Self Reliance of Refugees in Chad: A Business Case for Water Spreading Weirs (WSW) in Chad

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Their commitment has significantly contributed to advancing the empowerment of refugees and host communities, and to informing sustainable development and resilience-building efforts in the Sahel region.

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Executive Summary

- WSWs align with broader **priorities by national** and **international partners**.
- WSW helps increase **access to water**, which increases **access to arable land**, which increases **agricultural productivity**, which helps **strengthen economic activities** and **reduce food insecurity**, as well as support **social cohesion**.
- From an ecological/environmental point of view, the WSW improve the **greenness of vegetation**, **water retention**, **groundwater recharge**, **prevent sol erosion and loss**.
- **For every dollar invested**, **the WSW generates between 1.25 and 1.7 USD.**
- **Call for action:** We call on **national authorities, development partners, humanitarian actors**, and **donors** to scale up investments in **water spreading weirs** alongside **provision of improved seeds and agricultural tools** to i) foster economic self-reliance, ii) improve food security, iii) enhance resilience

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Objective

- The existing and planned investments for water spreading weirs (WSWs) needs socioeconomic justification to expand funding and attract new donors.
- An analysis of the socio-economic impact and rentability of investments in WSW is required as a proof of concept to expand the programme and attract additional support.
- A “business case” is based on popular economic calculations that indicate the attractiveness of an investment.
- More precisely, the following analysis assesses the:
  1. The impact and benefits
     1. Economic benefits from crop production; employment
     2. Social benefits in terms food security, and reducing the reliance on food aid; and
     3. Environmental benefits of reducing soil nutrient loss, water retention
  2. Provide a financial analysis of the project (Return On Investment, RoI)

Outline

1. Introduction
2. Description of the project and study area
3. Strategic and policy alignment
4. Methodological approach
5. Impact and benefits
   - Economic and social
   - Environmental
6. Financial analysis: Return On Investment (RoI)
7. Call for action

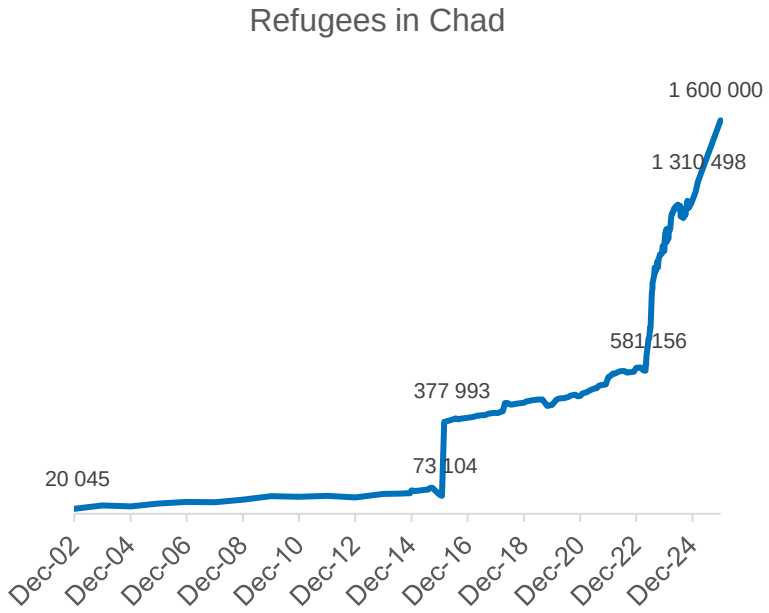
INTRODUCTION

Chad is one the world's largest refugee-hosting countries

- Chad is Africa' s largest refugee host per capita, with over 1.9 million individuals under the UNHCR mandate as of the end of April 2025
  - About half are in a protracted situation
  - The vast majority of refugees originate from Sudan (87%) and CAR (11%).

- More than 800,000 Sudanese refugees have arrived in Chad since the resumption of fighting in Sudan.

  - A large number of Sudanese refugees are currently housed in settlements scattered across the eastern border.



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Chad is one of the poorest countries in the world, and refugees in Chad face high levels of poverty and a persistent consumption gap

- Poverty and vulnerability are widespread in Chad:
  - Nationally, 44.8% of the population living below the national poverty line in 2022.
  - The World Bank's Human Capital Index for Chad is 0.30, indicating that a child born today will be 70% less productive as an adult compared to a child who has received quality education and proper healthcare.
- The vast majority of refugees in Chad are poor (82%) (WB, 2021)

- At a time when humanitarian support is shrinking, refugees' self-generated income does not cover the minimum consumption need (WB, 2024)

  - Self-generated income covers 54% of minimum consumption needs
  - Humanitarian assistance covers 14% of minimum consumption needs
  - Average **consumption shortfall of 32%** relative to the minimum consumption need

- While agriculture is a main livelihood activity for both hosts and refugees (92% in 2023), refugees are still highly dependent on aid as their major source of income.

- Expanding agricultural and small business opportunities are key to increasing refugee self-reliance.

Access to land is one of the main constraints of expanding agricultural opportunities

- Refugees in Chad have very limited access to land
  - While nearly 90% of Chadian nationals own at least one plot,
  - Only 4% of Sudanese and 7% of CAR refugees own at least one plot.

- Contrary to common perceptions, land rental markets do exist in refugee-hosting areas.
  - Around 90% of Sudanese refugee households engaged in agricultural production rent at least one plot of land.

- However, these ad hoc and informal rental arrangements limit opportunities for long-term investment, undermining both agricultural productivity and the potential for self-reliance among refugees.

- Consequently, there is a pressing need to increase the availability of land for refugee and host community use including interventions that facilitate inclusive land management in refugee hosting areas.

Climate hazards and low funding for innovation and advisory services are other key constraints

- Over 95% of Chad's agriculture relies on rainfall for irrigation leading to high vulnerability to climate change (UNDP, 2025).

