World Resources Report

ICTs as a Key Technology to Help Countries Adapt to the Effects of Climate Change

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Question Five: How can information for adaptation decision making be collected and disseminated so as to advance integration of climate risks into plans and policies and be useful for those who need it most?

Through practical examples, this paper shows the linkages between information and communications technologies (ICTs) and climate change adaptation. ICTs not only help advance weather forecasting and climate monitoring, but are also essential in disseminating information to large audiences, for example via mobile phones. This can help address major adaptation risks such as food and water shortages through providing early warning systems and better monitoring of soil conditions and water quality. The authors highlight the active engagement of the ICT community in providing guidelines on how ICTs can help with climate change adaptation.

Introduction

ICTs are a cross-cutting technology that can drive the deep transformation needed in the global effort to combat climate change and advance the implementation of the Convention and the Kyoto Protocol. This is all about opportunity. Forward-thinking *leaders already recognize the role of ICTs. The challenge today is to move forward and look to ICTs as a key enabler of a new model of social and economic development[i].*

Hamadoun I Touré, ITU Secretary General

The Nairobi Framework[ii], adopted in 2006, aims to assist all UNFCCC reporting Parties, in particular developing countries, including the Least Developed Countries (LDCs) and Small Island Developing States (SIDS), to improve their understanding and assessment of impacts, vulnerability and adaptation, and to make informed decisions on practical adaptation actions and measures to respond to climate change on a sound scientific, technical and socioeconomic basis, taking into account current and future climate change and variability. As part of its commitment to contribute to the fight against climate change, the International Telecommunication Union (ITU) is a partner of the Nairobi Framework programme.

The ITU is the specialized agency of the United Nations responsible for information and communications technologies (ICTs). Its membership, comprising 192 governments and over 700 private companies, has called for the ITU to take the lead in engaging the global community (including the UN system and the ICT industry, as well as academia and NGOs) to address climate change through the use of ICTs.

The intention of this article is to provide information on the linkage between ICT and adaptation through a series of practical examples and to show how the use of ICTs can help people adapt to the effects of climate change.

1. Adaptation to Climate Change

"We all know that information and communications technologies (ICTs) have revolutionised our world…ICTs are also very vital to confronting the problems we face as a planet: the threat of climate change…Indeed ICTs are part of the solution. Already these technologies are being used to cut emissions and help countries adapt to the effects of climate change…Governments and industries that embrace a strategy of green growth will be environmental champions and economic leaders in the twenty-first century."

Ban Ki-moon, UN Secretary General

The impact of global warming on the world's climate to date is relatively small compared with what can be expected in the future, even if the increase in greenhouse gas emissions is stabilized. Furthermore, the results are likely to be highly uneven in their distribution, with low-lying coastal areas (such as small island developing States, the Bangladesh delta and the Netherlands) at risk because of rising sea levels; sub-Saharan Africa at risk due to desertification; a growing number of environmental refugees; and increased pressure on sources of fresh water and on vulnerable ecosystems such as coral reefs, tundra and coastal wetlands.

In this context, ICTs including remote sensing and geographic information systems have expanded the possibilities for risk assessment of multiple hazards and enabled the development of various scenarios and contingency plans. Risk analysis includes: risk maps, hazard maps, and scenario maps. Risk analysis is therefore a key component in developing a disaster risk reduction strategy by establishing the links between exposure to hazards, level of vulnerabilities and the ability to cope.

2.1 Examples of information tailored to those who need it most

From 1980-2005, over 7,000 natural disasters occurred worldwide in which millions of lives were lost. Ninety percent of these disasters were caused by weather and water related events such as floods, cyclones and droughts[iii]. However, we will show how the science of weather forecasting and climate monitoring, which is critical to reducing such high casualty rates, is being advanced by the development in ICTs.

Box 1: An Example of Weather Forecasting and Telecommunication Networks

Extensive weather station networks are needed for monitoring key climate parameters such as wind speed, precipitation, barometric pressure, soil moisture, wind direction, air temperature and relative humidity. These parameters may be used both for forecasting and for decadal climate modelling. The technologies needed include weather satellites and both local and remote automated weather stations. Just as with telecommunications networks in general, there are logistical and financial problems in achieving sufficient global coverage to collect the required data.

Satellite observations include: visible spectrum cameras to detect storms and deforestation; infrared cameras to detect cloud and surface temperatures and sea level rise; particle detectors of solar emissions.

