Business Model Analysis for Irrigation in Zimbabwe

Water Powered Technologies

15/10/2021

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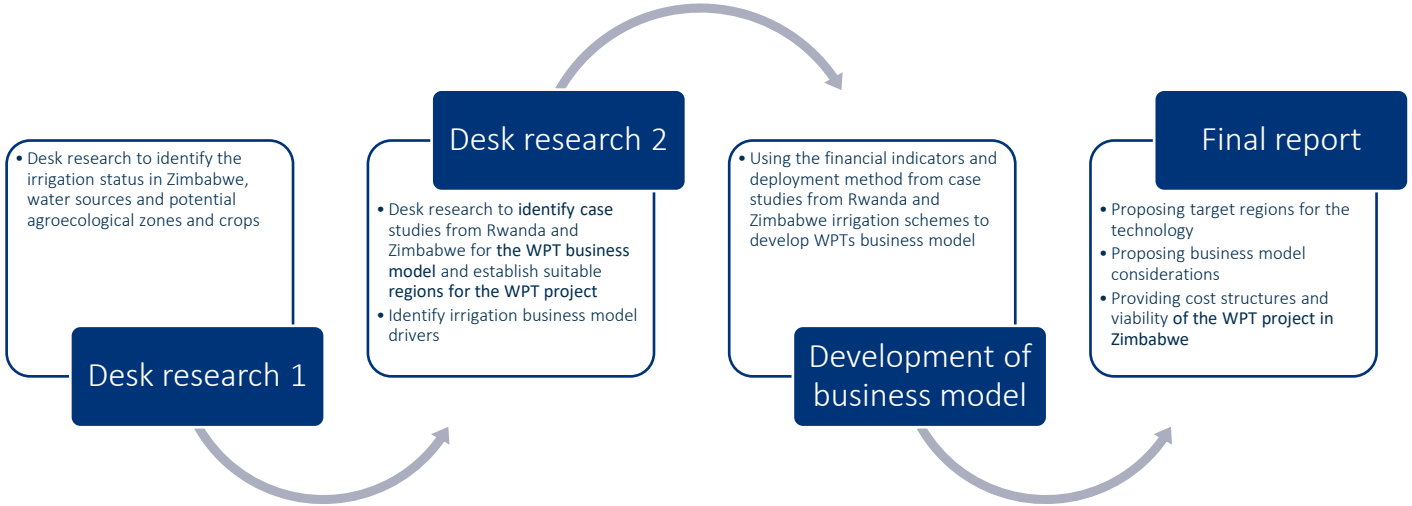
Scope of work and key findings

Energy Catalyst helpdesk support scope of work – Task 1

Task title	Business model analysis
Aims and objectives	Water Powered Technologies (WPT) designs and develops a variety of water pump-based products. For energy access applications WPT are developing a business model around water-as-a-service to meet the needs of agricultural, off-grid, commercial, and humanitarian sectors through their products. Their EC project in Zimbabwe is seeking to integrate WPT's 'papa pump'; a zero-energy pumping system for integration with community micro-hydro or agricultural applications. Pump sites will create a number of value points within the community; through electricity generation, water use in dry seasons, replacement of diesel irrigation systems etc. WPT has many case studies globally, where it has sold its pump directly to customers. The company is now looking to explore different business models to serve customers and communities with lower purchasing power, eg through leasing / Water-as-a-service models. There is uncertainty around how to best position WPT's offering to tell a compelling story that brings together all of the value points into such a model. The aim of this task will be to help WPT address the questions: What are withe different use cases and value points for WPT? what are the different business models for WPT in serving rural communities? How can WPT best integrate the small holder farmers and local value chains? It is anticipated that the findings of this task can be used as a basis for building a clear case study that demonstrates the multiple benefits of WPT's solution, as well as lead to further partner identification.
Methodology	Research into the different business models available to WPT for serving rural economies. - Review of rural community value chains in sites of deployment (crops for local and export markets) - Evaluation of WPT's large volume / long distance water transfer & storage proposition in rural community and agricultural applications vs other solutions - Assessment of different community and agricultural use cases and business models for WPT's long distance water transfer model, looking at financial viability (incl. ability and willingness to pay), as well as potential for revenue streams and socio-economic impact of the model (incl. pay as you grow, job creation through local installation and assembly of the papa pump, gender empowerment), - Key recommendations on different business model options to attract green infrastructure/ impact investors.
Budget	10-13 days
Deliverables	Short slide deck containing research findings and example case study based upon example community site identified by WPT
Timeline	TBD

Our Approach

- Water Powered Technologies Global wants to identify a viable irrigation business model that can be used to serve rural economies in Zimbabwe.
- Energy 4 Impact conducted a market research and developed a business model using the methodology outlined below:



Key findings

- The **major crops** grown in Zimbabwe are: maize, cotton, soybeans, wheat, tobacco and horticultural crops such as cauliflowers, roses, sunflowers and vegetables.
- **Water sources in Region I are reliable (rainfall), but less reliable in Region II;** Region III, IV and V have severe droughts(arid/semi-arid) and WPT thinks this should be a specific geographic focus of their technology
- Zimbabwe's agriculture sector is familiar with various irrigation schemes
  - **Most irrigation schemes are found in region III**
  - **Private and Farmer-owned schemes tend to be more profitable**
- The ability to pay is much higher in farmers managed irrigation schemes
- Technology allows to avoid some challenges of other irrigation technology (high electricity outages and electricity cost) which makes it more affordable and robust for operations
- The profitability of the project will be determined by :
  - Project financing mechanism
  - Distance for water delivery from the source to the farms
  - Farmers income from irrigation
  - Type of crops per season
  - OPEX cost(maintenance, labour, water etc)

Key recommendations

- WPT should consider the farmers managed irrigation scheme model to cut on the OPEX cost(The farmers will incur the opex cost). This raises profitability.
- To maximise on profitability, WPT should consider securing grants to offset part of their equity contribution
- Business model considerations:
  - Adjust capex in line with farmer monthly income and affordability
  - Cost and terms of (local) borrowing needs to be considered and factored in
  - Cross-check monthly operating cost, incl water, maintenance (per farmer?) and labour fee

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Market Research

Agenda

1. Background
2. Water Sources & Catchment Areas
3. Irrigation Status Quo
4. Horticulture Production
5. Main Take-Aways
6. Business Model Considerations
7. Rwanda Case Study
8. Appendices

Zimbabwe Overview

- Zimbabwe is a Unitary State with 10 Provinces two of which are cities (Bulawayo and Harare).
- Total population 13 Million (2012 Census)
- Main source of income: Mining and Agriculture
- 67% Rural population, 33% urban population
- **49% of the population practices agriculture;** Over 50% of the population in each region practices agriculture except in Bulawayo (1.5%), Matabeleland South (46%) and Harare (2.4%)
- Zimbabwe is divided into agro-ecological zones and irrigation schemes based on the farming sector
- 88% of the population is employed

