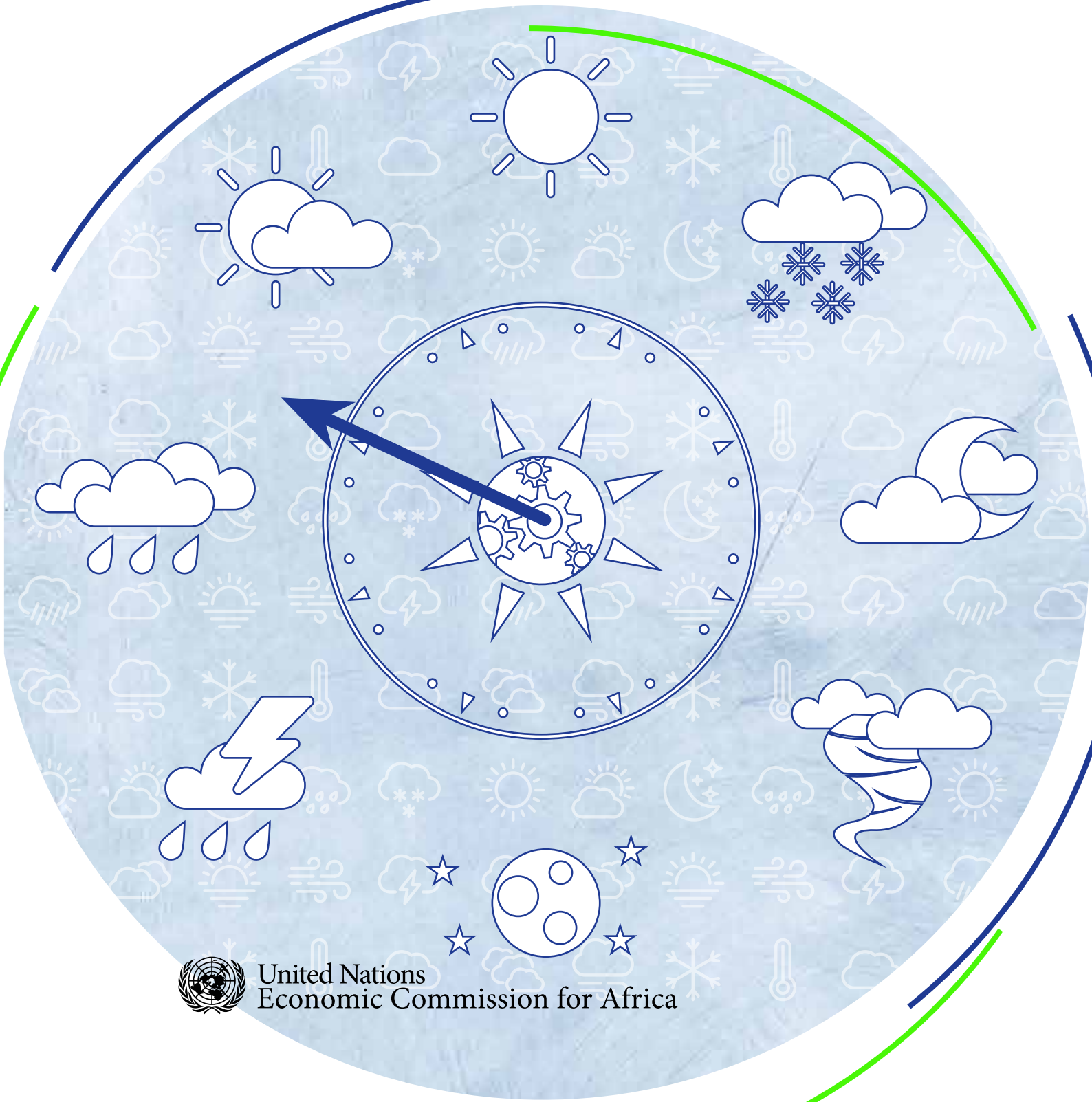
# PRIVATE SECTOR ENGAGEMENT IN CLIMATE INFORMATION SERVICES IN AFRICA



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# List of acronyms

| | |
|---|---|
| ACPC | African Climate Policy Centre |
| AMCOMET | Africa Ministerial Conference on Meteorology |
| CR4D | Climate Research for Development |
| ECA | Economic Commission for Africa |
| GFCS | Global Framework for Climate Services |
| ICT | Information and Communications Technology |
| IFI | International finance institution |
| IPCC | Intergovernmental Panel on Climate Change |
| NFCS | National Framework for Climate Services |
| NMHS | National Meteorological and Hydrological Service |
| PPP | Public-private partnership |
| PICSA | Participatory Integrated Climate Services for Agriculture |
| RCC | Regional climate centres |
| WMO | World Meteorological Organization |

# Executive summary

Private sector engagement in the provision of climate information services (CIS) in Africa will contribute to the efficiency of those services if the enabling environment is provided for their operations. Climate information services involve the acquisition, processing and packaging of weather and climate variables and their delivery to a range of users at different levels to support climate-resilient development and inform climate-related policymaking and decision-making. In Africa, the provision of such services has been the responsibility of governments through national meteorological and hydrological services. African governments have not, however, demonstrated the political will necessary to empower those services to operate effectively, although there is widespread recognition of the importance of weather and climate information. Moreover, climate information services have a long value chain and governments alone cannot effectively provide such services along its entire length. In addition, users are many and diverse, making it a challenge for governments to tailor climate information to every user specification. For effective delivery of user-specific climate information, it is imperative that appropriate institutional mechanisms be in place to generate, exchange, customize and disseminate information at all necessary levels. The importance of climate information services for the Global Framework for Climate Services priority areas and the rationale for the involvement of the private sector in climate information service production, processing and dissemination for the success of the priority areas in Africa has been discussed. To create an enabling environment in which the private sector can operate and contribute to the provision of climate information services, the physical infrastructure of national meteorological and hydrological services needs to be upgraded, professional human resources and succession plans in place and the policy and legal framework developed to guide the various responsibilities of the services and the private partners. It is essential to ensure collaboration between the management structures of the national services and the private sector. While national policies may not permit complete ownership of network observations by the private sector, there are opportunities to work with climate service providers at different levels, including observation networks and other network infrastructure. The national meteorological and hydrological services alone cannot meet the demand for climate-related information, so it is important to identify other actors and open up to the involvement of the private sector in order to ensure seamless climate information services operations.

There are some opportunities for the private sector in the delivery of climate services. For example, the mobile phone is an important tool and its use is increasing rapidly in Africa. More than 90 per cent of people live within range of a mobile Internet signal, making access to clients easy for private companies engaged in climate information services. The demand for climate information is high and creates a clear market for such services in Africa. More than 2.36 million end users receive climate information from private-sector providers in sub-Saharan Africa. There are still barriers limiting the optimal involvement of the private sector, notably the absence of a policy and legal framework to guide private sector operations. Another key challenge for the private sector is the absence of historical data and authenticated meteorological records. Most of the data collected have been recorded on paper and not catalogued electronically and there are data gaps at multiple levels. Despite the challenges facing the private sector, a few private actors have been successful in providing climate information services in Africa.

This report outlines a business model based on the success stories of these actors to encourage the engagement of the private sector. The recommendations include: putting in place a comprehensive policy and legal framework on the involvement of private actors in the provision of climate information services; and upgrading the current infrastructure, equipment and software of national meteorological and hydrological services to state-of-the-art systems to meet private sector demand for high quality,

high resolution data. Strategic and operational recommendations are made for the national and regional levels to improve the engagement of the private sector in the provision of climate information services in Africa.