The Geostationary Operational Environmental Satellites (GOES-11&12)[i], and others, are capable of making these observations, which are essential in providing input to weather forecasting and climate change models. Emphasis is now on improving coverage of space and land based sensors. Fine resolutions are needed, with frequent updates, to provide the most accurate forecasts. For example the European Meteosat-8 located over the Atlantic Ocean at 0° longitude provides an operational

European 'rapid scan' mode service, which commenced in the second quarter of 2008 (with images of Europe every 5 minutes))[ii]. Meteosat-9 also at 0º provides the main full earth imagery service over Europe and Africa (with images every 15-minutes). More work is needed to establish whether Africa and other developing regions could benefit from dedicated weather satellites, with improved resolution over their regions, to match the standards of weather and climate change forecasting in developed regions. Furthermore how would they be funded.[iii]

Source: ITU/WMO Handbook "Use of Radio Spectrum for Meteorology: Weather, Water and Climate Monitoring and Prediction"[iv]

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[i] Weather Satellite

https://en.wikipedia.org/wiki/Weather_satellite

[ii] https://en.wikipedia.org/wiki/Meteosat

[iii] https://ourworld.unu.edu/en/how-things-work-environmental-satellites/

[iv] https://www.itu.int/publ/R-HDB-45/en

2.1.1 Access to information

Access to information and increasing knowledge among policymakers and the general population is often referred to as 'capacity building' in UN terminology. In terms of the telecommunications networks 'capacity building' has an additional meaning which is the expansion of telecommunications networks to serve greater numbers of the population. Fixed access networks have been used to serve around 17% of the world's inhabitants. Mobile telephony networks have been the key technology to reach the next 2 billion. 76% of the world's 6.8 billion people are now served by mobile networks[viii]. Further investment and technical ingenuity are needed to serve the remaining 24%, who may live in sparsely populated areas with no access to grid electricity and/or have low incomes.

Adequate telecommunication networks are essential in ensuring that communications reach people and the appropriate relief organisations.

An example of how ICTs can help in reaching people in remote areas is the 'Green Power for Mobiles[ix]' initiative which is pioneering alternative power sources such as solar and wind for mobile base stations to serve the one billion people without access to grid electricity. The benefits of such initiatives are: to reach more people, provide them with climate related information and alerts, and to improve coverage of environmental monitoring systems.

Land-based weather stations use either satellite or terrestrial communication networks to feed local ground based data to weather and climate forecasting supercomputers. As with mobile network base stations, it is a problem to achieve sufficient coverage to serve the weather forecasting needs of local populations, especially farmers in remote rural locations. For example, the density of land based weather stations ranges from 1 per 872 square kilometers to 1 per 11000 square kilometers in Ghana. Work is in progress to increase coverage. The focus is on Africa which has a network eight times below the World Meteorological Office (WMO) minimum recommended standard, and less than 200 automatic weather stations that meet WMO observation requirements.

/sites/default/files/wrr_bueti_1.jpg

Source: RAWS Remote Automated Weather Station[x]

2.1.2 Increasing dissemination of weather information through mobile phone networks

To tackle this problem, the technical synergies between the problems of providing sufficient mobile base station coverage and land based weather stations are being exploited[xi]. Up to 5,000 automatic weather stations are to be deployed at cellular sites across Africa. This will increase dissemination of weather information via mobile phones to users and communities, including remote farmers and fishermen. The initial deployment in Zain networks focuses on the area around Lake Victoria in Kenya, United Republic of Tanzania and Uganda.

2.1.3 Supercomputers and Climate Forecasting

The accuracy of climate (general circulation) models, is being continuously improved through better understanding of the basic science (including the impacts of clouds, for example); advances in the technology, as observed by Moore’s law, whereby the processing power of computers doubles every two years, and by more extensive data gathering through weather and environmental sensors connected to telecommunication networks. In order to make relevant information available to local communities these models are being extended to predict changes in regional and local weather and sea level extremes.

2. How ICTs can be used to address major risks associated with adaptation: water and food shortage

Climate change endangers the quality and availability of water and food. It is causing more frequent and more severe storms, heat waves, droughts and floods, while worsening the quality of our air. The impact is most severe in poor countries. By 2020, up to a quarter of a billion Africans will experience increased water stress, and crop yields in some African countries are expected to drop by half[xii].

These climatic instabilities generally reduce agricultural yield. However, long range weather forecasts, taking account of human-induced and natural climatic variability such as El Niño, can give farmers sufficient warning to plant crops which will thrive in changing conditions. Broadcast radio or TV networks supplemented by text messages may be sufficient to offer alerts to the communities at risk, but access to the internet is needed to provide reference information, datasets and adaptation plans. Mobile phone networks with internet browsing capability are being extended to bring adaptation information to remote communities.

Medium term forecasting can assist in water irrigation. Monitoring environmental and soil conditions using ICTs makes farming more profitable and sustainable. Better water management[xiii] using ICTs improves the overall efficiency of water use, providing significant savings and a more sustainable use of water resources[xiv]. The main areas where ICT could play a pivotal role in water management are shown below.

