irrigation needs to be not only seen as a productivity investment to be deployed in Zimbabwe but as a strategic social protection policy-making area. These include expanded support for smallholder irrigation infrastructure, increased access to credit as well as extension services, and solidifying scheme governance to ensure equitable access is afforded to vulnerable households. Third, supply a resource for extension AGRITEX services within drought hit areas which will be able to provide irrigation management training that will cater to post-harvest handling and storage to address the recognised problem that fresh irrigation crops which include tomatoes, have

a limited shelf life that leads to a smaller contribution to food security. Fourth, water governance systems to support the application of land use practices in smallholder irrigation systems should make provision in the framework for equity considerations (i.e., reserved plot allocations and access to water for female-headed households and the elderly) to safeguard against elite capture. Fifth, the Environmental Management Agency (EMA) should develop and publish a common environmental sustainability toolkit for smallholder irrigation, covering the monitoring of water extraction, management of soil health, and scheduling of irrigation that adapts to climate. This will need future study to examine this argument with bigger probability samples, longitudinal designs and direct comparison to scheme-level equity and environmental sustainability.

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- Bezzel Chitsungo: Conceptualisation, Methodology, Data Collection, Literature Review, Formal Analysis, Writing – Original Draft, Writing – Review & Editing.