# 1. Introduction

## 1.1. CLIMATE INFORMATION SERVICES AND WHAT THEY ENCOMPASS

Climate information services are the activities that deal with the generation and provision of climate information to a range of users to support climate-resilient development and inform climate-related decision-making and climate-smart policy and planning. They involve the acquisition, processing, packaging and delivery of weather and climate variables such as temperature, rainfall, wind, soil moisture, ocean conditions and extreme weather indicators. The Economic Commission for Africa (ECA), defines these services as the packaging and dissemination of climate information to specific users (Kadi and others, 2011). For the European Commission, they are the transformation of climate-related data and other relevant information into customized products such as projections, trends, economic analysis, counselling on best practices and the development and evaluation of solutions and any other service about climate that may be used for the benefit of the society at large (European Commission, 2015). Climate services involve the generation, provision and contextualization of information and knowledge derived from climate research for decision-making at all levels of society (Vaughan and Dessai, 2014). They can describe historical, current and future weather and climate conditions and may entail future predictions on daily, monthly, seasonal or decadal timescales and projections at multidecadal and centennial scales (WMO, 2014).

Quality information tailored to the needs of an end user can enhance planning for positive outcomes, including safeguarding economic gains and advancing social development. Climate information equipped with accurate data helps policymakers by providing them with relevant information so that they can make informed decisions. Governments and the private sector are much more likely to integrate climate policies incorporating demand-led, evidence-based information into economic and development planning. Access to robust climate information services is therefore critical across the majority of local, governmental and private institutions to fostering growth along Africa's development pathway.

## 1.2. IMPORTANCE OF CLIMATE INFORMATION SERVICES IN GLOBAL FRAMEWORK FOR CLIMATE SERVICES PRIORITY AREAS

Climate change is impacting resources across many sectors. Strong scientific assimilation of the effects of these changing climate patterns on vital sectors is needed to keep Africa in a low-risk position. Climate information is a tool to help reduce the effect of climate impacts and the risks associated with them. It also has the potential to improve the resilience of climate-dependent sectors to climatic shocks. When climate information services are effective, climate-dependent sectors of the economy will be able to cope better with high productivity and improved livelihoods across the continent even with increased climate variability. The Global Framework priority areas are also priority areas for African countries. The implications of climate change on the priority areas and the need for climate information services are discussed in the subsections below.

### 1.2.1. AGRICULTURE AND FOOD SECURITY

Agriculture underpins Africa's economy (FAO, 2014) and makes a significant contribution to the GDP of many countries on the continent (Alliance for a Green Revolution in Africa, 2013). Agriculture in Africa is predominantly smallholder, traditional and rain-fed (Vanlauwe and others, 2014) and about 80 per cent of Africans rely on subsistence agriculture. Smallholder farmers represent a significant proportion of the world's population and are vulnerable to a variable and changing climate (Harvey and others, 2014; Kichamu and others, 2018). These farmers are key to food security in sub-Saharan Africa (Enfors and others, 2008; Dayamba and others, 2018); they grow most of the continent's maize and produce significant quantities of food crops, cash crops and livestock. However, the farmers are faced with several challenges, including the demand for increased production. Meeting these challenges is vital for the reduction of poverty and sustaining livelihoods in Africa. Climate change, climate variability and increasing extreme hydro-meteorological events are a threat to agriculture and especially to the smallholder farming system (IPCC, 2014). Since more than 90 per cent of the agriculture in Africa is rain-fed, the sector is highly vulnerable to climate variability and change (Rao and others, 2011). Changes in average temperatures and rainfall and climate extremes cause evident changes in pests and diseases and the nutritional quality of some foods (Gitz and others, 2016; Milius, 2017). Timely provision and access to weather and climate information can help reduce these impacts through adequate preparedness and planning, thereby helping farmers increase their resilience to climate variability and change.

### 1.2.2. WATER RESOURCES

Many other economic sectors (especially the agriculture sector) rely on water resources for their activities. Consequently, climate impacts on the water sector have repercussions on the entire economy. Climate change has increased pressure on water resources as a result of droughts and floods (Parry and others, 2007), thus endangering access to quality and quantity of water in Africa, a continent that lacks the technologies and infrastructure needed for the mobilization of water resources. It has been predicted that, between 75 and 250 million people will be exposed to increased water stress due to climate change in Africa by this year (2020) (Pachauri and Reisinger, 2007; Ngoran and others, 2015). Climate change is measurably altering the amount, distribution, timing and quality of water. For example, as air temperature increases, water temperature rises, causing the solubility of oxygen and other gases to decrease (Shrestha and others, 2014; Perlman, 2016). Moreover, more intense precipitation leads to increased run-off and decreased oxygen solubility in water bodies and hence more stress on the fish, insects, crustaceans and other aquatic animals that rely on oxygen dissolved in water. Using climate information can help the water sector to predict how water resources in Africa will be impacted and will lead to better management of the existing resources to prepare for droughts and floods if and when they come. Climate services are key

components in planning effective and sustainable water resources management to achieve sustainable development.

### 1.2.3. DISASTER RISK REDUCTION

The Intergovernmental Panel on Climate Change (IPCC) special report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation reports that climate variability and change will impact all sectors of the economy (Murray and Ebi, 2012). Many disasters are caused by weather and climate-related hazards such as floods, strong winds, extreme temperatures, landslides and wildfires. Disasters have social and physical dimensions whereby changes in the frequency and severity of physical events affect disaster risk, which has spatial and temporally dynamic patterns of exposure and vulnerability. Extreme weather and climate events have increased in frequency and magnitude in Africa (Change, 2013). These, coupled with increased populations and assets, increase disaster risk. The development of early warning systems with climate information will help minimize high future risks.

### 1.2.4. HEALTH

Diarrhoea, malaria and meningitis are examples of infectious diseases whose spatial and temporal prevalence is influenced by seasonal cycles in Africa. The seasonality of these diseases is further driven by changes in weather and climatic elements such as rainfall, temperature and humidity (Alexander and others, 2013; Klutse and others, 2014). Although there is limited research on climate change and health in Africa (Tanser and others, 2003; Ramin and McMichael, 2009), malaria is probably the most documented single disease in relation to climate change. The IPCC and other research reports a probable net extension in the distribution of malaria and an increase in incidence (IPCC, 2013; Barros and others, 2014). Detailed climatic analyses suggest that patterns of malaria transmission in Africa may also change as a result of climate change (Lindsay and Martens, 1998; Hay and others, 2002; Tanser and others, 2003; Peterson, 2009). The relationship between climatic variables and diarrhoeal disease in many places around the world has been established and widely reported (Pande and others, 2008; Bandyopadhyay and others, 2012; Alexander and others, 2013). The effects of seasonal variations in temperature and rainfall on the occurrence of pathogens in the environment and the incidence of diarrhoeal diseases (Alexander and others, 2013) is an example. Temperatures in Africa are high, so even small amounts of warming will lead to declines in agricultural production because crops are already close to critical temperature thresholds (Parry and others, 2004; Patz and others, 2008), a situation which is detrimental to food production and nutrition. Moreover, exposure to heatwaves is another direct climatic impact affecting many people, according to the World Health Organization (WHO) and other research reports (Lucas and others, 2014; Sylla and others, 2018). Similarly, the impact of heat stress and the proportion of the human population at risk under 1.5°C and 2°C global warming scenarios in West Africa has been established (Sylla and others, 2018). The projected seasonal proportion of the human population in discomfort will substantially increase to more than 50 per cent (Sylla and others, 2018). Timely provision of climate services is crucial for planning intervention measures and taking appropriate decisions to reduce climate risks.

