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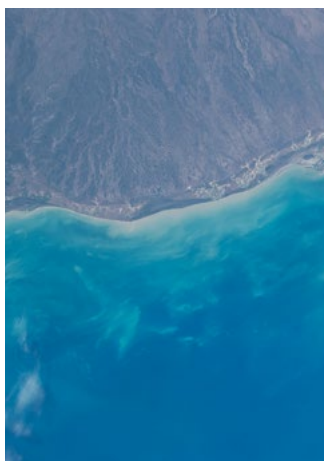
Compendium Of Good Practices On Innovations In Climate Information Services



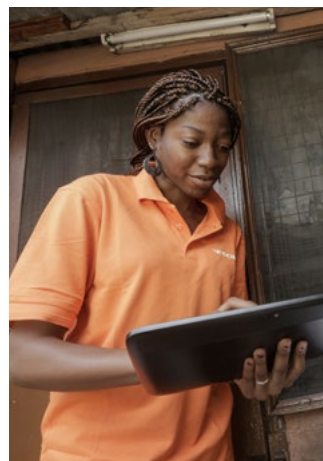
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Background

African Climate Policy Centre (ACPC)

The African Climate Policy Centre is to influence, strengthen and enable the transition to climate-resilient development in Africa through responsive policies, plans and programmes towards transformed economies, healthy ecosystems and human well-being. The Centre contributes to poverty reduction through successful mitigation and adaptation to climate change in Africa and to improve the capacity of African countries to participate effectively in multilateral climate negotiations.

Weather and Climate Information and SERVICES for Africa (WISER)

Weather and Climate Information and SERVICES for Africa is to deliver transformational change in the quality, accessibility and use of weather and climate information services at all levels of decision-making for sustainable development in Africa.

Definition - Climate service:

The provision of one or more climate products or advice in such a way as to assist decision-making by individuals or organizations. (World Meteorological Organization – Commission for Climatology, 2011)

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Foreword – James Murombedzi

Coordinator

African Climate Policy Centre

Innovation and information will have major roles as Africa undergoes a profound transformation that will have an impact on its citizens and economies. While this is a journey that is fraught with risks and uncertainties, emerging innovative approaches hold the potential to vastly improve efficiency in this regard. Africa is particularly vulnerable to climate change, more so than any other continent, owing to its historical economic and geographical circumstances. Nevertheless, innovations that integrate weather and climate information to provide services will enhance preparedness and capacities to manage and respond to the impacts of weather and climatic variations and extremes on livelihoods, infrastructure and economies.

The solutions presented in this compendium already demonstrate the various innovative responses through which the continent is addressing emerging challenges. They are only a beginning, however. More effort is required to incentivize increased innovation to match the scale of the challenge and to ensure that the continent becomes increasingly proactive rather than reactive in its generation and applications of climate information services in support of climate-resilient sustainable development.

Moreover, providing incentives for and deploying these innovations will require new partnerships between governments,

development institutions and innovators, as well as new business models and policy frameworks. In this compendium, leading innovators from various sectors will show how they are taking advantage of the weather and climate information available to them to design solutions to specific challenges. It is expected that this compendium will help to further expand the knowledge base on climate information services and illustrate to key stakeholders the gaps and challenges that climate information services innovators are facing.



James Murombedzi



© WISE-Up to climate

Introduction

To attain Africa's development objectives, as framed through the Sustainable Development Goals and the African Union's Agenda 2063: The Africa We Want, climate change must be integrated into development policy, planning and programmes in member States and regional economic communities. According to experts, some 200 million Africans lead insecure lives owing to climate change. Given that their livelihoods depend on climate-sensitive economic sectors¹, an enabling environment will require substantive investment and uptake of climate information services, supported by applied research and policy analyses, as well as coordinated approaches to service delivery and strengthened knowledge frameworks and partnerships between public institutions, the private sector, civil society and vulnerable communities. The aim of climate information services is to provide people and organizations with reliable, timely, user-friendly and tailored climate-related information to reduce climate-related losses and thereby enhance benefits². Seasonal forecasts can be used to predict whether too much or too little rainfall is expected, given that they consider factors from El Niño and other climate elements into account³. Such forecasts may be useful for planning in agriculture and disaster prevention, including the mitigation of malaria outbreaks⁴. For example, in 2012, floods in Nigeria affected several sectors of the economy, displacing approximately 4 million people and destroying thousands of hectares of farmland. The estimated total value of losses and damages due to the floods was \$16.9 billion⁵.

In the past, weather and climate data produced by national hydro-meteorological services in Africa were targeted mainly at the aviation industry and, to a lesser extent, for undertaking weather forecasting. Gradually, the role of these services has evolved to the provision of seasonal forecasts and climate modelling. Climate information services from meteorological agencies are increasingly being deployed to mitigate climate impacts and support resilience planning for climate-vulnerable users who include farmers, pastoralists, fishers and urban communities. These applications cut across development sectors such as water, energy, agriculture and transport.

This paper offers a look at weather and climate information services throughout Africa, showcasing some of the successes, good practices and lessons learned in the provision of climate services through the launch of a compendium of case studies. In a diverse continent as Africa, clear and concise communication of both successes and lessons learned is vital for further effective development of weather and climate information services. The primary aim of this report is therefore to increase the awareness of various stakeholders on and their support for innovative climate solutions.

Current state: why the compendium?

At present, most African countries do not have the infrastructure to handle the production and distribution of climate information. According to the World Bank, Africa is not equipped to meet the World Meteorological Organization observation standards, with only 1/8 of the required density covered and with less than 300 weather stations⁶. Significant gaps still exist in the provision of precise, downscaled location-specific, reliable, timely and user-friendly weather forecast information that effectively addresses the needs of vulnerable communities (e.g., women, the disabled, young people and older persons).

One of the main pillars identified by the African Ministerial Conference on Meteorology is the need to support the provisions of weather and climate services for climate change adaptation and mitigation⁷. Accordingly, new and emerging scientific technologies and innovations that enhance the livelihoods of their communities, improve the management of climate-related risks and help communities to adapt to change should be encouraged. Most communities in Africa rely on indigenous knowledge for their seasonal forecasts, in which locally observed variables and experiences are used to assess and predict the local weather conditions, in particular the onset of rain, given that it determines farming decisions. Such experiences are not widely documented, however, and are often passed on from one generation to the next only orally, creating a wide intergenerational gap between their custodians and the younger generation. The sharing of lessons and practices in ongoing innovations using weather and climate information can therefore catalyse new partnerships, research and collaborations in a continually changing climate. These good practices can also provide decision-makers, farmers, traders, disaster risk reduction experts and health professionals with timely, accurate and tailored climate services that can help to inform decisions, enhance resilience and improve social and economic outcomes.

Appropriate strategies for brokering and managing the information and knowledge produced from the numerous initiatives and interventions do not yet exist to enhance the impact of climate information services for end users nor to fully engage with civil society organization, the private sector, national hydro-meteorological services and various government ministries. The Global Framework for Climate Services addresses five priority areas in which climate information is critical for decision-making: agriculture and food security, water, health, disaster risk reduction and energy.