/sites/default/files/wrr_bueti_2.jpg

Source: ITU-T Technology Report, Major Areas for ICT in Water Management[xv]

3. ITU's activities to help countries to adapt to the effects of climate change

Changing global climatic conditions have an impact on ecosystems in general as well as on human habitat. Resources such as drinking water and food are particularly affected, which affects health and influences migration patterns. Citizens around the world are becoming more aware of the potential impact of climate change on their own lives. But the effects, and the ability to deal with these, vary from country to country. In particular, the most vulnerable countries in the developing world often do not have the technological, human, financial and governance resources needed to adapt to climate change.

Generally complex emergencies that need external intervention occur in resource-poor countries where data and communication facilities are scarce. Decision-making is often delayed due to lack of information. The effectiveness of humanitarian interventions and the ability to protect livelihoods from the impacts of hazards depends on the timeliness and appropriateness of responses.

ITU is well placed to help countries implement the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol through the use of ICTs.

The newly adopted Resolution "The role of Telecommunications/Information and Communication Technologies on Climate Change and the Protection of the Environment" (Guadalajara, October 2010) identifies the need to assist developing countries to use ICTs to tackle climate change and committed the ITU to work with other stakeholders to develop tools to support this aim.

Five Symposia on 'ICTs and the Environment & Climate Change', the last held in Cairo in November 2010, have provided vivid examples of ways in which ICTs play an important role in reducing greenhouse gas (GHG) emissions and helping countries adapt to climate change. These form part of ITU's vision for pervasive action on ICT and climate change in response to the Bali Action Plan and in the implementation of the outcomes of the Hyogo Framework for Action[xvi]. ITU:

- provides assistance to governments to build appropriate institutions for disaster risk reduction;
- develops international standards;
- provides assistance to countries in incorporating resilient features in telecommunications infrastructure;
- helps countries to develop policy and legal frameworks by providing inputs into policy formulation, and legislative and regulatory drafting for countries;
- helps countries with regard to their vulnerability by providing assistance in reducing and eliminating vulnerabilities in telecommunications infrastructure;
- assists Member States in designing and incorporating telecommunications/ICT into national adaptation plans;
- implements early warning systems in countries where there is a high incidence of disasters;
- designs national emergency telecommunications plans that include Standard Operating Procedures that are now in use in many countries;
- produces guidelines, toolkits and other publications that are in use by countries for disaster risk reduction.

New Questions on ICTs, Adaptation and Climate Change

ICTs are essential for rapid information transfer concerning risks of climate change. At its November 2010 meeting, ITU-T Study Group 5 on 'Environment and Climate Change' drafted two new Questions which will develop Recommendations and guidelines on adaptation to climate change. One Question is "How can ICTs be used to enable countries to adapt to climate change?" and the other is "How can a low cost sustainable telecommunication infrastructure be set up in rural areas of developing countries?" Some of the tasks include:

- Develop handbooks on practical examples and best practices of ICT standards, and, if necessary, Recommendations, to support adaptation to climate change.
- Produce a 'roadmap' to identify the types of ICT and standards available, propose improvements and facilitate more effective use of these.

More information about ITU's activities on climate change can be found at: www.itu.int/climate

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[i]https://www.itu.int/themes/climate/events/cop16/sg.html

[ii] The Nairobi Framework

https://cdm.unfccc.int/Nairobi_Framework/index.html

[iii] https://www.wmo.int/pages/mediacentre/press_releases/pr_864_en.html

[iv] Weather Satellite

https://en.wikipedia.org/wiki/Weather_satellite

[v] https://en.wikipedia.org/wiki/Meteosat

[vi] https://ourworld.unu.edu/en/how-things-work-environmental-satellites/

[vii] https://www.itu.int/publ/R-HDB-45/en

[viii] Mobile cellular subscriptions per 100 inhabitants

https://www.itu.int/ITU-D/ict/statistics/material/graphs/2010/Mobile_cellular_00-10.jpg

[ix] GSMA 'Green Power For Mobile'

https://www.gsmworld.com/our-work/mobile_planet/green_power_for_mobile/index.htm

[x] https://raws.fam.nwcg.gov/photos/misc/buddy/buddyraws.jpg

[xi] WMO ‘Mobile Systems to Revolutionise African Weather Monitoring

www.wmo.int/pages/mediacentre/press_releases/pr_855_en.html

[xii] UN SG - https://www.un.org/News/Press/docs/2008/sgsm11491.doc.htm

[xiii] ITU-T Technology Report on “ICT as an Enabler for Smart Water Management (October 2010)”. https://www.itu.int/oth/T2301000010

[xiv] ‘Wireless Sensor Networks for marginal farming in India’ by Jacques Panchard, École Polytechnique Fédérale de Lausanne, Switzerland.

https://commonsense.epfl.ch/Resources/thesis.pdf

[xv] https://www.itu.int/oth/T2301000010/en

[xvi] The Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, to which 168 Governments agreed in Hyogo, Kobe, Japan, in 2005 , provides an agreed plan for reducing disaster risks and provides relevant guidance to begin concrete adaptation measures. More information can be found at: https://www.unisdr.org/eng/hfa/hfa.htm

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