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SELF-RELIANCE OF REFUGEES IN CHAD

A BUSINESS CASE FOR WATER SPREADING WEIRS

UNHCR The UN Refugee Agency

TEXAS A&M UNIVERSITY

WATER SPREADING WEIRS

MARKETING GARDENS

MAIN FINDINGS

Chad: High Refugee Presence Amid Deep Poverty and Limited Livelihoods

Hosting 1.9 million refugees, Chad faces deep poverty, land scarcity, and growing climate variability. Refugees and host communities are highly vulnerable, relying on aid and informal land rentals. Expanding land access and agricultural investment is key to building self-reliance and food security.

Benefits of Water Spreading Weirs (WSWs)

Water spreading weirs generate economic, social, and environmental benefits that improve the wellbeing of refugees and hosts. Evidence shows the weirs contribute to:

- Better agricultural productivity by increasing soil moisture for rainfed and spate-irrigated farming.
- Livelihood support for pastoralist and agro-pastoral communities.
- Ecosystem restoration through vegetation regrowth in degraded drylands.
- Soil and water conservation by reducing erosion and slowing surface runoff.
- Groundwater recharge through infiltration into aquifers.
- For every dollar invested, the WSW generates **between 1.25 and 1.7 USD.**

IMPACT OF WATER SPREADING WEIRS

MORE ACCESS TO WATER

✓ More water available for agriculture and livestock

MORE ACCESS TO ARABLE LAND

✓ More zones suitable for lease and cultivation

IMPROVED PRODUCTIVITY

✓ Better yields and harvest reliability

✓ More variety of crops

IMPROVED FOOD SECURITY

BETTER SOCIAL COHESION

✓ More food and land available

✓ Less conflict between communities

Call to Action

- **Expand water management through Water Spreading Weirs and complementary measures such as improved seeds and mechanization.** These investments can boost agricultural productivity for livelihoods, food security, and self-reliance for refugees and host communities.
- **Greater impact requires joint action.** Donor investment, government budget support, stronger market links, and data-driven planning will help guide future agricultural development.

Background

Chad, among the poorest countries in the world, is also one the world's largest refugee-hosting countries. As of the end of April 2025, approximately 1.9 million individuals are under UNHCR's mandate, about half of which are in protracted situations. More recently, around 800,000 Sudanese refugees have arrived in Chad due to increased conflict in Sudan, a large number of which are housed in informal camps across the eastern border.

Refugees in Chad face high levels of poverty and struggle to meet their basic needs. Around four in five refugees are poor, and at a time when humanitarian support is shrinking, refugees' self-generated income does not cover the minimum consumption needs. Agriculture-based livelihood activities are the main source of income for both hosts and refugees, yet refugees are still highly dependent on aid. Expanding agricultural and small business opportunities are key to increasing refugee self-reliance.

Access to land is a major constraint of expanding agricultural opportunities. While nearly 90% of Chadian nationals own at least one plot of land, that share is only 4% and 7% among Sudanese and CAR refugees, respectively. Although land rental markets exist in refugee-hosting areas, ad hoc and informal rental arrangements limit long-term investment opportunities, undermining both productivity and prospects for self-reliance. Consequently, there is a need to increase land availability for refugee use, including through more inclusive land management practices.

Water Spreading Weirs as a Solution

Water Spreading Weirs offer promising potential for economic, social and environmental benefits, contributing to enhanced refugee self-reliance. WSWs are believed to provide:

- Improved agricultural productivity through increased soil moisture for rainfed or spate-irrigated farming.
- Livelihood support benefit pastoralists and agro-pastoral communities.
- Ecosystem restoration through vegetation regrowth in degraded drylands.
- Soil and water conservation as a result of reduced erosion by slowing and spreading runoff water.
- Groundwater recharge by enhancing infiltration into aquifers.

Investments in WSWs align with the broader strategic priorities of national and international partners. These include the government's national development plans, the EU INTPA's goals on sustainable development and climate resilience, the World Bank's promotion of new water-management techniques

to strengthen food security and enable the commercialization of agriculture, and UNHCR's transition to a Sustainable Response approach emphasizing self-reliance and inclusion in national systems.