The findings resulting from the implementation of the pan-African component of phase I of the Weather and Climate Information and SERvices for Africa indicated that the uptake and use of climate information services into development planning, policy and practice in Africa was dependent mainly on the relevance of the information to the needs of the users. Current data, however, are usually determined by the imperatives of the producers of the information, with little or no input from the users, thus contributing to the low uptake and use of climate information services. It was specifically noted in the study that the policy and legislative environment did not provide sufficient incentives for the uptake and use of climate information services. This could be attributed to weak institutional and human capacities to provide user-driven quality climate data and information. Furthermore, the existing numerous fragmented initiatives in Africa are unable to influence the policy and legislative agenda on the continent because of weak or the complete absence of coordination mechanisms. There is a significant need for the development and the recognition of effective climate innovations throughout Africa, and with that in mind, the African Climate Policy Centre and the Weather and Climate Information and SERvices for Africa have identified innovations aimed at improving the generation and use of weather and climate information services.



Case studies

The case studies of innovations selected in this compendium cover the key climate-sensitive sectors of agriculture, energy, health, and water. They reflect new ways of employing weather and climate information to help communities, governments and private businesses. These cases also contribute substantively to better knowledge and understanding of the good practices of innovative climate solutions that contribute to climate change resilience and strengthen the capacity of African nations.



Case study 1

Name of innovation	LandInfo Mobile App Technology
Contact person	Nicholas Ozor
Website	https://atpsnet.org/
Location	Nairobi
Target audience	Farmers, farmer associations, agricultural extension agents, agripreneurs, land investors and land-use planners
Funding mechanism	Development partners, national governments, state/county governments, African Development Bank (AfDB), etc.
Summary	The LandInfo app allows individuals and organizations to use a smart mobile phone to determine the potential of any given piece of land in supporting crop and pasture production and to predict its vulnerability to erosion under the prevailing climatic conditions. This is based on the accurate soil and climatic information provided by the app using global and local knowledge, which enables users to identify the suitability of any given piece of land for any specific crop in order to obtain maximum productivity under the prevailing climate.
Methods and tools	<p>The LandInfo app is part of a wider land potential knowledge system that allows individuals and organizations to use a smart mobile phone to determine land potential at a specific location on the basis of local and global knowledge and information about the potential of similar types of land. The app currently operates on Android and iOS. It integrates climatic and topographic information from existing databases with targeted field data collections of knowledge and information to predict relative productivity, soil erosion and the sustainability of crop and forage production for a set of locations.</p> <p>Tapping into recent advances in cloud computing, digital soil mapping and Global Positioning System-enabled camera phones, the LandInfo app allows users to enter point-specific information about soil texture, topography and easily observable soil properties and, in turn, obtain site-specific data, including annual rainfall and temperature distributions, average annual precipitation, available soil water retention capacity, elevation, longitude and latitude, length of growing period in days, the aridity index and the type of soil (by name) at any given location. Field data are captured into the app in two ways: through a field of observational assessment of the land cover type, use, slope, slope shape, occurrence of soil erosion, runoff and soil conditions; and by excavating up to 1 m depth of soil and examining its texture at various depths to identify the layers and the types of soil layers. Geo-referenced photographs are taken to serve as benchmarks for future monitoring. The app can be used anywhere. With improved mobile phone access and internet penetration in Africa, the app is surely a one-stop shop for supporting farmers' decision-making in agriculture.</p>

Landinfo -
Field trial of App

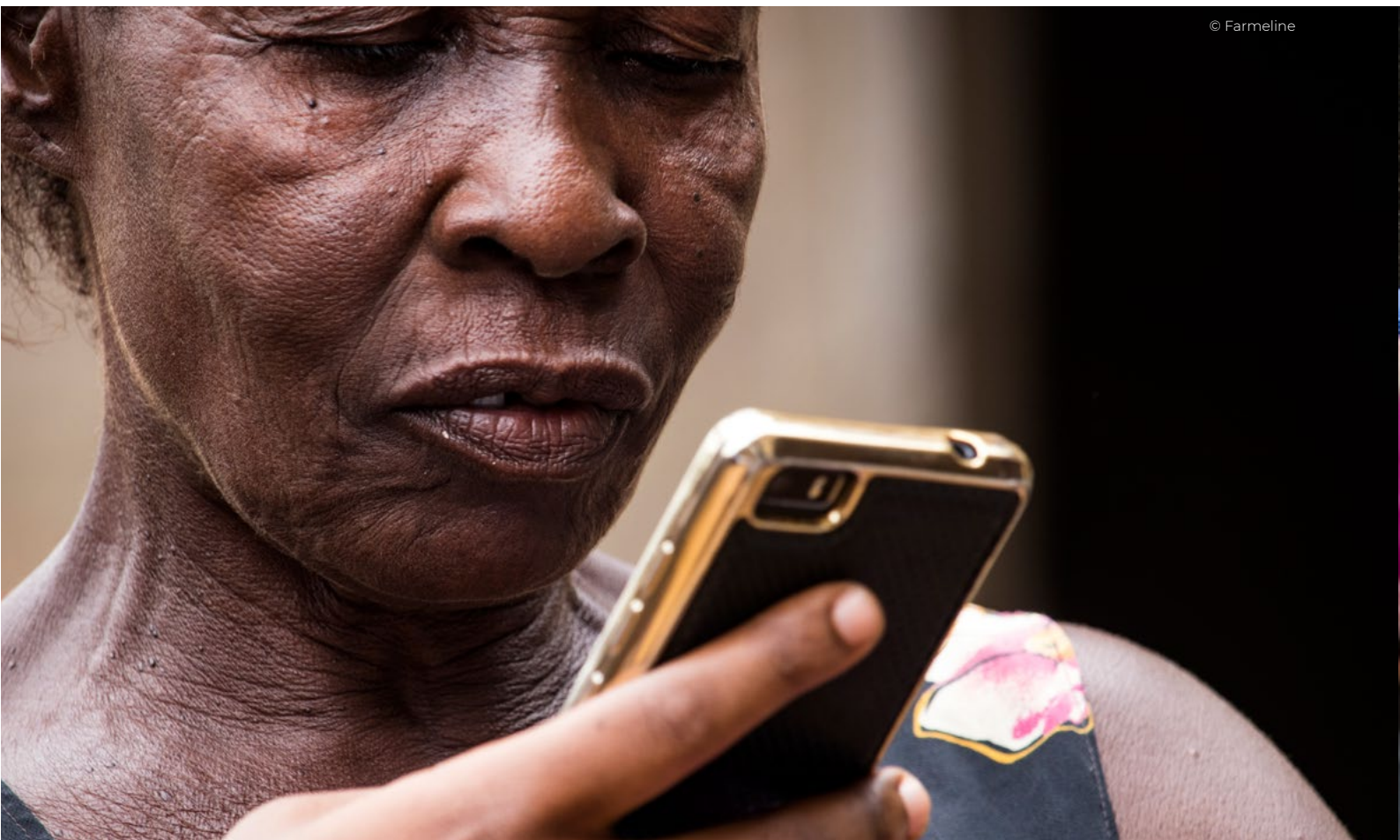


Future

There is an excellent opportunity for the upscaling and out-scaling of the LandInfo mobile technology. Through regular feedback received from users, the LandInfo app has been able to adjust and improve on the user functions and menus on the basis of demand and therefore improve the performance of the app in meeting beneficiaries' needs for improving agricultural productivity and climate change resilience. On the other hand, since the launch of the app in 2015, the African Technology Policy Studies Network has been popularizing it to have target users throughout Africa adopt the technology, given that it can be used anywhere. To this end, the app has been presented to the African Union Commission, the Economic Commission for Africa, the Africa Forum for Agricultural Advisory Services, the Technical Centre for Agricultural and Rural Cooperation, universities, organized private sector alliances and national and local/county governments. It received the coveted Climate Information Prize for the year 2016 in Kenya. It has also been recognised by AfDB as one of the innovations for the Technologies for African Agricultural Transformation programme.

