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Promoting solar irrigation with shallow groundwater sources among smallholder farmers in West Africa

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Innovative water solutions for sustainable development

Food · Climate · Growth

Contents

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Introduction

- West Africa is made up of 17 countries covering an area of approximately 7.3 million km^2, about one-fifth of Africa.
- Agriculture, the primary source of livelihood for the population, is still largely rain-fed.
- The region has an irrigation potential of about 9.1 Mha, with 55% of this potential in just three countries: Nigeria, Ghana and Sierra Leone.
- Only 12% of the irrigation potential is currently developed.

Water resources potential in selected WA countries

Country	Renewable GW(billion m^3/year)	Renewable SW (billion m^3/year)	Irrigation Potential* (ha)	Actual irrigated* (ha)	FLI Irrigated (ha)**
Burkina Faso	9.5	8.79	233,500	54,000	36,252
Ghana	26	53.2	360,000	4,550	185,000
Mali	20	110	566,000	371,000	10,000
Nigeria	87	279	768,797	95,289	681,914

*Formal developed command **FLI outside developed command area

Irrigation in WA using shallow ground water

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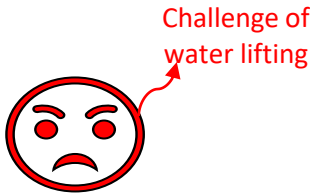
Water sources and lifting technologies



- Shallow groundwater is used for irrigation around the region, especially in Northern Nigeria, Ghana, Mali, and Burkina Faso.
- Manual water lifting and application is the most common method among smallholder farmers, limiting their ability to expand.
- Groundwater is abstracted from dugouts, open wells and tube wells.
- Water lifting devices include manual rope-bucket systems, PVC hand pumps, motorized pumps, hand and foot pumps, wind-powered pumps, and solar-powered pumps.

TAAT-WEC

Motorized pump, tube well and PVC pipe conveyance system in Burkina Faso, Mali and Nigeria,

- Bama, Burkina Faso: Rice yield between 3.7 and 5.6t/ha were recorded.
- Mali: 1.8 – 2.8 t/ha
- Nigeria: Rice 4.3 and 8.4t/ha and wheat yield of between 3.0 and 4.5t/ha were recorded.

AFRICAN DEVELOPMENT BANK GROUP
GROUPE DE LA BANQUE AFRICAINE DE DÉVELOPPEMENT

Technologies for African Agricultural Transformation

Value Chain	Country
Wheat	Ethiopia, Nigeria, Sudan
Rice	Burkina Faso, Mali, Nigeria
Sorghum-Millet	Burkina Faso, Mali, Nigeria
Maize	Tanzania
Orange-Fleshed Sweet Potato	Malawi

https://taat-wec.iwmi.org/

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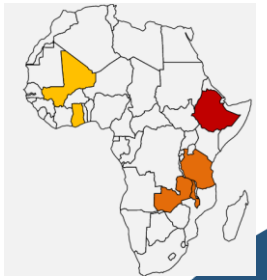
Africa RISING

Improving Water Use and Productivity

- Wetting Front Detector as irrigation-scheduling tool improved irrigation water-use efficiency by 35% and saved irrigation water by 16% in Nyangua and Tekuru communities (Upper East region of Ghana).
- Solar pumping of groundwater for irrigation



Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) (https://africa-rising.net/keydocs/)

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ILSSI

Innovation Lab for Small Scale Irrigation (ILSSI): Ghana

- SSI technologies using shallow ground and surface water sources,
- Water lifting technologies (motorized pumps, and solar pumps), - HTC, Pumptech, Deng
- Appropriate water application methods (overhead drip, furrow), and
- Irrigation scheduling tools

  (Wetting Front Detector)

Minh/IWMI

Maheder Haileselassie/IWMI

https://ilssi.tamu.edu/

https://ilssi.tamu.edu/files/2021/03/FTF-ILSSI_General-Overview_Letter-folded_web_front-to-back.pdf