- Increasingly erratic rainfall patterns—including long dry spells followed by intense rainfall—dry out land, reduce soil moisture, and cause floods and topsoil runoff, which further degrade natural resources (water, soil, forests).

- Low funding for innovation and advisory services(e.g, agricultural extension and technical support to farmers for adopting improved practices, technologies, and climate-resilient approaches) are key constraints .

The use of Water Spreading Weirs (WSWs) as a solution

- **Water Spreading Weirs (WSWs)** offer promising potential for economic, social and environmental benefits, enhancing refugee self-reliance.
  - **Improved Agricultural Productivity**: Increase soil moisture for rainfed or spate-irrigated farming.
  - **Livelihood Support**: Benefit pastoralists and agro-pastoral communities.
  - **Ecosystem Restoration**: Support vegetation regrowth in degraded drylands.
  - **Soil and Water Conservation**: reduce erosion by slowing and spreading runoff water.
  - **Groundwater Recharge**: Enhance infiltration into aquifers.

Water-spreading weirs are structures of stone and cement built to capture, slow, and spread floodwaters in the surrounding area, promoting soil infiltration, groundwater recharge, and the creation of fertile land, facilitating the growth of crops and grass for livestock, improving livelihoods in drought-prone dry regions (UNCCD).

DESCRIPTION AND AREA OF THE PROJECT

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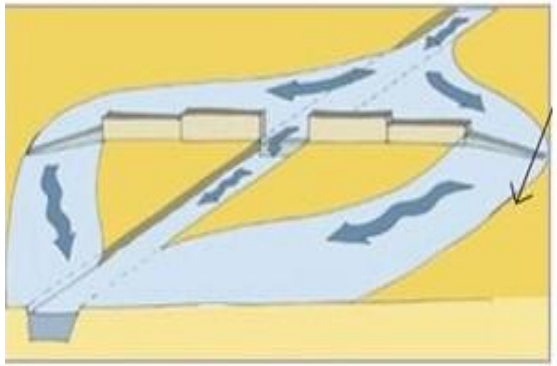
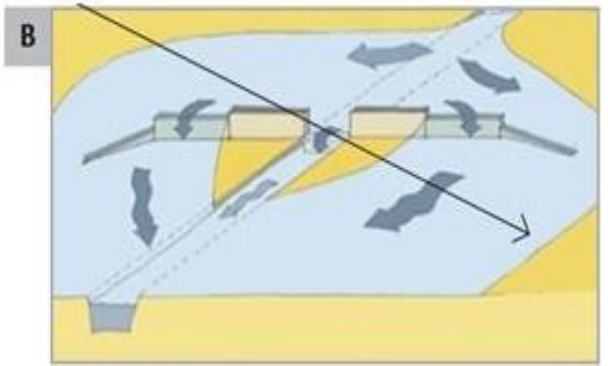
Type of investment: Water Spreading Weir





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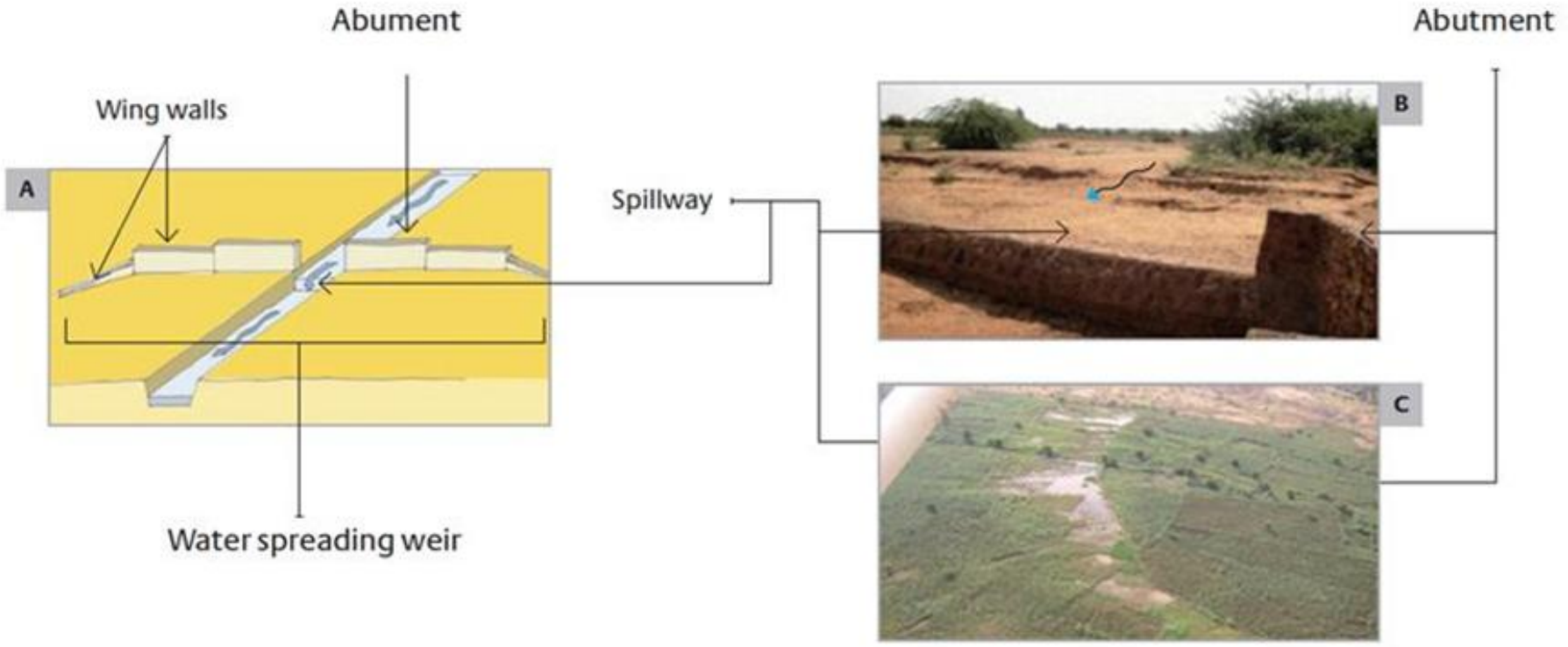
Type of investment: Water spreading weir