Province	Population
Bulawayo	653,337
Harare	2,123,132
Mashonaland West	1,501,656
Mashonaland East	1,344,955
Mashonaland Central	1,152,520
Midlands	1,614,941
Matabeleland	749,017
Matabeleland South	683,893
Masvingo	1,485,090
Manicaland	1,752,698

http://www.zimstat.co.zw/wp-content/uploads/publications/Population/population/census-2012-national-report.pdf

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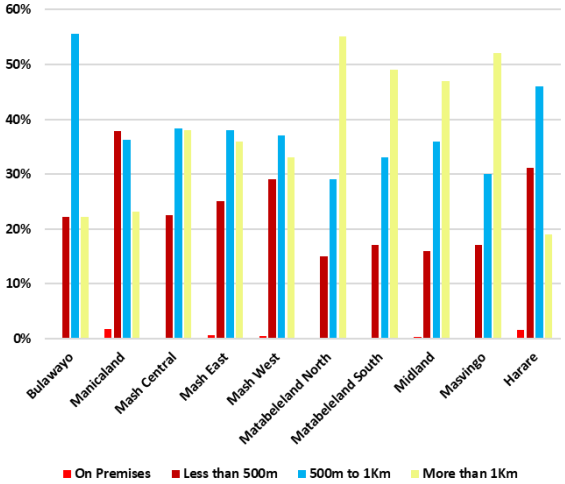
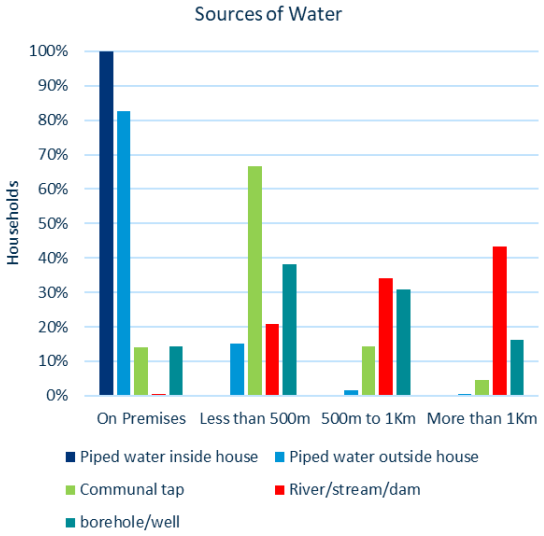
Sources of Water

- There are limited piped water sources for household more than 500m
- The majority of households rely on boreholes/wells water sources and only those living more than 500m and more rely on rivers/stream/dam water sources
- More than 40% of the population in Bulawayo, Harare, Matabeleland North, Matabeleland South, Midlands and Masvingo provinces relying on rivers/streams/dams live more than 500m away from water source.





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Catchment Areas

- Zimbabwe is divided into seven catchments that are based on the seven river basins
- Major rivers that serve Zimbabwe are:
  - Zambezi- Rises in North western Zambia. It's the fourth longest river in Africa, with a basin area of 1,390,000 sq.km: 3,540 Km long
  - Limpopo- Rises in Central southern Africa, 1,750 Km long with a drainage basin of 415,000 sq. Km.

Catchment areas that feed Zambezi River	Catchment areas that feed Limpopo River
Gwayi River	Mzingwane River
Mazowe River	Runde River
Manyame River	Save River
Sanyati River	Shashe River

https://www.gfdrr.org/[illegible]isk%20Assessment%20Report.pdf

Groundwater and Perennial Rivers

- Zimbabwe is a semi-arid country, as rain falls in one season from November to April, therefore most rivers are not perennial.
- Mean annual precipitation varies from **337mm/ year in the south** of the country to **1100mm/year in the Eastern Highlands**
- With relatively low rainfall and unequally distribute surface water resources, groundwater provides water to more than 70% of Zimbabwe's population.
- It is the source of water for both the communal and commercial sectors in rural areas and a major source of water for irrigation, mining and tourism.
- Ground water is also used to supply some urban areas supply systems
- The four largest surface water sources are **Zambezi, Limpopo, Save and Pungwe**
- Perennial rivers in Zimbabwe include: **Munyati, Manyame, Mazowe, Save and Runde**

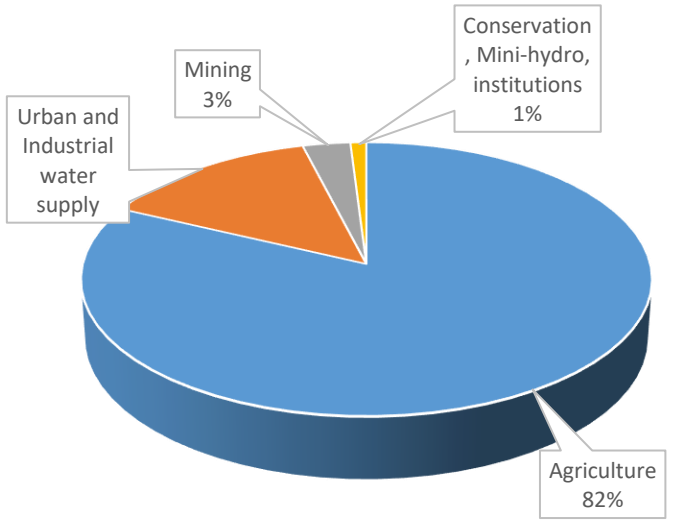
http://earthwise.bgs.ac.uk/index.php/Hydrogeology_of_Zimbabwe and https://www.ess.co.at/GAIA/CASES/ZIM/water.html

Water Use by Sector

- **Agriculture accounts for 82% of the water use,** it contributes :
  - 15% of Zimbabwe's GDP
  - 22.8% of export earning
  - 23% of formal employment

- The most important **agricultural commodities** are:
  - **Staple food grains** basically for local diet—maize, wheat, small grains (millet and sorghum), groundnuts, and beans
  - **Export and cash crops** (mainly tobacco, cotton, sugarcane, and horticultural crops (mainly Chilies, passion fruit, fine beans, peas, berries, baby vegetables such as carrots, baby corn, baby marrow, courgettes, chillies and broccoli)

- 80% of the agricultural water is used for irrigation of tobacco, cotton, maize, wheat, tea, coffee and horticultural crops.



https://www.foodbusinessafrica.com/2019/02/06/zimbabwe-reports-growth-in-horticulture-exports-to-us112m/#:~:text=The%20major%20commodities%20traded%20in,%2C%20courgettes%2C%20chillies%20and%20broccoli. & http://www.fao.org/3/i9842en/I9842EN.pdf and http://www.cfuzim.com/wp-content/uploads/2015/09/zinwa915.pdf

Raw Water Charges

- Raw water/untreated water includes rainwater, groundwater, water from infiltration wells, water from lakes and rivers.
- The water usage is monitored by and charges are payed to **Zimbabwe National Water Authority (ZINWA)**

Consumer Category	Price (USD per million litres)
Industry	9.45
Commercial agriculture	
Commercial estates	9.45
A2 farmers	6.82
A1 farmers	5.00
Local authorities	6.00
Local Communities	
Pumped water	4.50
Gravity fed water	4.50