### 1.2.5. ENERGY

Energy is essential for socioeconomic growth and sustainable development but changes in weather and climate extremes have significant impacts on the energy sector, particularly in Africa. Extreme climate events such as storms, floods, and drought significantly affect energy production, transmission and supply. Power generation in Africa has been heavily affected by drought and flood events in recent years (Deressa, 2014). The protection of the energy sector from variable weather and climate is a priority for the sector and therefore requires climate information if appropriate decisions are to be taken.

## 1.3. HOW CLIMATE INFORMATION IS PRODUCED, PROCESSED, DISSEMINATED AND USED IN DECISION-MAKING PROCESSES

In order to produce climate information, the key mechanisms that influence climate in an area are assessed to study the dynamics. The mechanisms may be local (e.g. land use), regional (e.g. African easterly waves) and global phenomena (e.g. El Niño–Southern Oscillation). Many climate services start with seasonal forecasts. A seasonal climate forecast or climate outlook indicating possible rainfall conditions is regularly produced for specific areas and times, usually one to three months ahead and beyond, before the rainy season. Climate services providers use modern and effective information integration and dissemination capabilities. Most providers have designed websites that present information and data stored and archived in the national climate services database. They also provide customized climate services on demand for sector-specific decision makers. The media are the primary communication channel for disseminating climate information services, both electronic and print media being used in Africa. The use of social media to disseminate climate information is also emerging.

## 1.4. MAJOR ACTORS INVOLVED IN THE PRODUCTION, PROCESSING AND DISSEMINATION OF CLIMATE INFORMATION IN AFRICA

The number and range of actors involved in climate service production and development have increased the visibility and potential benefits of climate services in Africa and various climate service providers provide such information and services. National meteorological and hydrological services are mandated to provide climate data, seasonal forecasts and weather forecasts, among others. They receive support from the regional climate centres (RCC) as the centres mainly manage regional climate data sets and climate databases and other functions, depending on the needs of the region. Academic and research institutions usually transform climate data into useful information for planning and decision-making. They are intermediary users and are sometimes the partners of national meteorological and hydrological services in producing climate services. They work with forecasters to transform climate information into climate services. Academic and research organizations play a critical role in climate services, focusing primarily on data compilation and analysis and product development, and engaging either on their own or with public or private sector partners. For example, the Climate Systems and Analysis Group of the University of Cape Town has developed a Climate Information Portal, which provides a wide range of users with climate information. The Ghana Space Science and Technology Institute provides a weather base insurance index on dekadal (10-day) rainfall estimates for Ghana Agriculture Insurance Pool, a private company based in Ghana. Dissemination is another important aspect of climate information services. The media are the main disseminators of climate information, although all service providers have some sort of communication strategy. Print, electronic (Radio, TV) and social media are used for climate information services in Africa. To enhance coordination of these services, the African Climate Policy Centre (ACPC) has mapped institutions involved in climate information services. It found 176 climate information service initiatives, programmes and projects and has established a means of communication with several institutes and organizations.

## 1.5. MOST PRESSING PROBLEMS CONCERNING CLIMATE INFORMATION SERVICES IN AFRICA

Although African governments recognize the importance of weather and climate information, they have not demonstrated the political will necessary to empower national meteorological and hydrological services to operate effectively. In many countries, these services lack:

(1). Political backing

(2). Financial resources

(3). Internal capacity.

These are needed to maintain the observing systems of the services and effectively use the data from those systems. Another critical concern is the lack of collaboration among institutions, especially between the private sector and the producers of climate information in Africa. The staff of national meteorological and hydrological services are already overburdened and struggle to comply with the different rules, policies and strategies for implementation. In most countries, hydromet stations rely on other national agencies, including ministries for disaster relief, water, transportation, communications, agriculture and finance, for support so hydromet stations are not completely managed by meteorological and hydrological services.

The challenges of availability of, and access to adequate and quality climate data is relevant to the risk of climate change and variability in Africa. All information about weather and climate is based on instrumental observations and the data obtained from them. Observational data are used directly or indirectly as input into reanalysis, numerical weather and climate prediction, climate projections and impacts models. Africa has inadequate observational instruments and limited information about past and future climate. There is a lack of historical climate records due to the poor coverage of climate and weather information recording equipment.

Another challenge facing climate information services in Africa is the digital gap in information and communications technology (ICT) in the promotion of climate services in Africa. This gap is the result of the lack of three main components: information technology (IT) infrastructure, which is critical to the generation of solid climate data; effective communications platforms, which are crucial for dissemination; and knowledge of how to package ready-to-use data. IT infrastructure is critical for generating robust climate information. Across the continent, only South Africa has an effective state-of-the-art high-performance computing system. Though the system is open to researchers throughout the continent at no cost, few are aware of it and those who are lack the necessary ICT infrastructure and/or expertise to access the potential benefits of the high-performance computing systems off-site. Another challenge is the credibility of and trust in information providers in Africa.

There are challenges in disseminating forecast information (e.g. weather forecasts) through national media channels. Journalists find it difficult to communicate climate information because they cannot easily understand and interpret the information released by national meteorological and hydrological services. This is often observed during the weather forecast on national media channels: newscasters present weather news in a way that often misrepresents the weather information. In addition, the format of the information provided by national meteorological and hydrological services is often incompatible with the existing in-house media system.

Although, regional climate centres provide a range of weather and climate products on a wide range of scales, the products produced at the regional and subregional scales, among others, are heavy rain and flood risk, weekly rainfall monitoring, daily rainfall observation, daily forecast, weekly forecast, seasonal climate outlook, long-range forecasting products and bulletins of dekadal climate, monthly climate bulletins, climate and health. However, the information provided by the regional centres through the Regional Climate Outlook Forums is not at the local scale so important weather and climate features of particular locations may be lost.

# 2. Rationale of the study

The process of providing climate information services involves many levels, including but not limited to, data production through monitoring and processing, contextualizing of data including research, value-adding or customizing information to sector-specific and dissemination to end users. The need for climate information must be understood and organized for sector use. Governments alone cannot effectively manage all the elements along the value chain of climate information services, especially as the impacts of climate change are becoming more varied and rampant, and as the concerns for adaption and mitigation are growing. Moreover, the increasing demand for accurate and timely climate information at different levels and in different sectors necessitates a collaborative approach. National meteorological and hydrological institutions struggle to meet the demands of the general public and the various sectors at the same time. The involvement of the private sector is the best option to relieve the operations of the national institutions to some extent. The private sector can take responsibility for the contextualization of information and knowledge derived from climate research for decision-making at all levels of society. In some countries, the private sector is involved in climate information services at all stages of the process and there is now a growing recognition that private service providers could offer the resources needed to fill key gaps in climate information across Africa.

Agriculture is a priority sector that presents a huge market for climate information services, particularly for smallholder farmers. The majority of such farmers have little or no formal education and may need assistance in interpreting climate information in order to understand it thoroughly. Private actors could act as intermediaries in the essential task of facilitating and interpreting climate information and interaction and dialogue for improved service provision.

Africa is highly vulnerable to climate change and the importance of climate information services for planning adaptation and mitigation actions has been established. The continent has limited capacity to adapt to climate change, however, in part due to the poor quality and inaccessibility of climate information, low financing capacity and lack of political interest. As climate change threatens development, the importance of private sector involvement cannot be exaggerated, if Africa is to achieve the Sustainable Development Goals. Two fundamental efforts are needed to bring about effective and efficient climate services in Africa: national meteorological and hydrological services need to champion the generation and analysis of new data, while the private sector champions research on effective and sustainable production of information, customization of sector-specific information and dissemination.