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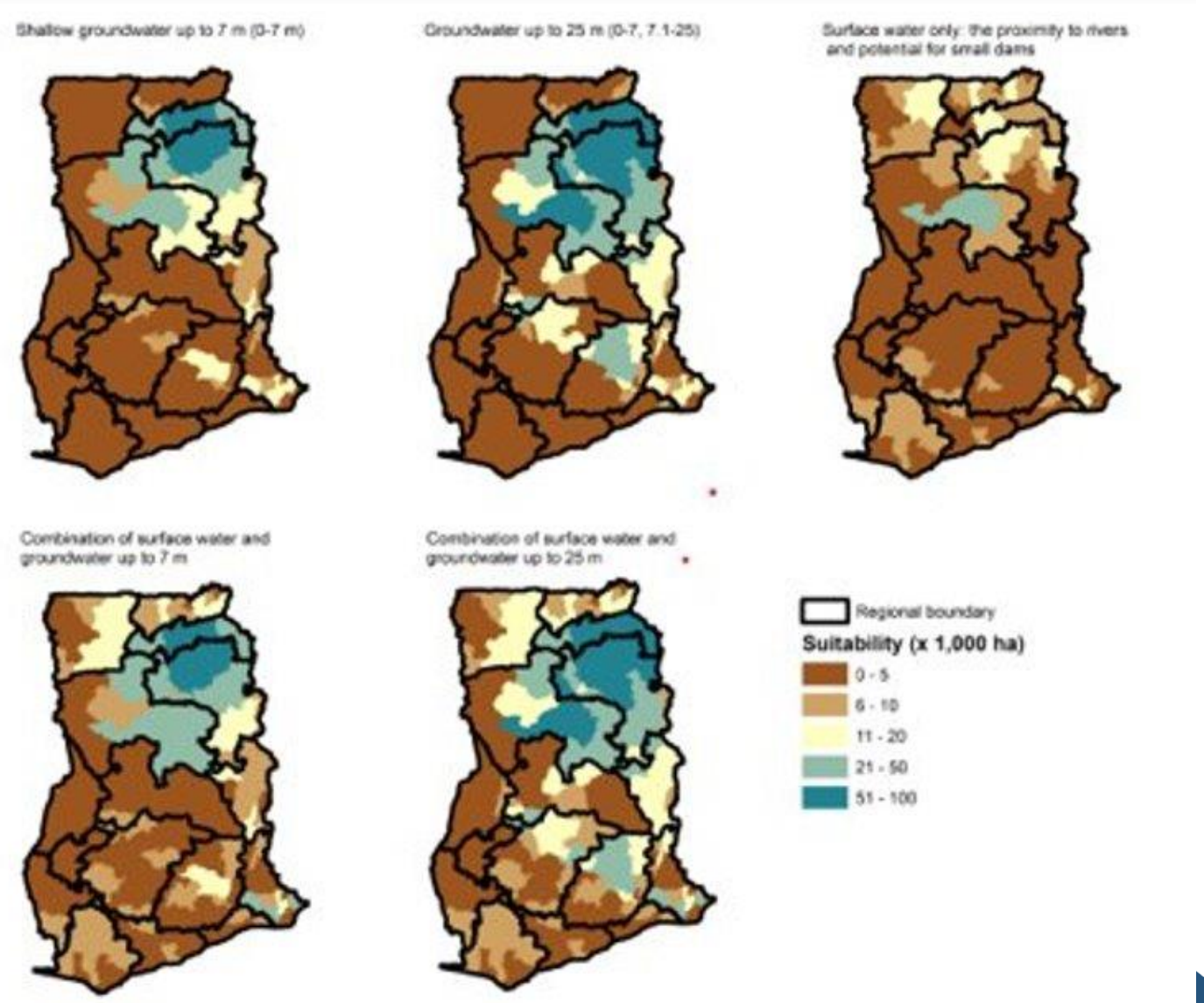
Suitability mapping for solar based irrigation in Ghana

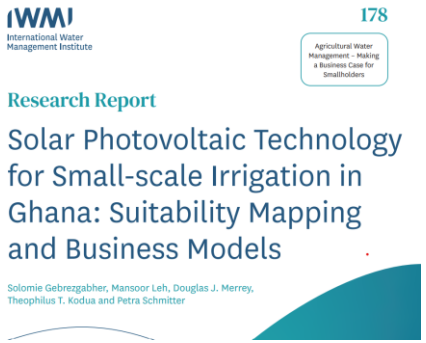
Five categories of data were used:

- ❑ topography and soil suitability;
- ❑ climate;
- ❑ surface water and groundwater resources;
- ❑ land use and protected areas; and
- ❑ road infrastructure and travel time to major towns

Each of these categories show the suitability of irrigation investments in general.

