



afrialliance socialinnovation

Monitoring water pollution from industries and urban areas to protect human health and ecosystems

DESCRIPTION

■ On one hand, the extent of the water and sanitation challenges vary across the African continent depending on the levels of urbanisation, industrial activities and the effectiveness of waste management law and regulation [a]. As an example of human pressure, between 2005 and 2010, Africa's urban population grew at a rate of 3.4 per cent mostly in peri-urban slum neighbourhoods [b].



Supplying safe drinking water and ensuring environmental hygiene has become a major challenge that could, for example, reduce morbidity from diarrhoea related diseases by 40 per cent in Africa. The burden of disease is also likely to increase as health-promoting ecosystem services are lost [c].

■ On the other hand, economic development is a political priority to improve the well-being of the population. One side effect is the growth of industrial activities, in a context where very few regulations are in place to keep these industries from dumping wastewater and toxic chemicals into existing water supplies.

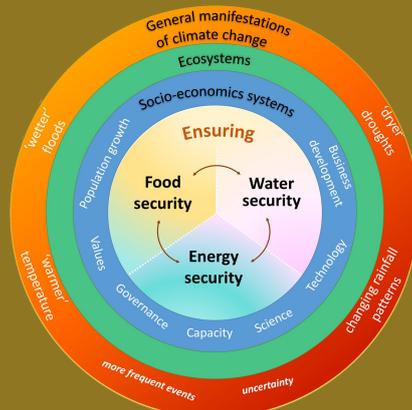
■ As a result of industrial and urban development, water pollution (including solid waste) is growing due to the indiscriminate dumping of effluents (e.g. chlorides, phosphates, oil and grease, heavy metals, etc.) that reaches water bodies. The type (e.g. chemical, biological) and the concentration of pollution become key information for integrated water management.

■ In the face of non-point source of pollution, monitoring industrial and urban emissions is necessary to identify and characterise the different sources and flows of pollutants. This would also provide opportunities for industries to adopt cleaner technologies, processes and practices as well as for water regulation and policy to set prevention, depollution and mitigation measures for water pollution.

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

#1.5

▶ 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.
- 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.
- 5 Monitoring water pollution by industries and urban areas to protect human health and ecosystems (this SIF).

■ 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

In urban and industrialised areas, water pollution is essentially chemical (nitrates, phosphorus, heavy metals, and hydrocarbons) and biological (bacteria such as faecal coliform bacteria and viruses).

Technical solutions are required to measure the different types of pollutants. From their emission to their transport (runoff, wastewater distribution network) and discharge into the aquatic environment, the pollutants are polymorphic and can reach different levels of quantity. At each stage, it is important to use a dedicated solution to carry out the monitoring.

Concerning emissions from human activities, the example of mining is especially important in Southern Africa. A scientific study was carried out in 2012 by WRC [d] to compare different sensors that measure metals in environmental samples.

When focusing on the transport of pollutants, as wastewaters are mainly collected by wastewater treatment plants, monitoring pollution could be done using smart sensors like Optiqua EventLab 2.0 [e]. This sensor is already operational (TRL 9) and allows for real time, continuous measuring a wide range of chemicals in water. One of its added-values is to provide a complete solution for monitoring in water treatment plants as well as in distribution networks.

Concerning the last stage of pollution discharge into water bodies, one interesting solution is the miniSASS [f], currently widely used in different countries in Africa such as Tanzania, South Africa and Swaziland. It is a participative, low-cost and very simple way to estimate the general health and water quality of a river. By observing the groups of macroinvertebrates present in a sample of water, the ecological state of the river can be ranged between 5 different levels, from very poor (meaning highly polluted) to natural condition. Moreover, all the results can be uploaded on a website,

making all the miniSASS results available on a map, showing land uses and activities in the catchment.

