



afrialliance socialinnovation

Monitoring of water availability in terms of quality and quantity for food security

DESCRIPTION

■ Sustainable development in Africa is reliant on increasing the viable use of water resources without significantly degrading ecosystem services, which are fundamental to human well-being. This is particularly challenging in Africa due to the high spatial and temporal variability of available water resources [a].



■ As stated by the IPCC in 2014 [b] “Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen”. Studies have predicted that the average world global temperature may

increase by 1.4 – 5.8°C and there would be substantial reduction in fresh water resources by the end of the 21st century [c].

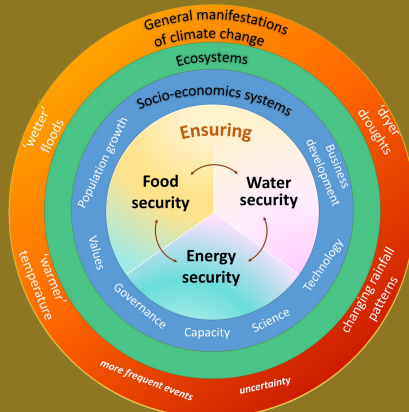
■ Due to these impacts of climate change, water availability and food security are becoming key challenges as both are highly vulnerable to continuously changing climatic patterns. And agriculture yield will likely be severely affected over the next hundred years due to unprecedented rates of changes in climate system [a]

■ The NEPAD report [d] shows that one in four undernourished people in the world live in Africa: Africa is the only continent where the absolute number of undernourished people has increased over the last 30 years. Food insecurity remains an essentially rural phenomenon and permanent economic access to food has become the decisive factor in food insecurity..

■ In this context, where climate change impacts, water availability and food security are closely linked, monitoring water availability to ensure the production is at stake to tackle economic, human, environment and political challenges.

SOCIETAL CHALLENGES IN AFRICA DUE TO CLIMATE CHANGE

- Given the manifestations of Climate Change and the constraints of ecosystems as well as socio-economic systems, the societal challenges in Africa are to:
 - ensure food security, water security and energy security and the balance among them (short term),
 - transform into a low carbon, resilient and sustainable society (long term).



Social Innovation Factsheet

#1.2

MONITORING

■ The overall objective of the AfriAlliance Social Innovation Factsheets (SIF) is to highlight innovation opportunities that scientists, NGOs, managers and SMEs can act upon, in order to foster short-term improvements in the preparedness of African stakeholders for water and climate change challenges.

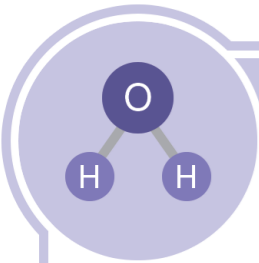
■ Over the duration of AfriAlliance (2016-2021), four sets of SIFs will be delivered. Each set will cover one main theme and explore it across five Social Innovation Factsheets. Monitoring is the main theme of this first series of SIFs, covering the following five sub-themes:

- 1 Monitoring « drinking water » quality for improved health in Africa.
- 2 Monitoring of water availability in terms of quality and quantity for food security (this SIF).
- 3 Monitoring climate for early warning systems to prepare for extreme weather events.
- 4 Monitoring groundwater quantity to ensure sustainable use of this resource and avoid conflicts.
- 5 Monitoring water pollution by industries and urban areas to protect human health and ecosystems.

■ As detailed below, social innovation combines four dimensions: technological, governance, capacity development and business road map. Each is described in a specific section of this thematic Social Innovation Factsheet.

SOCIAL INNOVATION

- In AfriAlliance, social innovation means tackling societal, water-related challenges arising from Climate Change by combining the technological & non-technological dimensions of innovation.
- Social innovation refers to those processes and outcomes focussed on addressing societal goals, unsatisfied collective needs or societal – as opposed to mere economic – returns. It is particularly salient in the context of the complex and cross-cutting challenges that need to be addressed in the field of water and Climate Change – and which will not be met by relying on market signals alone.
- Social innovation consists of new combinations (or hybrids of existing and new) products, processes and services. In order to succeed, social innovation needs to pay attention to technological as well as non-technological dimensions : **1) technology, 2) capacity development, 3) governance structures and 4) business road map**. As such, these four dimensions of the social innovation process cut across organisational, sectoral and disciplinary boundaries and imply new patterns of stakeholder involvement and learning.
- The success of social innovation is reliant on the accountability of diverse stakeholders and across all government levels.



TECHNOLOGICAL SOLUTIONS

Irrigation is a key component of food crop development in Africa closely linked to the agriculture sector and food security.

