5.20: ADAPTIVE HUMAN-CENTRIC APPROACH TO RESILIENT AND SUSTAINABLE WATER MANAGEMENT

What problem is the solution trying to address?

Food production and food security are highly vulnerable to water-related risks, including those associated with access to safe, high quality and sufficient water, and sustainable water (re)use levels. Climate change is compounding these challenges. Hydrological variability and extreme events, such as droughts and floods, are exacerbating already water stressed situations, and making more complex the distribution of resources across competing needs (e.g., agricultural and WASH). Pandemics such as COVID-19 further add to these vulnerabilities , especially as people struggle with water insecurity and unreliable food access. Finally, the use of untreated, partially treated or diluted wastewater occurs downstream of urban areas in four out of five cities in the developing world and is usually driven by farmers' lack of alternative water sources and/or search for nutrients.

Many recent publications from UN and various critical thought leaders have emphasized the need to support farmers to help manage climate risks and build resilience. Building resilience in a changing climate requires us to revisit *how, where and when* we (re)use water for production of healthy foods. Addressing water scarcity requires ways to store more water as we grow our food, find innovative financing to water access and incentivize sustainable use of water within our food system in an equitable and inclusive manner.

It requires us to address issues of physical water and economic water scarcity simultaneously and tackle challenges of too little and too much water use and degrading water quality. The multiple barriers to agricultural water management and multi-purpose self-supply arises from lack of coordination across actors, sectors and scales. The stressors and the risks communities face are diverse and highly contextual – likewise, interventions that intend to build resilience to these conditions need to be tailored to local conditions and needs.

What, in brief, is the solution?

Tackling the aforementioned water related risks within the farmer-led irrigation development sphere would provide opportunities for actors and stakeholders to come together and tackle challenges of both physical and economic water scarcity, resilience, and sustainability within our food system and multi-purpose self-supply – informing action that is intended to be inherently significant to the local context, and tailoring to the individual, communal and societal needs (including marginalized groups and women)

Farmer-led Irrigation development is conceptualized as '…a process in which farmers, individual and/or group, drive the establishment, improvement, and expansion of irrigated agriculture, often in interaction with other actors' (WB, 2018). Unpacking the definition:

Drive the establishment: Farmers invest or capitalize upon technologies in storage (i.e. water harvesting ponds, small reservoirs, underground storage, managed aquifer recharge), accessing (i.e. manual or motorized electric, diesel, solar photovoltaic pumps, river diversion) and using (i.e. drip, sprinkler, furrow) water for different agricultural value chains including animal and aquatic sourced food as well as water-sanitation and hygiene. These are areas where rainfed agriculture advances along the rainfed-irrigation continuum with different modalities of irrigation (i.e. supplementary irrigation, residual moisture cropping, full irrigation)

Drive the improvement: Farmers are found to re-invest into irrigation and agriculture by upgrading irrigation technologies (e.g. agrovoltaics, hydrophonics), agricultural inputs and move from staples to high value crops such as vegetables, fruits. Improvements do include for example climate smart agriculture, regenerative agriculture and increased moisture storage, moving from furrow to drip irrigation, moving to precision application, weather, irrigation and agricultural advisory services, reduce drudgery etc.

Drive the expansion: Farmers tend to diversify their cropping systems, bring more land into irrigation. The commercial logic of FLI development influences also the investment into improved seeds, fertilizers and strengthen reliability of high value crops (vegetables, fruit) all year around strengthening local food and nutrition security even in terms of a pandemic.

Conjunctive and alternative water use: Depending on the available water source, farmer-led irrigation development is found next to rivers, small reservoirs, poorly functioning irrigation schemes, shallow and deep wells but also the use of unconventional water sources (i.e. recycle and re-use) is gaining momentum in water scarce areas

What does farmer-led irrigation entail: Farmer-led irrigation development is a bundle of water centric solutions related to storage, access and (re)use in agricultural production systems translating in bundled solutions tailored to the local context (i.e. natural resources availability, socio-economic, climate) the individual or a small community of smallholder farmers (< 10 ha) are situated. Making the water solutions sustainable and equitable requires policy and institutional solutions coordinated across multiple sectors (agriculture, water, energy, finance/economy) and multiple actors (public, private, research), notably through multi-stakeholder engagement processes to jointly address barriers that occur at different scales whilst enhancing governance, integrated water resource management and food system transformation.