# 3. Climate information services and the private sector

## 3.1. ROLE OF THE PRIVATE SECTOR IN THE PRODUCTION, PROCESSING AND DISSEMINATION OF CLIMATE INFORMATION

A vibrant private sector is the engine of growth that generates decent jobs, releases stress on government tax revenue and creates increased opportunities for more inclusive and green growth. Thus, the private sector is a driving force for the transformation of Africa. While governments can empower poor people through regulation, funding and providing public goods, private initiative can also provide services and generate much-needed employment. In this regard, a large, formal private sector can also be a strong advocate for policy reforms and a force for good governance. In addition, a system can be created whereby an improving business environment that subsequently nurtures private sector growth is allowed to help strengthen governance reforms. The private sector drives the economic growth of Africa, meaning that adverse impacts of climate change on the private sector can greatly undermine its economic growth.

To respond to the challenges that emanate from not properly implementing climate information services, the African Climate Policy Centre, in collaboration with the United Kingdom Met Office, is implementing Weather and Climate Information Services for Africa (WISER). The WISER programme is aimed at helping to address climate information gaps and ensure accelerated uptake of climate information services for development planning and practice. The programme is essential to weather-sensitive business and economic activities such as transport, aviation, construction, and agriculture, agriculture being the dominant source of employment and highly sensitive to weather and climate. In implementing this programme, the Climate Policy Centre has noted the limited contribution of the private sector in the production and uptake of climate information services.

In Africa, climate information services have primarily been provided through national meteorological and hydrological institutions, which are largely funded by governments. It has been challenging for governments in Africa to fully support the operations of these institutions and this has resulted in inefficiency in the provision of climate services. Private sector partnership with national institutions to deliver information would help to alleviate the burden on those institutions and ensure more efficient services.

Economic development is linked to access to timely, location-specific and accurate climate information for decision-making. With the emerging gradual changes in climate and its variability, the use of climate information by policymakers, water resource managers, disaster managers, farmers and all other relevant stakeholders in the development of Africa is compelling. It is evident across the continent that there is a huge gap in the production of useful and usable climate information because government machinery alone is not able to provide tailored climate information to numerous and diverse users. Moreover, private sector participation in climate information services provision in Africa is minimal and, where there is private sector involvement, it is weak and fragile with weak investment. Private sector participation, whether a public-private partnership or purely private, is marginal throughout the value chain.

There is a growing market for climate information services for the private sector. There is also growing recognition that private service providers could invest in essential equipment and delivering quality climate information through public-private partnerships (PPPs). In some countries, such partnerships are helping to bridge gaps in public services in all sectors, and the private sector has begun to provide value-added climate services (Vaughan and Dessai, 2014) for their benefit and to complement the services of national meteorological and hydrological services. Many of the latter rely on the private sector for support to some extent, though commercial opportunities have been limited to the private sector actors. For long-term planning and to take into account the impacts of climate change, private companies in different sectors (especially energy and insurance) have created climate risk management teams to help them prepare for climate-related risks. The private sector in all climate-dependent sectors can take advantage of this opportunity.

Factors that influence the delivery of climate information services are limited media access, the time information is broadcast and the perception of climate information. The constraints of national meteorological and hydrological institutions in the delivery of climate services are lack of communications platforms between actors for better access and use of climate information, lack of high-speed Internet, poor radio coverage, limited radio listening groups, lack of weather presenters on television broadcasting in local languages and limited capacity. These shortcomings provide an opportunity for the private sector to invest in communication and dissemination of climate information.

## 3.2. TYPES OF PRIVATE SECTOR INVOLVEMENT IN CLIMATE INFORMATION SERVICE VALUE CHAINS

The private sector in Africa is diverse, comprising large national corporations, private investors, small and medium-sized enterprises and multinational companies. The number of private companies involved in and operating climate information services in African countries varies. Eight private companies operate in Ghana, six in Kenya, five in Malawi, Burkina Faso and Uganda, four in Nigeria and Côte d'Ivoire, three in Madagascar, and two in Ethiopia, Mali, Senegal, Sierra Leone, the United Republic of Tanzania and Zambia. The remaining countries have either one or none at all. The private companies operating in these countries in Africa are Viamo, Esoko, Ignitia, Farmerline, Farm Radio, Manobi, the Hershey Company and Ghana Agriculture Insurance Pool.

## 3.3. TYPES OF PRIVATE SECTOR CLIMATE INFORMATION SERVICES

The private sector engages in climate services at many different points along the value chain. The services it provides range from supporting weather observation from tailored, value-added products and services to delivery to end users. The products provided by the private sector include seasonal forecasts, the onset of rainfall (and the planting period for farmers), in simple and local languages in most cases. They also provide extreme climate information for vulnerable communities and disaster relief agencies. Private actors normally use government-collected data to develop new tools and products that they sell to individual users. For example, Farm Radio provides weather and climate information for farmers at no cost through a radio communication tool to over a million farmers in 11 countries. Ghana Agricultural Insurance Pool provides climate information to its clients free of charge as part of the insurance package, thus minimizing the risk of loss of agricultural products and reducing insurance claims. Among other services, for a fee, Viamo shares information (including on weather and climate) with anyone who owns a phone, in their language of choice. Esoko's Digital Farmer Services help connect farmers and informal sector actors to critical information and services. Its information services include weather forecasts, agronomic advice, market linkages and insurance coverage over a range of channels, including SMS, voice SMS and call centre. In partnership with mobile network operators, Ignitia provides daily, monthly and seasonal location-specific weather forecast to small-scale West African farmers through SMS to help them avoid the adverse impacts of an ever-changing climate. Farmerline distributes weather forecasts and provides real-time agricultural education to farmers across Africa through voicemail in local languages. Using their innovative Mergdata platform, Farmerline offers subscription-based information services to rural farmers and licenses its software to agribusinesses to bridge the information gap between organizations and farmers. Manobi uses mobile phone applications and web services to support various risk-sensitive sectors, such as agriculture, water and sanitation, artisanal fishing and local government, among others. The Hershey Company is dedicated to cocoa farmers, educating them through its CocoaLink programme, connecting cocoa communities. CocoaLink uses mobile technology to share practical information with rural cocoa farmers for sustainable cocoa farming. Farmers receive free text or voice messages that cover topics such as improving farming practices, farm safety and crop disease prevention, among others.

## 3.4. CLIENT BASE OF PRIVATE SECTOR CLIMATE INFORMATION PROVISION

The private sector is active in almost all countries in Africa and provides different services and products for different sectors. Generally, private sector climate information products go mainly to the general public, aviation, farmers, disaster relief agencies, local government, etc. Private companies provide services for aviation in most African countries, especially Côte d'Ivoire, the Niger, Nigeria and Senegal. Ghana, Mali, Nigeria, Rwanda and Senegal receive climate information services for agriculture and water resources. Farmers generally assess their financial capacity for the farming season on the basis of seasonal forecasts. Forecasts and other information help them to start planning and budgeting for the coming season before the season starts. Insurance companies in Ghana, Nigeria and Rwanda receive climate information from private companies. Other sectors receive such information from private companies in one or two countries, for example, Nigeria for health and transport.

# 4.Existing enabling environment

## 4.1. POLICY AND DATA-SHARING PROTOCOLS

National meteorological and hydrological services provide free data to students, universities and research scientists, provided the correct procedure is followed. The requests of other users, mainly for commercial activities, are handled differently according to the request. In response to all request types, the provision of data is accompanied by conditions with which the user has to comply. For example, they may not share data with third parties and must acknowledge the national institution as the source of the data.

