Irrigating Africa – Reframing Agricultural Investment: A micro and macro perspective on investment priorities in SSA

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Part 1: Smallholder Irrigation Livelihoods and Entrepreneurship in South Africa

Part 2: Agwater potential and development pathways in SSA



- What social and economic changes are associated with agwater practices
- What institutions and policies lead to investment by irrigation farmers
- Typologies of irrigation initiatives useful to policy-makers
- Country-level significance of farmer-led development

Part 1: Smallholder Irrigation Livelihoods and Entrepreneurship in South Africa



Research Project K5//2179/4 ...

Smallholder irrigation entrepreneurial development pathways and livelihoods in two districts in Limpopo Province

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Specific objectives

To **evaluate** the **five livelihoods assets** with particular attention to:

- **irrigation** farming potential
- entrepreneurial spirit and management capabilities
- incentives of secure land tenure, water use rights and leadership

To determine:

- role of agriculture in livelihoods
- how the agricultural contribution can be increased
- aspirations and goals in relation to expansion



Rural entrepreneurship with specific reference to irrigated agriculture

Entrepreneurship in smallholder agriculture can be equated to the **production of crops and animals** in order **to make profit** (produce for markets).

Survivalist

- Motivated by necessity
- Generate limited income
- Rarely beyond self-employed

Micro-growth

- Motivated by opportunity
- Best potential to expand farming
- Create employment
- Generate economic development

Different emphasis in texts on:

- Personal qualities of the individual (agentic performance)
- Constraining or enabling power of structural arrangements



3 main irrigator populations



Whole-systems perspective & livelihoods overlay



MAP 2 - Dzinai Scheme & Surrounas

22 9

Two sites - 3 Groups of smallholde

Homestead gardeners (n=172)
 Scheme irrigators (n=122)
 Independent irrigators (n=127)



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bendent irrigator fields Scheme Infrastructure burg irrigation scheme ani village

Main inlet box

 \times Water treatment works

Pipeline

River ~

Tours Dam

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Cabbage remains the 'money maker' at the Dzindi canal scheme

Studying African Farmer-led Irrigation

SAFIile name

Typical physical assets of the pumper group of independent irrigators in Thulamela

SAFiile name

9-Feb-18

Physical assets of the collector group of independent irrigators

SAFiile name

9-Feb-18

A supply channel constructed by a group of independent irrigators

SAFIile name

9-Feb-18

Greater Tzaneen-Independent irrigator

Farming in Greater Tzaneen-Marketing

SAFIile name

9-Feb-18

Findings

- 1. Compelling evidence that **irrigation is associated with improved livelihoods** of rural households
 - Irrigator incomes 2 to 3 times higher (all above poverty line)
 - Food security was higher (77% vs 60%)
- Irrigator households had a stronger capital base (natural, physical & financial capital) - suggesting irrigation farming positively affects the overall capital base of rural households
 - independent irrigators held 20% and 42% more land
- 3. Irrigation farming shown to be positively associated with:
 - size of *regular income* flows received by households,
 - *better education levels* among household members
 - *lower unemployment* rates

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Purpose of production - irrigators

Frequency distribution of goals of crop production on irrigated plots among scheme and independent irrigator households

Purpose of production – home gardens

Frequency distribution of goals of crop production in home gardens among the three groups of farmer households

Farming and livelihoods – Sources of household income

Irrigation makes a significant contribution to household income.

- Irrigators: on-farm (39%); salaries and wages (38.5%); social grants (14.9%)
- Non-irrigators: on-farm (0%); salaries and wages (58.6%); social grants (26.8%)

Rural entrepreneurship

Operationalising entrepreneurship (7 factors)

- Degree of commercialisation of farming (market participation = business)
- Efficiency (professional and managerial skills of the farmer).
- Capitalisation of the farm enterprise (entrepreneurial motivation)
- Wealth status of the household (entrepreneurial motivation)
- Gross farm income (scale and importance)
- Gross income derived from entrepreneurial activity other than farming (scale and importance);
- Contribution of entrepreneurial activity to household income (importance of all entrepreneurial activity in the livelihood portfolio of rural households).

=> Cluster analysis aimed at identifying 'rural household types' from an entrepreneurial perspective.