Status: 2012 https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/9.%20Zimbabwe%20Report_Chapter%207.pdf

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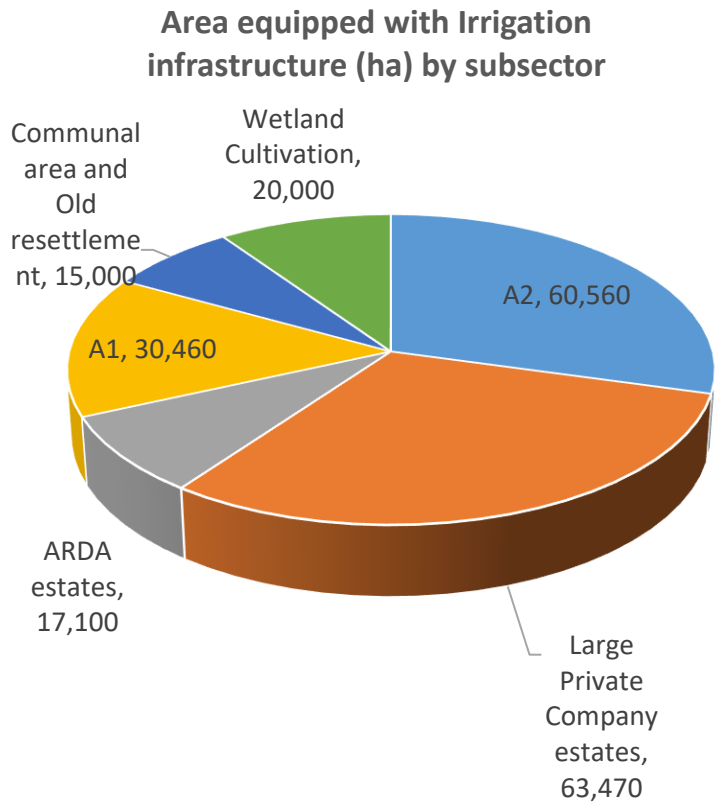
Irrigation Schemes

- ARDA-Agricultural and Rural development Authority (Parastatal responsible for running government owned estates and lands

- Zimbabwe has two types of irrigation schemes: commercial and smallholder irrigation
  - **Commercial: A1,** A2, large private Estates, ARDA Estate
  - **Smallholder irrigation:** A1, Communal and Old resettlement and wetlands cultivation



Status:2015 http://www.iwmi.cgiar.org/Publications/Other/Reports/PDF/country_report_zimbabwe.pdf

Irrigation Schemes C'ntd

	Large Scale Private Company Estate	ARDA Estates	Small Scale Commercial Irrigation System (A1 and A2)	Communal and old resettlement
Water Source	Own water source or use existing government dams	Government-developed dams and mainly located in the communal area	Government-developed dams	Government/NGO-developed dams
Farm/ Plot size	>100ha	>600 ha	2ha-10ha	0.1ha to 2ha
Pumping Technology	Pumped irrigation	Overhead and surface irrigation (have operational constraints and old equipment)	Surface irrigation system (have operational constraints and old equipment)	Surface irrigation system
Crops	Tobacco, cotton, tea, coffee, citrus, wheat, sugar cane and a large variety of horticultural crops (mange tout, baby com, as paragus and peas)	Cotton, wheat, sugar cane, beans and a variety of horticultural crops	Sugar cane, coffee and tea	Maize, cotton, beans, tomatoes and other horticultural crops for home consumption and markets
Ownership	• Private individuals • Groups • Companies	• ARDA (managerial problems, lack of funds)	• Smallholders (managerial problems, the high cost of inputs and poor access to affordable credit)	• Government • NGOs and Missionary societies • Community (The majority of the infrastructure in these schemes has outlived its lifespan and needs to be rehabilitated)

http://www.fao.org/3/ae568e/ae568e00.pdf

Smallholder Irrigation Schemes

Attributes:

- Irrigated plot-holding ranging from 0.1-1.5 ha
- Shared irrigation infrastructure
- Self management (50%), predominantly government management (32%) or joint management between farmers and government (18%)
- Communal land tenure
- Communal elect Irrigation Management Committee (IMC)

Definition: Group of farmers irrigating together, sharing the same water source and delivery line, with individual or joint control of irrigation and farming activities on their plot(s)

- Typically individually owned and managed
- Crops: Maize, cotton, wheat, tomatoes, leafy vegetables such as kale, and other horticultural crops for home consumption and marketing

Status:2015 http://www.iwmi.cgiar.org/Publications/Other/Reports/PDF/country_report_zimbabwe.pdf

Examples of Irrigation Schemes

- There are a total of about 187 irrigation schemes in Zimbabwe
- This table shows the performance of 10 major irrigation schemes
- Appendix 41 shows the irrigation scheme distribution in Zimbabwe provinces

Irrigation Scheme	Water Source	Province	District	Area	Natural region	Water Delivery System	Irrigation technology
Chitora	Chitora River	Mashonaland East	Mutoko	Resettlement	III	Water is pumped from a pick up weir on the river by an electric motor driven pump through a buried pipeline in to the field.	Sprinkler
Longdale	Borehole	Masvingo	Masvingo	Resettlement	III	Water is pumped from a borehole by an electric motor driven sub-mersible pump through a buried pipeline in to the field.	Sprinkler
Mambanjeni	Insukamini dam	Midlands	Gweru	Communal	IV	Water is pumped from dam by an electric motor driven pump through a buried pipeline in to the field.	Sprinkler
Murara	Murara dam	Mashonaland East	Mutoko	Communal	IV	Water is delivered through gravity from the dam via a concrete lined canal to the scheme.	Surface
Mzinyathi	Umzingwane dam	Matebeleland South	Umzingwane	Communal	IV	Water is delivered through gravity from the dam via a concrete lined canal to the scheme	Surface
Ngezi Mamina	Mamina dam	Mashonaland West	Kadoma	Communal	III	Water is pumped from the dam by electric motor driven pumps to a reservoir from which it is gravitated into the field.	Sprinkler
Oatlands	Oatlands dam	Masvingo	Masvingo	Resettlement	III	Water is delivered through gravity from the dam via a concrete lined canal to the scheme.	Surface
Principle	Eben dam	Mashonaland Central	Shamva	Resettlement	II	Water is pumped from dam by an electric motor driven pump through a buried pipeline in to the field.	Sprinkler
Rozva	Rozva dam	Masvingo	Bikita	Communal	III	Water is pumped from the dam by electric motor driven pumps to a reservoir from which it is gravitated into the field.	Surface
Wenimbi	Macheke River	Mashonaland East	Marondera	Resettlement	III	Water is pumped from a pick up weir on the river by an electric motor driven pump through a buried pipeline into the field.	Sprinkler

http://www.fao.org/3/x5594e/X5594e05.htm

Examples of Irrigation Schemes C'ntd

- Longdale and Principe irrigation schemes use imported electric pumps
- The rest of the schemes either uses gravity supply or are supplied by locally manufactured electric pumps
- The number of plot holders varies depending on the plot size.
- The plot sizes vary from **0.3 ha - 1.55 ha**
- Each of the irrigation schemes has an **Irrigation Management Committee (IMC)** and sub-committees under the IMC
- There is mixed scheme ownership and management between Farmers and Government

