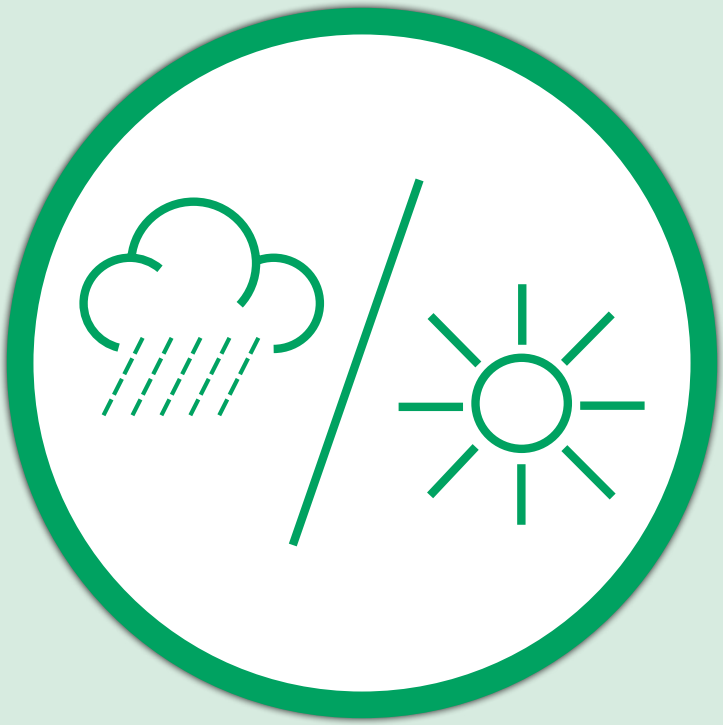
ICTs for **CLIMATE CHANGE ADAPTATION** in Africa



eTransform **AFRICA**

This document, on the use of ICTs for Climate Change Adaptation in Africa, is the summary of the full sector study which was carried out by a team from the International Institute for Development led by Heather Creech, and comprising Ben Akoh and Jo-Ellen Parry, with assistance from Livia Bizikova, Daniella Echeverria, Philip Gass, Ann Hammille and Julie Karami. The full report is available at www.eTransformAfrica.org. This document forms chapter three of the publication edited by Enock Yonazi, Tim Kelly, Naomi Halewood and Colin Blackman (2012) “eTransform Africa: The Transformational Use of ICTs in Africa.”

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eTransform AFRICA

ICTs for **CLIMATE CHANGE ADAPTATION** in Africa

Information and communication technologies (ICTs) have the potential to transform business and government in Africa, driving entrepreneurship, innovation and economic growth. A new flagship report – eTransform Africa – produced by the World Bank and the African Development Bank, with the support of the African Union, identifies best practice in the use of ICTs in key sectors of the African economy. Under the theme "Transformation-Ready", the growing contribution of ICTs to Agriculture, Climate Change Adaptation, Education, Financial Services, Government Services and Health is explored. In addition, the report highlights the role of ICTs in enhancing African regional trade and integration as well as the need to build a competitive ICT industry to promote innovation, job creation and the export potential of African companies.

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INTRODUCTION

Like other regions of the world, Africa is beginning to experience the impacts of human-induced climate change. Temperature increases of 0.1 to 0.3°C per decade have been observed in South Africa, for example, with indications that Africa is warming faster than the global average. Rainfall patterns are becoming more variable across the continent, reflecting in part the influence of traditional factors such as the El Niño/La Niña-Southern Oscillation (ENSO). Warming in the south Atlantic and Indian Oceans may have led to a weakening of monsoons, depriving the Sahel region of rainfall in recent years.

These observed changes in climate parameters have not occurred uniformly across Africa:

- In East Africa temperatures have risen by an average of 1.3°C since 1960. Rain patterns have altered and droughts and floods are becoming more frequent. Since 1912, Mt Kilimanjaro's ice fields have decreased in total area by about 80 per cent.

- In North Africa significant warming has occurred during the summer while winters are becoming drier. Sahelian Sudan experienced a 25 per cent decrease in rainfall during the last quarter of 20th century.

- In Southern Africa decadal warming of 0.1 to 0.3°C occurred between 1961 and 2000, while the duration of the dry season lengthened between 1961 and 2005.