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Rural entrepreneurship

Important findings

- The majority of households at both sites demonstrated low levels of entrepreneurship.
- **Survivalist** entrepreneurs were most common (>90%)
- **Opportunity** (micro-growth) entrepreneurs were very few
- Household head is the farmer in >80% of households
- The latter characterised by multiple enterprises (farming and other activities; taxi, spaza shop etc.) and was key to farm financing.
- Majority want to expand their farming but face critical constraints
- Agentic performance is severely limited by systemic inadequacies

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Constraints across 3 groups (farm-level system)

Farming system factors	Constraints for Pathway 1
Turning system factors	(home gardeners)
Water recourse	Boreholes used but expensive. Roofwater tanks not
water resource	widespread. Unlawful connections increasing.
Land recourse	Homestead space limited in size but secure in
Land resource	exclusive use-right.
Irrigation infrastructure –	Hand-watering or hose systems generally adequate
pumped	for small gardens. Pumps not essential.
Irrigation infrastructure –	As above, delivery to garden not limiting in itself.
gravity	Cost of storage and supply is main water issue.
Fencing – ability to install	Homestead plots are typically fenced.
fencing	
Mechanisation -	Hand-cultivation prevails in the gardens.
availability	
Labour availability and	Family labour.
willingness	
Farming knowledge and	Production knowledge needed but can be accessed
skills	via local or commercial networks.
Marketian keeviledee	Not a key driver of Pathway 1
Marketing knowledge	
In put finance	Financed by household income.
input finance	
Climatic and post risks	Exposure to risk, but overall impact relatively small,
climatic and pest risks	given other primary livelihoods means.
Risk to profitability (local	Not a key driver of Pathway 1
markets)	
Risk to profitability	Not a key driver of Pathway 1

(distant markets)

Constraints for Pathways 2 and 3	· ·
(independent and scheme irrigators)	Severity
Resource from Tours dam at risk and not reliable in	3
drought. Reliable source < 25% of surveyed total.	5
Physical portions of unused irrigable land is available	1
but getting access to use the land is difficult.	-
Very high capital investment costs – nearly	-
mpossible to develop at scale without loan finance.	2
Manageable with own finance but difficult.	3
Can manage somehow to sort out the fencing	3
although it is difficult.	J
Available but delays of 4 weeks or more in getting	2
them to the field.	5
abour available for work in the fields when they are	1
baid; affordability is the issue.	-
ome feel access to knowledge is easy, others found	2
t significantly more difficult	2
Major challenges with transport, aggregation (small	4
individual volumes), and agent trust regarding prices.	
mpossible to get input financing as small farmers:	_
water and land issues; business plans required.	2
High risks of climate/pest impact that leave farmers	-
exposed – can partly mitigate with insurance.	
Green maize, tomato, beans, cabbage, potatoes for	1
local market. Limited absorption, but predictable.	1
Green beans, okra, green pepper, chilli (mainly	4
distant market). Unpredictable but attractive.	4

Severity

Constraints – Independent and Scheme irrigators (Institutional environment)

TABLE 9.8: Severity of organisational and institutional obstacles at Greater Tzaneen

Institutions impacting on farming	Institutional Obstacles for Pathway 2 (independent irrigators)	Severity	lns (so
Rules of land access and control	Irrigable land available but distant from water sources. Verbal agreements with Traditional Authorities prevail. Limits to very small scale < 4 ha	4	An dis inf
Rules of transfer (rentals/leasing)	No formal provisions for leasing on tribally- managed lands. Major disincentive when scheme and other land is unused.	5	Ca wit the
Rules of water authorisations (GA/license)	Lack of knowledge of authorisation and licensing requirements. Bureaucratic hurdles viewed as major. Not linked to CMA or allocation systems.	4	Jul wa suj
Scheme Operations and Maintenance rules	Independent irrigators need no on-farm collaboration around irrigation systems.		Co dir on

Institutional Obstacles for Pathway 3 (scheme irrigators)	Severity
Annual PTOs viewed as an uncertainty and	
disincentive. Minimal investment in on-farm	4
infrastructure (fencing, piping etc.).	
Cannot lease unused scheme land as plot-holders	
with rolling annual tenure fear losing their rights if	5
they lease out unused portions.	
Julesburg farmers have no formal permission to use	
water and are uncertain on rights. Tours Dam water	4
supply is over-allocated and legally insecure.	
Coordination of water efforts is limited. System is in	
dire straits technically. Ad-hoc emergency repairs	5
only. Rules are weak or absent. Repair needed.	