Irrigation Scheme	Area (ha)	No. of plot holder	Plot size/holder (ha)	Average dryland area (ha)	Fulltime or part time irrigation	Scheme ownership	Scheme Management
Chitora	9	18	0.5	Nil	Full time	Scheme is owned by the farmers	Farmers
Longdale	7.5	15	0.5	Nil	Full time	Scheme is owned by the farmers	Farmers
Mambanjeni	78	168	0.3-0.5	Nil	Full time	Land belongs to the farmers but the infrastructure is owned by the government	Government
Murara	18	36	0.5	Nil	Full time	Scheme is owned by the farmers	Farmers
Mzinyathi	32	81	0.4	Nil	Full time	Scheme is owned by the farmers	Farmers
Ngezi Mamina	216	154	0.5-1.5	Nil	Full time	Infrastructure is owned by the government but the land is owned by the farmers	Government
Oatlands	5	12	0.4	4	Part time	Scheme is owned by the government	Government
Principle	60	60	1	0.4	Full time	Scheme is owned by the government	Farmers and government
Rozva	21	33	0.5-1	1	Part time	Land belongs to the farmers but infrastructure is owned by the government	Government
Wenimbi	34.2	22	1.55	8	Full time	Scheme is owned by the farmers	Farmers

http://www.fao.org/3/x5594e/X5594e05.htm

Case Study: Farmer Irrigation Scheme Chitora

Ownership

- Farmers own and manage the scheme
- Capex funded by the Gvt and Danish International Development Agency (DANIDA): Investment cost Z$ 72,164 ($475)
- AGRITEX (Ministry) provides the scheme extension services required, technical advise and support farmers on water management
- Number of plot holders: 18
- Plot size per plot holder: 0.5ha
- Farmers/plot holders avg. net income p.a.: Z$ 60,000 ($165)

Operational Financing Mechanism

- Farmers are fully responsible for the O&M of the scheme (hydrant, hoses, tripod and sprinklers).
- The pumping system is jointly maintained by all farmers through a maintenance fund to which farmers contribute Z$30/month each ($0.8/ month)
- Hired labour is paid Z$ 20/day for hoeing and Z$15/day for harvesting (5 $cents, 4 $cents)
- Security Guard: paid Z$600 per month ($1.65)
- Electricity bill (grid): each farmer contributes an average of Z$ 200 ($0.55) per month depending on the bill amount
- Transport of crops to market: Truck hire at Z$ 1,500 ($4) per trip to Harare

Technology and Water Management

- Water Source: Chitora river
- Technology: Water is pumped by an electric motor driven pump from a pick-up weir on the Chitora river to the irrigation farms
- Drag-hose sprinkler system are used for irrigation
- One farmer is designated to open and close the water. Late comers are not given extra time to irrigate. This is works well for the farmers given the escalating energy costs.

Crop and Market

- Diversified cropping pattern reduce risk associated with price variations and market uncertainties
- Production sub-committee scans the market and finds out the most profitable crops at a particular time
- The major crops grown: Horticulture (leafy vegetables, cabbage, onion, butternuts, green maize, groundnuts, tomatoes, peas, butternut, green pepper, carrots, cucumber, and beet root)
- The major markets are Mbare Musika (Harare) for horticultural crops; there is also Gweru and Bulawayo. Farmers are willing to be assisted to enter export markets.

http://www.fao.org/3/x5594e/X5594e08.htm#TopOfPage

Case Study: Gvt Irrigation Scheme Mambanjeni

Ownership

- Funded by the Gvt (Department of Water Resource - DWR): Investment cost Z$ 536,897 ($ 1,483)
- Located in Natural region IV and managed by the IMC
- IMC acts as a link between DWR and the irrigators)
- AGRITEX (Agricultural Technical and Extension Services) provides the scheme extension services required, technical advise and support farmers on water management
- Number of plot holders: 164
- Plot size per plot holder: 0.3 – 0.5ha
- Farmers/plot holders avg. net income p.a.: Z$ 1000-4000 ($2.7 – 11)

Operational Financing Mechanism

- DWR is responsible for maintaining the pumping unit, the conveyance and the infield infrastructure: at a cost of about Z$ 75,100 p.a. ($207)
- DWR pays the electricity bill: Z$23,000-40,000 per month ($63.5 – 110)
- IMC organizes transport of farm produce to the market and has (farm gate approach)

Technology and Water Management

- Water Source: Insukamini dam
- Technology: Water is pumped by an electric motor driven pump from a pick-up weir on the Insukamini dam to the irrigation farms
- Semi portable sprinkler system are used for irrigation
- AGRITEX Provincial office in Gweru prepares the irrigation schedule for the scheme and carry out training programmes for the irrigators
- Water charges: Z$ 185/1000m3 ($0.5)

Crop and Market

- The major crops grown: Maize, beans, wheat and green maize
- Crop yields are estimated at 0.5-2 t/ha for maize, 0.8-5 t/ha for wheat and 0.6-1 t/ha for beans

http://www.fao.org/3/x5594e/X5594e19.htm#TopOfPage

Irrigation Financing

Grants

- **September 2016, OFID (The OPEC Fund for International Development)** signed a $15 million public sector (Diplomatic Security Foundation) DSF grant agreement to support the Smallholder Irrigation Revitalization Project (SIRP) for around 25,000 small-scale, low-income farmers in four rural regions.
- This project aims to rehabilitate irrigation schemes in Manicaland, Masvingo, Matabeleland South and the Midlands regions. It will also repair and construct roads, culverts and bridges and pilot schemes that will convert fuel / electricity-driven pumping systems to solar power. Also planned is a training component.
- **In 2016**, the government of Zimbabwe released a $500 million farming input subsidies program called **Command Agriculture**.
- The Programme aims to produce two million tonnes of maize on 400,000 hectares of land by providing farmers with inputs, irrigation and mechanized equipment

Loans

- **March 2017**, The Government of Zimbabwe signed a loan agreement for $20.4 million with the Kuwait Fund for Arab Economic Development (KFAED) to assist in the financing of Zhove Irrigation Project in southern Zimbabwe (Beitbridge District), through sustainable use of water from Zhove Dam.
- The proposed project aims to support commercial and communal farming through the construction of a conveyance system to irrigate about 2,500 hectares of agricultural land and boost production in citrus fruit and cash and food crops such as maize, sugar beans and tomatoes in the generally dry district.

https://www.ifad.org/en/web/operations/project/id/2000001233 & https://agecon.unl.edu/cornhusker-economics/2018/farmer-support-model-zimbabwe & https://allafrica.com/stories/201909190470.html