The African Technology Policy Studies Network solicits support and collaboration from development partners and donors to enable it to upscale and out-scale the LandInfo mobile app technology throughout Africa through raising awareness, capacity-building/training of farmers and extension agents on how to use the app and policy advocacy to mainstream it into other agricultural development initiatives.

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Case study 2

Name of Innovation	Eco-Frontier Kenya Limiteda
Contact person	Teddy Odindo
Website	Being developed
Location	Kisumu, Kenya
Target audience	Smallholder farmers
Funding mechanism	Self-funded
Summary	<p>Eco-frontier is a Kenya-based social and environmental enterprise that works with the resource-poor smallholder farmer in mind. It has established a climate-smart agriculture resource centre that is intended to serve as a knowledge learning and demonstration centre for climate-smart agriculture in Kisumu County. The centre seeks to empower smallholder farmers through: (a) providing targeted climate information coupled with agro-advisories to smallholder farmers who will be empowered to plant high-value crops; (b) enhancing the uptake of urban agriculture for urban and peri-urban populations in the environs of Kisumu County; (c) leveraging informal agricultural value chains to meet urban demand for fresh produce; and (d) providing leadership in production aggregation and value addition of fresh fruit and vegetables from smallholder farmers and targeting the urban markets.</p> <p>Eco-frontier runs a climate smart agriculture resource centre, which offers smallholder farmers information and skills for improving agriculture practices.</p>
Methods and tools	Eco-frontier uses a mobile phone-based SMS platform to disseminate information to registered farmers in the Lake Victoria Basin Region, as well as host events for farm skills sharing and learning.
Future	Eco-frontier seeks to offer other broad-based services to include farmer outreach and exchange visits with other organizations to improve the information services that it offers and to offer further engagement with smallholder farmers.



Case study 3

Name of Innovation	Trans-African Hydro-Meteorological Observatory
Contact person	Frank Annor
Website	http://tahmo.org
Location	Primary non-governmental organization (NGO) based in the Netherlands, with two spin-off NGOs in Ghana and Kenya (regional)
Target audience	Local meteorological services to provide weather data for research, services and education (school-to-school programme)
Funding mechanism	Currently project-based
Summary	<p>The Trans-African Hydro-Meteorological Observatory is a programme that is aimed at developing a vast network of weather stations throughout Africa. It provides stations to projects, at its own cost, for teams seeking weather data. The data collected by Observatory stations are always made available to the national meteorological agencies first. These agencies have free access to the data and can use it for any purpose that they deem fit. The data are free for government and scientific use. A fee is incurred for commercial use of the data, including the development of new services. Costs depend on geographical coverage and the level of exclusiveness of use within a sector, while respecting the national policy on data use. The data are also freely accessible for any researcher seeking to develop peer-reviewed publications that would benefit from the data collected. These researchers can acquire any and all of the data for their use. They simply have to contact the Observatory (info@tahmo.org) with a description of their need. As long as it satisfies this basic requirement, a no-cost agreement is completed.</p>
Methods and tools	<p>The Observatory installs weather stations in collaboration with the local meteorological services, mostly at schools. The programme uses automatic weather stations produced by the Meter Group. The Meter Group ATMOS41 station has been developed in recent years in close cooperation with the Observatory, with special attention given to African conditions. It has no moving parts, which greatly reduces the maintenance burden. Through the Meter Group's social corporate responsibility programme, the stations have become optimal in terms of high-quality measurements and price. The Observatory recognizes that there may be better solutions for other specific problems, but finds that the present ATMOS41 station provides the best overall performance.</p>
Future	<p>The Observatory aims to install 20,000 weather stations throughout Africa. It also seeks to become a self-sustaining public-private partnership curating an international scientific-grade continental-scale weather and climate observatory that supports the national meteorological agencies and the global research community.</p>

TAHMO-

Students visit the observatory installed weather station



© TAHMO

Case study 4

Name of Innovation	Circle Time initiative/G-Power
Contact person	Pamela Kaithuru
Website	Being developed
Location	Nairobi
Target audience	Persons living with HIV/AIDS
Funding mechanism	Donations from members of community-based organizations
Summary	<p>The initiative is aimed at using climate information to empower women living with HIV to make informed decision on agriculture practices (enterprises) to improve their nutritional levels, besides enhancing livelihoods, and therefore reduce HIV-related opportunistic diseases, delay disease progression and improve their psychological health. The initiative (also referred to as G-Power) is premised on the recognition of climate change impacts on socioeconomic status and psychological health, in particular of vulnerable populations. People living with HIV (especially women), owing to their gender roles and responsibilities, are likely to develop psychological health problems, compared with the general population, further exacerbating their conditions. It is currently working with women in Homabay County based on the fact that this region has the second-highest HIV prevalence in Kenya, which is four times higher than the national prevalence (26 per cent). The HIV prevalence in Homabay County for women is 27.8 per cent, compared with that of men, at 24 per cent, making them more vulnerable (NACC, 2016). The initiative targets women of all ages.</p>
Methods and tools	<p>The initiative's members are volunteers, some of whom are living with HIV. The initiative works with key institutions in Homabay County (e.g., the county director of meteorology to provide relevant climate information such as forecasts on a weekly, monthly and seasonal basis through SMS), local government and community-based organizations. Field visits to the farms (enterprises) are regularly conducted to individual farmers and groups. In addition, focused group discussions with the community-based organizations in the programme, consultation forums and meetings are also used. The women are provided with SMS information and a weather intermediaries reference guide.</p>
Future	<p>The initiative is working on a website and hopes to develop more information education communication materials such as audiovisual materials and partnerships with local FM radio stations. CTI wants to include men living with HIV (e.g., the fisher community), as well as engage with Ministry of Agriculture for relevant information on crop and animal husbandry, and the Kenya Forest Services for correct species of fruit trees to plant and nurture. The initiative wants to form local partnership and ; upscale to 10 high HIV burden counties. Currently, CTI is developing a resource mobilization strategy to complement member donations and a volunteer subsidy.</p>

