afrialliance socialinnovation

Monitoring groundwater quantity to ensure its sustainable use and to avoid water conflicts

Social Innovation Factsheet #1.4

MONITORING

DESCRIPTION

Groundwater is a resource to be protected due to its high but fragile resilience to climate change, as it responds much more slowly to meteorological conditions than surface water and, as such, provides a natural buffer against climate variability, including drought [a]. On the institutional side, GRAPHIC initiative [b] highlighted the need for more explicit discussion regarding groundwater since strategic management for climate resilient groundwater resources is the foundation for long-term adaptation and mitigation plans for development and poverty reduction.

Groundwater is an important resource in Africa that is unevenly distributed. In 2012, scientists [c] estimated that African groundwater reserves are about 0,66 million km^3. Not all of this groundwater storage is available for abstraction, but the estimated volume is more than 100 times that of the annual renewable surface water resources in Africa.

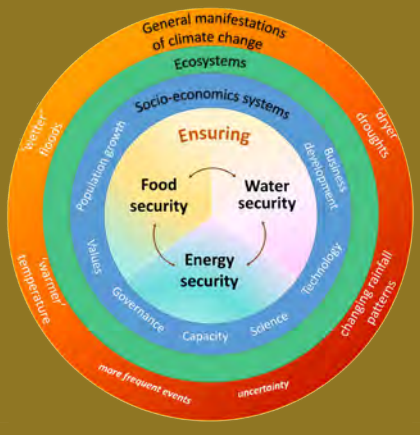
Since the early 19th century, many countries in Europe and in Africa have developed water management system mainly focusing on surface water. Progressively, the key role of groundwater as a support for different water uses in the context of climate change has been taken into acount. For example, in times of serious drought boreholes are generally drilled. As scientists predict climate with hotter and drier weather and more intense but less frequent rainfall events and considering how important groundwater is to reduce poverty and support economic growth notably in rural area, plans for integrated sustainable management of water resources (surface and groundwater) are necessary. These plans need data on the availability of the resource and on the recharge capacity of aquifers through monitoring schemes at national, regional and local levels.

SOCIETAL CHALLENGES IN AFRICA DUE TO CLIMAT 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).



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.
3. Monitoring climate for early warning systems to prepare for extreme weather events.
4. Monitoring groundwater quantity to ensure sustainable use and avoid water conflicts (this SIF).
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

Monitoring the groundwater quantity to ensure its sustainable use and to avoid conflicts requires an understanding of the geological types of water tables, the relation between groundwater and surface regimes and to have access to data on water availability.

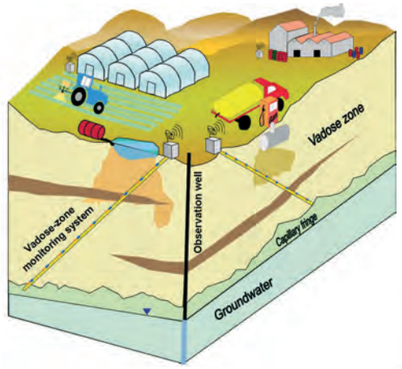
Groundwater as opposed to surface water is not visible but plays a very important role in the overall availability of water. Understanding the level of aquifers, their fluctuation over seasons and extreme events requires technical solutions for their permanent monitoring.

The understanding of the vadose zone (the area between the land surface and the water table) helps to picture how groundwater is interlinked with surface water. Some interesting protocols have been developed for South Africa on the vadose zone assessment on spatial and temporal influences for aquifer susceptibility [d]. These protocols help to locate potential sources of contamination and support the mitigation and rehabilitation of contamination, through improved understanding of the spatial (or lateral), vertical (or horizon-based) and temporal (or time-dependent) influences on vadose zone seepage.

Other challenges to ensure long-term groundwater management are first to gather data and, second, to ensure that the data are stored and comparable over time. Different tools and software's are available to monitor the level of aquifers in a combined way with water surface surveillance.

For example EPOCH Environmental Compliance and Task Management Software [e] is a software that documents data on monitoring wells, stores sampling results to record water quality, and calculates statistical data for both up-gradient and down-gradient wells. It also provides early detection of problems by instantly analysing if the results are statistically different from the background, valuable statistical information, and constitutes a central repository for all groundwater monitoring data. It can be adapted to receive data by modem from labs or remote sites for direct input into the database.

Similar equipment and probes focus on surface and groundwater level and quality solutions such as ELARD [f]. They can be used for profiling, sampling, permanent data logging, and can be installed together with stand-alone communication and telemetry equipment to permit remote control and data transmission as well as a network of monitoring stations. This application includes functionalities surface and groundwater level and quality monitoring; water conservation management; agriculture and irrigation.



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 [j].

Capacity development is required to ensure the successful implementation of social innovation. CD aimed at improving groundwater monitoring to ensure sustainable use of this resource and to avoid conflict needs to cover a range of aspects.

Source: [k]

Technical capacity is needed to adapt to and successfully implement (new) technologies. This can be achieved by means of training, the creation and implementation of knowledge management systems and networks, and data storage and sharing mechanisms to generate climate and hydrogeological data, monitor groundwater and increase the knowledge base on groundwater dynamics, quality and quantity, which is needed to support policy and decision-making.

Institutional capacity development involves helping institutions from local to international and transboundary levels to create and effectively implement formal and informal mechanisms to collaborate and share groundwater data and information to support policy and management decisions on the use and distribution of groundwater. This needs to be based on equitable rights and allocation regimes to help prevent conflicts among users, with a focus on shared use and management.