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Type of investment: Market gardens

Market gardening is the small-scale commercial production of a variety of crops like vegetables on a small plot of land, typically sold directly to local customers

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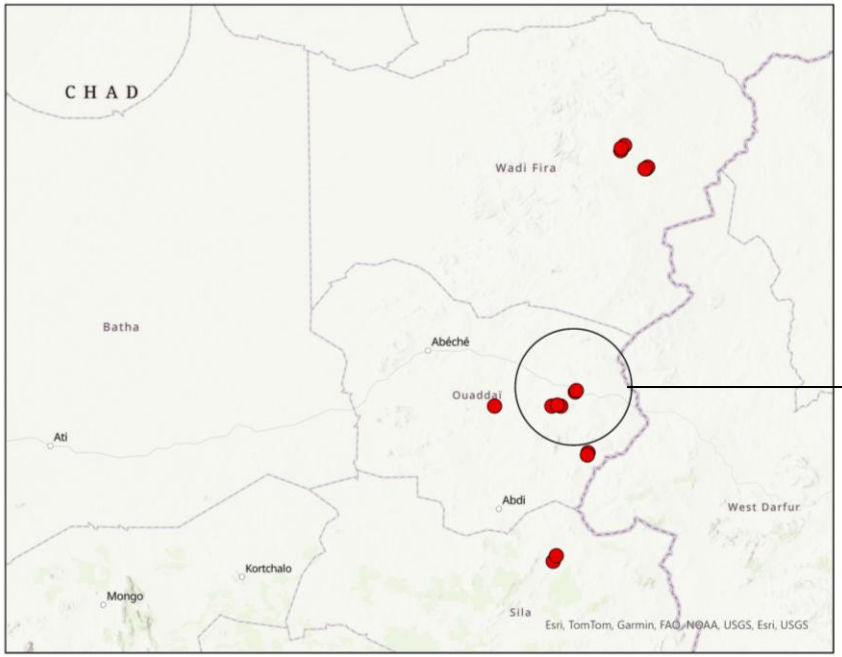
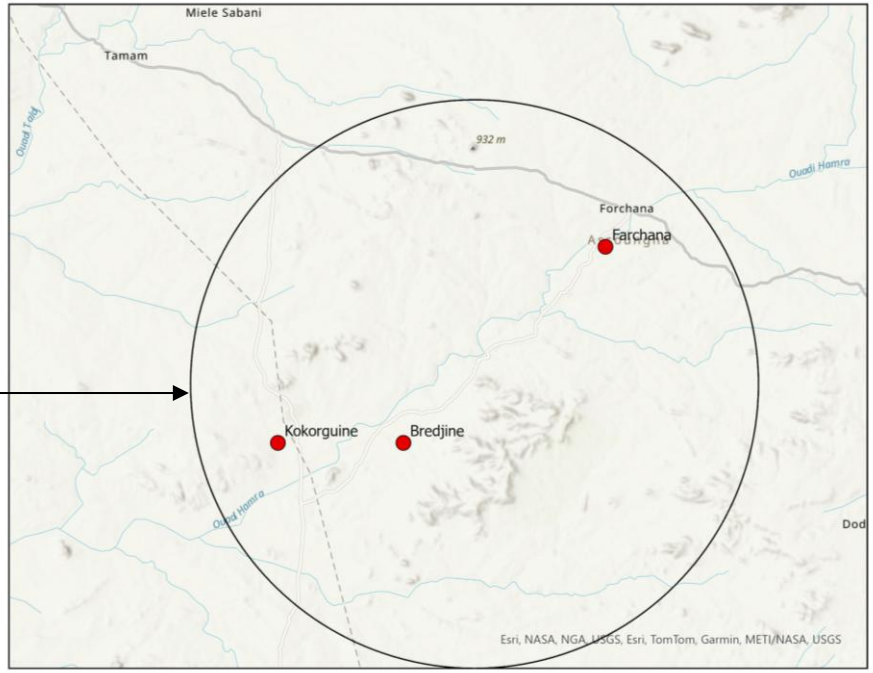
Sites studied for the WSW impacts





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Interventions and packages

Farchana

Infrastructure components:

1. WSW
2. Market garden (5 ha)

Kokorguine

Infrastructure components:

1. WSW

Bredjing

Infrastructure components:

1. WSW
2. Market garden (5 ha)

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STRATEGIC AND POLICY ALIGNMENT

WSWs align with broader priorities by national and international partners

- **Alignment with national development plans**
- **Building on over ten-year long expertise developed in Chad by GIZ, with support of AFD & SDC**
- **Alignment with EU INTPA Goals on Sustainable Development and Climate Resilience**
  - EU's approach to fragile and conflict-affected contexts emphasizes integrated approaches that address humanitarian needs, sustainable development, and peacebuilding.
  - The Team Europe Initiative on Transboundary Water Management in Africa to mobilize funding and expertise for water-related investments.
- **Contribution to SDGs**: SDG 1, SDG 2, SDG 6, SDG 13
- **Alignment with the development actors' priorities in Chad**:
  - **World Bank's priorities in Chad** "*Promoting the adoption of new water-management techniques and other productive technologies could strengthen food security and enable the commercialization of agriculture*" (WB Chad 2021 Poverty Assessment)
- **Fit with agricultural transformation or climate resilience strategies**
- **Alignment with the *UNHCR Sustainable Response*** seeking to empower affected communities until durable solutions are found with a focus on **self-reliance** and **inclusion in national systems**