Severity of farming challenge	1	2	3	4	5	
	none	minor	moderate	major	critical	

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Rocky Pathways – land tenure on schemes

Wholly inadequate communal land administration systems ...

- land property relations defined ito <u>user</u> not <u>ownership</u> rights
- 'ownership' widely accepted to be with Chief or TA who must distribute it
- legal disagreement about ownership (1913 NLA says Minister but Upgrading of Land Tenure Rights Act 112 of 1991 to TA's with upgraded PTOs.)
- IPILRA 1996 with new legislative measures scrapped PTOs.
- CONFUSION REIGNS and INTERPRETATIONS INFLICT ONGOING PAIN

PTOs continue as dominant land-use right on schemes within collapsing landadministration systems with wide variations in application.

"Many lessors have experience of 'losing' land to lessees, and lessees have experience of entering into agreements which are arbitrarily terminated or simply ignored. Farmer's leasing land reported the **'owner' harvesting their crops** as this was 'their land' or others using land they had leased without permission."

Parched Pathways – scheme water wars

Access to water at no cost ... but severely limiting institutions and organisations

- Allocations and licensing uncertain or unknown
- WUAs not formally established
- Informal rules with limited enforcement
- Infrastructure progressively in decline and near-zero maintenance
- Sense that independent irrigators are better off but interest/movement both ways. 'FREE WATER' <-> 'SELF DETERMINATION & COST'

Key points of relevance to SAFI

- 1. Irrigation is strongly associated with significantly **improved livelihoods**, reflected by higher incomes and a stronger asset base (39% income from farming)
- 2. Farming for **cash is central to irrigation success**, but farming for food using other agwater methods makes a significant contribution to food security.
- 3. Strong association between pumping & lower net operating incomes (3-5 times)
- 4. Agentic **entrepreneurial abilities are weak** most are survivalists
- 5. Independent and scheme irrigators face **severe to critical systemic constraints** that undermine individual 'agentic' performance as entrepreneurs.
- 6. In the land domain, enabling more **formalized leasing of land** is a key opportunity to reduce risks for survivalists (have low-resilience to shocks)
- 7. In the water domain, rules are weak or absent, water-tenure is high-risk. Locally appropriate **WUO development, protection of use-rights** is a top priority.
- 8. Production **financing**, **knowledge and marketing-linkage** interventions are high priorities.

Part 2: Agwater potential and development pathways in SSA

- Literature review
- Consolidation of selected World Bank program data
- Typology and implications for the future

Africa is different from most of the world:

- **Population growth** beyond 2100 (only continent +ve growth)
- **Double the food** by 2050 (vs 70% average increase)
- Rest of the world irrigation largely developed: focussed on modernisation/intensification
- Africa has largest irrigation resource globally (42.5 Million ha;
 15.4 developed)
- Africa has 23.5 Million ha irrigable with POSITIVE EIRRs (You et

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al., 2010) – more than 90% in SSA

SSA Rainfed Agriculture is of high

- 188 Million ha of rainfed agriculture
- Responsible for 99% of main cereals
- Yield gap = 76% (vs. Asia of 11%)
- 75% of additional food will come fro

ortance:

f all cultivated land) , millet, sorghum)

owing the yield gap to 20%

Climate change:

- Increase in variability, temperature a
- Rainfed farming is highly vulnerable
- Yield reduction of 10-20% of major ε

ntly reduced average rainfall and failure) ops across most of Africa

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Agwater responses

- Wide range of agricultural water management techniques
- Water harvesting and conservation, dambos etc.
- Small storage, supplementary irrigation
- Full scale irrigation

Water for food

for life

Comprehensive

Diverse options for agricultural water management along the spectrum

Indicative targets and agwater responses

- Expand rainfed farming = 14 Million ha (7%)
- Triple rainfed yields
- In a climate change context (CSA)

- Irrigation expansion = 2.3 Million ha (26%)
- Double irrigation yields

Irri Type	IRR > Marginal (million ha)	IRR >12 % (million ha)	(Typical IRRs	Unit costs (USD/ha)
Large scale expansion	15.1	1.7		13-18%	
Small scale expansion	6.6	3.9		26-40%	

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To meet future food needs agricultural water interventions will have to formulate diverse responses:

- Using different agwater technical solutions
- With responsiveness to different farming types (peasant, survivalist & opportunity entrepreneurs)
- Aligning agwater interventions with production, marketing and financing elements

What agwater typology is appropriate ? What kinds of interventions will catalyse growth ? What policy responses are needed to support ?