- West Africa saw substantial reductions in rainfall during the latter half of the 20th century, including prolonged droughts in the 1970s and 1980s, and greater rainfall variability.

The current trends of rising temperatures and altered rainfall patterns are set to continue during the remainder of this century. At a continental level, mean annual temperatures are projected to rise by between 3.2°C and 3.6°C by the period 2080 to 2099. Precipitation patterns will also continue to change – very likely decreasing along the Mediterranean coast, Northern Sahara and west coast to 15°N, while increasing in tropical and eastern Africa. An increase in the number of extreme climate events experienced within the continent is likely to accompany these changes in climatic averages. Rising sea levels are also projected to affect Africa's coastline, particularly the eastern coastline, as well as island states.

African countries are especially vulnerable to the impacts of climate change for three interrelated, mutually reinforcing reasons:

1. Africa's climate is likely to be more severely affected by climate change than other regions, as recent data suggest that it is warming faster than the global average.

2. Its major economic sectors, such as agriculture, are climate-sensitive.

3. Low levels of human development (income, education, health) and the

greater presence of other stress factors (such as conflict and disease) constrain adaptive capacity.

The 2008 *Human Development Report* identifies five major "transmission mechanisms" through which climate change will affect human development:

- Losses in agricultural production and food security: Africa could experience the largest losses in agricultural output potential.

- Increased water stress and water insecurity: The number of people experiencing water stress is likely to increase in northern and southern Africa, while the opposite is likely to happen in eastern and western Africa.

- Rising sea levels and exposure to climate disasters: More frequent and intense extreme events, such as cyclones and droughts, will increase disaster-related losses.

- Transforming ecosystems and biodiversity: Coral bleaching, ocean acidification, warmer inland lakes and shifts in species ranges are pushing many ecosystems beyond their capacity to adapt to changing climate conditions.

- Increased human health risks: The likelihood of malaria epidemics may increase since previously unaffected populations will not have the genetic modifications to protect against infection.

While these impacts will present themselves in different ways and with varying degrees of severity in different regions and countries, they are likely to translate into significant development losses, particularly in Sub-Saharan Africa. Many will be irreversible and efforts to achieve the Millennium Development Goals (MDGs) or sustain progress made are likely to be compromised.

Understanding climate change mitigation and adaptation

International responses to climate change are coordinated through the United Nations, and focus in particular on the UN Framework Convention on Climate Change (UNFCCC) and its subsequent Kyoto Protocol. These responses fall into two main categories. Mitigation is concerned with reducing the level of greenhouse gas emissions in the Earth's atmosphere that are the principal causes of climate change. Adaptation is concerned not with prevention but, in the words of the Intergovernmental Panel

on Climate Change, with "adjustments in human and/or natural systems... to reduce [its] adverse impacts or take advantage of opportunities" that may arise from it.

Adaptation takes place at all levels in society, from large-scale interventions that are driven by governments and regional organizations to the autonomous actions taken by threatened communities and individuals. Appropriate adaptation requires:

- access to current understanding of the potential physical and socio-economic changes which are or could occur as a result of climate change;
- design and implementation of effective responses to the challenges and opportunities arising from climate change;
- coordinated action by all stakeholders, including those at the local level; and
- reliable information and guidance on actions that may be taken to increase the resilience of vulnerable communities and individuals.

Over the past decade, understanding has grown regarding how to enable adaptation around the world. Four principal lessons can be derived from that experience to guide future interventions:

1. There is an intimate connection between adaptation and sustainable development. Measures that tackle the underlying economic, social and environmental challenges of low-income countries and communities also help them to address the outcomes of climate change. Healthier and better educated populations living in robust ecosystems are better equipped to adapt.

2. The impacts of climate change and the requirements for adaptation are highly contextual. The impacts of climate change will vary markedly from country to country and location to location. Interventions must be carefully tailored to the circumstances in which they are being applied.

3. Adaptation must be integral to national development strategies and institutions. Addressing adaptation needs is not an option within development policy; climate change is occurring and will affect countries' development priorities. All development planners and managers need to be aware of its implications and mainstream climate change considerations into development thinking.

4. As in many areas of human activity, adaptation involves trade-offs. Actions which will protect some vulnerable communities may have adverse impacts on other groups. Development planners need to model likely impacts while remembering that climate change itself renders the status quo in many contexts unsustainable.