METHODOLOGICAL APPROACH

Mixed method approach: qualitative and quantitative analysis

Methods

1. **Qualitative analysis of socioeconomic impacts through focus groups with:**
   - Local chiefs and management committee leaders
   - Beneficiary refugees (men and women)
   - Beneficiary host populations (men and women).
2. **Satellite Data and Water Balance Model to evaluate the environmental and ecological impact analysis.**
3. **Cost-benefit Analysis to calculate the Return on Investment (RoI).**

Data Source

- **FAOSTAT**
- **Government data (ANADER)**
- **Project data**
- **Desk review**
- **Satellite imagery**

IMPACT AND BENEFITS OF THE WSW

Socio-Economic benefits of the WSW

- Livelihood support as a result of Cash for Work
- Improved access to water
- Greater arable land for cultivation and higher productivity
- New income-generating activities
- Income gains
- Better food security and diversification
- Enhanced social cohesion

The construction of weirs constitutes a Cash for Work (CfW) programmes

CfW provides "Triple dividend" by reducing poverty and vulnerability through:

1. Paid employment,
2. Creation of public goods in underserved regions, and
3. Provision of skills training (Gehrke and Hartwig 2018)

- **Construction duration**: XX
- **Number of casual workers hired per WSW**: 45 per day
- **Daily salary:** Each worker earns an average of **2,500 FCFA** (3.81 USD) per day, representing on average **twice the value of a monthly food ration for a typical household of five members.**

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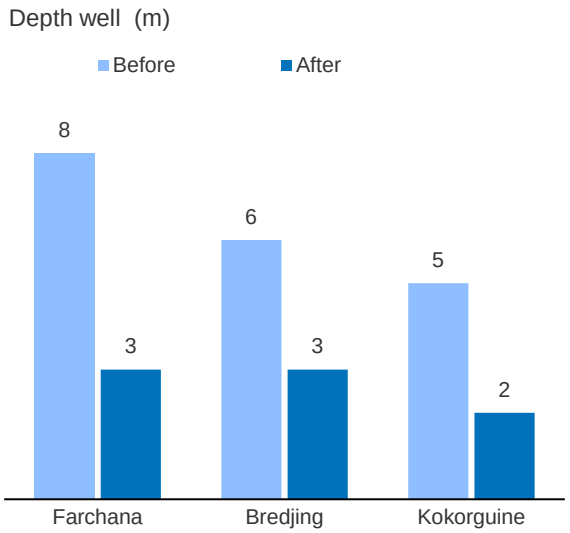
The WSWs ease access to (drinking) water



In the past, We had to crowd together at a few water points to collect water. Since the installation of the weir, however, many wells have been built in the village, reducing the need for large gatherings at a single source. Today, ***drinking water*** *is* ***easier to access and of much better quality.***

Before, we didn't have access to large gardening plots, and the soil would become too dry after a few months. Water was becoming increasingly scarce. Today, thanks to the WSW, the soil retains moisture for longer, and ***our wells no longer dry up as quickly****. ….*

Achta Ismail,
Refugee Sudanese

We have seen our land become more fertile and our pastures improve. Before, it took us three days of digging to find water. **Now, in just a few hours, we can draw enough to meet our needs**….

Ibrahima,
Host community member

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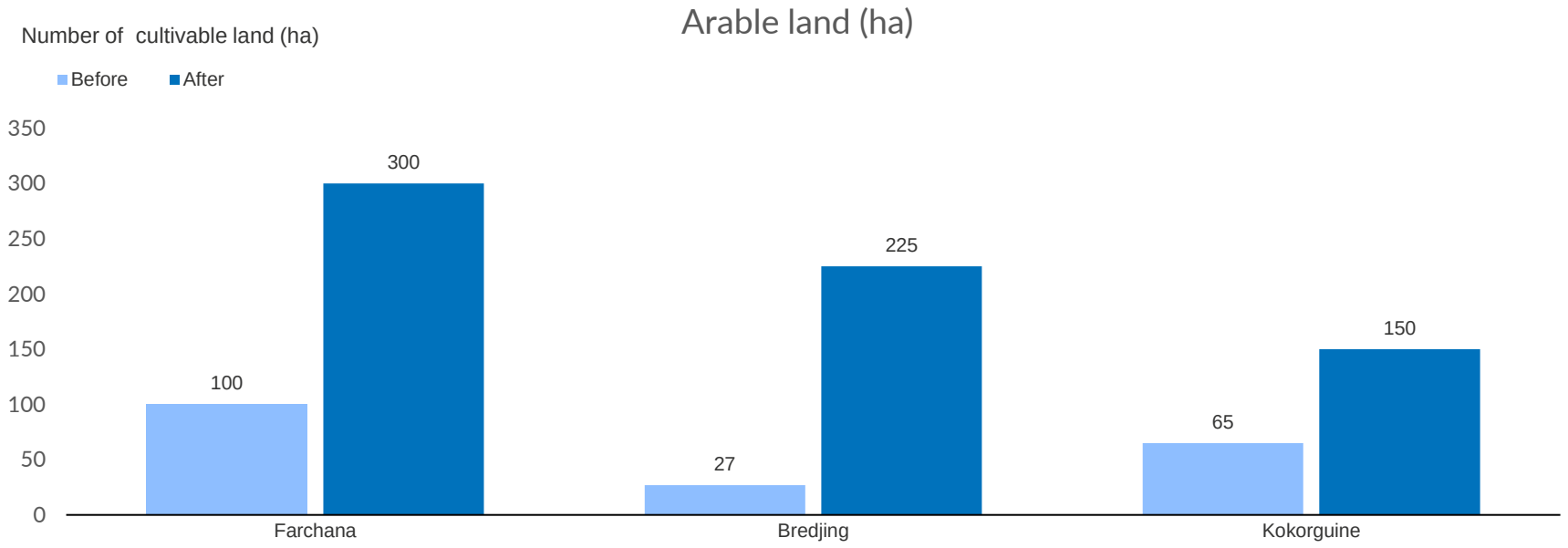
The WSW help expand the availability of arable land for cultivation