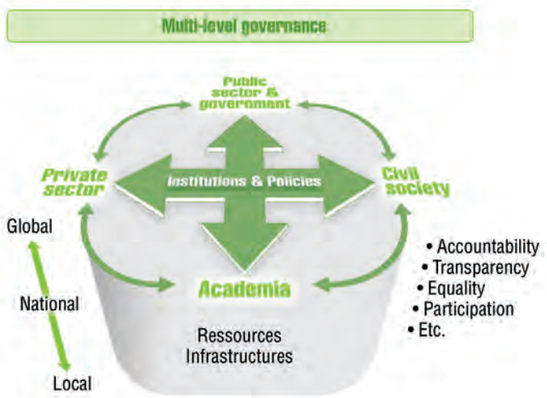
Strengthening the capacity of water users involves the dissemination of knowledge on how human activities influence groundwater quality and quantity, and how individuals and organizations can contribute to the sustainable use of groundwater. This also involves training of farmers and other water users on the collection and use of data and on technologies to use groundwater more efficiently. For example, farmers may be trained on alternative crops and water-efficient irrigation practices to reduce the withdrawal of groundwater, and on the use of alternative chemical fertilizers or pesticides to reduce groundwater pollution.

SOCIAL INNOVATION

GOVERNANCE STRUCTURES

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

The use of groundwater is part of the strategies to adapt to climate change, however, it may also be affected by shifts in weather patterns, decreasing aquifer recharge. Strong governance ensures that groundwater is used to satisfy human needs and to sustain the benefits that ecosystems and biodiversity provide for human well-being.



Source: [h]

Groundwater governance is reflected in effective institutions that collaborate across sectors, through the engagement of stakeholders (e.g. women, indigenous people, communities, NGOs, and the private sector) in sharing knowledge and best practices and in shaping and implementing integrated policy and regulation to manage groundwater use and protect recharge areas. Formal and informal governance structures are needed to reach out to actors involved in various activities, such as agriculture, forestry, mining, energy development, urban development, sanitation, and disposal of solid waste and wastewater, to design strategies to minimize the impacts of human activities on groundwater quality and quantity. In addition at the transboundary level, groundwater resources management suffers from a lack of advanced UN conventions.

Groundwater governance extends beyond borders and relies on water diplomacy and other resources to replace conflict with cooperation to use shared aquifers sustainably for the benefit of all parties. It is highly reliant on the development of trust to support networks and share knowledge, resources, and technology to better understand groundwater dynamics and how groundwater is influenced by changes in land cover and by climate change.

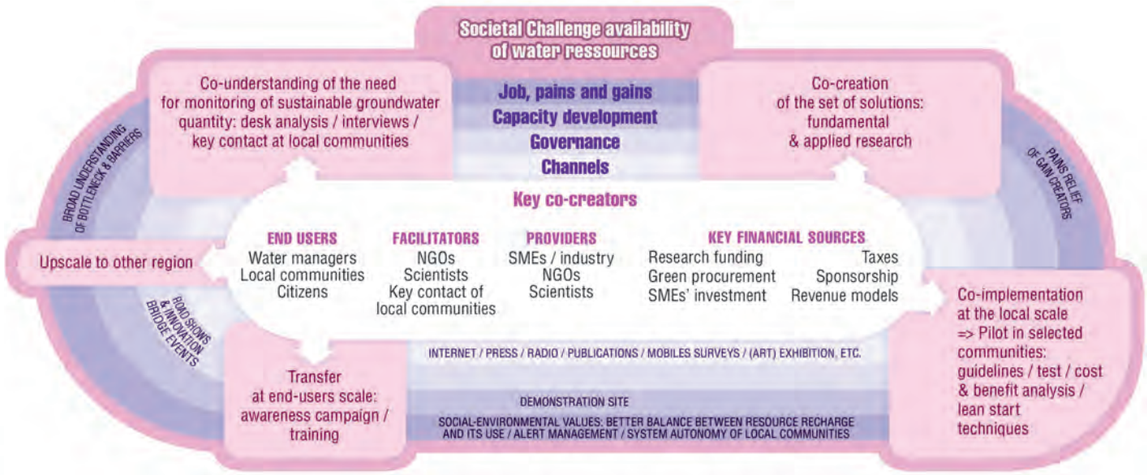
Good groundwater governance relies on increased awareness, from individuals to organizations, of how human actions, large or small, make a difference in improving or deteriorating groundwater in the short and long-term, and creates an enabling environment for joint action for the common good. A framework for action for groundwater governance has been set in South Africa [i].

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.



Further reading

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DESCRIPTION

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[c] MacDonald A.M., Bonsor H.C., Dochartaigh BÉÓ., Taylor R.G. (2012), Quantitative maps of groundwater resources in Africa, IOP science, Environmental Research Letters, http://iopscience.iop.org/article/10.1088/1748-9326/7/2/024009/pdf

TECHNICAL SOLUTIONS

[d] http://www.wrc.org.za

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GOVERNANCE STRUCTURE

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CAPACITY DEVELOPMENT

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LIST OF ACRONYMS

- CD: Capacity development.
- ELARD: Earth Link an Advanced . Resources Development.
- GRAPHIC: Groundwater Resources assessment under the pressures of Humanity and Climate Change.
- IHP: International. Hydrological Programme
- SIF: Social Innovation. Factsheet.
- UNESCO: United Nations Educational, Scientific, and Cultural Organisation.

Presentation of

About 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 developping 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

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