ICTs and climate change

Information and communication technologies have had an increasing impact on economic and social development over the past two decades, resulting from their capacity to generate and disseminate information, to facilitate the coordination of different actors in and beyond government, and to make government, business and development processes more efficient. These three capacities are as relevant to climate change adaptation as they are to other fields. However, the extent of experience in deploying ICTs for adapting to climate change is currently less than in other development fields, such as health and education.

ICTs also have a complex relationship with sustainability and with the underlying cause of climate change. This relationship can be described in terms of the effects of ICTs:

- First order (direct) effects concern the impacts which ICTs themselves have on climate change, in particular the CO2 emissions from the production, use and disposal of communications equipment and services, accounting for between 2 and 2.5 per cent of global emissions.

- Second order (indirect) effects concern the role ICTs can play in reducing emissions resulting from other industrial sectors, by having them adopt ICTs to improve efficiency and production. A complication arises from rebound effects which may eliminate the gains resulting from apparent reductions, such as increased power consumption resulting from lower energy prices achieved through greater energy efficiency.

- Third order (societal) effects result from large-scale changes in social and economic behaviour resulting from widespread use of ICTs, including changing patterns of trade, production and consumption, and global to local engagement of citizens in decision-making.

There are a growing number of perspectives on how to approach the intersection of ICTs and adaptation. IISD has built on several analytical approaches to create a new framework to guide future policy and programming interventions. This framework categorizes interventions at four points along a continuum of adaptation, which are as follows:

1. Addressing the drivers of vulnerability – interventions which are concerned with the underlying factors that make people and communities vulnerable to the impacts of climate change, rather than being concerned with those impacts themselves.

2. Building the response capacity of local and regional systems and

communities – interventions which help communities to acquire the resources they need to respond to the impacts of climate change.

3. Reducing and managing risks related to climate variability and climate change – interventions which provide information and facilities to help communities change lifestyle and economic behaviours in ways that make them more sustainable in new climate conditions.

4. Confronting climate change – interventions which directly address the physical impacts of climate change such as rising sea levels and the spread of malarial mosquitoes into newly favourable regions.

Within this framework, it is possible to categorize interventions more precisely in a number of ways:

- By sector: A number of development sectors are particularly susceptible to the impacts of climate change, notably agriculture and water resources, forestry and fisheries, health and livelihoods.

- By geographic scale: Climate change is a large-scale phenomenon but will also have impacts that vary greatly between individual locations. Interventions therefore range from those at regional or national level down to specific actions to meet the needs of individual communities.

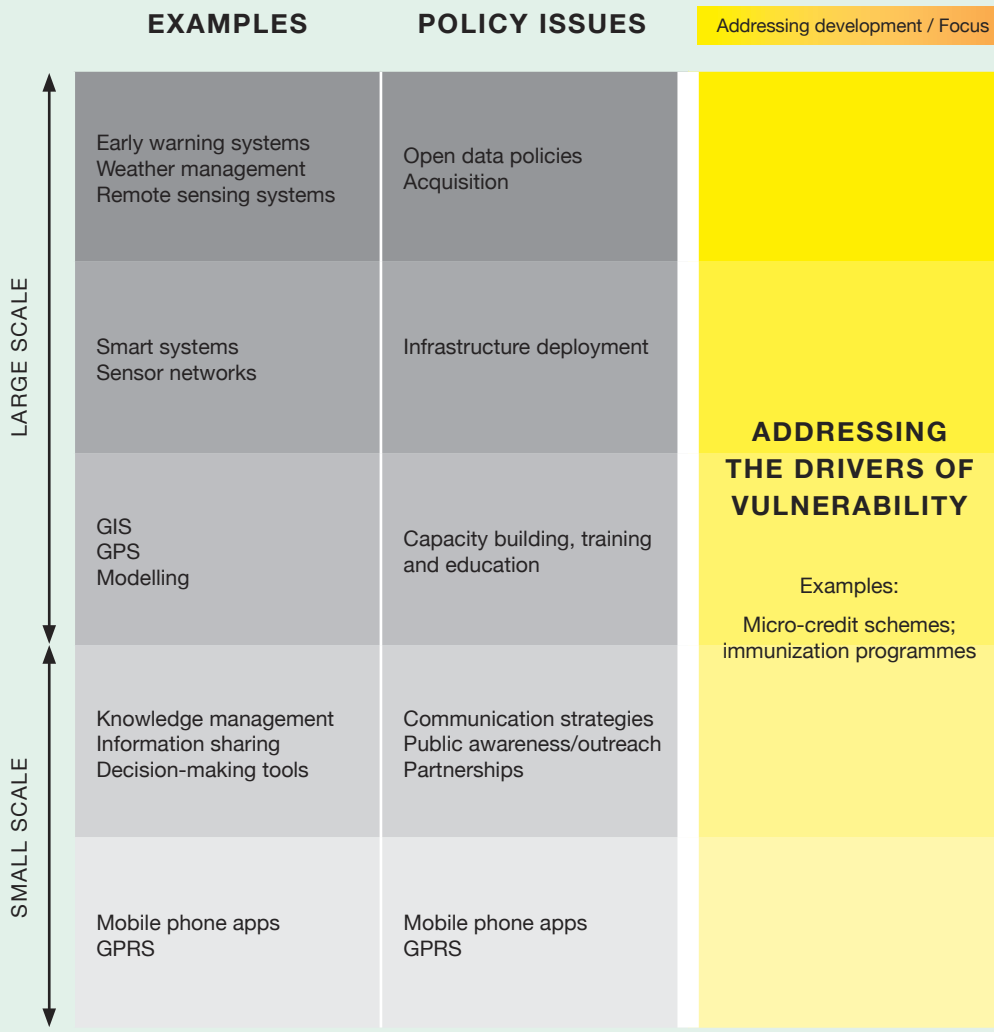
- By technology: ICTs are highly diverse and can be implemented on different scales. At one end of the scale they include expensive one-off applications such as sensor networks, satellite earth stations and meteorological systems. At the other, they include the mobile phones that individuals can use to access information, report problems or share experiences.