GPower -

Farmers show their crop during the field visit



Case study 5

Name of Innovation	Climate Information Programme for Resilient Development and Adaptation in Africa
Contact person	Bonizella Biagini
Website	http://www.adaptation-undp.org/projects/programme-climate-information-resilient-development-africa-cirda and http://undp-cirda.blogspot.com/
Location	Regional
Target audience	Development practitioners, policymakers and governments (ministries of agriculture and ministries of finance/planning), stakeholders in the 11 Programme partner countries, national hydro-meteorological services, technology providers and industries using climate information
Funding mechanism	Global Environment Facility Least Developed Country Fund
Summary	<p>The Climate Information Programme for Resilient Development and Adaptation in Africa is implemented by the United Nations Development Programme, with funding from the Global Environment Facility Least Developed Country Fund, and is an example of the specific actions that the United Nations is taking to reduce the impact of climate change in all development sectors. The Programme provides support to the following countries in Africa to use climate information as a key tool in long-term planning fundamentals for economic development: Benin, Burkina Faso, Ethiopia, the Gambia, Liberia, Malawi, Sierra Leone, Sao Tome and Principe, Uganda, the United Republic of Tanzania and Zambia.</p> <p>The ability of decision-makers to understand and communicate the likely impact of climate change is of critical importance in adapting development plans to new climate realities and the increasing rate of climate-related shocks. The Programme works with countries and the region in strengthening their ability to develop and operate modern climate information and early warning systems by making available technical assistance and provide access to new technologies. Countries benefit from regional coordination and a knowledge-sharing platform.</p>
Methods and tools	The Programme provides a roster of individuals with highly specialized technical expertise in forecasting and weather/climate monitoring, innovative technologies, establishing public-private partnerships, market studies on weather services in the region and communicating climate information to end users. Assistance is provided through regional workshops, technical training events, South-South cooperation, a knowledge management platform and publication, as well as in-country missions to evaluate existing monitoring systems and identify needs and provide practical troubleshooting.
Future	The Programme will continue to assist countries in successfully implementing all components of their country-specific projects. In alignment with the outcomes of the approved national projects, technical assistance will be delivered in the context of: (a) enhanced capacity to monitor and forecast extreme weather, hydrology and climate change; (b) The efficient and effective use of hydro-meteorological information for generating early warnings and supporting long-term development plans; (c) mainstream/integrating data into development planning; and (d) providing financial sustainability planning/public-private partnerships. The Programme was recently extended until December 2019.

Case study 6

Name of Innovation	Elum Africa
Contact person	Karim El Alami
Website	www.elum-energy.com
Location	France and Morocco
Target audience	Commercial and industrial buildings, microgrids for rural electrification and Telecom Base transceiver station (BTS)
Funding mechanism	Subsidies, private funding and net sales generated
Summary	Elum develops a software to monitor and control energy assets (i.e., photovoltaic, battery, diesel and grid) in order to reduce the operating expenditure for buildings, microgrids or telecom companies.
Methods and tools	The technology behind Elum is artificial intelligence algorithms that can help to forecast consumption and solar production in order to perform optimization measures in charging and discharging the battery and switching on/off the Genset. Elum uses a powerful algorithm based on artificial intelligence that forecasts the consumption of the plant coupled with the weather forecasts. This software also can be plugged into any kind of photovoltaic technology or brand.
Future	Elum wants to be integrated into every system in which batteries are incorporated and wants to help companies to accelerate the energy transition with increasing energy profitability.



Case study 7

Name of Innovation	West Africa Coastal Areas Management Programme
Contact person	Dahlia Lotayef
Website	www.worldbank.org/en/programs/west-africa-coastal-areas-management-program
Location	West Africa
Primary target audience	The principal partners of the Programme are its ultimate beneficiaries: the people who live along the West African coast and depend on it for their livelihoods, nutrition, food security and prosperity. It collaborates with national decision-makers, including the ministries of finance, planning, economy, environment, agriculture, transport and energy, the media and civil society.
Funding mechanism	<p>Development partners, national governments, state/county governments.</p> <p>The regional integration project is intended to unite development partners around country-led multisector investment plans so that adequate resources can be mobilized for interventions at the scale needed to reduce the risk to people by coastal erosion and flooding.</p> <p>The Nordic Development Fund is sponsoring the baseline information required to make informed decisions on coastal zone management in four countries.</p> <p>With support from the Africa Climate Investment Readiness Partnership, a mechanism supported by Germany, multisector investment plans have now been prepared in several countries, and the Programme hopes to mobilize additional resources to provide investment planning support to additional countries.</p> <p>The Global Facility for Disaster Reduction and Recovery is sponsoring the development of a decision-making framework for planned relocation, which countries can use as part of their decision to engage in adaptation in situ, incentivised relocation or a specific relocation programme.</p>
Summary	<p>The Programme convenes countries to gain access to expertise and finance to sustainably manage their coastal areas. It was created in response to countries' requests for solutions and investment to help them to save the social and economic assets of their coastal regions.</p> <p>The Programme aims to improve the management of shared natural and human-made risks, including climate change, affecting targeted coastal communities and areas on the West African coast. It is designed as a regional integration programme providing finance to countries and regional organizations. In addition, it serves as a forum in which countries and regional organizations can share lessons learned and solutions.</p>
Methods and tools	<p>The methodology for selecting hotspots is based primarily on the existing West African Coastal Area Management Plan and country-specific analyses generating a list of the most vulnerable areas on the West African coast, based on geomorphology (e.g., sandy coast, rocky and mangroves).</p> <p>Technical assistance is provided to determine the factors that threaten people, ecosystems and economic assets along the coast. It also offers finance for identifying multisector solutions such as land management and spatial planning, infrastructure, natural habitat management and pollution management.</p> <p>Science and modelling: To better understand the science and bio-physical environmental conditions affecting coastal erosion, the World Bank undertook a study on the human intervention and climate change impacts on the West African coastal sand river. The study was used to derive a regional-scale sediment budget analysis for Benin, Côte d'Ivoire, Ghana and Togo. The report's authors documented how sand originating from rivers and from large coastal sand deposits is now retained behind river dams and/or interrupted by port jetties. As a result, it was concluded that the sandy coastal barrier was eroding almost everywhere along the coast, from Benin to Côte d'Ivoire.</p>

Ecosystem services evaluation: Building on lessons from the Worldwide Assessment of Vulnerabilities System partnership, approaches for using ecosystem services valuation and natural capital accounting in the coastal zone context have been assessed.

Supporting the implementation of nationally determined contributions: The Nationally Determined Contribution Partnership Support Facility is providing funding to pilot an approach to result-oriented action to meet the nationally determined contribution of Côte d'Ivoire, focusing on coastal adaptation.

Remote sensing: The West Africa Coastal Areas Management Programme is in dialogue with the European Space Agency, the French Naval Hydrographic and Oceanographic Service and the National Oceanic and Atmospheric Administration regarding approaches to cube data management, setting baselines for bathymetry and monitoring changes to the coastal environment.

The West Africa Coastal Areas Management Programme multisector investment plans provide a prioritized list of investment needed for physical and social investment, as well as for policy and institutions at the national level. They vary a bit in approaches, given that they are based on existing processes in the countries concerned. Some apply a multi-criteria approach, while others are based on local or national development plans for the coastal zone. Common to all of them is that they have a set of prioritized investment from which the World Bank will support some projects, while partner financiers support other ones.

Future

The West Africa Coastal Areas Resilience Investment Project will be submitted to the World Bank's Board of Directors for approval in March 2018.

Discussions are under way with AfDB, the Agence française de développement, the French Global Environment Facility, the Green Climate Fund, the International Union for Conservation of Nature and Natural Resources, The Global Environment Facility, the United Nations Environment Programme and the Food and Agriculture Organization of the United Nations about a common framework of investment in support of country-led investment plans for the sustainable management of coastal areas.