What was/ were the source(s) from which this solution emerged?

Farmer-led irrigation has been gaining momentum over the last decade following funding from Bill and Melinda Gates Foundation called Agwater Solutions (2008-2012), the 2017 Water for Food International Forum event held in Washington DC, Daugherty Water For Food Global Institute (DWFI) and the Farmer-led irrigation flagship event at the 2018 Africa Green Revolution Forum (AGRF) in Kigali Rwanda. Results from IWMI's Agwater Solutions project have informed several new initiatives over the past 8 years (2013- Present) in sub-Saharan Africa such as the Innovation Lab for Small scale irrigation funded by USAID and Studying African farmer-led Irrigation program funded by the Economic and Social Research Council (ESRC) and the Foreign, Commonwealth & Development Office (FCDO). African Union Commission (AU) has identified FLI (pillar 2) and unconventional water use (pillar 4) as two out of the 4 pillars in the Framework for Irrigation Development and Agricultural Water Management (IDAWM). Leading up to the UNFSSS, Bold Actions for Food as a Force for Good, Pre-event in support of the UN Food Systems Summit 2021 held a session titled "Achieving Duality of water savings and food security by transforming value chains"

Since the last 4-5 years FLI has been gaining attention in the international development community, regional economic communities, national governments, and private sector as a game changer to build resilience in Sub-Saharan Africa and Asia. For example, private sector initiatives and investments bring innovations, expertise, resources and new business perspective (e.g. solar powered irrigation, PAYGO services) to farmer-led irrigation (e.g. WE4Fhub) and WASH benefiting different societies and addressing different water challenges. For example, a case study by the Self Employed Women's Organization (SEWA), a trade union of 1.5 million poor women workers with land sizes between 2 to 5 acres have adopted a mixed-grid approach of solar powered energy to address challenges in irrigation and WASH resulting in cost saving for irrigation, increase in cultivated area whilst reducing water wastage, reduction of labor and drudgery and asset creation.

How can this solution address that problem?

As stated in section 2.2, farmer-led irrigation encompasses the establishment, improvement, and expansion of irrigation and therefore water access and (re)use. Hence, FLI development is a process which enables contextualized and demand-driven water access and management. While it is not a single solution or 'silver bullet', the process occurs across nested scales to respond to technical, social, and institutional needs in irrigated production. It needs contextualization, adaptation to local context(s) and collaboration between private, public or communal actors and stakeholders within the irrigated agricultural value chains and the food system more broadly to catalyse investment to overcome water related risks as well investments to enhance sustainable water (re)use in our food system and multi-purpose self-supply. It requires functional input and output markets, enabling policies, upstream and end-user financing in bottom of pyramid market segments and good, inclusive governance. The latter is important to build resilience and to prevent further widening of existing inequalities related to water access, agricultural livelihoods, land, and water tenure. Women and resource-poor farmers are particularly disadvantaged in accessing natural resources (land and water), financial mechanisms, information and exhibit limited integration into markets. Hence, scaling approaches and principles to FLI development within the food system will require addressing gender and social inclusion gaps in technology development and access, financial access, market systems, water-energy-agricultural- climate change policies, institutional and governance structures strongly embedded in a sustainable water resource framework.