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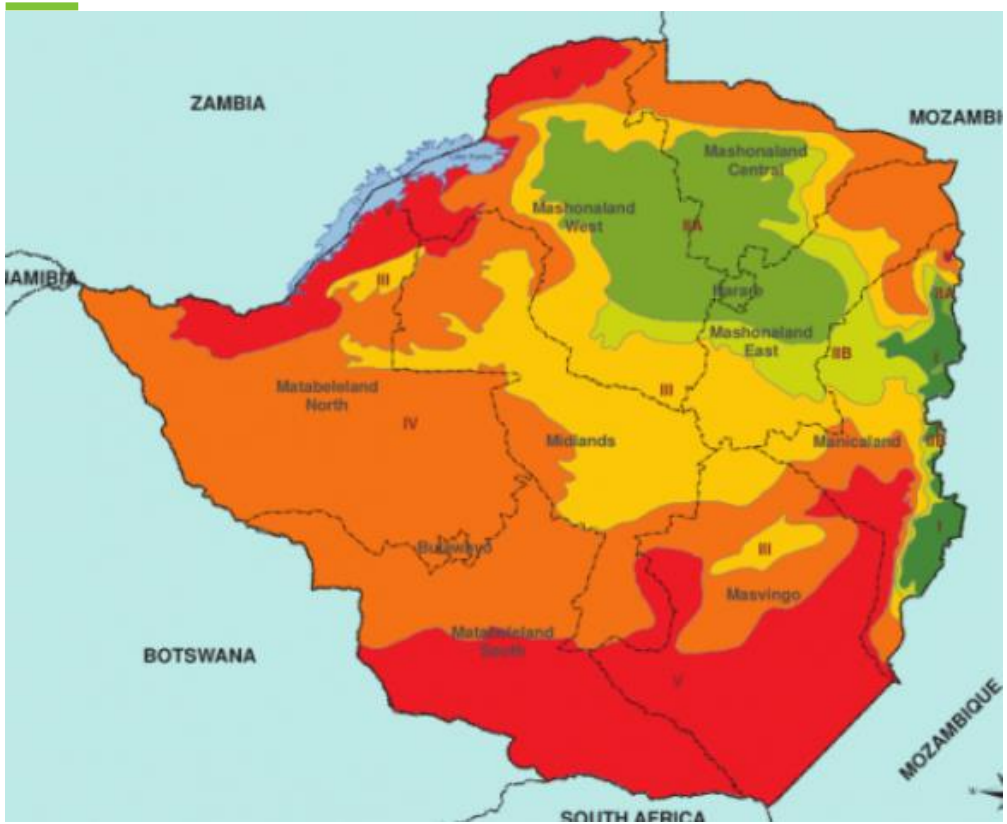
Agro-Ecological Zones Map

Legend
Region I
Region II A, Region II B
Region III
Region IV
Region V

The WPT project would be potentially located in region III and partially region IV and V



- **Region I Crops:** Tropical crops (coffee and tea), deciduous fruits (bananas, pears and apple), horticultural crops (potatoes, peas and other vegetables), Macadamia Nuts and Chillies
- **Region II Crops:** Tobacco, maize, cotton, wheat, barley, soybeans, sorghum, groundnuts, seed maize and flowers such as proteas and roses are grown for export
- **Region III Crops:** Maize, cotton, groundnuts, sunflowers.
- **Region IV Crops:** Maize, sorghum, pearl millet and finger millet
- **Region V Crops:** Maize, millet, cotton and sorghum

https://www.gfdrr.org/sites/default/files/publication/Zimbabwe%20Agriculture%20Sector%20Disaster%20Risk%20Assessment%20Report.pdf

Agro-Ecological Zones

80% of the agricultural land lies in arid or semi arid areas (NR III, IV and V)

Rainfall in the arid and semi-arid regions is too erratic and unreliable for dryland farming, making supplementary irrigation necessary for successful agriculture

Irrigation schemes in region II, III and IV are fed by rivers

Agro-ecological regions	
Region I (Eastern border highlands: Nyanga, Mutare, Cashel, Chimanimani, Chipinge)	Lies in the east and is characterized by rainfall pf more than 1,000 mm per year, low temperature, high altitude and steep slopes. Crops: tropical crops, deciduous fruits and horticultural crops
Region II (Harare, Mazoe, Bindura, Chinhoyi, Norton, Chegutu, Marondera and Beatrice)	Located in the middle of northern Zimbabwe, characterized by rainfall ranging from 750-1,000 mm per year and is fairly reliable (falling in November to March/April). Crops: tobacco, maize, cotton, wheat, barley, soybeans, sorghum, flowers(roses and proteas), groundnuts and seed maize;
Region III (Kwekwe, Gweru, Wedza, Mvuma, Mashava, Mhangura and Mt Darwin)	Located mainly in the Mid-altitude areas, characterized by rainfall of 500-700 mm per year, midseason dry spell and high temperature. Crops: Maize, cotton, groundnuts, sunflowers.
Region IV (Kariba, Binga, Kamative, Hwange, Lupane, Bulawayo and Masvingo)	Located in low-lying areas in the north and south, has annual rainfall of 450-650 mm per year, severe dry spell and frequent seasonal droughts. Crops: maize, sorghum, pearl millet and finger millet
Region V (Beitbridge, Mwenezi, Chiredzi and Chirundu, Zambezi Valley and Sabi Limpopo Valleys)	Covers lowland areas below 900m above sea level in the north and south, highly erratic rainfall less than 650mm per year. Crops grown are Maize, Millet, Cotton and Sorghum

https://www.ruzivodigitallearning.co.zw/demo/content/908/2-10/HS/ and https://www.gfdrr.org/sites/default/files/publication/Zimbabwe%20Agriculture%20Sector%20Disaster%20Risk%20Assessment%20Report.pdf

Horticultural Crop Market

Crop	Market Price (usd)	Quantity	Maturity Time
Bell Pepper	3.00	Per Kg	2 Months
Bitter Gourds	3.00	Per Sack (5Kg)	4 Months
Yams	3.00	Small Bucket	5 months
Apples	2.70	Per Kg	6 Months
Cucumber	2.19	Per Kg	3 Months
Beetroot	2.00	Per Kg	2 Months
Brocoli	2.00	Per Kg	3 Months
Cauliflower	2.00	Per Kg	5 Months
Garlic	2.00	Per Kg	1 Month
Groundnuts	2.00	Per Kg	2 Months
Onions	2.00	Per Kg	3 Months
Okrah(Derere)	1.80	Per Kg	2 Months
Green peas	1.60	Per Kg	5 months
Red Pepper	1.60	Per Kg	4 Months
Carrots	1.45	Per Kg	3 Months
Yellow Pepper	1.45	Per Kg	4 Months
Potatoes	1.44	Per Kg	4 Months
Butternut	1.08	Per Kg	4 Months
Cabbage	1.02	Per heads	3 Months
Peanuts	1.00	Per Kg	2 Months
Green Beans	1.00	Per Kg	3 Months
Green Mealies	1.00	each	1 Month
Spinach	1.00	Per 3 Bundles	1.5 Months
Tomatoes	1.00	Per Kg	5 months
Green Pepper	0.97	Per Kg	4 Months
Red Chillies	0.75	Per Kg	3 Months
Sweet Potatoes	0.75	Per Kg	5 months
Lettuce	0.58	Per heads	2.5 Months
Tomatoes	0.45	Per Kg	5 months
Water Melon	0.30	Per Kg	3 Months