UNHCR received funding from the EU to build WSWs in refugee settings in Chad. This evaluation covers three sites – Farchana, Korguine, and Bredjing – and examines two main intervention components: WSW and market gardens.

Figure 1: Type of infrastructure

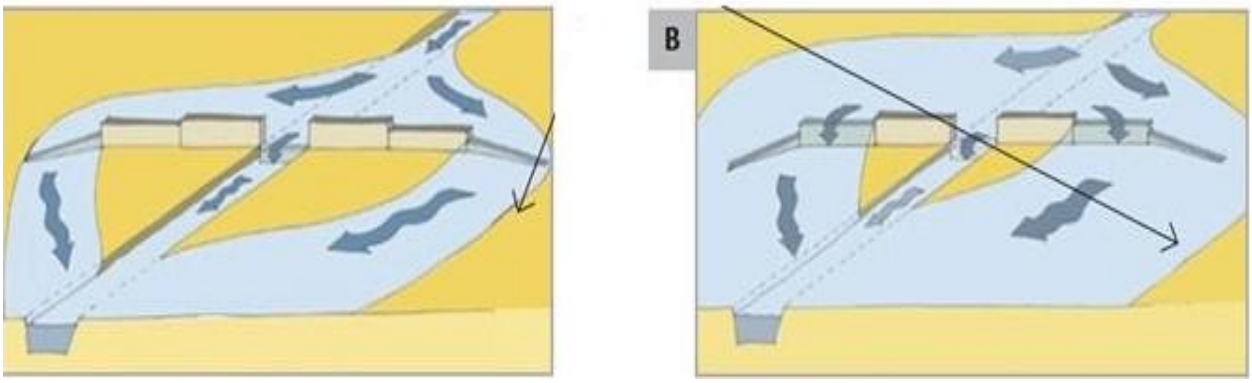


Figure 2: Site studies for impacts of WSWs

Figure 3: Intervention and packages

Farchana	Korguine	Bredjing
• 1 WSW • Market garden (5 ha)	• 1 WSW	• 1 WSW • Market garden (5 ha)

The study employed a mixed-methods approach, combining qualitative and quantitative analysis. Socioeconomic impacts were explored through focus group discussions with three key stakeholder groups: (i) local chiefs and management committee leaders, (ii) refugee beneficiaries (men and women), and (iii) host community beneficiaries (men and women). Quantitative evidence, including administrative datasets and satellite-based environmental indicators, was analyzed to assess ecological and environmental outcomes. In addition, a cost–benefit analysis was conducted to estimate the project's overall return on investment (RoI). Data sources include FAOSTAT, national administrative records from ANADER, project monitoring and reporting systems, a detailed desk review, and satellite imagery to validate environmental changes and enhance analytical robustness.

An initial analysis in three locations with WSWs documents the economic, social and environmental benefits. In addition to Cash for Work, a simple before-and-after comparison shows that improved access to water has led to increased access to arable land and, as a result, higher agricultural productivity for staple crops such as millet, peanut, and sorghum.

The construction of weirs was implemented as a Cash for Work programme employing 45 casual workers per day, each earning FCFA 2,500 (≈ USD 3.81), equivalent to twice the value of a typical monthly food ration for a five-member household. Cash-for-Work (CfW) interventions generate a "*triple dividend*" by simultaneously reducing poverty and vulnerability through (i) the provision of temporary paid employment that supports immediate income security, (ii) the creation or rehabilitation of community assets and public goods in underserved areas, and (iii) the delivery of practical skills training that enhances beneficiaries' future employability and livelihood opportunities (Gehrke & Hartwig, 2018).[1]