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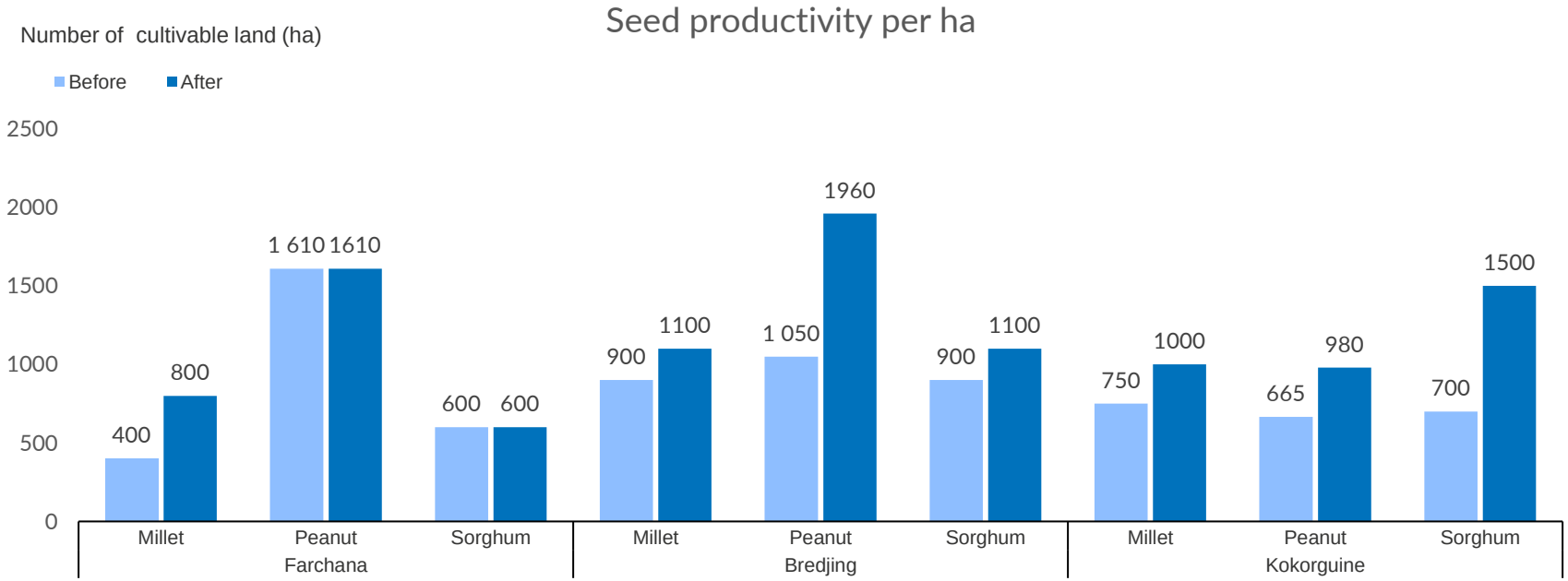
The WSW drives higher agricultural productivity



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The WSW have created new economic activities and employment opportunities

1. Market gardening
2. Temporary pisculture
3. Brick making
4. Water selling

> Before, we (women refugee) were staying home only or begging in the community. Since the construction, we come to the WSW for **laundry** or **selling water**. Thanks to the project, some of us are engaged in farming. A potential expansion would allow more refugee women to start being engaged in income generating activities .

Women refugees discussions group, Farchana

...We can earn between 40,000 and 80,000 francs XOF per week. *This allow women to take care of their family and buy notebook, pen for their children, send children to hospital when ill. Before some refugees were working as house help to earn less than 15,000 francs XOF .*

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The WSWs are improving refugee food security and diversification

> “Before, we didn’t have access to large gardening plots, and the soil would become too dry after a few months, and water increasingly scarce. Today, thanks to the WSW the soil retains moisture for longer, and our wells no longer dry up as quickly. We can **grow crops over a longer period and in greater quantities,** which has **greatly improved our food situation.**”

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In refugee settings in Chad, where access to land has long challenged social cohesion, the local conventions of the WSW help bridge divides and foster stronger relations between refugees and host communities

Social benefits enhanced social cohesion through two pathways:

1. **Improved access to natural resources** (water, pasture, farmland) enhances social cohesion by reducing competition and tensions.
2. **Inclusive community engagement in WSW planning, construction, and management** fosters dialogue across conflict groups, integrates conflict sensitivity, and strengthens local collaboration.

> *…. The management committee of the WSW is composed **equally of refugees and host community** members. During operations, refugees and hosts work together side by side and share the land. This further facilitates **better coexistence** and **social cohesion**.*

Member of the commmitee, Host member

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Ecological/Environmental benefits

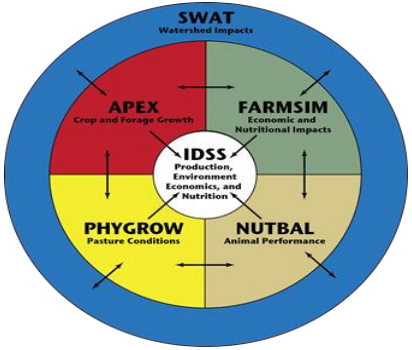
- Greenness of vegetation
- Water retention
- Groundwater recharge
- Sol loss and erosion

Ecological/Environmental benefits

Two main assessment components

- **Remote sensing**: Assessing the impacts of watershed interventions using remote sensing products