Regional data-sharing policies are implemented at country level by national meteorological and hydrological services. For example, the Intergovernmental Authority on Development (IGAD) Climate Prediction and Application Centre (ICPAC), based in Nairobi, Kenya, implements a data-sharing policy with the services of countries in the Greater Horn of Africa; the AGRrometeorology, HYdrology, METeorology (AGRHYMET) regional centre in Niamey, the Niger, implements a data-sharing policy with national services in countries in West Africa; and the Southern African Development Community – Climate Service Centre (SADC-CSC) implements a data-sharing policy with national services in countries in Southern Africa. Recently, the Climate Prediction and Application Centre (ECPAC) was established to act as a regional climate centre and will thus implement a data-sharing policy with countries in Central Africa. The RCC-Network Northern Africa operates on four nodes, with Algiers Node on Data Services led by the National Meteorological Office (ONM) of Algeria. In addition, World Meteorological Organization (WMO) Resolution 40 (Cg-XII, 1995) on WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities was adopted to support national information services and regional climate centres. WMO Resolution 25 (Cg-XIII, 1999) on exchange of hydrological data and products and WMO Resolution 60 (Cg-17, 2015) on policy for the international exchange of climate data and products to support the implementation of the Global Framework for Climate Services are designed to promote and support climate information services in African countries. Countries in Africa have various private sector policies providing a framework that guides private sector engagement with the public sector in public-private partnerships. The policies are general in scope and serve as a primary reference point for both private and public sector engagement. Most countries and subregions have data privacy and data protection legislation, however (Makulilo 2016), for example, the SADC data privacy policy, the Economic Community of West African States (ECOWAS) Supplementary Act 2010 and the East African Legal Framework for Cyber Laws 2008. At the continental level, the African Union adopted the African Union Convention on Cyber Security and Personal Data Protection 2014, which includes a data privacy policy. The first data protection legislation was enacted in Cabo Verde in 2001.

## 4.2. INSTITUTIONAL CAPACITY

Existing structures and functioning institutions for climate information services provide an enabling environment for private sector operation. The functions of the regional climate centres are, among others, to acquire, develop and manage regional climate data sets, databases and archiving services in collaboration with national meteorological and hydrological services. They also conduct applied climate studies, including monitoring anomalous conditions, promoting regional research and the creation of specialized products and decision-making support tools. Their functions may vary according to the regional needs determined by the economic and climatic situations of the regions. Most regional climate

centres in Africa enhance their funding by grants and contracts for services, data and research projects from government and private-sector sources (De Gaetano and others, 2010).

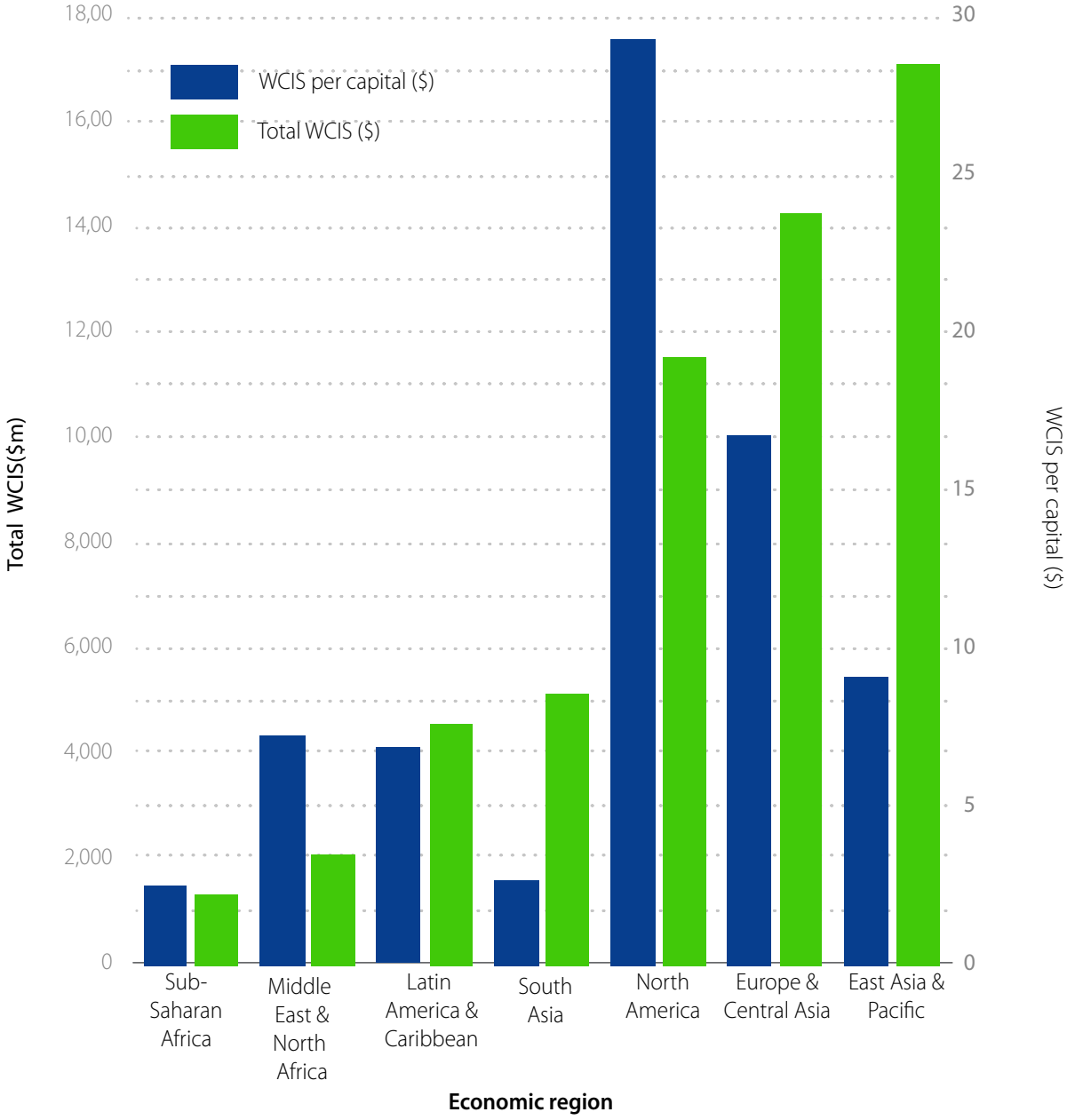
The functions of national meteorological and hydrological services are the provision of meteorological and climatological services to the public and private sectors; coordination of research in meteorology and climatology, including cooperation with other authorities in all aspects of applied meteorological research; and involvement in training programmes in meteorology and other related scientific subjects.

Each regional climate centre and national meteorological or hydrological services is also supported by the academic institutions in the region. Other climate information providers offering support include international institutions such as the International Research Institute for Climate and Society (IRI), founded by the United States National Oceanic and Atmospheric Administration (NOAA). These international institutions provide climate information for decision-making in developing countries. The International Research Institute for Climate and Society has developed Maproom (Greene and others, 2011) and, in collaboration with the International Federation of Red Cross and Red Crescent Societies (IFRC), developed the forecast in context in Maproom (IRI-IFRC). These are global climate service tools to aid disaster-related decision-making.

Non-governmental organizations (NGOs) have contributed to the provision of climate information, but they have generally remained as the communication and awareness-raising component. Not-for-profit organizations and their activities are project-based and may not live beyond the life of a particular project. This is another reason why private sector participation is crucial in making climate information a business and a lucrative venture. The involvement of the private sector will help the multiple fronts of climate information to progress and provide innovative products and services and bring in new capacities.