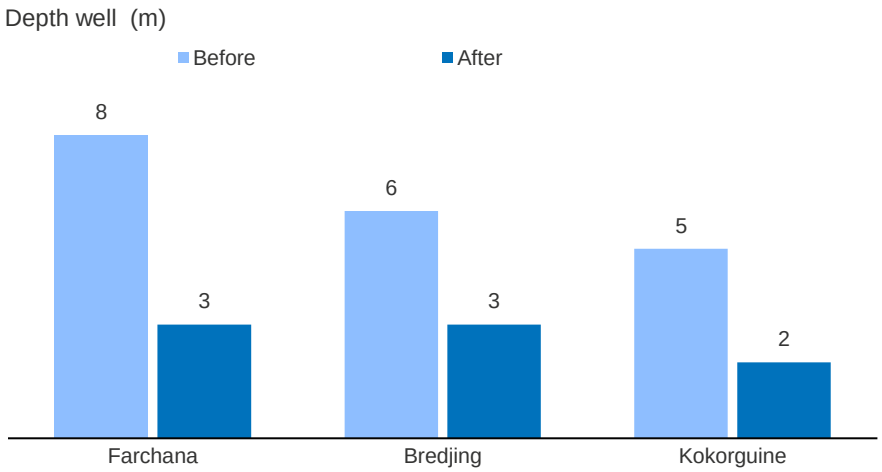
The WSWs ease access to (drinking) water. Focus group discussions among refugees, hosts, and local authorities indicate that greater access to water (including drinking water) has contributed to improved food security and created new income-generating activities.

> *"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."*

[1] Esther Gehrke and Renate Hartwig, "Productive Effects of Public Works Programs: What Do We Know? What Should We Know?," *World Development* 107 (July 2018): 111–24, https://doi.org/10.1016/j.worlddev.2018.02.031.

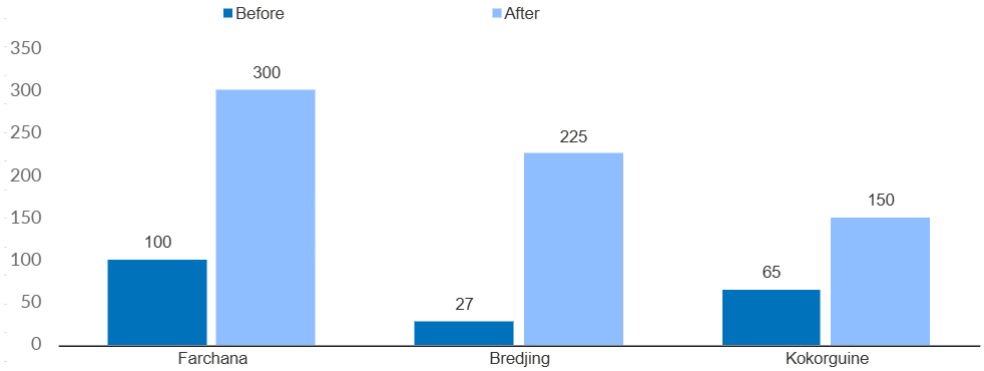
> *"Before, we didn't have access to large gardening plots, and the soil would become too dry after a few months. Water was becoming increasingly scarce. Today, thanks to the WSW, the soil retains moisture for longer, and our wells no longer dry up as quickly."*
>
> "We have seen our land become more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

Figure 4: Depth well (meters)



The WSW help expand the availability of arable land for cultivation. Thanks to the building of the WSWs, agricultural land becomes more available across all places of the intervention.

Figure 5: Increase in arable land (ha) before and after the WSW



Qualitative evidence corroborates the benefits of WSWs for both refugees and hosts. Focus group discussions among refugees, hosts and local authorities indicate how greater access to water (including for drinking) has contributed to better food security and created new income-generating activities.

> *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.*

The use of gardening plots in particular was routinely emphasized by participants. Greater access to water and thus arable land has supporting the cultivation of previously uncommon crops such as tomatoes, carrots and nawet, among others, the surplus of which is able to be sold on the local market.