Inputs required to unlock the potential of FLI development at scale centres around the following 5 key components:

- *Strong agricultural financing* ecosystem: Strengthening finance access across the agriculture finance ecosystem and ensuring financing options are available for end-users of FLI bundles. This requires addressing gaps in suitable end-user financing for women and vulnerable groups (e.g. bottom of pyramid markets).
- *Appropriate/available best-fit tech:* Bundling of best-fit technologies and services along the storage-access- (re)use continuum tailored to the specific agricultural, animal, and aquatic food chains, integrated within local food systems as well as responses to and resilience from climate change impacts. This requires a gender and socially inclusive approach to technology preferences, information access and control over assets. Developments combined with climate data services supports farmers responding to forecasting, facilitates government response during extreme events to help farmers recover.
- *Multi-stakeholder/actor cooperation:* Strengthening alignment and coordination of public, private, research, and development actors to move together along the scaling continuum, fostering interactive learning and building institutional capacity to facilitate systemic change and inclusive outcomes.
- *Enabling environment:* Guiding legal and policy frameworks to enhance governance of natural resources, economic, social, and natural impact – to promote resilience across the board.

Monitoring and management: 4IR and innovative solutions to understand water consumption behaviour, water (re)use across scales, sectors and users.

Why does this solution align to the definition and criteria for a 'game changing solution' developed by the Summit?

Farmer-led irrigation development has the potential to reduce existing water insecurities and inequalities in the food system and WASH sector. Below we outline a few examples.

Unlocking the potential: With only 6-7% of current agricultural land in SSA under irrigation there is a potential of 27 to 64 million ha irrigation expansion depending on crop types, using available replenishable groundwater resources. A potential expansion in SSA of 24 million ha under motorized pumping. The latter benefitting 185 million people with net revenues up to 22 billion USD per year. Increasing the number of

small reservoirs would meet nearly 400 million people generating net revenues of USD 20 billion. Dry-season smallholder irrigation in SSA could improve rice yields by 70% to 300%. In the Niger basin irrigation potential is estimated at 1% to 5 % of the total crop area (approx. 0.55-0.9 M ha). Recent research shows that the financial attractiveness of solar powered irrigation over diesel will be dependent on crop choice, diesel fuel price, solar PV. For example for maize, under a future diesel fuel price of 2% and solar PV installed cost of USD 2 per kWp, solar irrigation is a more cost-effective option than diesel irrigation on more than 85% of cropland in southern Africa, 65% of cropland in central African and about 40% and 30% cropland in west and east Africa, respectively. The solar pump outlook 2019 estimated the small solar pump market (<1 kW) by 2030 could potentially reach up to 2.8 million household at a value of 1.6 billion USD. For small solar water pumps irrigation of high-value vegetables can achieve a payback period of around two years.

Unlocking storage and smarter use: For example, a recent global study highlight that in areas with high suitability (i.e. biophysical suitability) enhancing groundwater storage (UTFI *Underground transfer of floods for irrigation*) could account for a population of 3.8 billion people and a crop area of 622 million hectares. Aggregation of the country-specific available data reveals that, currently, 380 billion m³ of wastewater are produced annually across the world. In terms of use as a source of irrigation in agriculture, this volume of water (without further dilution) could be used to irrigate a maximum 31 million ha, considering no municipal water is discharged into oceans and no losses occur through evaporation, leakages or infiltration into the soil during storage or transportation, agricultural area is available and suitable for irrigation, two crops are grown per year and the cumulative water requirement of both crops is around 12,000 m³ per ha.

What is the current and/or likely political support for this idea?

Farmer-led irrigation has been incorporated into several agenda's recently:

- African Union Commission (AU) has identified FLI (pillar 2) and unconventional water use (pillar 4) as two out of the 4 pillars in the Framework for Irrigation Development and Agricultural Water Management (IDAWM). AU is currently supporting Member state's internalization
- The World Bank Group (including the International Finance Cooperation have taken up farmer led irrigation in their investment programs in Rwanda, Uganda, Nigeria, Sahel
- Bi-laterial donor support: USAID Feed the Future Innovation Lab on Small Scale Irrigation, Kingdom of the Netherlands Smart Water for Agriculture, Bill and Melinda Gates, Swiss Development, Global Affairs Canada Cooperation, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, African Development Cooperation
- (I)NGO: Mercy Corps (Agrifin), Practica, Overseas Development Institute (ODI), Wetlands International, Caritas
- Private sector investments especially in the field of solar based irrigation, end-user financing modalities and climate smart advisory services have been gaining momentum. This also includes City water and Sanitation Utility Companies
- Global, regional and national multi-stakeholder platforms/dialogues (MSD): Studying African Farmer-led Irrigation, MSD Ghana, MSD Ethiopia, 2030 Water Resources Group, The Global Framework on Water Scarcity in Agriculture (WASAG), Rural Water Supply Network (RWSN), Global Water Partnership (GWP)
- Research community: International Water Management Institute, International Food Policy and Research Institute, Texas AM, Wageningen, University of Manchester, University of Leeds, Daugherty Water for Food Institute at University of Nebraska, Group For Research and Technology Exchanges (GRET)
- International Community on water recycling and re-use: UNU-INWEH, WHO, FAO, UNEP.

Are there certain contexts for which this solution is particularly well suited, or, conversely, contexts for which it is not well-suited at all?

The extent to which farmer-led irrigation scales depends on the availability and reliability of natural resources, energy, the socio-economic environment, labor, input and output markets. FLI is well suited to areas where large scale and infrastructure based projects have relatively high cost and low return on investment. The combination of FLI with water (re) use, is especially highly suited to urban and peri-urban areas where there is opportunity for water re-use and high proximity to market. This will help build resilient cities including adaptation to changing climate, through productive and sustainable use of water bodies and unused urban lands; flood protection; maintenance and increase in biodiversity; retention of prime land through intensification close to markets; urban greening; and protection against heat island effects. But most significantly, it presents the opportunity for improved urban management in combination with developing sustainable agriculture in Africa because of their capacity for recycling water and nutrients.

FLI is less suited in extreme fragile areas with poorly functioning markets as the incentives for investment by farmers and other actors will be too risky for smallholder farmers to invest; development partner support is useful to reduce risks to farmers and input suppliers in these contexts.

What do you think are the key actions required to address this solution?

To unlock the potential would require actors, sectors and investments in FLI, WASH and waste re-use to come together and strengthen policies, investments and markets to address inequalities, accelerate storage, inclusive access, (re) use of water whilst addressing sustainability issues of water and energy in our food system.

Developing policy and legal frameworks to:

- Stimulate cross-sectoral public investment in WASH, FLI and Circular Economy
- Align sectoral policies related to water, agriculture, WASH, energy, climate, gender, and social inclusion where relevant
- Incentivize low carbon and water use (e.g. tax/importation, water, or carbon credits) whilst stimulating water access for the most vulnerable in food systems

Investments and economic leverage:

- *Bundling of best-fit technologies and services which support multiple SDGs* along the storage- access-(re)use continuum requires a systemic, gender and social inclusive approach to ensure its contextual relevance to meet water, climate, agriculture, WASH
- *Aligning and coordinating* of public, private, research, and development actors *across the sectors* to come and move together along the scaling continuum, fostering interactive learning, break down sectoral investments and approaches and building institutional capacity to facilitate systemic change

Fill knowledge gaps through research and pilots

- *Strengthening financing ecosystems for win-win solutions:* This requires the irrigation, agriculture, climate, WASH sector to assess gaps and perverse incentives in the current financing environment both for upstream (private sector investment) and end-user financing. It requires tailored financing to facilitate investments which benefits multiple sectors. An opportunity here is understanding gender gaps in access to, management of and benefits from financing modalities.

Fill data gaps to enhance inclusive governance and monitoring of investment and use: Strengthen data gaps related to public and private sector investment in water solutions, use and management. These can include block chain technologies, 4IR, remote sensing, water accounting. Stimulate open-source data platforms where actors, users and stakeholders can share water information to enhance governance and decision making, reporting on the SDGs, GAP certification and other national and internationally relevant standards across relevant sectors.