- Horticulture crops have short maturity times of 1 – 5 months (garlic, green mealies and spinach have the shortest maturity times; yams, cauliflower, green peas, tomatoes and sweet potatoes take 5 months to mature)
- The highest market price/ kg is achieved for bell pepper of $3/kg
- The lowest is water melon of $0.30/kg
- As of 2012, the growth and export (local and international) of chili increased majorly in Nyanga.
- In 2019, the export prices for chilies went up ($2.85-$3/ kg)
- The local businesses add value to produce a range of products including chili sauces and pastes.

https://zimpricecheck.com/news/the-prices-of-fruit-and-vegetables-in-selected-supermarkets-for-the-week-of-08-august-2019/ & https://www.seedcogroup.com/zw/vegetables & https://assets.publishing.service.gov.uk/media/57a08d52e5274a31e00017be/R7485c.pdf & https://wire.farmradio.fm/farmer-stories/zimbabwe-poor-prices-force-farmers-to-switch-from-cotton-to-birds-eye-chilies/

Horticulture

Indicator	
GDP contribution	6.5%
Production areas	Region I and II
Production type	Small and large scale • Large-scale commercial horticultural production produces vegetables, fruits, and flowers for the export market, local retailers (supermarkets), and food processing companies. • Small-scale horticultural producers are divided between : ➢ Those who produce principally for household consumption (crops grown are cabbage, rape, tomatoes and onion) ➢ Those who produce mainly for the market (crops grown are baby corn, baby marrow and mange tout) are grown specifically for direct sale on the national market (traditional urban wholesale and retail markets), or produced on a contract basis for the export market
Exports	• Fruits: Citrus (oranges, grapefruit, lemons), subtropical fruits (bananas, mangoes, passion fruit), deciduous fruits (peaches, apricots, plums, other stone fruit, apples, and pears), and strawberries • Vegetables: cherry tomatoes, sweet corn, chilies, peas, and fine beans. These are processed and sold as packs of pre-washed mixed vegetable that are ready to cook

https://assets.publishing.service.gov.uk/media/57a08d52e5274a31e00017be/R7485c.pdf &
https://www.gfdrr.org/sites/default/files/publication/Zimbabwe%20Agriculture%20Sector%20Disaster%20Risk%20Assessment%20Report.pdf

Small Scale Horticulture Production

Small Scale Horticulture Production

- Consists of communal, resettlement A1, old resettlement, small-scale commercial farms, and peri-urban and urban producers (in the garden or backyards of residential stands).

Irrigation

- Smallholder farmers who have access to irrigation facilities and have sufficient water supplies during the dry season produce for the traditional urban and retail market. Most of the produce from these farmers is sold through the informal sector, while a few are contracted to supply formal markets, agro-food processing companies, and export markets
- Smallholder farmers without access to irrigation facilities majorly produce crops for household consumption

Contract farming is another production system under which both large and small scale farmers are engaged.

- Viewed as a more profitable venture, as the returns are usually higher than selling on the local market, and there is a guaranteed route-to-market.
- The companies that provide contracts are Cairns Foods, FAVCO, and Interfresh Limited, as well as retailers such as TM/Pick N Pay and Food Lovers Market.

https://www.gfdrr.org/sites/default/files/publication/Zimbabwe%20Agriculture%20Sector%20Disaster%20Risk%20Assessment%20Report.pdf

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2. Water Sources & Catchment Areas
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8. Appendices

Main Take-Aways

- The **major crops** grown in Zimbabwe are: maize, cotton, soybeans, wheat, tobacco and horticultural crops such as roses, sunflowers and vegetables.
    - Region I – III grow horticultural crops, but mostly Region I
    - Vegetables are grown by both small and large scale farmers
    - Bell peppers generate the highest price/ kg
    - Maize is the country's staple crop and accounts for a substantial proportion of the fertilizers applied
    - Most maize are produced by small scale communal farms, while larger commercial farms focused on cash crops like tobacco, paprika, fruits, flowers and beef exports.

- **Water sources in Region I are reliable (rainfall), but less reliable in Region II;** Region III, IV and V have severe droughts thus not favorable for irrigation due to lack of constant water supply
- **Most irrigation schemes are found in region III**
- **Private and Farmer-owned schemes tend to be more profitable** (see next slide)

Main Take-Aways: Profitability

Farmers managed irrigation Scheme	Government managed irrigation scheme
•May contribute to the investment cost or get funds externally •Operations and Maintenance cost: Contribute Z$30/month each(US$ 3,675) •Farm Labour:Z$15-20(Us$1,835-2,450) •Electricity bill:Z$200/month each(Us$ 24 500) •Crop yield transport •Farm input: fertilizers, pesticides etc	•Water charges: Z$ 185/1000m3(Us$ 22 700) •Farm input: fertilizers, pesticides etc. •Farm labour
Profitability: Avg. net income p.a. Z$60,000 ($7,352,187)	**Profitability:** Avg. net income p.a. Z$ 1,000 - 4,000 ($122,500-490,145)

- **Summary of the findings:**

➢ Projects that are planned with full farmer participation appear to be more viable than those that are imposed on farmers.

➢ By involving farmers in the planning they develop a sense of ownership, making them willing to participate in the operation and maintenance.

➢ High electricity bills are a problem for some electric pumped schemes (grid connected)

➢ Frequent pump breakdowns and disconnection of electricity are common at government managed schemes

➢ The ability of some farmer managed schemes like Chitora and Wenimbi to pay for their O&M costs indicate that these schemes can be self sustaining and that the government in future should concentrate on establishing such type of irrigation schemes.

http://www.fao.org/3/x5594e/X5594e19.htm#TopOfPage

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A case study business model consideration for WPT (1/2)

Deployment Model

- Projects supported: 1,260
- Number of farmers per project: 19
- Number of PAPA Pump per project: 1
- Crops grown in the two seasons: Horticultural crops(broccoli, tomatoes, chilies, cauliflowers etc)

Cost & Financing Mechanism

- Total investment cost is **$ 21,441,247**
- Capex per project which includes an irrigation water reservoir plus pumping system serves/delivery systems 19 farmers at a cost of **$ 17,017**
- OPEX per projects(Civil works, salaries and overheads) is : **$ 15,878**
- Considering grants from investors, Loans from FIs , farmers contribution (**$ 9,000** per project), pay as you grow payment plan.
- The interest rate for loan payment from FIs in Zimbabwe is 35% with a repayment period of 2.5 years

Logistics

- The irrigation water sources will be flowing rivers
- The irrigation water will be pumped up to 1-2 km from the source
- They model also considers use of storage tanks for farmers living further from the water source
- WPT geographic focus for their technology is Region III, IV, V

A case study business model consideration for WPT (2/2)