Case study 8

Name of Innovation	Esoko
Contact person	Simone Fugar
Website	www.esoko.com
Location	Accra
Target audience	Smallholder farmers, NGO projects, government agencies and agribusinesses
Funding mechanism	Private equity funds

Summary Esoko provides smallholder farmers with vital information through their mobile phones to help them to plan farming activities better in order to improve their welfare and livelihoods. The content includes:

- Market prices of commodities in major markets in Ghana
- Targeted weather forecasts and seasonal forecasts
- Climate-smart agronomic practices
- Nutrition tips

Aside from information services, Esoko also has a data-collection service that includes web and mobile tools for collecting and visualizing data, coupled with field deployment services.

Methods and tools For a farmer to be registered on the Esoko platform, his or her details are recorded. At a minimum, their name, crops farmed, languages spoken and location are recorded. Farmer acquisition is done either through project partnerships, the Vodafone Farmer Club or individual farmers expressing interest.

With details of crops farmed, Esoko is able to send farmers relevant information focused on their crop of choice. Knowing which language a farmer speaks means that information is sent in his or her language. With information on a farmer's location, Esoko is able to send targeted weather and seasonal information, thereby improving the reliability of the information received.

Esoko uses three channels to send information to smallholder farmers: SMS; voice SMS, which comes in the form of a call (i.e., once selected, the voice message is played in the farmer's native language); and, most important, a farmer helpline, which is a call centre that houses agriculture experts who cater to farmers in 15 local languages. The Esoko platform from which the administrator sends out information is web-based.

Esoko has partnered with the following organizations to provide weather information: the Ghana Meteorological Service, aWhere and TOTO Agric.

Future Esoko is working on providing farmers with warning alerts on imminent weather threats so that when a storm, for example, is imminent, farmers who are likely to be affected will be alerted immediately through an SMS or a voice SMS.

Esoko -
Agent in the field



Case study 9

Name of Innovation	WISE UP to Climate project (Water Infrastructure Solutions from Ecosystem Services underpinning Climate Resilient Policies and Programmes)
Contact person	Rebecca Welling and James Dalton
Website	http://www.waterandnature.org/initiatives/wise-climate Case studies on the Volta and Tana Basins: Volta Basin: https://social.shorthand.com/IUCN_Water/uCveSad9IT/wise-up-to-climate Tana Basin: https://social.shorthand.com/IUCN_Water/ugTJkK5pcyj/wise-up-to-climate
Location	Tana River Basin (Kenya) and Volta River Basin (Burkina Faso and Ghana)
Primary target audience	Decision-makers and policymakers, basin stakeholders, research networks and scientists and finance managers
Funding mechanism	The project was funded by the International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
Summary	<p>WISE UP to Climate is a project that demonstrates that natural infrastructure can be used as a nature-based solution for climate change adaptation and sustainable development. The project has developed knowledge and options on the use of portfolios of built water infrastructure (e.g. dams, levees and irrigation channels) and natural infrastructure (e.g. wetlands, floodplains and watersheds) for poverty reduction, water-energy-food security, biodiversity conservation and climate resilience. WISE UP to Climate results show the application of optimal portfolios of built and natural infrastructure using dialogues with decision-makers to agree to trade-offs and to identify possible options going forward.</p> <p>WISE UP to Climate is underpinned by the premise that, to build resilience and attain equitable and sustainable outcomes in the face of climate change, built water infrastructure must be planned and managed in conjunction with natural infrastructure. Working with natural processes at a basin scale, however, remains a challenge. In contrast to built infrastructure, a limited understanding of the benefits from natural infrastructure and the likely impacts of changing flow regimes makes the meaningful incorporation of natural infrastructure into water resource planning and management difficult.</p>
Methods and tools	<p>The WISE UP to Climate approach combines multi-criteria and multisector assessments of benefits and costs with the engagement of basin stakeholders to meet basin needs under various plausible climates. Interdisciplinary by design, the project bridges the natural and social sciences to better reveal the value and role that natural infrastructure can play in sustainable development. Stakeholder engagement is initiated from the project's beginning, helping to guide and validate results and build ownership and cooperation.</p> <p>Its structure is highly interlinked, in that delivery relies on collaboration between partners. The approach begins by identifying natural and built infrastructure benefits that stakeholders receive from the water resource system and the potential planning and management interventions, which can be a newly built infrastructure or a change in operating rules of existing infrastructure. Some benefits may already exist and can potentially be affected positively or negatively by the intervention or they can be created when the intervention is implemented. Examples of benefits include hydropower production, food production through irrigation, water supply and fishing from artificial reservoirs. Benefits from natural infrastructure include, but are not limited to, flood recession agriculture and floodplain fishing, water treatment effects from wetlands and soil retention by forests.</p>

These natural and built infrastructure benefits are quantified as “benefit function” (using eco-hydrological modelling). In general, these functions use the flow or storage of water through the system over time to determine the magnitude of benefits generated (e.g., annual amount of hydropower generated or yield from flood recession farming). If implemented, the new interventions may change the flow regime through the system and therefore change the magnitude of the benefits generated. These benefit functions are then valued to monetize the benefit functions by performing an economic analysis. Monetization allows decision-makers to directly compare a range of different biophysical benefits.

Alongside this process, a simulation model of the water resource system is developed that includes the existing natural and built infrastructure, as well as the possible future interventions. An Interactive River-Aquifer Simulation-2010 (IRAS-2010) software was used. Water resource system simulation models can help to predict the effects of planning and management decisions under various scenarios of input conditions. The benefit and value functions are incorporated into the system model, which is then used to quantify the benefits under various future scenarios using, for example, climate-perturbed hydrological flows. Several climate change scenarios for the two basins generated were considered using a calibrated soil and water assessment tool hydrological model of each basin and a combination of global climate models and regional climate models from the Coordinated Regional Climate Downscaling Experiment. The system is simulated under the various intervention decisions. Each combination of built and natural infrastructure provides a different balance of benefits, which is then represented graphically for stakeholders to discuss.

The political economy analysis was carried out in parallel to determine decision logics and political drivers, bringing a deeper understanding of why and how basin stakeholders make the investment decisions they do and how climate change is understood. Working alongside this research are the basin partners in Ghana and Kenya whose essential links to basin stakeholders and realities on the ground help to “ground-truth” and validate the research results. This also builds in-country skills and capacities for sharing results, aiming to strengthen the understanding and ownership of data and tools under WISE UP to Climate.

Weaving a joint project narrative through iterative learning was the action learning process under WISE UP to Climate. That engaged basin stakeholders directly from the beginning, putting them in the driver’s seat to actively guide project research. The process is designed to operate at the intersection between the development of new scientific evidence and the identification of the political dynamics and economic drivers shaping decision-making and policy. This is critical to better understand how to make information and innovative tools practical, useful and trusted, that is, how to take science into policy circles and decision-making processes. It has helped to shape the future stages of research and field work and allows WISE-UP to Climate to continually evaluate the relevance of its work.

Summary results: Tana River Basin

WISE UP to Climate has demonstrated how benefits from natural infrastructure directly support hundreds of thousands of livelihoods in the Tana River Basin in Kenya. On average, the benefits accruing from natural infrastructure are currently worth more than \$170 million annually, going mainly to subsistence smallholder farmers and pastoralists in the Lower Tana Basin. The removal or degradation of these benefits risks further heightening tensions over land and water resources in the Lower Tana Basin. Natural infrastructure in the Tana Basin underpins the provision of services derived from current built water infrastructure worth on average \$139 million annually.