Ensuring sufficient water both in quantity and quality, as a vital good for the population and as an input all along the food production chain (from crop production to food preparation and processing), has become a major challenge in African [e].

In the specific phase of agriculture, despite available water resources, only a very small proportion of land is irrigated. This means that yields are mainly determined by climatic conditions. This uncertainty influences the strategies adopted by farmers [d]. Solutions are needed in terms of technical capacity, institutional arrangements and market linkages [c] to tackle water related food security challenges in the context of climate change:

■ **Develop water resources within the sustainable limits of the catchment/aquifer* and water availability.** Providing accurate rainfall data has become of major importance in the context of climate change impacts to help decide, for example, when to seed crops. Satellite data are increasingly used to provide this type of information. Tamsat [f] enhances the capacity of African meteorological agencies and other organizations by providing and supporting the use of satellite-based rainfall estimates and related data products.

■ **Plan water and nutrients to enable high crop yields.** Irrigation management solutions are provided by management systems designed to provide growers with simple, science-based irrigation recommendations to enable faster, better-informed irrigation management decisions (e.g. Fieldnet Advisor [g]).

■ **Farmers participating in water management to ensure governance arrangements** that ensure efficient and equitable distribution of water.

Software programs such as SAPWAT 4 [h] can estimate irrigation water requirements of crops, farms and drainage or administrative regions for planning purposes. These types of solutions are lower cost solutions compared to inter-basin transfer or desalinating seawater. They can also help to the discrepancy in water distribution to various segments of population.



■ See QR code on page 4 to access details on the mentioned technologies or click here : <http://afrialliance.org/SF1.2DEF.pdf>

* monitoring related to groundwater is treated in SIF1.4; monitoring of drinking water is treated in SIF 1.1

SOCIAL INNOVATION



CAPACITY DEVELOPMENT

Capacity Development (CD) is conceived as the inherent responsibility of people, organisations and societies themselves in which support by external parties can play an important role [k].

■ Stakeholders across different levels of the agricultural sector (e.g. policy makers, small and large scale farmers, etc.) need to understand how adopting holistic approaches to water management, such as IWRM, can support food

production goals while making the sector more resilient to climate change. This includes increasing awareness of the impacts of climate change and the influence that food production has on water quality and quantity, and on aquatic ecosystems. For example, buffer zones and wetlands play an important role in protecting water resources and reducing flood risk.

■ **Training smallholder farmers in water monitoring and on how to use monitoring data to plan water use** for irrigation empowers them to participate in water management and in the allocation and understanding of the trade-offs that increasing food production may involve [m]. Such support can be provided through training materials for extension advisors (new corps of extension officers who will respond effectively to the needs of smallholder farmers and contribute to their successful integration into the food value chain) in irrigation water management [m]. The training material consisting of nine parts is aimed to help build the necessary skills and competencies required of irrigation extensionists to assist irrigation farmers in the learning process they need to undergo regarding irrigation management.

■ **In areas where flood irrigation is used, farmers also need training on other irrigation techniques** that require less water. To reduce water pollution from non-point sources, farmers also require training on the proper use of chemical fertilizers, herbicides and pesticides and on alternatives to reduce their use.



Source: [l]



GOVERNANCE STRUCTURES

“Governance is essentially the processes and institutions through which decisions are made » [i].

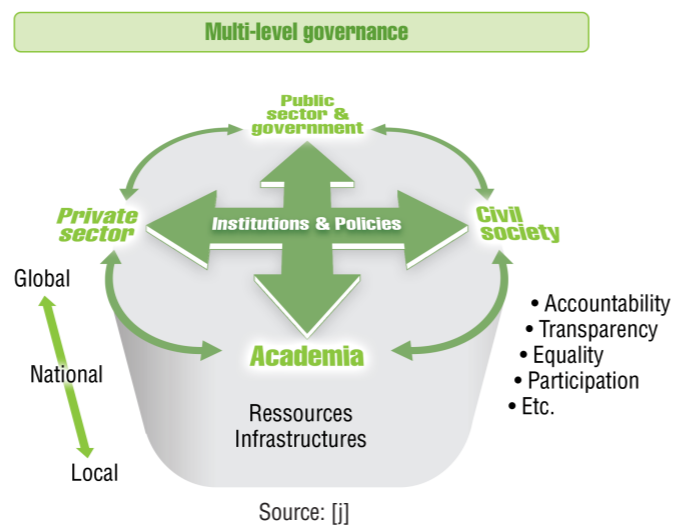
■ **Strong institutions and greater stakeholder involvement are required to improve and ensure sustainable and efficient water use for food production.** This requires monitoring water quantity and quantity to inform water users and authorities about the water that is available for irrigation from reservoirs, rivers or lakes, groundwater or rainfall. Monitoring data are needed to inform about water consumption for agriculture and the impacts that aquaculture and agricultural practices, fertilizers, pesticides and agricultural waste have on water quality.