Adding the eight-month period of high sunshine and solar radiation levels (about 4-6 kWh/m2), in the dry season in northern Ghana, the findings support solar irrigation specifically





Promoting irrigation using solar-based irrigation bundles (SBIBs)

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Innovation Lab for Small Scale Irrigation (ILSSI): Ghana

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What are innovations?

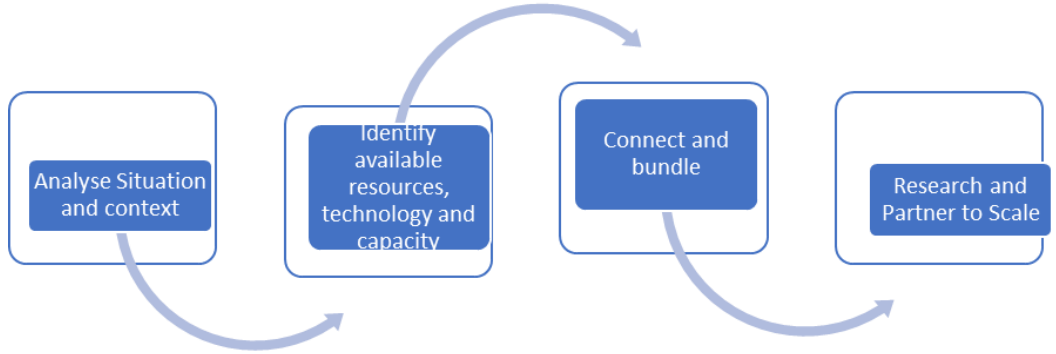
- Innovations to support irrigation may be in the form of a product, service or process.
- An innovation bundle may include a core innovation and complementary solutions and services.
- Core innovations are innovations that are in high demand and can be scaled to be accessible to more farmers.

Why must we bundle?

- A single technological, social or economic innovation may not be applicable everywhere. Bundling provides different combinations suitable for the context and objectives.
- Technological or social innovations are not standalone solutions. They interact with each other and may even catalyze other innovations.
- Bundling innovations with existing products and services helps to de-risk investment for the private sector.
- Bundling unites actors to address challenges and tradeoffs associated with individual innovations.

The bundling process

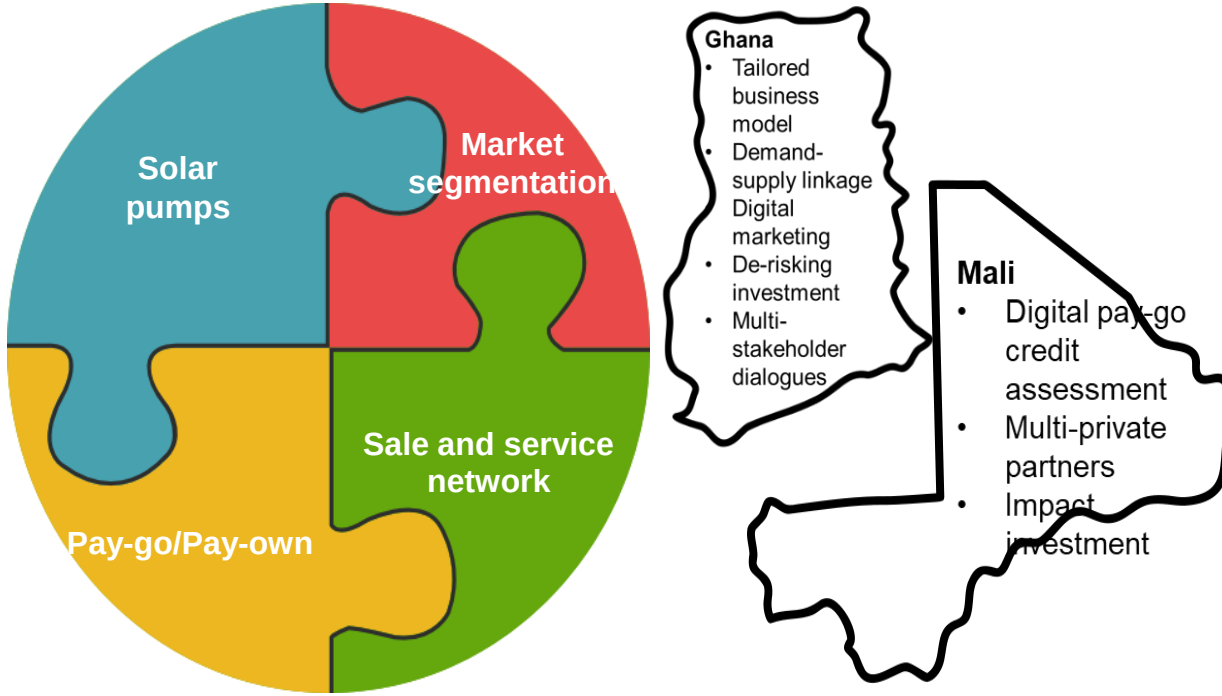
Although the bundling process may occur organically, it may also be actively promoted to achieve intended outcomes.
The innovation bundling process generally follows 5 major steps:
(1) Research available technologies and services
(2) Identify the demands
(3) Identify core innovations
(4) Co-design the bundles and
(5) Grow and fit into a different setting.