Through WISE UP to Climate, a simulation model for the Tana Basin system was developed to investigate the impact of changing the operations of built infrastructure, of adding new built infrastructure (e.g., the Northern Water Collector Tunnel, the High Grand Falls Dam and large new irrigation schemes near the Tana Delta) or of investing more in natural infrastructure. The Northern Water Collector Tunnel extension project may have an impact locally, but the additional abstraction is unlikely to strongly influence downstream ecosystem services or the ability of built infrastructure to provide benefits (see figure below).

The system model has also been used to investigate the impact of climate change on the benefits available from the system. To achieve this, natural infrastructure benefits were recognized and valued, including seasonal floodplain fish catch, flood recession agriculture, reservoir fisheries, estuary fisheries, floodplain cattle grazing and sediment transport through the delta to the coast.

Results showed that natural infrastructure in the Tana Basin underpins the provision of services derived from current built water infrastructure worth on average \$139 million annually. The current cascade of dams in the Tana Basin provides significant economic benefits in terms of electricity sales, of at least \$128 million annually and, from irrigation, \$9 million annually. The Basin provides 65 per cent of the national electricity needs from hydropower and nearly all of Nairobi's domestic water supply for 4 million people through a cascade of dams in the Upper Tana Basin. Furthermore, WISE UP to Climate results show that scaling up current investment in natural infrastructure in the upper catchment, such as those being undertaken by the Nairobi Water Fund in the upper Tana, would likely further improve dam performance and safeguard benefits, even in the face of future climate change.

By factoring future climate scenarios into the system model trade-off analysis, results point to the operation of current built infrastructure playing a central role in adapting to a hotter, wetter but more variable environment, with more variable and extreme rainfall patterns likely. More water available in the basin due to climate change could lead to increased floods and "spills" from the existing hydropower cascade. Increased floods from dam spills could lead to increases in some natural infrastructure services downstream. Increased flow in the Basin provides more opportunity for managing natural infrastructure downstream but requires improved coordination with the planning and management of built infrastructure.

Esoko uses three channels to send information to smallholder farmers: SMS; voice SMS, which comes in the form of a call (i.e., once selected, the voice message is played in the

WISE-UP to climate - Ecosystem services mapping



farmer’s native language); and, most important, a farmer helpline, which is a call centre that houses agriculture experts who cater to farmers in 15 local languages. The Esoko platform from which the administrator sends out information is web-based.

Esoko has partnered with the following organizations to provide weather information: the Ghana Meteorological Service, aWhere and TOTO Agric.

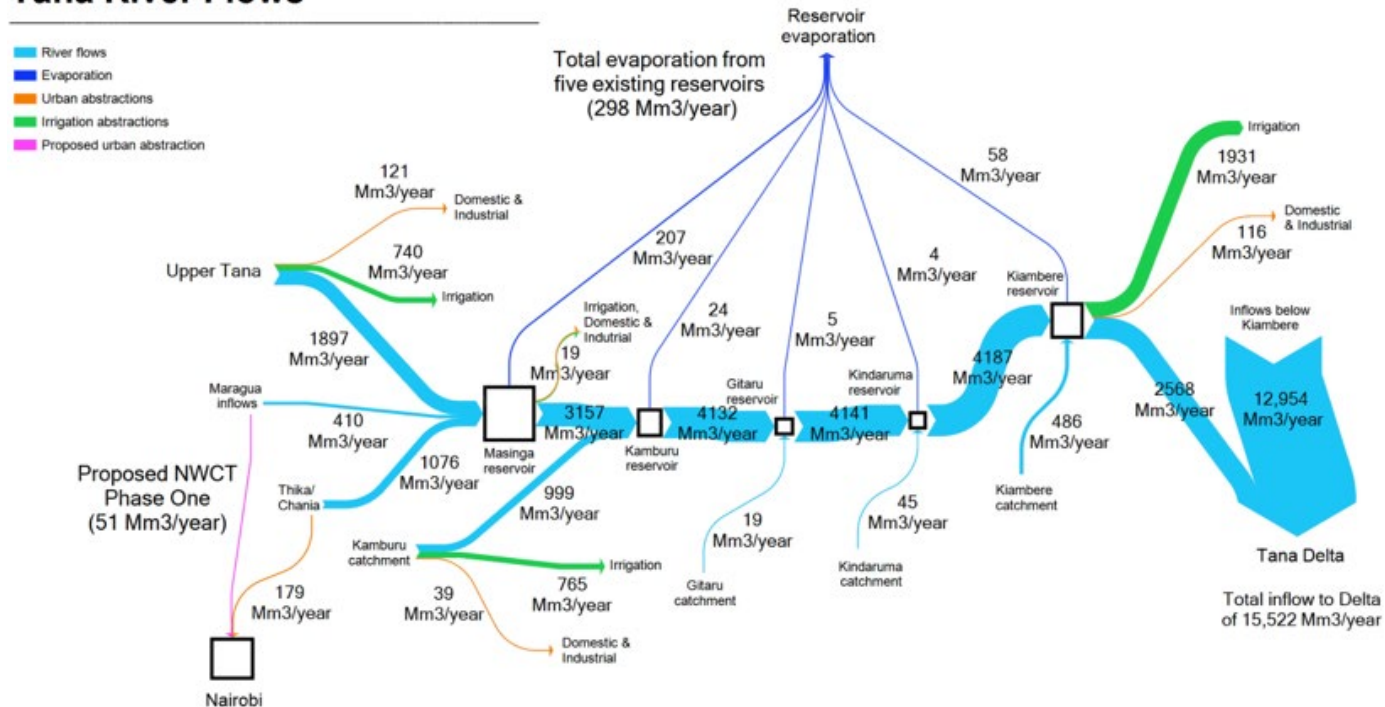
Future

The project closed in December 2017. Nevertheless, a second phase of the WISE UP to Climate project is expected to continue in the two current basins and expand to newer ones in West and East Africa. WISE UP 2: Adapting River Landscapes to Climate Change would run for much longer, approximately seven years, focusing on implementation and working closely with government ministries and stakeholders.

It is an ambitious programme designed to deliver long-term and country-driven adaptation benefits using the natural functions and benefits of ecosystems to deliver social, environmental and climate services. It will focus on nationally determined contribution priorities and vulnerable people, using cutting-edge science to transform ecosystem-based-adaptation into a scalable option for climate investment in five countries with similar climate threats and shared borders. Driven by a broad and diverse local, national and international partnership, the programme will identify areas in which such adaptation can deliver a range of climate, water, development, and biodiversity benefits. It will create a pipeline of robust and stakeholder-accepted adaptation projects in river basins and invest directly in their design, implementation and monitoring and evaluation. It will leverage private and public finance using access to other climate funds to scale the adaptation to an effective and transformative approach to economic development and climate response. The programme will use tools and methods developed in WISE UP to Climate for the large-scale implementation of the adaptation using negotiated decision-making to identify trade-offs for adaptation to climate change (i.e., floods, drought, erosion, flows and ecological changes), economic development, social equity and biodiversity conservation in river basins.

Figure 1 - Sankey diagram of the main flows into, out of, and within, the Tana River system. Flow arrows are proportional to the size of the flows. This illustrates the relative small size of the additional abstraction in pink for the Northern Water Collector Tunnel Phase One.