Ownership& Management

- Zero energy water pumping systems jointly owned by farmers-local partner
- Considering a farmers managed irrigation scheme
- Expected average income per farmer is **for instance $ 15,200 per month on Tomatoes and $ 120,000 on Broccoli** depending on the season and type of horticultural crop

Operation Cost

- Farmers incur the operation cost (water fee, labour fee, transport and maintenance fee)
- The farmers will incur an average monthly water fee of **$ 18,000 per month/farmer**
- A monthly maintenance fee contribution of **$ 170 per farmer (assuming a 1% of the CAPEX)**

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Rwanda Irrigation Case Study

Technology

- Stand alone water systems are used to pump water to the farms
- Irrigation Water sources are Lakes, rivers and in many Marshy lands across the country
- Use of gravity to irrigate-to transfer water from the storage system to the farms
- Irrigation technology: Small scale irrigation using Ennos sunlight pumps and SF2 Future pump both portable and surface pumps and submersible Lorentz pump.
- The submersible pumps are installed in systems which use drip irrigation, and the portable ones use surface irrigation

Cost & Financing Mechanism

- An irrigation water reservoir plus pumping system serves 5-7 farmers at a cost of $3,500 for popular pumping systems (Ennos Sunlight pump) and $5,500 upwards for other types of pumping systems which are expensive
- Balloon mode of payment for the irrigation technology is used where farmers contribute 30% of the capex while the government and E4I offers 50% and 20% respectively subsidies on the technology
- Balloon Payment Principle: debt accumulation and the repayment is done in one off instalment or two instalments depending on the loan size and negotiation outcome
- The interest rate for balloon payment principle is **24% per season for Sacco**(the payment is done per season) and **18% for other FIs** (payment made per month)
- The average loan repayment period is 2 years

Cont'd....

Ownership& Management	• Stand alone water systems owned by various individuals • Irrigation schemes are managed by farmers themselves through their corporative leaders • The average income per farmer depends on the crops grown and season, for instance chillies ranges from $350-$700 per season, other horticultural crops(tomatoes, eggplant, tree tomatoes) ranges $100-$300 per season and Maize/beans ranges $40-$100 per season.
Operation Cost	• Farmers incur the operation cost(water fee, labour fee and maintenance fee) • The water fee is set according to regulations at **$40 per season**(3 seasons each with 4 months). • The water fee is enforced in large irrigation schemes only • Labour fee averages **$75 per season** (here we are considering labour for irrigation only and not farm agricultural activities) • Maintenance fee averages **$80/season**
Logistics	• 50m is the recommended distance for pumping water from the source in Rwanda • Storage tanks are used to supply water for farmers living far from the sources.

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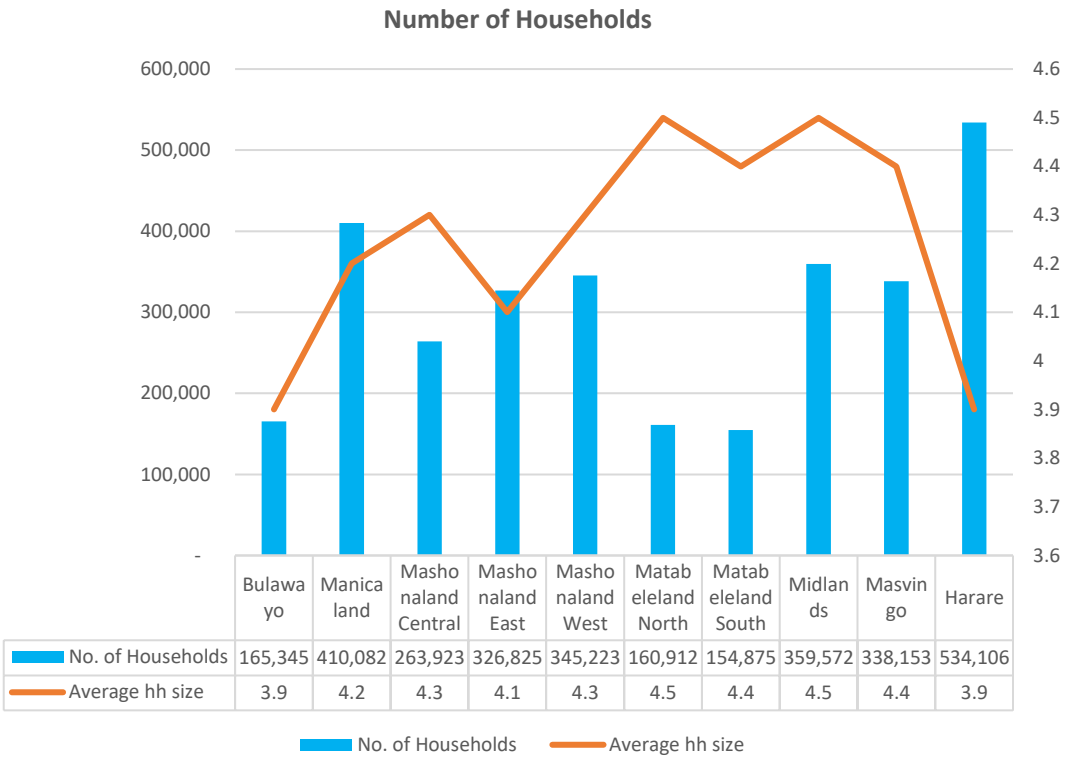
Households

- There is a total of **3,059,016 households** in Zimbabwe
- The average number of people per household is **4.3**
- With the largest population living in Harare(City) and the least populations in Bulawayo, Matabeleland North and South.
- This could be due to the dry nature of Matabeleland North and South areas which are located in region IV and V respectively
- The low Population in Bulawayo could be attributed by the de-industrialization caused by political and cultural differences.



	Bulawayo	Manicaland	Mashonaland Central	Mashonaland East	Mashonaland West	Matabeleland North	Matabeleland South	Midlands	Masvingo	Harare
No. of Households	165,345	410,082	263,923	326,825	345,223	160,912	154,875	359,572	338,153	534,106
Average hh size	3.9	4.2	4.3	4.1	4.3	4.5	4.4	4.5	4.4	3.9

http://www.zimstat.co.zw/wp-content/uploads/publications/Population/population/census-2012-national-report.pdf and https://en.wikipedia.org/wiki/Bulawayo

Legislative Status

- **Water use in Zimbabwe is governed by the Water Act of 2005, the main features of the Act are:**
  - A permit is required of a person who wishes to carry out any operations that affect:
    - Banks, beds or course of a public stream
    - Any Marshes, springs, swamps or vleis
  - No private ownership of water
  - Water use must be priorities as follows: Primary, Environment, Urban, Industry, Mining, Agriculture
- **Validity of the Permit:**
  - 20 years or as determined by catchment council
  - Permit amended if holder fails to make use of water for 3 consecutive years
  - Permit transfers to new owner of land