Finally, once data and information about water pollution from urban and industrialised areas are collected and analysed thanks to the monitoring, actions of remediation and regulation could be developed to prevent new pollution from being discharged. To do so, tools to support policy could be useful, such as W2RAP – a Web-enabled Wastewater Risk Abatement Planning Tool [g].

See QR code on page 4 to access details on mentioned technologies or click here : http://afrialliance.org/SF1_5DEF.pdf



SOCIAL INNOVATION

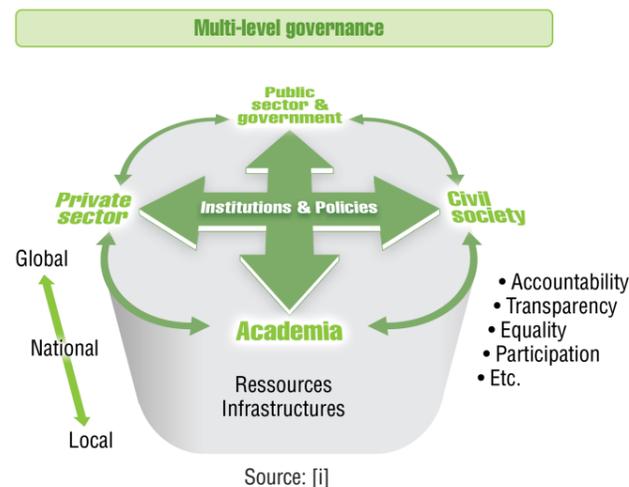
GOVERNANCE STRUCTURES

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

Water pollution in Africa is directly related to deficiencies in governance at multiple levels. This is partly related to poor coordination among policies for ecosystem protection, water management, urban development and economic activities extending from local to national and transboundary levels and resulting in water pollution. Limited financial and human resources in environmental agencies to inspect business operations result in the poor enforcement of environmental regulations that have been created to improve water quality. The improper disposal of solid and liquid waste (including human waste) into the environment stems from absent or deficient infrastructure for sanitation, solid waste and wastewater treatment.

At the same time, it is also a consequence of entrenched behaviour, perhaps due to low awareness among the population and industry leaders, of how improper solid and liquid waste disposal is related to water pollution and incidences of insect and water-borne diseases. Low participation of citizens in water management and land use planning reduces acceptance and affects the implementation of strategies to improve water quality.

Environmental management tools such as the Environmental Impact Assessment (EIA) and Environmental Management Systems (EMS) are designed to control environmental impacts from urban and industrial development. Their successful implementation relies on baseline water quality data, participation of citizens, and public access to EIA reports and adopted measures to increase accountability for water quality among public and private organizations.



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].

Engaging citizens, and the public and private sectors in monitoring water quality needs to be related to information campaigns on the side effects of poor planning and management of human activities, at multiple geographical levels,



Source: [k]

on water quality, human and ecosystem health. Combining information on the effects of different pollutants on human health, with training and opportunities to participate in water monitoring can motivate individuals, communities and organizations to collaborate for improving water quality.

At institutional level, the staff of water and environment agencies can be trained on IWRM and multi-sector collaboration to improve policy and legislation on water quality, including guidelines for water management in specific sectors. Equally, water polluting industries require training and guidance to ensure their compliance with applicable policies and legislation, to learn about the advantages of adopting best practices (e.g. from the mining and minerals as well as the oil and gas industries) and to help them develop voluntary initiatives to improve the conditions of water resources.

The establishment of regional monitoring networks requires the formation of staff in government agencies and knowledge centres to manage monitoring programs, which can be complemented with the creation of citizen observatories that train individuals on gathering data for local and regional monitoring programs. Developing this capacity is needed to also support the enforcement of environmental regulation to reduce water pollution from industrial and urban sources.