Tana River Flows



Case study 10

Name of Innovation	M'Chikumbe/Airtel Malawi
Contact person	Nicole Darabian
Website	http://africa.airtel.com/wps/wcm/connect/AfricaRevamp/malawi/airtel_money/home/mchikumbe
Location	Malawi
Target audience	Smallholder farmers
Funding mechanism	Commercially driven, the development and scaling up of the product was supported by a matched funding agreement with the GSMA mAgri programme (funded by UK Aid Direct).
Summary	M'Chikumbe is an innovative service aimed at providing phone-based agricultural information, advice and support to smallholder farmers through Airtel's mobile network. The service provides farmers with access to practical information about agriculture and Airtel Money through interactive voice response and SMS..
Methods and tools	<p>M'chikumbe, using mobile technology, provides service to farmers with access to practical information about agriculture and Airtel Money through interactive voice response and SMS. The product has been advertised through radio and ground campaigns. In collaboration with Airtel, more than 1,000 government agricultural agents have been trained to instruct potential users on the product. The service helps them to learn new agricultural techniques, which they share in regular meetings and training sessions with their farmer groups. Airtel Malawi's M'chikumbe has been a support tool for both agricultural extension department officers and lead farmers.</p> <p>Users of M'Chikumbe dial 212 to gain access to the agriculture-specific interactive voice response service or 321-2 to enter the broader 321 educational service provided by Human Network International. They register for 1 of 15 crops and thereafter have access to a crop-relevant menu, with further options for Airtel Money advice, market prices and weather forecasts. Crop-relevant SMS are sent every Sunday. Access is free for the first three interactive voice response calls each month. The fourth call is charged at 40 Malawian kwacha (\$0.06) to provide unlimited access to the service for the rest of the month.</p>
Future	<p>Going forward, the technology vendor must ensure that it will have the capacity to support a large number of concurrent calls to the interactive voice response system. In addition, the innovation intends to add outbound dialling capacity to their platform to make push messages more engaging and understandable.</p> <p>To make M'chikumbe sustainable, Airtel will need to reduce costs and, ideally, increase revenue by outsourcing the day-to-day management of the service to Human Network International, the technology vendor. Airtel Malawi will minimize its operational costs, keeping acquisition and running costs per user low. Early research identified a possible link between M'chikumbe and Airtel Money (e.g., built-in vouchers claimable against farming inputs), which was never fully explored but may improve the M'chikumbe value proposition internally. Entering into business-to-business arrangements with agribusinesses by offering, for example, targeted advertising of their products could potentially lead to new revenue opportunities and new sources of content.</p>



Airtel -
Airtel's UX lead at work

Case study 11

Name of Innovation	Forecast-based financing, Red Cross Red Crescent Climate Centre
Contact person	Eddie Wasswa Jjemba
Website	http://climatecentre.org/programmes-engagement/forecast-based-financing
Location	The Hague, the Netherlands
Target audience	Disaster risk managers, meteorologists, hydrologists, governments and humanitarian and development organizations.
Funding mechanism	German Foreign Office through German Red Cross
Summary	<p>The forecast-based financing approach involves the disbursement of funds for preparedness actions after the release of the forecast but before a disaster occurs. This approach is used to address the interdisciplinary challenges by developing standard operating procedures to be defined in advance of a forecast and carried out when a forecast exceeding the pre-specified risk level is issued. The standard operating procedures specify what action should be taken at what probability/magnitude of forecast and by whom, for example, "when a 60% chance of a river flow of 400m³ /s over the next 48 hours ...". The goal of forecast-based financing is to reduce losses and suffering by accelerating the delivery of disaster response services and, whenever possible, prevent the losses and suffering from happening in the first place, or even to take advantage of opportunities offered by unusual conditions. Forecast-based financing has now been used operationally by the Red Cross Red Crescent Movement in Uganda twice and, most recently, in Togo.</p>
Methods and tools	<p>Forecast-based financing develops new processes and methodologies to prepare, deliver and respond in a more effective and efficient manner, on the basis of national and international hydro-meteorological forecasts. It helps to formulate defined danger levels and early actions. Such action is triggered when a forecast exceeds a danger level in a vulnerable intervention area (e.g., a specified amount of rain that makes rivers and communities flood). Action can therefore be taken before the impact of the disaster and strengthen resilience of both communities and institutions.</p> <p>The key aspects for implementation of forecast-based financing are:</p> <ol style="list-style-type: none"> 1. Understanding the risk scenarios <ol style="list-style-type: none"> a. Risk scenarios are consulted to analyse threats, including the historical impact data and level of vulnerability 2. Identifying available forecasts <ol style="list-style-type: none"> a. Use of national and international data b. Taking into consideration the probability, intensity and time prior to the occurrence of an event 3. Formulating early actions <ol style="list-style-type: none"> a. Awareness-raising campaign on hygiene or safe drinking water b. Strengthening of houses 4. Identifying the danger levels <ol style="list-style-type: none"> a. Define the threshold for a specific hazard b. Identify the critical character, analysing vulnerability and the historical impact in the area of intervention c. Consider institutional capacity to act

5. Creating a standard operating procedure (or early action guidelines). This includes:

- a. Responsibilities
- b. When to act
- c. Where to act
- d. Funds to be made available

6. Validating the standard operating procedure with key actors

- a. Meteorological service
- b. Local governments
- c. Members of the national disaster risk management system

Future

The pilot projects were conducted on a local (subnational) scale, but now new projects are implemented on a national scale. As the forecast-based financing concept continues to spread, there is a need to address the following questions to make it more effective;

- What disaster effects are most efficiently mitigated by disaster risk reduction versus forecast-based financing, and which disaster effects are not efficient to mitigate?
- What incentives are created by investment in forecast-based financing and how can this avoid creating unnecessary disincentives for investment in risk reduction and disaster response?
- How do organizational culture and aims influence the governance approach for forecast-based financing?

Red Cross Red Crescent Climate Centre - Distributing NFI Uganda

Case study 12

Name of Innovation	Farmerline Limited
Contact person	Lindsey Allen, Director of Corporate Services
Website	http://farmerline.co/
Location	Accra
Target audience	Business-to-farmer model: smallholder farmers and business-to-business model: agribusiness
Funding mechanism	Subscription fees to services and technology platform, customization charges and professional fees for service delivery (clients)
Summary	Farmerline as a software company that is dedicated to transforming smallholder farmers into successful entrepreneurs. The company specializes in building technologies to connect rural customers to information, financial services and supply chains to improve the livelihoods of farmers who are often out of reach owing to barriers in connectivity, literacy or language. In the past five years, Farmerline has built a social business, software technologies and a partnership network that spans 11 countries throughout Africa and reaches more than 200,000 farmers.
Methods and tools	Mergdata, Farmerline's proprietary software, is a cloud-based application that offers farmer education, farmer profiling and mapping, certification audits, mobile finance and traceability. By building relationship and trust with farmers, Farmerline has a dedicated team of officers and field agents who organize between four and six face-to-face workshops.
Future	Leveraging satellite and drone imagery and technologies to provide crop health and deforestation tracking.



