IWMI
International Water Management Institute

Digital Twin for Resilience Planning

Technical Brief

Digital Twin for resilience planning in the Somali Region of Ethiopia

Digital Twin

- Implementation led by the **International Water Management Institute (IWMI)**
- In partnership with the **World Food Program (WFP)**
- Funded by the **CGIAR Food Frontiers and Security Program** and the **CGIAR Digital Transformation Accelerator**
- With foundational support from the **DIWASA** initiative and **Helmsley Charitable Trust**

Our ambition:

- Stronger climate resilience for over 200,000 refugees and 1.5 million people living in the Somali region of Ethiopia.
- Real-time planning tools deployed across local and humanitarian entities (e.g., WFP, UNHCR, regional government agencies).
- Training for local planners and humanitarian coordinators to use Digital Twin tools for disaster risk reduction, climate adaptation and anticipatory action.

Scaling Up Planning Tools for Resilience

The Dolo Ado district, located in Ethiopia's Somali Region, is home to over 200,000 refugees and host community members living in one of East Africa's most climate-vulnerable and fragile humanitarian zones. The area faces repeated displacement, chronic water scarcity, and escalating climate shocks. In 2023 alone, over 1.5 million people were affected by flood events in the region — the worst on record.

Traditional planning tools are too static to respond to such fast-evolving challenges. This project offers a breakthrough: a dynamic, real-time simulation model of Dolo Ado's water systems, infrastructure and population flows that enables humanitarian and government actors to plan in advance, adapt and respond more effectively and reduce disaster impacts before they escalate.

With the co-design phase complete, the project is ready for deployment in 2025. Donor support is urgently needed to operationalize and scale the Digital Twin, delivering a first-of-its-kind tool in a region where it is needed most.

A Digital Solution for On-the-Ground Impact in Fragile Settings

The Dolo Ado Digital Twin is an interactive, real-time model that simulates the region's water systems, infrastructure networks and demographic dynamics. Users can test future scenarios such as flood risks, drought conditions or settlement growth and see how different decisions will affect resilience on the ground (Figure 1).

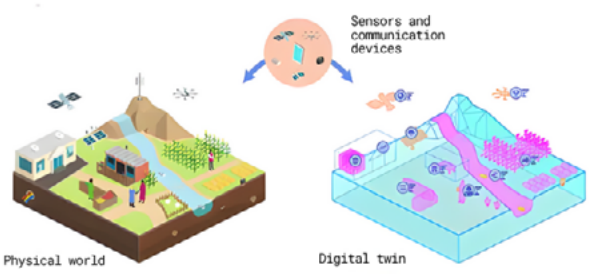

Figure 1. A graphical representation of the Digital Twin.

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DIGITAL TRANSFORMATION

What we have achieved

- Co-design process completed with UNHCR, WFP and Somali Region authorities, defining the primary use case for the Digital Twin.
- Core spatial datasets developed: water points, flood zones, settlements, infrastructure
- Stakeholder engagement workshops conducted to align the tool with local planning cycles
- Prototype 3D topographic model
- Developed to support initial scenario testing

Next steps for scaling impact

- Deploy the Digital Twin across several refugee camps and surrounding host settlements in Dolo Ado, and in other fragile and climate-vulnerable regions
- Train planners, humanitarian coordinators and local officials to use the tool for anticipatory planning
- Model flood depths, evacuation routes and infrastructure vulnerabilities using real-time data and local priorities
- Answer the Global WASH Cluster's call for water-focused digital tools
- Develop a one-stop-shop, operational planning portal for day-to-day use, including the AI chatbot and scenario builder

Flood risks and response gaps in Dolo Ado

The Dolo Ado region in Ethiopia is a humanitarian hotspot, home to over 200,000 refugees across five camps. The area faces chronic water scarcity, high climate variability and overlapping pressures from displacement, land degradation and resource conflict. The region is increasingly affected by both riverine and flash floods — driven by intense rainfall, climate variability and land degradation. Refugee and IDP settlements, often located near rivers with limited infrastructure, are especially exposed.

The data gap:

- Incomplete flood risk maps and low-resolution elevation models,
- Sparse hydro-meteorological station coverage,
- Limited access to real-time weather and flood forecasting systems.

Therefore, agencies lack the tools to:

- Translate rainfall forecasts into specific flood impacts (e.g., depth, duration, coverage),
- Identify evacuation zones or safe infrastructure corridors in real time,
- Coordinate responses based on dynamic data.

Planning for infrastructure and service delivery is reactive and fragmented, often disconnected from real-time data and risk forecasts. Traditional planning approaches are not equipped to keep pace with evolving conditions — especially when decisions must be made quickly, collaboratively and under uncertainty.

What is a Digital Twin?

A Digital Twin is a dynamic, living model that mirrors real-world systems in real time. Unlike static maps or GIS layers, it evolves with changing conditions — allowing users to simulate future scenarios and test planning decisions before taking action. In Dolo Ado, IWMI adapted this technology to fragile, conflict-affected settings. The Digital Twin integrates spatial data layers (flood zones, boreholes, refugee settlements), scenario modeling (droughts, floods, displacement), and community priorities to help planners predict water shortages, identify flood risks, optimize future settlement locations and simulate emergency relocation plans. The Dolo Ado Digital Twin is part of a broader planning platform designed for replication and scalability across humanitarian settings.

1. Images from the survey area are captured by drone

2. The data is developed into a virtual digital twin

3. Planning and risk reduction at scale

- Dashboards and early warning alerts deployed
- Tool rolled out across camps and host areas
- Trained users simulate scenarios and test plans
- Regional integration with disaster protocols begins

1.3D Topographic Model
2.Flood Forecasting & Sensors
3.Early Warning System
4.Scenario Builder & AI Chatbot
5.Damage Assessment Tools

Once scaled up to the regional level, these tools help reduce the spread of misinformation during emergencies, improve food and water security and promote a greater trust in science, local planing and humanitarian coordination. Figure 2 illustrates a representation of a digital twin of a river basin.

Figure 2. Representation of a digital twin of a river basin. **Source:** AI-generated image (prompt by Mariangel Garcia)

Acknowledgments

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CGIAR Food Frontiers and Security Program

The CGIAR Food Frontiers and Security Program focuses on strengthening fragile, urban and island food systems by catalyzing innovative policies, investments and local capacities to improve food and water security, nutrition and climate resilience for the world's most vulnerable communities. https://www.cgiar.org/cgiar-research-porfolio-2025-2030/food-frontiers-and-security/

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