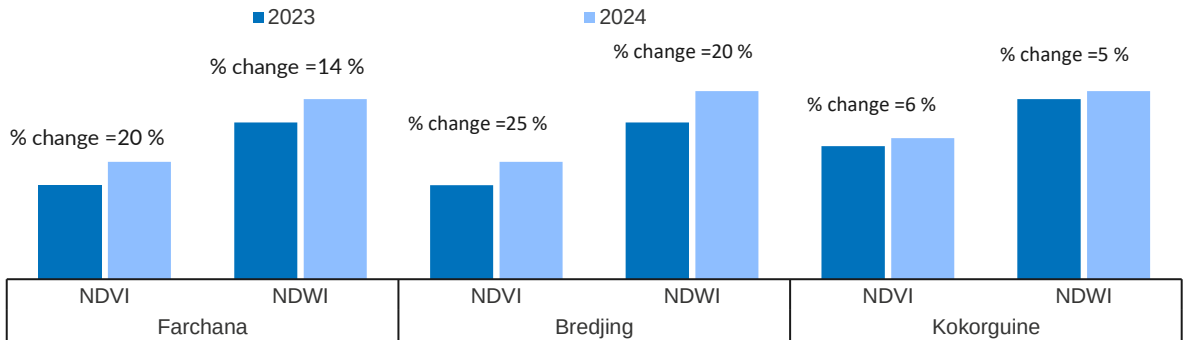
> *Thanks to the HCR and the partner for the marketing gardens that allow us refugee women to produce vegetables and sell them in the markets. We can earn between XOF 40,000 and 80,000 per week. This allows women to take care of their family and buy notebook, pen for their children, send children to the hospital when ill. Before some refugees were working as house help to earn less than XOF 15,000.*

The management of the WSWs are also shown to contribute to better social relations between refugees and hosts. Competition for water and land – intensified by climate change – have historically led to tensions, reduced trust and potential conflict between groups. An inclusive governance approach that promotes equitable sharing of resources and the recognition of vulnerable groups helps to foster collaboration and mutual respect.

> *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*

The environmental benefits of the WSW are clearly demonstrated through innovative analyses using remote sensing and biophysical models. Based on satellite imagery, after only one year, the WSWs begin to generate denser and healthier vegetation, which is expected to only intensify over the medium- to long-term (Figure 6).

Figure 6: Vegetation greenness (NDVI) and moisture content (NDWI)



Cost–Benefit Analysis (CBA) – a systematic approach used to assess whether the long-term benefits of an intervention outweigh its financial, operational, and opportunity costs – is performed to assess the WSW's benefits in the long run. CBA monetizes both the expected gains – such as increased economic productivity, improved soil fertility, and residual asset value – and the required expenditures, including establishment, maintenance, administrative costs, and productive inputs. By comparing total discounted benefits with total discounted costs, CBA helps determine the project's net value, return on investment, and overall economic viability, supporting evidence-based decision-making and resource allocation.

Following previous studies commissioned by GIZ in Ethiopia and Chad,[2] the cost–benefit analysis considers both the economic and environmental benefits generated by the intervention, as well as the financial and operational costs required for its implementation. The expected benefits include: i) the economic gains derived from increased agricultural production; ii) improvements in soil fertility resulting from enhanced nutrient retention; and iii) the residual or long-term value of the physical investment created through the intervention. On the cost side, the analysis accounts for: i) the initial establishment costs of the WSWs; ii) the recurrent expenditures associated with maintaining the WSWs; iii) administrative and coordination costs; an iv) the cost of productive inputs, including seeds, oxen traction, and labor.

To assess the economic viability of the investments, three standard financial indicators were applied: Net Present Value (NPV), Internal Rate of Return (IRR), and the Benefit–Cost Ratio (BCR). NPV measures the present value of expected net benefits after discounting future cash flows, with a positive NPV indicating that benefits exceed costs. IRR represents the discount rate at which the NPV becomes zero, and higher IRR values signal more attractive investments. The BCR compares the present value of total benefits to total costs, with ratios greater than one demonstrating that the investment yields more benefits than it consumes. Together, these indicators provide a robust assessment of financial profitability and investment desirability**.**

[2] Mesfin Tilahun, "Cost-Benefit Analysis of Investments on Water Spreading Wires for Sustainable Land Management in Flood Prone Areas of Afar," 2021; DDC and GIZ, "Analyse Coû T-Be Ne Fice (ACB) Dû Programme de Gestion Des Eaûx de Rûissellement Dans Le Tchad Sahelien," 2015.

The cost–benefit analysis indicates that all three sites are financially profitable, with every dollar invested generating between USD 1.5 and USD 1.9, and Farchana yielding the highest return. Actualized benefits amounted to XOF 683 million in both Farchana and Kokorguine, compared to 61 million XOF in Bredjing, while actualized costs ranged from XOF 395 million in Farchana to XOF 463 million in Kokorguine and XOF 49 million in Bredjing. As a result, the Net Present Value (NPV) was positive across all sites, estimated at XOF 288 million in Farchana, XOF 219 million in Kokorguine, and XOF 12 million in Bredjing. The Internal Rate of Return (IRR) was well above typical reference rates in Farchana (39%) and Kokorguine (41%), but much lower in Bredjing (4%). The actualized benefit–cost ratio confirms profitability in all locations, with the highest ratio in Farchana (1.73), followed by Kokorguine (1.47), and Bredjing (1.25), indicating that while all sites are economically viable, Farchana offers the greatest return relative to costs.