Farmerline - Field agents providing local training

Challenges and lessons learned during implementation

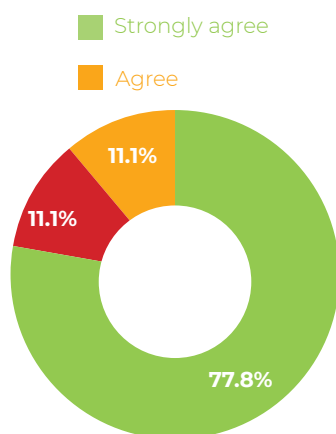
With an increasing African population of half a billion in the coming decade, ⁸benefits from access to quality and localized weather information and climate services will be critical to meet the demand for food security, energy, health care and resilience in Africa. Currently, climate-smart development is a rapidly growing area, with investment opportunities of up to \$783 billion in sub-Saharan Africa and \$265 billion in the Middle East and North Africa according to a study by the International Finance Corporation⁹. Internet penetration in Africa has increased by more than 7400 per cent since the year 2000¹⁰ and mobile phone penetration has similarly swelled exponentially in the past decade to top 81 per cent in 2017¹¹. This has spawned rapid advances in information technology uptake for development applications on the continent. With the right information, the most recent technology and increased capacity, Africa can therefore scale up efforts to achieve its developmental goals, while combating climate change. In the efforts to reach these essential development milestones, there have been some challenges and lessons learned.

Challenges

Looking at these innovations, innovators faced several challenges that restricted the support that they received in developing solutions. A common problem is resource allocation for climate change interventions that are not available owing to few funding agencies, thus limiting their ability to scale up. Accordingly, these innovations will not be able to have a significant and lasting impact on the economy. From our online survey, about 80% agreed that there is a lack of funding in climate services (see chart 1). The Government of Tunisia, for example, passed a law that supports startups by providing the ones that qualify with grants, tax exemptions and government incentives, as well as helping them to file for international patents¹². Another obstacle is the lack of knowledge of existing innovations due to gaps in communication and connection between key stakeholders (i.e., private sector, government and user communities), which prevents these innovations from reaching their full capacity and harnessing the full potential of the solutions being developed. A third aspect is the complexity of down-scaling climate information for end users who are interested mainly in obtaining readily usable information and not technical or general climate information. There remain significant gaps in terms of the reach and understanding of climatic information and data. With the rise of the data generated in Africa, attention to the potential users of the service and their specific needs, as well as providers' abilities, will therefore be vital to ensuring effective climate information services.

Chart 1 -

Lack of funding in CIS?



Data source: ACPC CIS Survey 2018



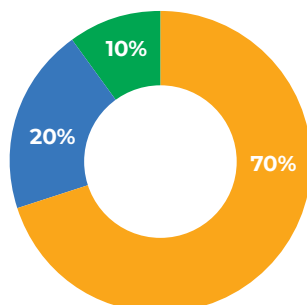


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Lessons learned

Although different in scope, it is important to recognize that these innovations help one to gain insight into methods that will improve and benefit new innovations and increase the value and profitability of existing ones. Accordingly, one of the lessons learned is the need to formulate a business model on the provision of climate information services to make them sustainable and demonstrate the added value of weather and climate information-based innovations for resilience, given that they usually lack support in later stages. Another lesson learned is that, once the desire to integrate climate information into the livelihood activities of the user is identified, there is a critical need to invest in the capacity of end users to use climate information services so that they can reap the maximum benefits of the solutions and technologies being developed (see chart 2). The advantage of such an approach can be seen in the training programmes under the capacity-building component of WISE UP to Climate, which attracted a great deal of interest from stakeholders, given that their capacities were being enhanced on various fronts regarding the importance and valuation of ecosystem services and climate change impact analysis for supporting decision-making on water management. Training on participatory scenario development (also known as foresighting), for example, made a strong impression on national and basin water management stakeholders to the extent that they are planning to integrate the training into their workplans. A second example is the training provided by Airtel Malawi's M'chikumbe to more than 1,100 agricultural extension department officers and other government officials. Their training included not only the use of M'chikumbe, but also lead farmers in their communities and encouraging farmers to join the service. In addition, because some of these innovations are technology dependent and literacy is low among some end users, some practices had to adapt and incorporate capacity-building as part of the innovation. For example, to overcome this, Esoko provides farmers with training on how to recognize a message from Esoko and how to dial the call centre if further assistance is required. Esoko set up its call centre and voice SMS service to attend to smallholder farmers in their local languages. The lessons that these early innovations offer will improve the design of upcoming climate information service innovations, ultimately advancing the impact of future investment.

Chart 2 - How could the climate service you receive be improved?



- Include users in the co-design, co-production, and co-evaluation of climate services
- More capacity building (training/workshop)
- Other

Data source: ACPC CIS Survey 2018



Way forward

Throughout the continent, innovative solutions have begun to adapt and mitigate the effects of climate change. Climate technology need differs from one area to another. Accordingly, climate innovations developed locally have been shown to produce relevant technologies that are oriented towards the communities that they serve. These innovative solutions demonstrate how weather and climate information can be used to support various sectors and represent a new opportunity for industries and the growing African population of young people. Strengthening and promoting climate-based innovations will boost job creation, sustainability and the formation of a low carbon-based economy. The importance of social inclusion is also an integral aspect of climate information services, in particular in terms of facilitating the climate information services value chain. Moving forward, however, there remains a great need to encourage and demonstrate the value of these innovations to achieve a higher economic impact and build the capacity of the end user to enhance uptake. The investment will need to be made in all aspects, including by developing policies, improving communications, increasing the use of weather and climate-related information by the private sector and building and strengthening access to financial mechanisms.

Key recommendations:

- Integrate ongoing and future policy planning that encourages and facilitates the scaling up of climate information service innovations and technologies;
- Foster the co-design and co-production of climate information service innovations and technologies using a nexus approach between information producers, translators and user communities to improve uptake of the services; and
- Enhance synergies between public institutions and the private sector to strengthen their capacities and understanding of weather and climate information services

Annex

Objectives

The objective is to establish a compendium of good practices on climate information service innovations that is aimed at bringing together a collection of numerous initiatives and interventions that are accelerating the uptake of climate information services for development in Africa by showcasing a collection of case studies from various development sectors. The compendium can be used as a tool for communicating user-driven climate information and services by demonstrating important elements of good practices in this sphere and the lessons learned to inform the field of training on climate information services.

Methodology

The compendium will draw on numerous initiatives and interventions to better understand and demonstrate the needs of users in Africa climate information service using:

- Information and data collection from relevant literature and organization on ongoing activities that can address the perspective of research and innovations for enhancing the processes of production and uptake of climate information service in Africa
- A desk review of effective policymaker engagement for an improved climate information service enabling environment
- Mapping of institutions, which are accelerating the uptake of climate information services for development in Africa
- A final step, which will include a survey of the selected case studies for the reporting of the findings
- This approach will look at good practices on climate information service innovations, which focus on the following:
 - Mainstreaming climate information services into development planning and implementation
 - Innovative approaches to cross-sector climate information service coordination (i.e., water, energy, agriculture, transport and health)
 - Entrepreneurship and technological advances in climate information service last mile deliver (that has reach till end users)
 - Role of gender and young people in climate information services

The selection will be based primarily on four criteria:

1. Does the innovation go beyond straight ideas/industry standards or course of action in its field?
2. Does it significantly improve on existing methods and approaches?
3. Can the proposed innovative project or proposal be scaled up?
4. What would be its broader impact on the lives of the most vulnerable part of the population?

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