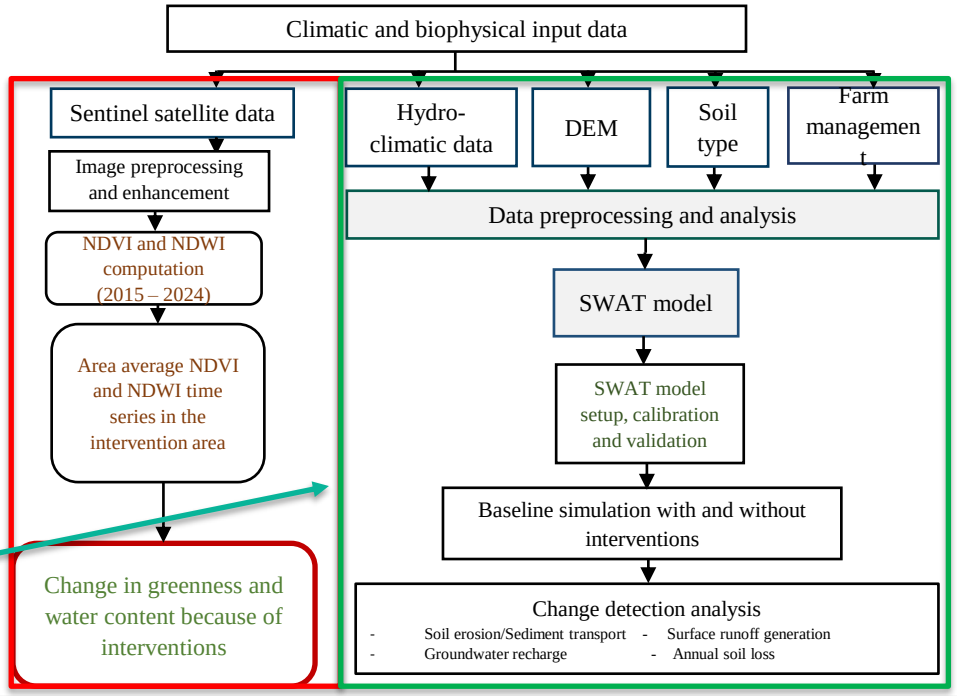
- **Biophysical Models**
  - **Water Balance**: Assessing the impacts of the intervention on the water balance components using SWAT hydrological model



Ecological/Environmental benefits

Methodology

- Approaches Applied in selected watershed
  - Remote Sensing
  - Biophysical modeling



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Ecological/Environmental benefits

Remote sensing approach

Assessing enhancement in vegetation greenness and water availability

Indicators:

- **NDVI** = (NIR+RED)/(NIR−RED)

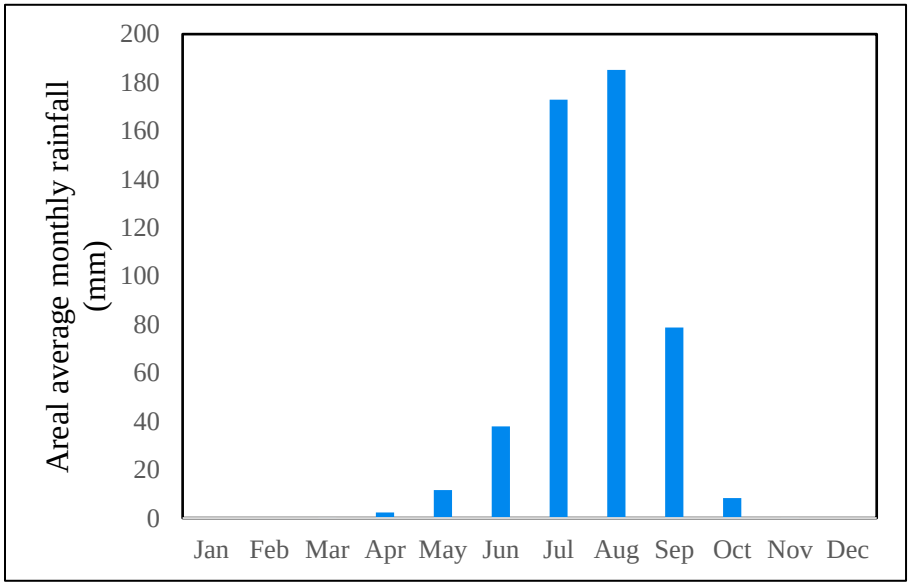
NDVI: Measures vegetation health, vigor, and density by quantifying the amount of green vegetation

- **NDWI** = (NIR+SWIR) /(NIR−SWIR)

NDWI: Detects and monitors moisture content in vegetation, soil water availability and water bodies

Analysis:

- Pre- and Post-intervention analysis
  - Before interventions → 2023
  - After interventions → 2024
- Seasonal analysis
  - Dry season → Oct – Mar
  - Wet season → Jul – Sep



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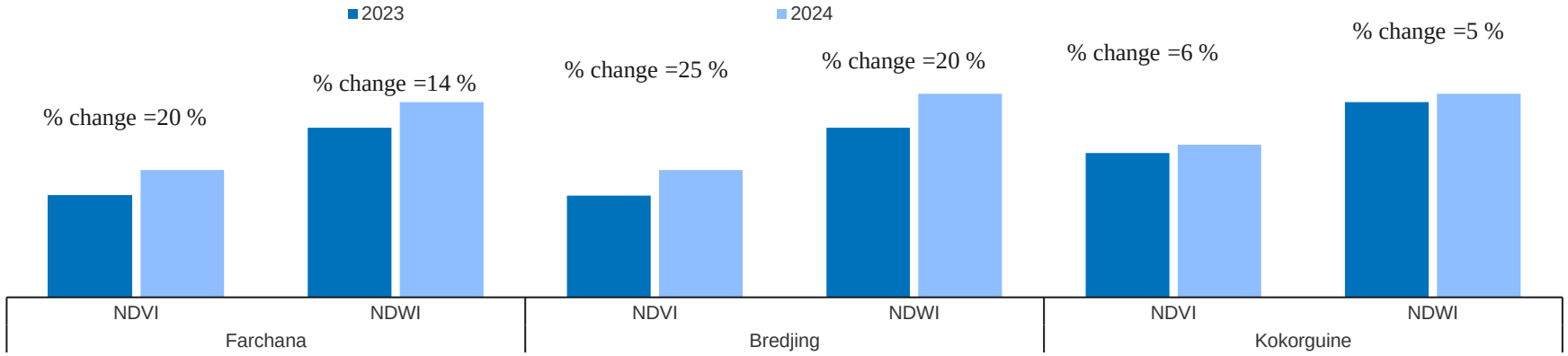
After only a year, the WSWs start generating denser and healthier vegetation with a high potential in the next years

- The dry season result showed some improvement after the intervention period compared with before.
- For example, in Farhana, the humidity index and the vegetation greenness index increased by **14%** and **18%** respectively compared to the period before the intervention.