Table 1: Cost-Benefit Analysis

Indicator	Farchana	Kokorguine	Bredjing
Actualized benefits (Millions, XOF)	683	683	61
Actualized costs (Millions, XOF)	-395	-463	-49
Net Present Value (NPV) (Millions, XOF)	288	219	12
Internal Return Rate (IRR)	39%	41%	4%
Ratio Benefit Cost (BCR) actualized	1.73	1.47	1.25
Ratio Benefit cost (BCR) nominal	1.90	1.55	1.63

The results are quite similar to results from studies across different context. Overall, the benefit–cost ratios from our analysis fall within the profitability range reported in previous GIZ studies in Chad and Ethiopia, indicating that WSW investments remain economically attractive and competitive across contexts.

The sensitivity analysis for Farchana demonstrates that the WSW investment remains economically viable even under several adverse and conservative assumptions. Under the base scenario, the intervention generates a strong a high Benefit–Cost Ratio (BCR) of 1.96, confirming strong profitability. When crop yields decrease by 20%, profitability is reduced but remains robust, a BCR of 1.46, which still exceeds the threshold of economic desirability. Even under progressive land-use pressure – which represents a gradual decline in the area available for production – the BCR stays above 1.0 (1.06), indicating the investment continues to generate net gains. Finally, under a drought scenario, which represents one of the most extreme risks for agricultural systems, the investment still shows very favorable a BCR of 1.57.

Table 2: Sensitivity Analysis

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

The way forward, informed by refugees' voices

Refugees emphasized the need to strengthen agricultural production capacity, noting that most activities are still carried out manually. Through the discussions, refugees indicated some ways forward and identified priority, interventions including:

i) **Expanding water management infrastructure in the form of WSWs**

ii) **Facilitating access to inputs, including improved seeds**

iii) **Facilitating agricultural mechanization tools, including motor pumps and tractors.** Refugees noted that channeling these tools and inputs through existing cooperatives and farmers' organizations would ensure equitable access, enhance the use of available infrastructure, and ultimately increase productivity and yields.

> "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."

Call to Action

The preliminary analysis makes clear the need for expanding water management infrastructure in Chad and the benefits of Water Spreading Weirs. Further initiatives could help complement such investments to ensure greater agricultural productivity and enhanced self-reliance of refugees and hosts. These include the provision of improved inputs such as seeds as well as agricultural mechanization tools like motor pumps and tractors, which can be channeled through existing cooperatives and farmers' organizations.

To expand the impact and sustainability of WSWs, we propose a comprehensive approach that combines the comparative advantage of different partners. Bilateral donor such as EU INTPA can be keys in scaling up the WSW. Multilateral donors can provide additional funding, leveraging the existing financial instruments targeting refugee hosting areas (e.g. IDA/WHR). Partnerships with the private sector can explore agribusiness value chains to connect local production with markets and support agricultural cooperatives to expand purchasing power and sustainable practices. In additional, greater advocacy towards the government can encourage the inclusion of agricultural infrastructure in national and local budget allocations as part of climate adaptation and rural development strategies. Finally, partnerships with academia and other knowledge actors can help ensure decisions such as where to prioritize future investments are informed by robust data and evidence. For example, UNHCR partners with Texas A&M University on this front, and additional assessments are envisioned, subject to availability of research grants.[3]

[3] The team is composed of Ibrahima Sarr (Economist, UNHCR), Xavier Beogo (Economist, UNHCR), Yves Amoussougbo, UNHCR), and Raghavan Srinivasan (Texas A&M University), and Yared Bayissa (Texas A&M University). The team received feedback and guidance from Craig Loschmann (Senior Economist), Rebecca Ong (Communication Expert), Jessica Some (Senior Economist), Senior management and field colleagues in Chad.