This analytical framework is illustrated graphically in Figure 1.

Figure next page ➸

Figure 1

A framework to assess ICT tools for climate change adaptation




on vulnerability
Responding to climate change / Focus on impact
BUILDING RESPONSE CAPACITY
Examples:
Improving information and communications infrastructure; training in GIS technology
MANAGING CLIMATE RISK
Examples:
Introduction of drought-resistant crops; emergency response systems
CONFRONTING CLIMATE CHANGE
Examples:
Reducing potential for glacial lake outburst flood; building sea walls

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LANDSCAPE ANALYSIS

The UNFCCC lies at the heart of much of the work which addresses adaptation in Africa today. Strategic instruments arising from this work include countries' National Communications on their climate response activities, and the National Adaptation Programmes of Action (NAPAs) which have been developed by Least Developed Countries (LDCs). The African Union, NEPAD and some Regional Economic Communities (RECs) in Africa have sought to achieve coordinated action by governments at the continental or regional levels, and to stimulate national policy development for adaptation.

A number of projects and programmes are currently being implemented in Africa to support adaptation to climate change. Major continental programmes focusing on climate change adaptation with a budget above US$50 million include: the Climate Change Adaptation Support Programme for Action-Research and Capacity Development in Africa; the Africa Adaptation Programme; and the Climate for Development in Africa (ClimDev-Africa) Programme and its component, the African Early Warning and Advisory Climate Services.

In conjunction with these multi-country, multi-sector projects are others that focus on capacity-building (including policy linkages) and research activities in specific sectors such as:

- Agriculture: "Strategies for Adapting to Climate Change in Rural Sub-Saharan Africa: Targeting the Most Vulnerable" (FANFRAN) and "Developing rice and sorghum crop adaptation strategies for climate change in vulnerable environments in Africa" (RISOCAS).

- Water and energy: "The Water, Climate and Development Programme in Africa" and the "Climate Proofing Energy Systems: Vulnerability-Adaptation-Resilience" (HELIO).

- Forestry: "Adapting the Framework of Forestry Policy to meet the needs of climate change in the MENA region" (GIZ).

- Health: "Transferring the Malaria Epidemic Prediction Model to Users in West Africa" (CCAA).

- Meteorology: "The Regional Science Service Centre for Adaptation Climate Change and Sustainable Land Management in Southern Africa".

Two critical challenges arise from this work:

- the extent to which adaptation is integrated with wider development planning; and

- the extent to which strategic planning leads to practical implementation on the ground.

Both of these are challenges in many development sectors, not just for climate

change adaptation. Where the use of ICTs is concerned, they are supplemented by two more specific issues:

- the extent to which ICTs are integral to adaptation planning; and
- the extent to which they can be deployed in practical implementations, given current infrastructure, financial and human resource limitations.