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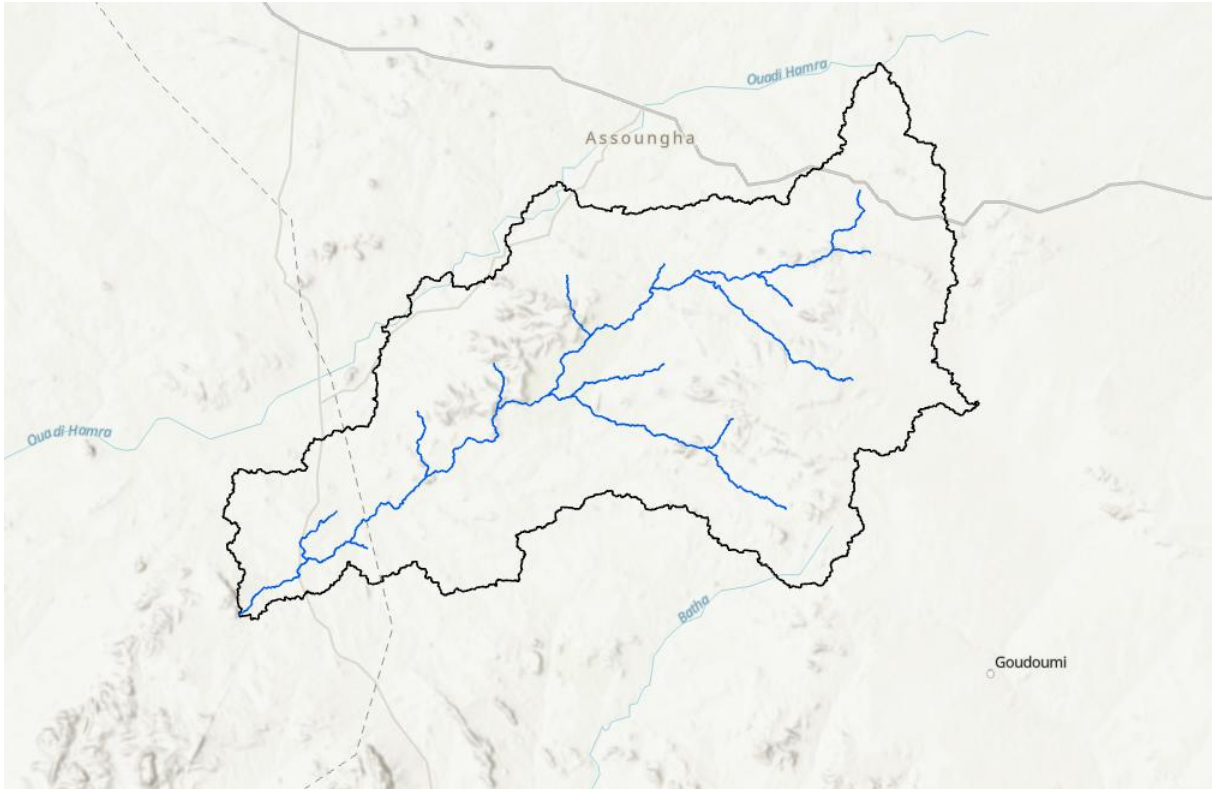
SWAT simulates water balance components

- ✓ Model setup and calibration
- ✓ Baseline SWAT model simulation for each watershed
- ✓ Model simulation with and without interventions



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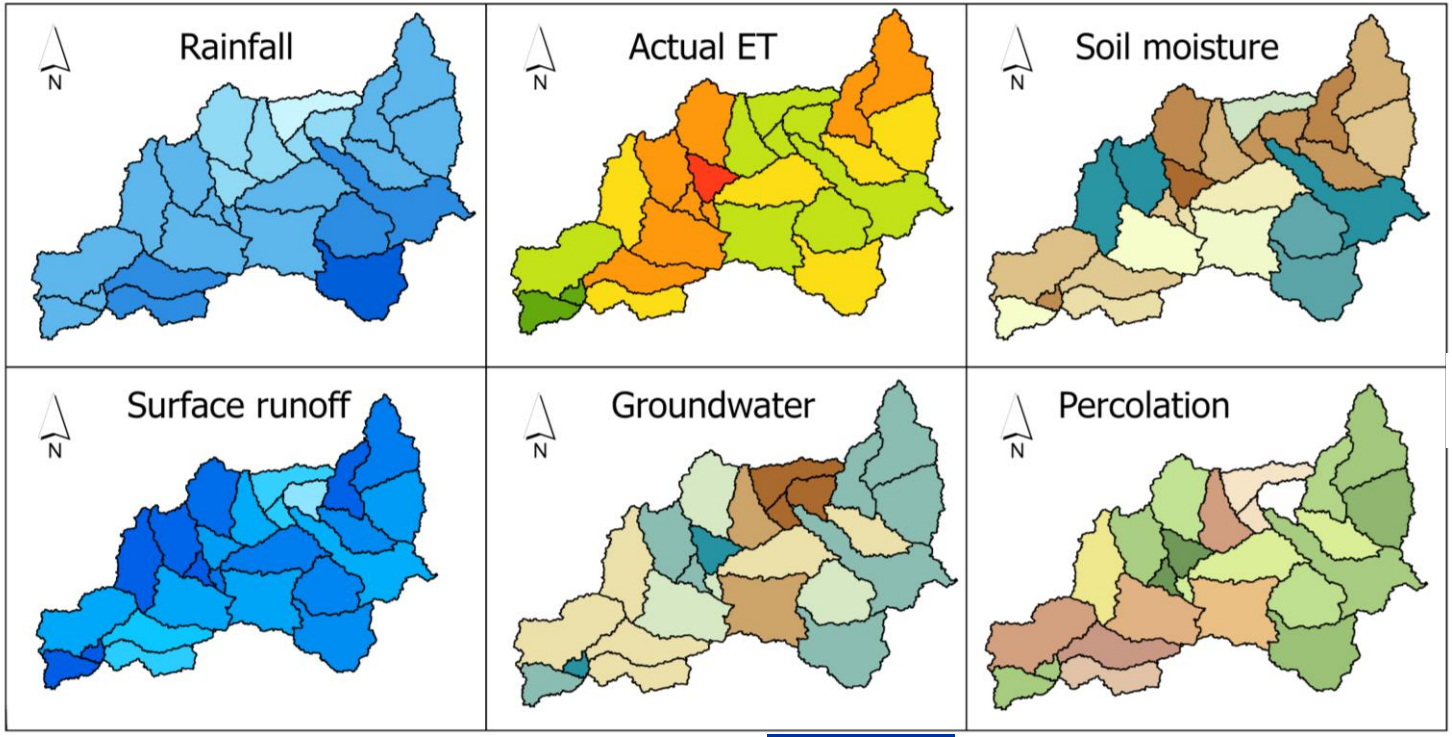
Water balance components in sample watershed