Sub-Saharan Africa spends less than $1.4 billion on weather and climate information services (Georgeson and others 2017). According to the World Bank's regional classification of the transactions relating to weather and climate information services, sub-Saharan Africa spends both a lower total amount and lower amount per capita than any other region. Figure 1 shows the disparities that exist in investments in weather and climate information services across in 192 countries grouped by economic regions. Significant markets for weather and climate information services in North America, Europe and Central Asia, and East Asia and the Pacific provide opportunities for private-sector investment. At the 2015 World Meteorological Congress, it was reported that, as of June 2013, $30.5 million had been pledged to fund the Global Framework for Climate Services, which appeared to overcome the disparity in access to and investment in weather and climate information.

**Figure 1** Per capita spending (in dollars) and total spending (in millions of dollars) on weather and climate information services, in 192 countries (grouped by region)




## 4.3. FACILITIES, DATA ARCHIVES AND DATA SOURCES

Data archives play a critical role as the source of the observation data used for weather and climate research. Climate data is usually archived at national meteorological or hydrological services and regional climate centres. The former have their hydromet stations for weather observation, from which they obtain data for archiving. Other sources of weather data available to them for use and archiving are satellites. Other institutions, such as the universities, research institutions and some sectors, also archive climate information, usually obtained from the national services.

Past weather data are needed for many agricultural and natural resource management applications and research and could bolster the climate record and enhance our understanding of climate. The historical data captured on paper, microfilm and outdated digital media have now been digitized at the various

national meteorological or hydrological services in Africa. Under the WMO data rescue projects, countries must archive and migrate their climate observation records to new technologies to make them available for research. The conversion of observation data to common electronic formats is part of the knowledge management practices that enhances data storage, preservation and compatibility with modern technology.

Smallholder farmers in Ghana, Mali, the Niger, Senegal and a few other countries have experienced the Participatory Integrated Climate Services for Agriculture (PICSA) approach (Dorward and others, 2015). The approach uses historical climate records, participatory decision-making tools and seasonal climate forecasts to help farmers identify and better plan livelihood options suited to their circumstances and climate conditions (Dayamba and others, 2018). In many countries in Africa, farmers are organized into farmer organizations and community volunteers, making the dissemination of information easier. This also enhances training in new products.

## 4.4. THE MARKET AND DEMAND

The demand for climate information is high and creates a clear market for climate information services in Africa. According to the report by Winrock International, more than 2.36 million end users receive climate information from private-sector providers in sub-Sahara Africa (Usher and others, 2018). There is a demand for climate information products from the general public, the aviation industry, farmers, disaster relief agencies, water managers, event organizers, etc. Although the national services provide information for such entities, it is not completely tailored to their specific needs. This gap provides an enabling environment for the private sector. There is a demand for climate information from the aviation industry in most countries in Africa, especially those with vibrant air transport systems. Demand is highest in the agricultural sector, however, because a large number of people in Africa engage in farming. In a few countries (e.g. Ghana, Nigeria and Rwanda) there is demand for climate information from insurance companies. Nigeria is a typical example where there is demand for climate information from the health sector.

# 5. Private sector challenges

## 5.1. PRIVATE SECTOR CHALLENGES IN THE PROVISION OF CLIMATE INFORMATION SERVICES

### 5.1.1. POLITICAL CHALLENGES

A major barrier to the growth of private sector provision of climate information services is the weak partnership with national meteorological and hydrological services. Such partnership adds very little value and does so at a slow rate (Usher and others, 2018). Throughout Africa, there is a lack of or limited inter-agency collaboration between national meteorological and hydrological services and other governmental bodies, making partnership with those services a barrier to the growth of the private sector (Usher and others, 2018). The limited weather and climate information in national services is tightly controlled by government in most countries. Another obstacle the private sector faces in Africa is inadequate government regulation, and restrictive policies.

### 5.1.2. ECONOMIC CHALLENGES

One of the main challenges the private sector faces is the high data price charged by national meteorological and hydrological services in Africa compared with other continents. There is a lack of expertise in data pricing in sub-Saharan Africa and in most countries no proper structure is in place for data length, quality and pricing. The private sector also suffers from trade restrictions and tariff and non-tariff barriers to African exports (South Africa is an example).

Demand for climate information services comes at different times of year from different sectors or institutions. For example, farmers want climate information services during specific agricultural seasons, making private sector service providers lose constant revenue, hence impairing their growth. Furthermore, unlike the private sector, government agencies, NGOs and donors usually have financial support and do not provide climate information for commercial purposes. Governmental and non-governmental organizations are able to subsidize weather and climate information services, such that companies and end users rely on those subsidies to deploy their products and services. This distorts the market for the private sector, as its potential clients obtain information for nothing from other providers. Furthermore, private companies have limited capacity and time to do as much as governmental organizations to reduce risk.

Another huge challenge is the high cost of electronic communication in Africa, which limits the number of subscribers to climate information services. According to the broadband pricing league table compiled by Cable.co.uk, broadband Internet is expensive in many African countries. As of 2017, Egypt had the lowest monthly cost for Internet at $12.33, and Angola the highest at $139.29 (Kazeem, 2019). The monthly cost of broadband Internet in other African countries falls between these two extremes. In addition, potential clients are unwilling to pay in Africa and this is a barrier to the growth of the private sector.

#### 5.1.3. SOCIOLOGICAL CHALLENGES

The low literacy levels in African countries that cause severe skills shortages and mismatches between employers' needs and available workers are a hindrance to the delivery of climate information services. Lack of resources for broadcasting in local languages is a further challenge and hinders the delivery of climate information by the private sector. The private sector has a wide range of clients and demand for products. Disseminating information in different languages could enhance the delivery of climate information services.

Although climate change affects women more due to their vulnerability and exposure, there is a gender gap in the provision of climate information in general. The gap manifests in the accessibility and use of technology. Women in Africa have particularly limited access to mobile communication devices. This makes it very difficult for the private sector to target and effectively provide climate information to women. Poor infrastructure, particularly in energy and transport, also hinders the operations of the private sector in Africa.

#### 5.1.4. TECHNOLOGICAL CHALLENGES

Africa has limited technical ability for the provision of climate information, which is another barrier to the private sector. The continent lacks adequate ICT and technological know-how for their effective provision. The specific challenges are:

- Lack of access to climate and weather data, which are archived at national meteorological or hydrological services.
- Lack of communications platforms between actors for better access and use of climate information.

Lack of high-speed Internet. Internet speeds across Africa are far below the global minimum standard. Apart from Madagascar, which has an Internet speed of more than 10 Mbps and up to 22.57 Mbps, most African countries have speeds of less than 10 Mbps. For example, in 2019, South Africa had 8.4 Mbps, Kenya 7.62 Mbps, Mauritius 5.02 Mbps, Namibia 3.39 Mbps, Rwanda 3.34 Mbps, Cabo Verde 3.31 Mbps, Uganda 3.22 Mbps, Ghana 3.2 Mbps and Zambia 3.1 Mbps. While global average speeds have increased by over 20 per cent recently, much of that growth has taken place in developed nations, which already have established connectivity infrastructure (Kazeem, 2019).

Lack of weather presenters on national television stations broadcasting in local languages.

- Although mobile phone usage is rapidly increasing in Africa, smart phones are less common and literacy rates are also low, limiting technical ability.

#### 5.1.5. LEGAL CHALLENGES

There is no clear policy to ensure paid or free data services by national meteorological or hydrological services in Africa, despite the importance of appropriate legal and regulatory frameworks for the effective operation of their services (Rogers and Tsirkunov, 2013). There is also no framework guiding those national services to sign agreements with private partners and serve private clients. The private sector is diverse, and different actors respond to different incentives; without clarity, projects may struggle to identify opportunities for private-sector involvement.