Governments have made some references to ICTs in National Communications, NAPAs and other documents which establish these sectoral priorities, though these references are rather few and limited. The use of ICTs is suggested for tasks such as the collection and dissemination of agro-meteorological information, monitoring for flood projection, and planning for and tracking of changes in the distribution of diseases such as malaria and meningitis, early warning systems and disaster preparedness. Many countries in West, East and Southern Africa have identified a desire to improve their meteorological and forecasting capacity and to strengthen their early warning and disaster risk reduction systems.

In general, current uses of ICTs in the context of climate change tend to achieve the objectives of:

- generating, organizing and communicating information about the risks resulting from climate change, climate variability and extreme climate events, as well as preparing for their effects on food security and water supply;
- developing information systems within the food sector that are better able to reflect household access to food and food consumption;
- developing early warning and hazard risk information systems to deal with the additional fire hazards associated with climate change and to enable integrated fire management; and
- developing ICT mapping tools to map vulnerable areas and provide spatial representations of climate change impacts.

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OPPORTUNITIES AND CHALLENGES

Programmes and projects across Africa confirm the importance of interventions in several areas of activity. These include:

- monitoring and measurement of climate impacts, including weather systems, the impact of weather/climate on natural resources such as water (sea levels, rainfall) and weather-dependent economic sectors (agriculture, forestry, fisheries), and the potential impact of climate change on health;
- early-warning systems concerned particularly with acute events resulting from climate variability and climate change;
- knowledge-sharing between intergovernmental and national government agencies, businesses and academic institutions that have the capacity and/or the responsibility for designing or coordinating responses to climate change;
- implementation of small-scale activities to protect lives and livelihoods in vulnerable communities and to support the lifestyle and behavioural changes needed to enable survival and prosperity in contexts that are changing as a result of climate variability or climate change; and
- transmission of information and advice to and between local communities on impacts that they may experience, actions that they could take to protect themselves against sudden (weather-induced) crises, and potential lifestyle and behavioural changes that could help to secure their lives and livelihoods in the longer term.

These practical applications use a wide variety of technologies which are interconnected using existing communications networks and services, including:

- high-value remote monitoring equipment such as satellites;
- networks of remote sensors;
- global positioning and GIS applications;
- communications services such as the internet, mobile networks and SMS; and
- handheld devices such as mobile phones and PDAs.

It is clear that there are important shortfalls in current adaptation policy and practice and in the application of ICTs to adaptation.

- While nearly all African countries have ratified the UNFCCC and so committed themselves to taking action to reduce their vulnerability to climate change, there is a big gap at present between strategy development and implementation activity. Adaptation has not yet become effectively mainstreamed into development planning in many countries,

and remains absent from many comprehensive national development strategies.

- ICTs, likewise, have not yet become effectively integrated into adaptation planning. The potential of ICT-related interventions is insufficiently explored in NAPAs and other adaptation strategies and rarely integrated into comprehensive thinking about how adaptation can best be achieved. This leads to under-use of ICTs in programmes and projects which are associated with these strategies.

- Most ICT-related interventions which are currently taking place are either at a macro or a micro level – intergovernmental dialogue, national strategies, large-scale projects such as weather monitoring by satellite and large-scale sensor networks; or projects aimed at increasing awareness and information for vulnerable communities and individuals which will help them identify and manage their own adaptation needs. There is a shortage of the meso level activity which is essential in bridging the gap between grand strategies and local circumstances.

- Use of ICTs to support adaptation to climate change is concentrated in a small number of development domains, notably agriculture, water and coastal zone management. The degree to which these actions, and adaptation efforts more broadly, are coordinated with the broader development objectives of African countries varies from country to country, and generally could be strengthened. As ICTs can have a pervasive impact across the spectrum of development, their use at the community level also could be expanded to more holistically encompass the diversity of adaptation needs in different sectors at the local level.

The evidence that emerges nevertheless confirms that ICTs do have significant potential value in adaptation and that this potential should be exploited more effectively. More attention, in particular, should be paid to:

- high-level meteorological and other climate monitoring, using satellites, sensors and other ICTs, and associated early warning systems;

- knowledge-sharing among climate change and development professionals; and

- using locally available communications media (broadcast services and mobile phones, and internet as it becomes more readily available) to support local communities' adaptation efforts with information and advice, and to integrate local information and knowledge more effectively into large-scale planning.