In developing countries, food production is typically the most water-demanding sector. As water becomes scarcer in some regions due to Climate Change, there is greater competition between agriculture and other water users. Agricultural authorities, farmer associations and other food producers need to agree on goals to reduce water pollution from agriculture, to increase water productivity and to reduce problems with salinity and waterlogging.

Poor coordination among water, energy and agricultural policies at country level and at transboundary basin level may reduce the amount of water for agriculture downstream. This may lead to conflict, especially in transboundary basins, where there are no agreements between countries to manage the shared basin.

■ **Water budgets for river basins need to be developed together with the participation of all stakeholder groups.** Data on water availability from different sources, and on current and expected water demand, is required to

create a baseline to inform authorities and stakeholders so they can negotiate how the various needs can be satisfied. Joint monitoring programs, involving users at various levels, could help develop trust in the implementation of water management plans and evaluate their effectiveness.

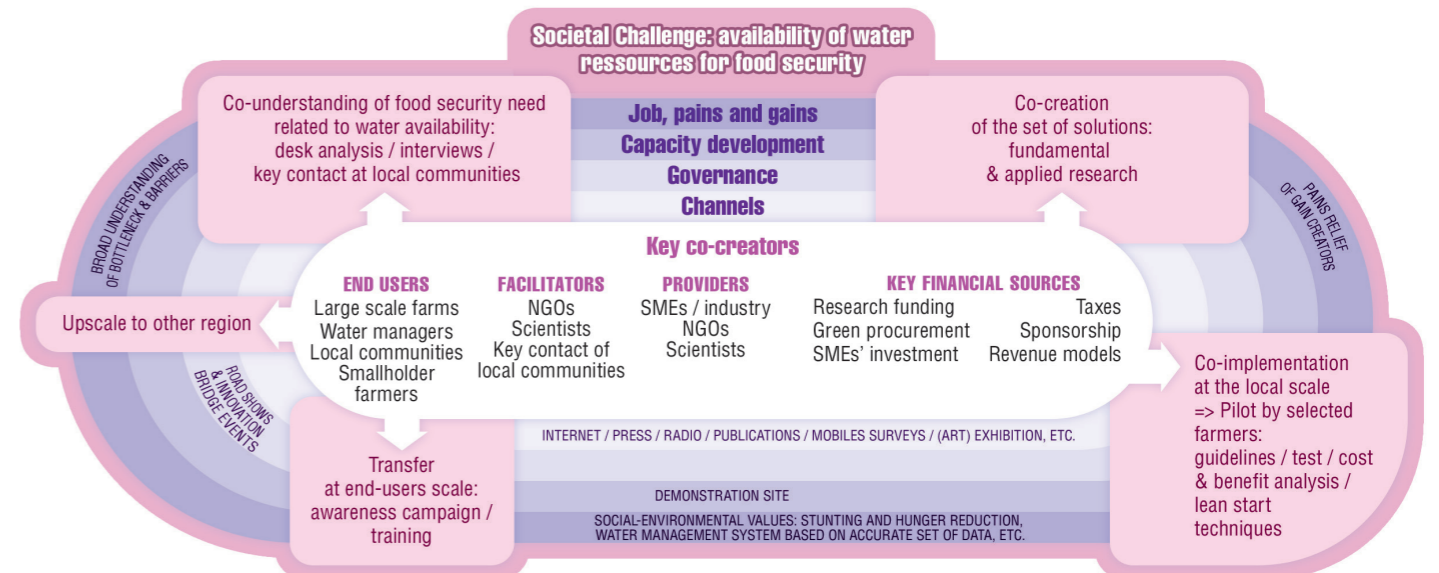


BUSINESS ROAD MAP

Social innovation relies on means other than market mechanisms in order to link the demand and supply sides.

■ Stakeholders from both sides (solution providers and potential users) need to interact during the different stages of the innovation process to create a common ground for the co-production of the required knowledge: from the comprehension of the need to the design, implementation and use of innovative solutions.

■ The scheme highlights the key business opportunities that exist at the different stages, indicating key activities and their socio-environmental values for co-creators.