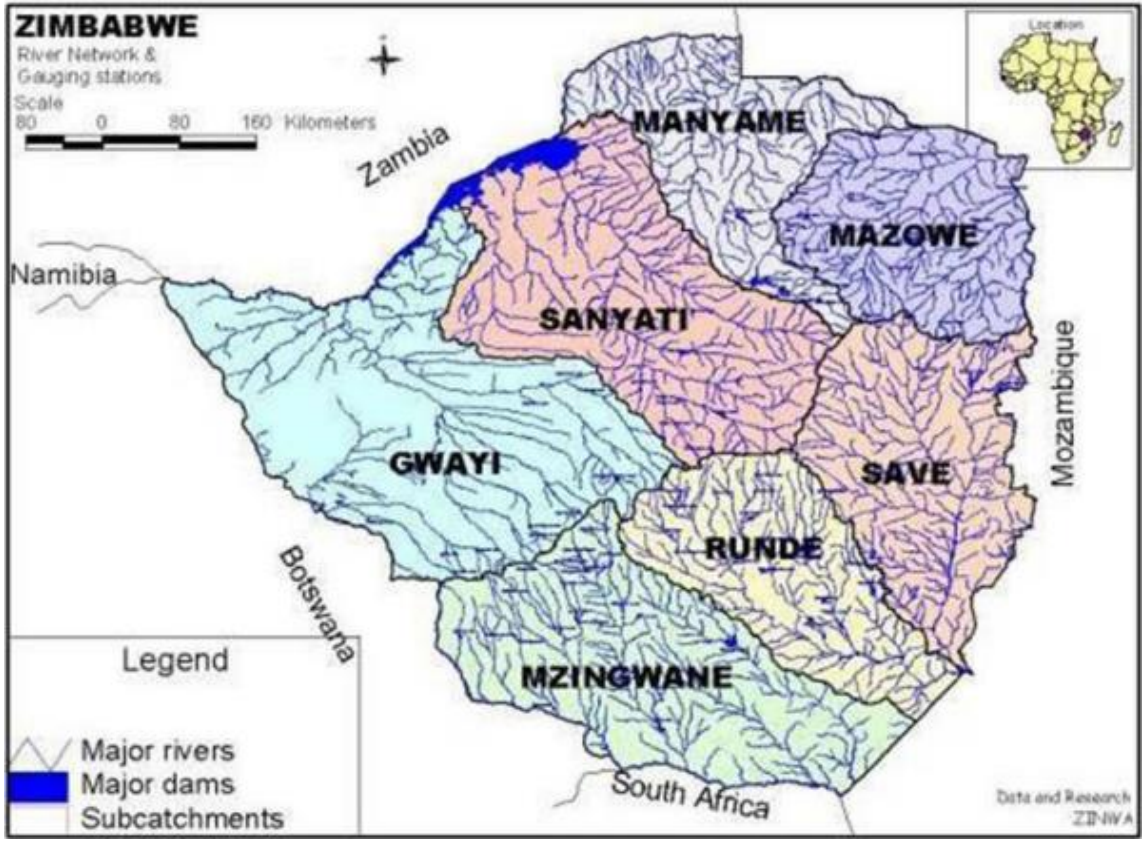
http://www.cfuzim.com/wp-content/uploads/2015/09/zinwa915.pdf

Legislative Status

- The ZINWA Act CAP 20:25 created ZINWA with the responsibility of:
  - Providing a coordinated framework for planning, development and management of water resources.
  - Advising the Minister on national water policy, pricing and water resources development and management.
  - Providing technical support to Catchment Councils through its Catchment Managers,
  - Ensuring that Catchment and Sub-catchment Councils carry out their functions under the Water Act.
  - Managing and selling agreement water up to field edge
  - Supplying potable water to local councils and government institutions.
  - Management of the water permit system, the pricing of water, operating and maintaining existing infrastructure, and executing development projects

http://www.cfuzim.com/wp-content/uploads/2015/09/zinwa915.pdf

Catchment and Sub-catchment Map



http://www.cfuzim.com/wp-content/uploads/2015/09/zinwa915.pdf

Major Dams

- The major dams include:
  - Mazvikadei dam
  - Mwenje dam
  - Manyame dam
  - Chivero dam
  - Muzhwi dam
  - Mutirikwe dam
  - Mshabezi dam
  - Muzingwane dam
  - Shangani dam
  - Kariba dam

- Dams in Zimbabwe have multiple uses such as cattle watering, drinking water supply, domestic use and irrigation

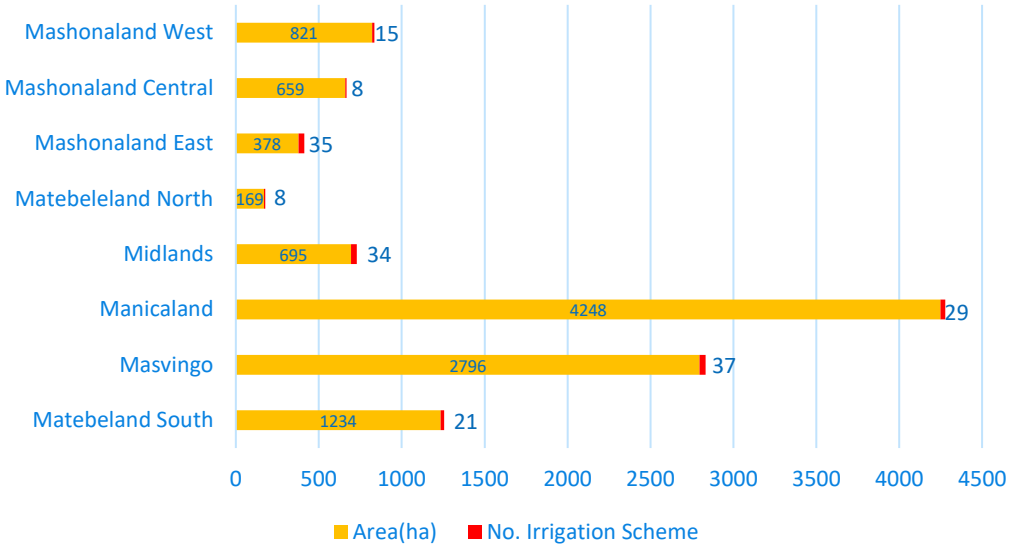
- 75% of this dams are used for agricultural purposes

- Most dams are found in Mashonaland East and West, Mavsingo, Matabeleland South and Midlands.

https://reliefweb.int/map/zimbabwe/zimbabwe-agro-ecological-zones-map-administrative-boundaries-05-oct-2009

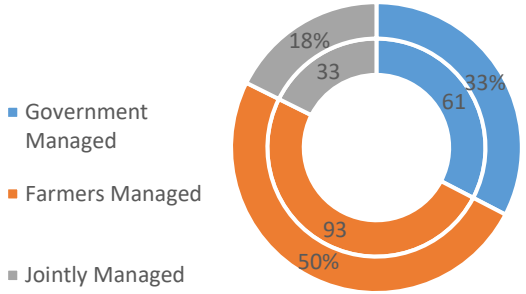
Irrigation Status Quo

No. of Irrigation Schemes



- There are a total of 187 irrigation schemes

Irrigation Scheme Management



Irrigation Technology