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African Agricultural Water Partnership

Agricultural Water Management 'Development Trajectories'

- 1. Individual micro- and small-scale irrigation
- 2. Community-managed small to medium-scale irrigation
- 3. Large-scale irrigation system modernization and development
- 4. Market-oriented irrigation on PPP or purely private basis
- 5. Enhanced water management in rainfed agriculture

Priorities and indicative costs of agricultural water development pathways in Africa

R	EVISED AGWATER Pathways	Characterization	EIRRs*	Priority and Contribution to Growth	Path Driv	way ver
1.	Improved water control and watershed management in a rainfed environment	1-2 ha farms; self-provisioning { s 70 to 80% of fut	ure ag	Wide reach, large no. farmers. ;ains through <u>and CSA.</u>		
2.	Independent private irrigation for high-value crops	s investment a cropping; market-oriented.	nd eff	ort ty: 50-70% of on expansion.	armer le	
3.	Small-scale <i>gravity</i> community-managed schemes (< 200 ha)	0.1-1 ha farms; self-provisioning & market farming; often grain & horticultural rotation.	20-30%	10-20% of future irrigation expansion.		$\widehat{\prod}$
4.	Reform, modernization and expansion of med & large- scale irrigation schemes	0.2-1.5 ha farms; transitioning from social origins to market- oriented; older dilapidated.	20% 15% 10%	Rehab a priority (++ve EIRRs) New gravity = 20-30% of future expansion.		e led
5.	Private-sector involvement in market-oriented irrigation	Key actors in input-output value chains for all paths.		Potential bulk water operator & farming JVs. Key to IMT, and productivity agendas.		State
6.	Small-scale <i>pumped</i> community-managed irrigation (< 200 ha)	Typically low-head pumping, located on flood-plains or small reservoirs.	5-15%	0-5%	~	\bigcup

Pathway 6: Small-scale *pumped* community-managed schemes (<200 ha)

- Strongly correlated with high running costs, complexity and a high risk of failure.
- The task of operating pump stations, typically in distant locations from major hubs, with poor support infrastructure (electricity, roads, transport, supply-chains) and usually on rivers with a high sediment load, is fraught with technical, managerial and administrative problems.
- Pump-station OMM demands a highly effective fee-collection arrangement to ensure sustained water delivery.
- Socially acceptable and enforceable land-exchange mechanisms that ensure the exit of non-paying farmers and allow entry of new ones (or expansion of existing farming enterprises).
- Underpinned by high-value crop production to generate the necessary revenue, and by intensive WUO development and market support.
- The high operational costs combined with organizational risks make this option a low priority going forward.

Policy thrusts for agwater development in SSA

1 – Rainfed Agwater Management	Shift from an irrigation to an agricultural w paradigm, and establish the basis for an in	vater management itegrative watershed / ´ neso 500-1000 km2)	
2 – Private irrigation	investment and effort costs.	narket, emphasis on cing farming risks and	
3 – Small gravity group- schemes (<200 ha)	Water efficiency interventions (such as canals replaced by pipes; low-cost lining; flow-control), and locally appropriate WUO establishment are key.		
4 - Modernization and expansion of public schemes	Appropriate high-tech modernization (transmission efficiency upgrades, SCADA etc.). Purpose-specific WUO laws for compulsory membership, fee-retention at scheme, and processes for regulation of water pricing. Farm mapping and local leasing.		
5 – Private sector in market-oriented irrigation	Potential role as bulk-service operator from 4 above (WUO laws). Identify mechanisms for enabling land-consolidation and leasing for potential corporate agric partners on schemes.		
6 – Small pumped group- schemes (<200 ha)	Set as the lowest priority in agricultural water management policy, rather targeting other pathways where possible, to achieve food security and economic goals		

Thank you!

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