References

■ DESCRIPTION

[a] Misra, A.K. (2014), Climate change and challenges of water and food security, International Journal of Sustainable Built Environment, June, 3 (1), pp 153-165

[b] IPCC (2014), Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

[c] Thornton P.K., Jones P.G., Ericksen P.J., Challinor A.J. (2011) Agriculture and food systems in sub-Saharan Africa in a 4 °C+ world. *Philos. Trans. R. Soc. A: Math. Phys. Eng. Sci.*, 369 (1934), pp. 117-136

[d] NEPAD (2014), Agriculture in Africa, transformation and outlook, <http://www.un.org/en/africa/osaa/pdf/pubs/2013africanagriculture.pdf>

■ TECHNICAL SOLUTIONS

[e] FAO (2015), Water for food security and nutrition, HLPE reports series #9.

[f] Tamsat, <https://www.tamsat.org.uk/about>.

[g] Fieldnet Advisor, <http://www.myfieldnet.com/fieldnet-advisor%E2%84%A2>

[h] SAPWAT4, <http://www.wrc.org.za/Knowledge%20Hub%20Documents/Conference%20Proceedings/van%20Heerden.pdf>

■ GOVERNANCE STRUCTURE

[g] Lautze J., de Silva S., Giordano M., Sanford L. (2011), Putting the cart before the horse: Water governance and IWRM, *Natural Resources Forum*, 35, 1-8.

[j] Wehn U. (2017) Digital transformations and the governance of human societies, presentation at EC Joint Research Centre, ISPRA, Italy, 7 April.

■ CAPACITY DEVELOPMENT

[k] Vallejo B. and Wehn U. (2016) Capacity Development Evaluation: The Challenge of the Results Agenda and Measuring Return on Investment in Capacity Development in the Global South, *World Development*, Vol. 79, pp.1-13, doi:10.1016/j.worlddev.2015.10.044.

[l] Wehn U. (2015) The Global Content: National Capacity Development Strategies, Tailor Made Training for contact points of Uganda's National Water and Environment Capacity Development Strategy, in collaboration with the Ministry for Water and Environment (Uganda), Kampala, Uganda, 10-11 November.

[m] FAO [2013], Investing in smallholder agriculture for food security, HLPE reports series #6, www.fao.org/cfs/cfs-hlpe

[n] Stevens J.B., van Heerden, P.S., Buys, B., Laker M.C. (2012), Training material for extension advisors, in irrigation water management, Volume 1: Main Report, Water Research Commission, Department of Agriculture, Forestry and Fisheries, October, 155p.

■ LIST OF ACRONYMS

- CD: Capacity development.
- FAO: Food and Agriculture Organization.
- SIF: Social Innovation Factsheet.
- IPCC: Intergovernmental Panel on Climate Change
- IWRM: Integrated Water Resource Management

■ MORE INFORMATION



AfriAlliance

■ AfriAlliance is a five year project funded by the European Union's Horizon 2020 research and innovation programme. AfriAlliance facilitates the collaboration of African and European stakeholders in the areas of water and climate innovation, research, policy and capacity development by supporting knowledge sharing and technology transfer.



■ Rather than creating new networks, the 16 European and African partners in this project consolidate existing ones. The ultimate objective is to strengthen African preparedness for future climate change challenges. AfriAlliance is led by the IHE Delft Institute for Water Education (Project Director: Dr. Uta Wehn) and runs from 2016 to 2021.

■ Website : <http://afrialliance.org/>

AfriAlliance activities

■ Africa-EU cooperation is taken to a practical level by identifying (non-) technological innovation and solutions for local needs and challenges. AfriAlliance also identifies constraints and develops strategic advice for improving collaboration within Africa and between Africa and the EU.

■ To help improve water and climate Monitoring & Forecasting in Africa, AfriAlliance is developing a triple sensor approach, whereby water and climate data from three independent sources are geo-spatially collocated: space-based (satellites), in-situ hydro-meteorological station observation networks and data collected by citizens.

■ Sharing of knowledge is facilitated through a series of events and through an innovative online platform. Demand-driven AfriAlliance 'Action Groups' bring together African and European peers with relevant knowledge and expertise to work jointly towards solutions.

Realisation

■ Authors: Natacha Amorsi, Sonia Siauue (Office International de l'Eau), Uta Wehn, Angeles Mendoza-Sammet (IHE Delft).

■ Contributors: Andrea Rubini (WssTP), David Smith (WE&B), Mamohlodging Tihagale (WRC).

■ Graphic Design: Gilles Papon (Office International de l'Eau).