Although African countries voted for the adoption of WMO resolution 40 (Cg-XII, 1995) on the exchange of meteorological and hydrological data, it is not legally binding. Resolution 40 was drawn up to leverage data policies and data-sharing standards across the world (Yost, 2017), but it is adaptable and recognizes the right of governments to choose the manner in which and extent to which their data are shared.

# 6. Success stories

## 6.1. SUCCESS STORIES

Despite the challenges faced by the private sector in contributing to climate information services in Africa, a few private actors have operated successfully.

Farmerline is one successful African social software private company. It started in Ghana and extended to Cameroon, Malawi, Nigeria and Sierra Leone, reaching over 200,000 farmers. It has a subscription-based information service that sends SMS and voice messages on weather forecasts, market prices, new farming techniques, agrochemical applications and finance directly to the mobile phones of rural farmers in the local language of their choice. According to Farmerline.co, farmers who subscribe to Farmerline services see a more than 50 per cent increase in their income.

Another successful company is Hershey's, a confectionery company that depends on cocoa farmers for its raw materials. The company is dedicated to educating farmers through its CocoaLink programme, which connects cocoa communities. CocoaLink uses mobile technology to share practical information with rural cocoa farmers for sustainable cocoa farming. Farmers receive free text or voice messages that cover topics such as improving farming practices, seasonal climate updates, farm safety and crop disease prevention, among others.

Farm Radio is a successful private company operating in 11 African countries and reaching tens of millions of farmers. It combines radio and mobile phone communication tools to disseminate weather and climate information on agriculture, health and nutrition, gender equality and environmental sustainability.

There is a more promising enabling environment for the private sector in Africa. Gambia, Guinea, South Africa and the United Republic of Tanzania have prepared their national frameworks for climate services, guided by the Global Framework for Climate Services. Other countries preparing national frameworks are Ghana, Nigeria and Rwanda. These frameworks have components for private actors in the countries concerned. The involvement of the private sector in the Global Framework priority areas is outlined in the national frameworks. The frameworks will enhance the provision and use of climate services in planning and decision-making to reduce the threats of climate variability and change to the achievement of development goals.

## 6.2. WORKABLE BUSINESS MODELS FOR GREATER PRIVATE SECTOR INVOLVEMENT IN CLIMATE INFORMATION SERVICES

The private sector is vital to economic growth and development but, in order to function effectively, it requires governments to provide an enabling environment through appropriate regulations and institutions, among others. Meanwhile, the challenges the private sector faces in using climate information services in Africa need to be addressed so that they can be used fully to enhance the performance of the private sector. Partnership among private actors and with governments has been shown to be a convenient tool for enhancing the performance of the private sector and has yielded success in some areas. For example, Farmerline, Telcos and Hershey's are three private organizations that have effectively partnered with governments to deliver important services to their clients. Hershey's is a foreign corporation that buys cocoa as a raw material and processes it. It buys the cocoa through national cocoa boards,

which come under a ministry, and is therefore unable to interact directly with farmers. To obtain quality and sustainable cocoa at a competitive price, Hershey's wishes to influence the production of cocoa by advising farmers to adopt good farming practices. Since it does not deal with farmers directly, it has to partner with Farmerline, which has a good history of data management, customized information delivery and farmer education. Hershey's provides the necessary resources for the development of appropriate mobile application software for educating farmers and the input required to customize the information. The mobile network is used for the delivery of information to and education of farmers because it is already a ubiquitous and versatile technology in most parts of Africa. To complete the public-private partnership, the Ministry of Agriculture and other ministries are engaged in order to access the required data and information needed for adequate farmer education. Farmerline accesses data and information from the government, customizes information and delivers it to farmers through Telcos networks on a subscription and subsidized basis. Data gathered from cocoa boards shows that customized education has helped cocoa farming in several ways. Farmers have high yield and good quality cocoa leading to premium prices. They enjoy good health through knowledge of the proper application of chemicals to protect themselves and the environment. Hershey's benefits from good quality and high-yield cocoa at a competitive price.

Most farming activities in Africa are rain-fed and therefore highly dependent on favourable weather. Thus, accurate and timely weather information can enhance the effect of good farming practices in ensuring high quality, sustainable agricultural yield. Sometimes, changes in weather conditions, especially rainfall, can easily erase the effect of all a farmer's good farming practices. In view of this, the kind of public-private partnership between Famerline, the Ministry of Agriculture and Hershey's, which has been demonstrated as a good practice, can serve as a workable business model for private and public sectors along the climate information value chain.

To demonstrate this business model, figure 2 represents four sets of entities identified as A, B, C and D. A is a data management company that has the capacity to process data into useful information and delivers user-specific information. B is a set of climate information service end users, including in the health and agricultural sectors, the general public, disaster risk managers, SMEs, etc. C is an array of corporations doing business through direct use of products and services from B but that are unable to provide user-specific information that can benefit B. D is a set of government agencies that are able to acquire data and information from the primary sources but are faced with challenges that include a lack of the financial, human and infrastructural resources to enable them to acquire and process data into user-specific information. Note that B is made up of a number of users with diverse needs. However, research by government has shown that the use of information from D can greatly improve B's product and services and subsequently C's business outlook. The combined cost of data procurement, processing, customization and delivery to the end user is huge, however. Most end users in B cannot afford the cost. In the scenario described so far, the government acquires data through D but in the end to no economic benefit. At this point, C can come in and indirectly subsidize the cost of information to B by:

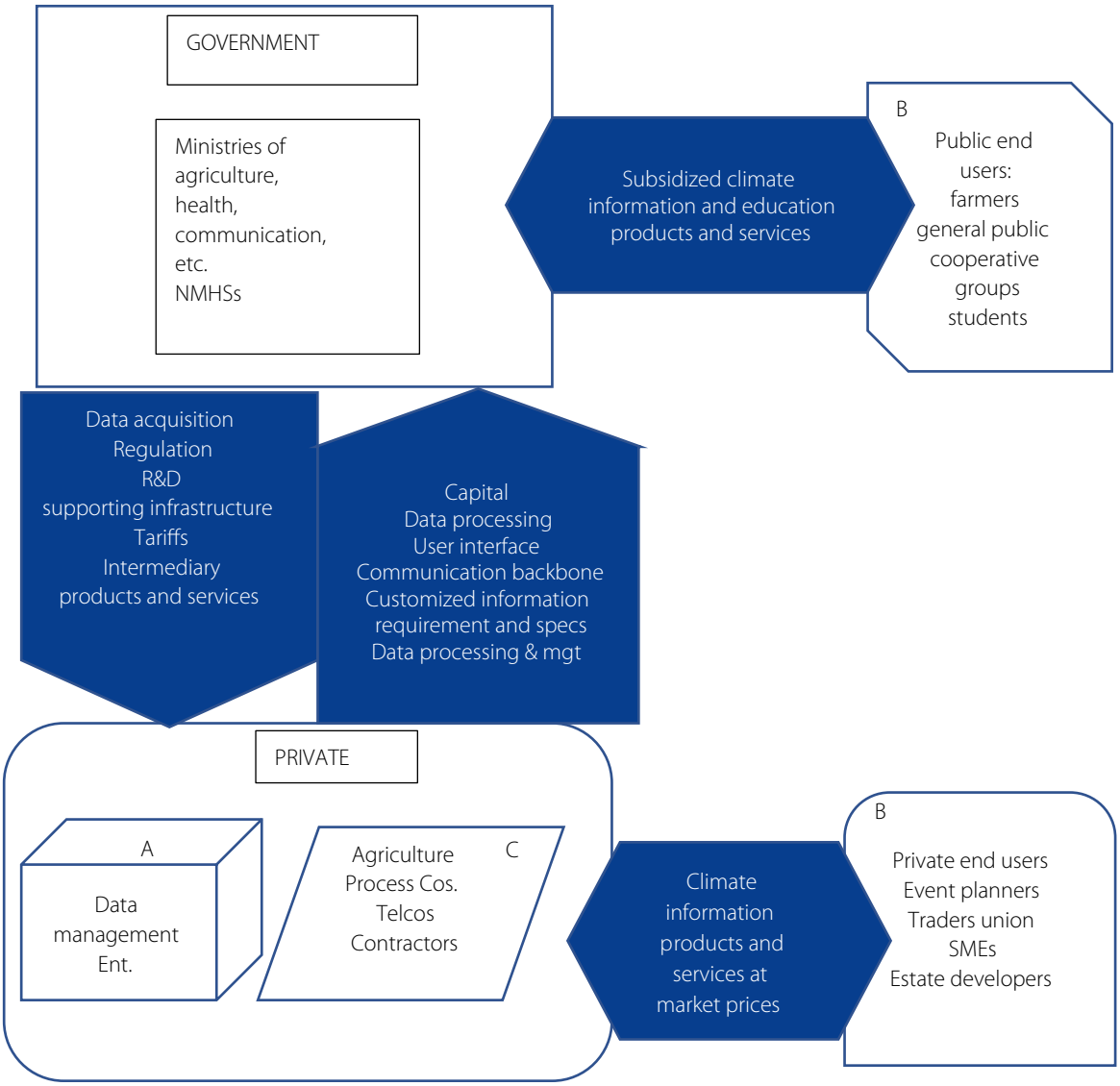
(1). Leveraging the cost of data acquisition by government through provision of resources and absorption of certain cost components in data acquisition.