A number of factors will be critical to enabling governments and development partners to maximize the value of ICTs' potential. These include:

- improvements in the availability and quality of communications networks, including rapid progress toward ubiquity in the availability of mobile networks, rapid growth in broadband networks, and lower prices for end-users in communications markets;

- commitment on the part of political leaders and development policymakers to integrate adaptation effectively in development planning and to integrate ICTs effectively in adaptation;

- awareness-raising and capacity-building at all levels, from decision-makers to residents in vulnerable communities, concerning the importance of adaptation to climate change, the ways in which adaptation can be achieved, and the potential role of ICTs in this regard;

- improved governance that is capable of taking advantage of better information resources and translating strategy more effectively into implementation on the ground; and

- the financial resources required to achieve these goals.

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CASE STUDIES

In reviewing the evidence on the use of ICTs in climate change adaptation in Africa, three country case studies were conducted. These studies paid particular attention to:

- adaptation and agriculture: the needs of farmers in Uganda and the role that community knowledge workers play as local information brokers for sharing knowledge that can aid in adaptation (see Box 1).

Box 1

Climate change adaptation in agriculture – the role of Community Knowledge Workers in Uganda

Established by the Grameen Foundation, Community Knowledge Workers (CKWs) in Uganda are a network of locally-based "trusted intermediaries" who interface between content producers and smallholder farmer groups. They conduct mobile based surveys of their communities, and act as the conduit for dissemination of centralized information to community farmers. The objectives of the CKWs include improvements in farm productivity, increases in revenue and the collection of information that can help farmers to meet their needs. Specific types of information that the CKWs transmit which are relevant to climate change adaptation include:

- advice on land preparation based on available weather forecasts, especially expected rainfall;
- information on pests (farmers can send pictures of an infested crop and seek diagnostic advice);
- information about value-chains, market prices and opportunities; and
- Information about available storage facilities.

CKWs are themselves farmers and are elected by fellow members of local cooperative farmer groups. They must speak English, must be judged innovative in their farming practices, must be willing to serve their communities, and must aspire to meet target objectives which are regularly checked and monitored through an online dashboard. They are incentivized with a rented smartphone kit which is preloaded with applications concerned with crop production such as land preparation and weather projections; a solar or bicycle operated battery recharge system to power community cell phones; and a shirt, hat and vest to indicate their role.

By July 2011, over 20,000 farmers and households had registered to receive information by a total of 463 CKWs. The initiative aimed to achieve a total of 800 CKWs by the end of 2011.

- adaptation knowledge sharing among policy makers and practitioners: the use of knowledge-sharing platforms in Senegal such as Africa-Adapt (see Box 2).

Box 2

Adaptation and knowledge sharing for decision making

Senegal: AfricaAdapt - knowledge sharing for adaptation:

AfricaAdapt aims to facilitate the flow of climate change adaptation knowledge for sustainable livelihoods between researchers, policymakers, civil society organizations and communities that are vulnerable to climate variability and climate change across the continent. This distributed community of practice (CoP) is supported by a website that lists face-to-face events and allows members to upload their profiles and showcase their work. AfricaAdapt is animated by four network conveners (called Knowledge Sharing Officers), one from each of the main partners.

Other applications with potential for adaptation, information gathering, knowledge sharing and decision support:

- Satellite and remote sensing – The number and range of remote sensing (RS) infrastructure and applications has continued to grow in Africa, though this is primarily located in a few countries (South Africa, Nigeria and Algeria). Limited financial resources and the challenge of establishing strong academic and research bases have contributed to the slow uptake of remote sensing on the continent. African remote sensing data, information and applications have been used in many different sectors, including agriculture and rural development, climate and weather analysis, exploitation of natural resources, forestry, natural disaster and water resources management.

- The South African Risk and Vulnerability Atlas (SARVA). This electronic spatial database directly supports access to and visualization of data about the impact of global change (including climate change) on human and natural environments. The Atlas initiative provides access to a large collection of scientific data and knowledge, including climate and weather related datasets including forecasts of rainfall, wind and temperature, seasonal forecasts, and climate change projections for rainfall, temperature and circulation.

- adaptation and water: the management of water in Malawi through community based participatory geographic information systems (see Box 3).