Bundling process for solar irrigation scaling

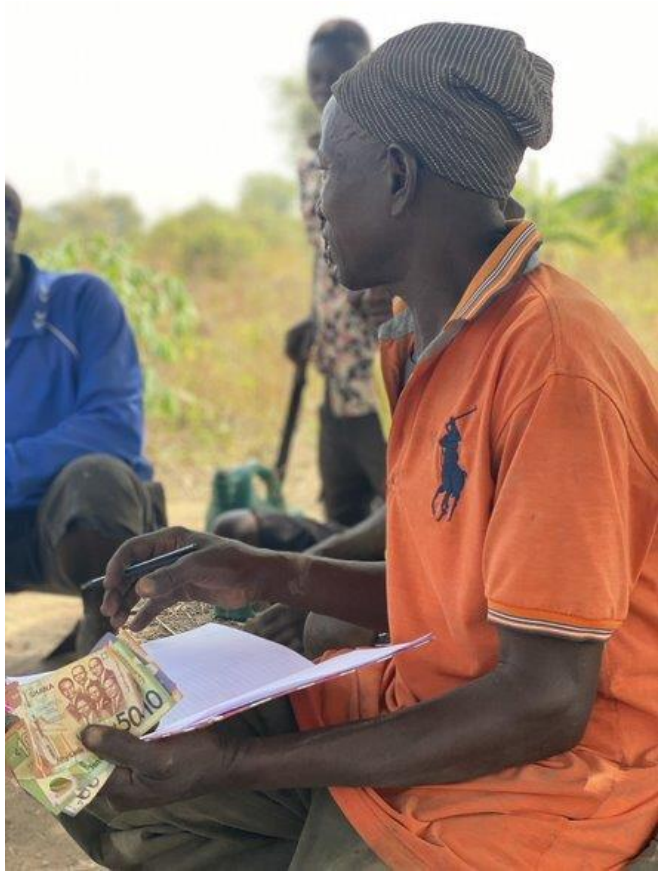
Innovation bundles in West Africa

- Innovation bundles involve core innovations and complementary solutions and services.
- Core innovations are innovations that are in high demand and can be scaled to be accessible to more farmers.
- IWMI in partnership with its partners has piloted and scaled several innovation bundles to promote farmer-led irrigation in the region, especially in Ghana and Mali.



Challenges of investing in innovation bundles

- Limited capitals: natural, human and financial
- Farmer group dynamics
- Value chain dynamics
- Best-fit-packages



Benefits of irrigation to smallholder farmers

Irrigation has increased total output in three ways:

- By augmenting water supply to reduce crop losses through erratic rainfall and moisture stress.
- Permitting multiple and continuous cropping, increasing total output per parcel of land.
- Allows for intensive crop cultivation where water supply is minimal or seasonal.

The way forward

- The irrigation potential in West Africa is high but requires relevant bundles to increase productivity.
- Multistakeholder dialogues offer opportunities to identify relevant bundles, actors and challenges.
- Coordination of interventions from the donors, government and other institutions will support the scaling of SBIBs in the region.
- With the complementary inputs of fertilizers, high yielding crop varieties and good management practices, irrigation will ensure a better crop output which translates to improved livelihood among smallholder farmers in West Africa.

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Thank You

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