(2). Partnering A to develop platforms for delivering data to B through cost sharing. By doing so, government agencies can do business by acquiring data and selling it to A at a subsidy. A can manage the data and then deliver useful information to the end users in B at a nominal price.

(3). The end users in B use the information to improve their products and services, which in the long run are of direct benefit to the corporations in C. In the end, there is a ready market for the data acquired by D; they are processed by A; and the value of the data is indirectly related to the gains made by B. The improved products and services achieved by B are seen directly in the profit

made by C, which in turn spends part of its proceeds to leverage the cost of data acquisition and management.

**Figure 2** Representation of a model of public-private partnership in climate information services




her successful model is the involvement of international finance institutions and public-private partnerships (IFI report, 2011). A few programmes have been successfully implemented through this model. The Africa Sustainable Forestry Fund is a pan-African private equity fund focusing on sustainable forestry investments by CDC Group. The programme has resulted in two investments in sustainable forestry in sub-Saharan Africa. Wind Power is a climate change project supported by the European Investment Bank for the development, construction and operation of four onshore wind farms on four islands of the archipelago of Cabo Verde with a combined capacity of 25 megawatts. It is a public-private partnership with the Government of Cabo Verde and the national power utility. The project demonstrates the success of a commercial public-private partnership wind farm in Africa. Kenya has also benefited from a climate change project, this one concerning a geothermal power plant, with the German Development Finance Institution. The project expanded a 13 MW geothermal power plant to 48 MW. It is the only privately

owned geothermal power plant in Africa. This project has reduced dependence on carbon fuels and demonstrated a technology that promises to supply the energy needs of 12 African countries.

# 7. Recommendations

Organizations in the private sector that use data from national meteorological and hydrological services normally insist on specific requirements. For instance, each private actor requires the data to be customized for its specific applications, but, increasingly, they require data to be of high quality, high resolution, customized and delivered on time. Demand for the products of national services has increased over the years and the future looks promising. Governments in Africa must understand the possible detrimental impact of climate change on national development. It has the potential of derailing all the investments and the gains made so far towards poverty reduction, economic growth, infrastructure development and the general improvement of human welfare. It is therefore imperative for the governments of African countries to equal emphasis on investing in infrastructure for managing climate change. In that regard, investments need to be channeled to at least three crucial areas: agriculture, which is a major sector of the economy; hydropower, which accounts for two thirds of the energy supply of most African countries; and infrastructure, mainly roads, for which not less than 10 per cent of budget allocations should be spent on maintenance. The private sector will be more likely to invest in climate information services when governments follow through on these initial commitments. The recommendations on promoting climate information services in the private sector are presented for the national and regional levels for strategic and operational needs.

## 7.1. STRATEGIC NEEDS

### 7.1.1. NATIONAL LEVEL

The business model of climate information providers in African countries must be compatible with the needs and requirements of the private sector. National meteorological and hydrological services should therefore take pragmatic steps to fully integrate private sector services. There should be a clear national policy and legal framework on collaboration with private actors, specifying the roles and responsibilities of each player, especially those of national services and private actors. There should also be an independent national regulatory framework to moderate the roles of national services and private actors, and private actors and clients to ensure a climate information market that enforces good practices and meaningful results. It is important for national services to have a pricing plan and strategy to ensure consistency and improve user confidence in their services. Moreover, staff may need additional skills for upgraded infrastructure and it is important to have a succession plan to ensure continuous availability of qualified personnel for continuity of service.

### 7.1.2. REGIONAL LEVEL

There should be stronger collaboration among national meteorological and hydrological services for knowledge and infrastructure sharing. Staff exchange programmes would promote knowledge transfer and sharing of expertise. The Climate Research for Development (CR4D) framework is available for coordination and exchange of knowledge. It is an African initiative, a partnership of the ECA African Climate Policy Centre, the African Ministerial Conference on Meteorology (AMCOMET), WMO, and the Global Framework for Climate Services. It was launched to strengthen links between climate science research and climate information needs in support of development planning in Africa.

The node system strategy of the RCC-Network Northern Africa should be adopted for all regional climate centres to avoid duplication of efforts and allow improvement in the services of national meteorological and hydrological climate services. The northern Africa centre operates a node system whereby responsibilities are shared among national services in the region. The Casablanca Node on Long-Range Forecasting is led by the Direction de la Météorologie Nationale (DMN), Morocco; the Tunis Node on Climate Monitoring is led by the Institut National de la Météorologie (INM), Tunisia; the Algiers Node on Data Services is led by the National Meteorological Office (ONM), Algeria; and the Cairo and Tripoli Node on Training is led jointly by the Egyptian Meteorological Authority (EMA) and the Libyan National Meteorological Centre (NMC).

## 7.2. OPERATIONAL NEEDS

### 7.2.1. NATIONAL LEVEL

The quality and resolution of data is highly dependent on technology. In order to meet the demands of the private sector, cutting-edge technology must be deployed. This means that the current infrastructure, equipment and software of the national services needs to be upgraded. They need to improve their existing infrastructure to enable them to deliver high quality, high resolution, customized information in a timely manner. They need to build high-quality databases of clients and partners that will be used to create access to climate reports tailored to the needs of the private sector and development sectors, such as health, agriculture and water resources.

### 7.2.2. REGIONAL LEVEL

The climate system is complicated, and any form of negligence can be detrimental to climate information services. For this reason, data integrity is of optimum importance. Regional climate centres should therefore provide guidance on data distribution to ensure curation, transparency, traceability and stability of data and scenarios. This will make it clear where the services are developed and subsequently help create a greater common understanding of climate and its impacts, improve access and dialogue between users and providers and improve dialogue between sectors on climate characteristics and impacts.

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