Box 3

Adaptation and water management: Participatory Geographic Information Systems (PGIS) in Malawi

Mangochi is an old town set on the west bank of the Shire River, which flows between Lakes Malawi and Malombe, and is close to important forest reserves and nature parks. Using Participatory Geographic Information Systems (PGIS) and problem tree analysis, deforestation has been identified as a major environmental problem that has left much of the area's customary land bare, leading to soil erosion, loss of soil fertility, siltation of rivers and water holes, loss of biodiversity and flooding in low lying areas around the Malombe and Shire Valley.

The PGIS project established to address the problem of deforestation was conducted in a study area of nine village communities that are within 500 metres of a water body (as stipulated by the National Water Policy), and 2000 metres of a source of fuel for food supply. Its objective was to engage government officials and local communities in the process of participatory decision making for environmental and natural resource management. Through this process, it aimed to establish a baseline assessment and to investigate climate change adaptation strategies concerned with access to forest resources, food security and the availability of water for irrigated agriculture and domestic consumption.

As part of the programme's work, communities were trained and required to map their villages using GPS devices, to generate maps of their own communities, and to create a centrally located model that can be used to determine current and future water needs. The outcome of the project suggested that men produced less detailed maps than women, who more precisely located fuel, water, forestry and areas prone to floods and droughts. The exercise illustrated the extensive knowledge of the immediate local community as well as its susceptibility to the impacts of climate change or variability. Communities were empowered by the initiative which improved their understanding of the presence or lack of resources in their immediate surroundings, of climatic variations and of approaches to developing communal adaptation strategies, including long-term strategies. It also improved communities' capacity to negotiate with government agencies over issues such as the location of water points.

While the case studies have been presented through the sector lenses of agriculture and livelihoods, knowledge management and water management, it is important also to consider the various applications aligned according to the ICTs and adaptation framework, as shown in Table 1.

Table 1 **ICTs and climate change adaptation framework**

TOOL & APPLICATION CATEGORIES		
Scale	**Examples**	**Policy Considerations**
Large scale implementations of ICTs	• Early warning Systems • Weather Management • MET Systems • Satellite and Remote Sensing Systems	• Open Data Policies • Acquisition
	• Smart Systems • Sensor Networks	• Infrastructure deployment
	• Geographic Information Systems • Global Positioning Systems • Modelling	• Capacity building, training, and education
Small scale implementations of ICTs	• Knowledge Management Systems • Information Sharing Systems • Planning and decision tools	• Communication strategies • Public information, outreach and awareness • Partnerships
	• Mobile Phone Applications • General Packet Radio Systems (GPRS)	• Access and Affordability of Access

CONTINUUM OF ADAPTATION ACTIVITIES			
Addresing Drivers of Vulnerability	**Building Response Capacity**	**Managing Climate Risk**	**Confronting Climate Change**
Examples: Micro-credit schemes; immunization programmes	**Examples:** Improving information and communications infrastructure; training in GIS technology	**Examples:** Introduction of drought-resistant crops; emergency response systems	**Examples:** Reducing potential for glacial lake outburst flood; building sea walls
• Increasing the number of weather stations (METs) • Satellite and remote sensing systems		• Distance early warning system • Community flood information system	
• Hartebeespoort Dam programme		• Himalayas glacial lakes sensors	
• Malawi Participatory GIS • Water-related information system, Mekong Delta (WISDOM)		• South Africa Risk and Vulnerability Atlas • PRECIS regional climate modelling system	
• Uganda Community Knowledge workers • AfricaAdapt • Ushahidi		• Open Risk Data Initiative • Climate Change Explorer Tool • AfricaAdapt • Ushahidi	
• MPESA • TextToChange		• Kilimo Salama	

Vulnerability Focus

Impact Focus

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RECOMMENDATIONS

Three broad observations should pervade the thinking of governments and development partners in this field of ICTs and climate change adaptation:

1. Understanding local circumstances – the ecosystem itself and its social and cultural environment – is essential if adaptation interventions are to be successful. In this field, as in others, large-scale programmes will only work if they respond to the granularity of local contexts.

2. Reliable, high quality communications infrastructure is essential for the effective use of ICTs. Technology can only deliver services and applications if that underlying infrastructure is available. It needs strengthening across the continent.