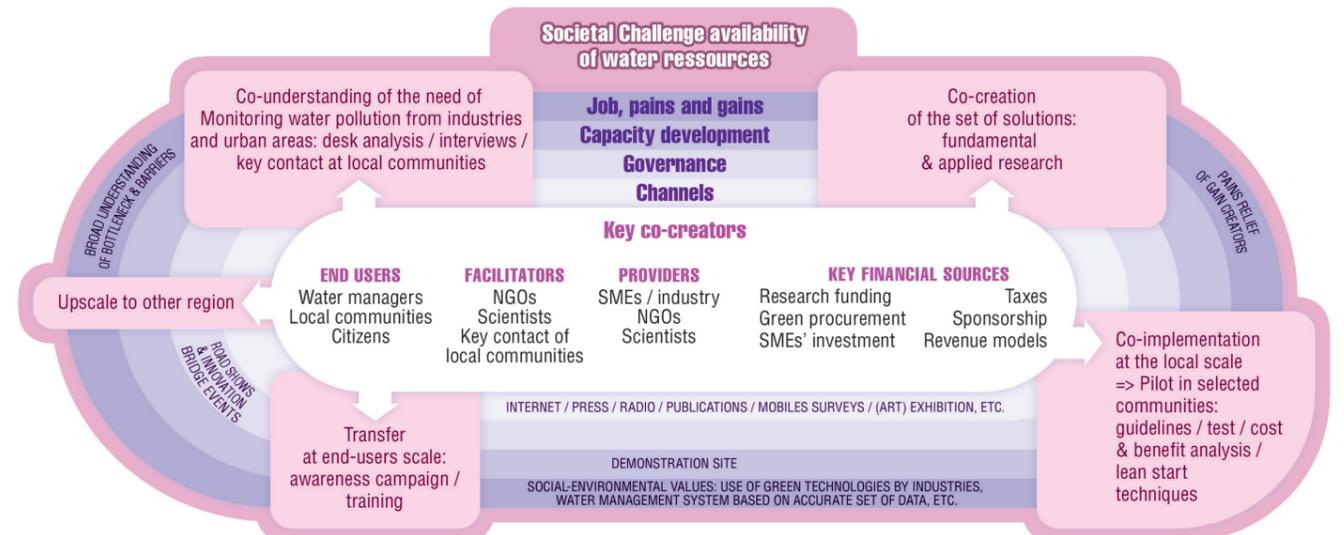
The dissemination of water management and sanitation practices among the population, together with information on water treatment options for communities can drive local action to reduce water pollution and improve community health.

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] UNEP (2013), Africa Environment Outlook 3: summary for Policy Makers, United Nations Environment Programme (UNEP). Nairobi, Kenya.

[b] <http://www.unep.org/ourplanet/may-2015/articles/time-act>

[c] UNEP. (2010). "Africa Water Atlas". Division of Early Warning and Assessment (DEWA). United Nations Environment Programme (UNEP). Nairobi, Kenya.

TECHNICAL SOLUTIONS

[d] V. Somerset, C Van der Horst, B Silwana and C. Walters, (2012), Development of analytical sensors for the identification and quantification of metals in environmental samples, WRC Report No. 2013/1/12.

[e] <http://www.optiqua.com/eventlab.html#.WZ7Wn3cjHMJ>

[f] P Mark Graham, Chris WS Dickens & R Jim Taylor (2010), miniSASS - A novel technique for community participation in river health monitoring and management, pages 25-35, published online: 07 Jan 2010, African Journal of Aquatic Science, Volume 29, 2004 - Issue 1.

[g] Marlene van der Merwe-Botha & Leonardo, Wastewater Risk Abatement Plan - A W2RAP GUIDELINE To plan and manage towards safe and complying municipal wastewater collection and treatment in South Africa, (2011), WRC Report No. TT 489/11.

GOVERNANCE STRUCTURE

[h] 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.

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

CAPACITY DEVELOPMENT

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[k] 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.

LIST OF ACRONYMS

- CD: Capacity development.
- EIA: Environmental Impact Assessment.
- EMS: Environmental Management Systems.
- SIF: Social Innovation Factsheet.
- TRL: Technology Readiness Levels.

MORE INFORMATION



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 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

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