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FINANCIAL ANALYSIS

Cost-benefit analysis framework

Benefits

1. Economic benefits from crop production
2. Soil nutrients
3. Residual value of the investment

Costs

1. WSWs establishment
2. WSW maintenance
3. Admin costs
4. Inputs
   - Seed
   - Oxen power
   - Labor

Cost-benefit analysis framework: Indicators used to assess profitability of the investments

Net Present Value (NPV)

NPV is the present value (updated using a discount rate that represents the opportunity cost of capital) of the incremental net flow of benefits of an investment.

If the **NPV is greater than zero**, this means that taking into account the effect of time on the value of money, **the benefits of an investment are greater than its costs** and the inversion is therefore feasible from the economic

Internal Rate of Return (IRR)

IRR is a metric used in financial analysis to estimate the profitability of potential investments.

IRR is a **discount rate** that makes the **net present value (NPV)** of all cash flows equal to zero in a discounted cash flow analysis.

The **higher** an internal rate of return, the **more desirable an investment is** to undertake

Benefit-Cost Ratio (BCR)

The Benefit-Cost Ratio is the mathematical relation between the **costs** and **financial benefits** of a project.

The cost-benefit ratio compares the present value of the estimated costs and benefits of a project or investment.

The **higher** a **BCR**, the **more desirable an investment is** to undertake

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For every dollar invested, the WSW generates between 1.5 and 1.9 USD

Indicator	Farchana	Kokorguine	Bredjing
Actualized benefits (Millions XOF)	683	683	61
Actualized costs (Millions XOF)	-395	-463	-49
VAN (Millions XOF)	288	219	12
TRI	39%	41%	4%
Ratio Benefit cost actualized	1.73	1.47	1.25
Ratio Benefit cost nominal	1.90	1.55	1.63

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Comparison of the RoI with previous studies on WSW

Country	Description	Ratio Benefit Cost
Our results	UNHCR and Texas A&M Univ	Farchana: 1.73 Kokorguine: 1.55 Bredjing: 1.63
Chad	GIZ study	Tahous: 1.89 Sofaya:1.81
Ethiopia	GIZ study	Afar: 1.94

For Farchana, the WSW remains economically viable even with least favourable scenarios including drought and other under conservative assumptions

Parameters modified compared to the base option	NPV (5%)	IRR	BCR
Base option	288.3	39%	1.96
Yield decrease by 20%	214.9	21%	1.46
Prorgressive land use	155.2	15%	1.06
Drought	230.9	28%	1.57

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CONCLUSION

Way forward based on refugees' voices

- **Expanding water management infrastructure: WSWs**
- **Facilitating access to inputs: improved seeds**
- **Facilitating agricultural mechanization tools: motor pumps and tractors**

"There is a need to strengthen **production capacity**, given that the work is still **done manually**. It is necessary to **increase the WSWs** and facilitate **access to improved inputs** and **agricultural mechanization tools,** such as **motor pumps** and **tractors**, in order to maximize the use of infrastructure and allocations. The provision of these agricultural tools could be channeled through existing cooperatives and farmers' organizations. This would help boost yields and overall production.."

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Summary and Call to Action

- A broad range of socioeconomic and environmental benefits of WSWs
- The cost-benefit analysis demonstrates that for every dollar invested, the WSW generates 1.25 and 1.73 USD in return
- We call on **national authorities, development partners, humanitarian actors**, and **donors** to scale up investments in **water spreading weirs** alongside **provision of improved seeds and agricultural tools** to:
  - Foster economic self-reliance
  - Improve food security
  - Enhance resilience

To expand the impact and sustainability of WSWs, we propose an approach combining:

1. **Bilateral and Multilateral Donor Support**
   - Seek additional funding from EU INTPA to scale up
   - Leverage existing humanitarian-development-peace nexus funding (World Bank IDA, IFAD).

2. **Government and Local Contributions**
   - Advocate for national and local budget allocations to support WSW infrastructure as part of climate adaptation and rural development strategies.

3. **Private Sector and Impact Investment**
   - Explore partnerships with agribusiness value chains that benefit from local production
   - Supporting agricultural cooperatives to expand purchasing power and support sustainable practices

4. **Evidence-Based Planning**
   - Be data-driven including through partnership with academia that support the use of satellite data, agroecological and SWAT models, and economic models to prioritize high-potential sites.