3. Human skills are just as essential to the application of ICTs for adaptation as infrastructure, equipment and applications. ICTs can play a crucial role in supporting public outreach and building awareness of the impact of climate change and adaptation, as well as offering opportunities to address those challenges.

Recommendations for government and development partners

RECOMMENDATION 1

Use a systematic framework to structure thinking

A systematic framework, such as that illustrated in Figure 1, is fundamental to structuring the approach to the role of ICTs in adapting to climate change. Such a framework should focus on:

- reducing vulnerability, such as on ICTs that contribute to improvements in health, food, nutrition and other social drivers of vulnerability; and

- building adaptive capacity, such as on ICT-enabled interventions in the water and agriculture sectors, on weather prospects and water hazards, land management and adaptive capacity of farmers and pastoralists.

In addressing direct impacts of climate change, the framework should focus on:

- developing climate change projections at national, regional and sectoral levels; and

- programme and project interventions in urban planning; coastal and water resources management, the establishment and management of early warning systems, and the delivery of disaster and emergency relief.

RECOMMENDATION 2

Build capacity for integrating ICTs into national strategic adaptation plans

Building the capacity for integrating ICTs into adaptation policy development will have significant benefits. Particular attention should be paid to including more detailed application of ICTs in National Adaptation Plans in LDCs and adaptation planning efforts in other countries. Traditional bureaucratic "silos" separate environment, climate change and adaptation policy makers and planners from those working on ICTs and telecommunications. Planned interventions should be undertaken to bring those responsible for adaptation policy and planning (particularly National Adaptation Plans) together with ICT/telecommunications government staff to work together for more effective planning and implementation.

RECOMMENDATION 3

Involve the private sector more extensively in planning and implementation

Engagement of the ICT private sector in climate change adaptation is less substantial and widespread than it is in mitigation, where the private sector is directly involved in developing clean technologies, energy efficiency, dematerialization to reduce carbon footprints and other areas of innovation. More work is needed to engage strategically with the private ICT sector, to review where privately motivated interests in applications could directly or serendipitously enhance adaptation while also delivering commercial value.

Recommendations for governments and donors

RECOMMENDATION 4

Embed ICT planning in the adaptation planning process

Use of ICTs should be embedded in the adaptation planning processes that are already underway in most African countries. In particular, for the LDCs, the preparation of second generation National Adaptation Plans should be seen as a window of opportunity for the inclusion of ICT-relevant interventions. Preparation for these should include a capacity building programme to review where and how investments in ICTs might be best integrated within these plans.

RECOMMENDATION 5

Develop open data policies across Africa

Access to data is a fundamental requirement for adaptation planning. Model policy frameworks and guidance could be developed for countries across Africa, with a view to making environmental and meteorological data open to all interests (public, academic, and private).

RECOMMENDATION 6

Invest in tools and infrastructure

There is considerable scope to invest in tools and infrastructure that will have a direct impact on knowledge of current and projected climate change impacts. These include:

- early warning systems, weather management, meteorological systems, satellite and remote sensing systems;
- smart systems and sensor networks;
- geographic information systems/modelling/planning and decision-making tools;
- knowledge management systems, information sharing systems, planning and decision-making tools; and
- mobile phone applications and GPRS.

RECOMMENDATION 7

Support for the sharing of knowledge and action for adaptation

Adaptation policy makers and planners need to be able to connect with and learn from one another about what is working and what is not – and this knowledge exchange needs to be informed by real experience on the ground. Two major gaps need to be addressed:

- mechanisms for sharing information between platforms, and for meta-level search-and-retrieval access across all platforms; and
- mechanisms for managing, sharing and developing flows of communication with vulnerable communities.

The potential for using crowd-sourcing techniques to address these gaps should be explored, particularly those that are enabled by mobile phones, to generate real-time data on both acute and chronic impacts of climate change.

Further reading

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www.eTransformAfrica.org

Publications for eTransform Africa include the Summary Report, Main Report which includes an overview chapter and summary chapters of the full reports, and the full reports themselves covering the following sectors and cross-cutting themes:

Sectors themes:

- Agriculture
- Climate Change Adaptation
- Education
- Financial Services
- Modernizing Government
- Health

Cross-cutting themes:

- Regional Trade and Integration
- ICT Competitiveness

For a more detailed presentation on the role of ICT in climate change adaptation in Africa, see the full eTransform Africa sector report: http://www.etransformafrica.org.

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