Technology Fact Sheet for Adaptation

Technology: Integrated Climate Change Monitoring and Early Warning System [i]	
Technology characteristics	
Introduction	This technology combines a National Climate Change Monitoring System, a Seasonal to Interannual Prediction System and a Decentralised Community-run Early Warning System to provide comprehensive, wide range and distributed information for implementation of appropriate adaptation measures against the impacts of climate variability and change across a range of spatial scales. For countries to understand their local climate better and thus be able to develop scenarios for climate change, they must have adequate operational systematic observing networks, and access to the data available from other global and regional networks. These systems enable the integration of national early warning systems, GIS mapping of vulnerable areas, meteorological information on flooding and droughts, as well as the mapping of disease outbreaks. In this way, they provide indicators for monitoring the impacts of climate change and facilitate disaster preparedness and adaptation planning. It is critical to provide access to information about expected climate changes which should clearly explain the uncertainty involved in estimating future impacts. Monitoring climate change, forecasting impacts and using early warning systems to disseminate data to a range of stakeholders from the national to the local level are all vital components to successful long-term adaptation planning and implementation. A climate change monitoring system integrates satellite observations, ground-based data and forecast models to monitor and forecast changes in the weather and climate. A Seasonal to Interannual Prediction System allows for a forecast of weather conditions for a period of three to six months ahead. Seasonal forecasts are based on existing climate data; in particular, on sea surface temperatures, which are then used in ocean-atmosphere dynamic models, coupled with the synthesis of physically plausible national and international models. Modern and science-based systems facilitate seasonal forecasting. Predicting climate seasonal anomalies requires the use of complex coupled atmosphere-ocean models. Knowledge of climatic variability can lead to better decisions in water resources management and agriculture, regardless of geographical location and socio-economic conditions; the technology can therefore increase preparedness and lead to better social, economic and environmental outcomes.

	An Early Warning System (EWS) is a set of coordinated procedures through which information on foreseeable hazards is collected and processed to warn of the possible occurrence of a natural phenomenon that could cause disasters. Decentralised community systems, usually operated by a network of volunteers employing simple equipment to monitor meteorological conditions and operate radio communication networks. Operators of decentralised community meteorological stations report the information to a local forecasting centre where the data is analysed and then communicated back to the community network. The demand for community-led systems is increasing due to lower operational costs and the need for local forecasting and monitoring of climate variability and potential disasters. EWS technology designed as a climate change adaptation strategy must therefore be capable of forecasting a number of climatic events that correspond to different time scales such as three to four months of advance warning of a drought and a few hours of advance warning of torrential rain, hail and floods. The main disadvantage of an integrated climate monitoring system is the cost. Not just the capital required to purchase, install and/or operate all the necessary equipment, but also the ongoing costs of maintaining the equipment and ensuring accurate collecting of data, building and maintaining databases, making sure that data is correctly interpreted and, ultimately, ensuring that relevant information is communicated to the appropriate people in a timely fashion.
Institutional and organizational requirements	While an integrated climate monitoring system may be managed and coordinated by the designated National Meteorological or Hydrometeorological Service (NMHS), decentralized systems involves a participatory, cross-disciplinary research approach that brings together institutions (partnerships), disciplines (such as climate science, agricultural systems science, rural sociology, and many other disciplines) and people (scientists, policy makers and direct beneficiaries) as equal partners.
Operation and maintenance	An integrated climate monitoring system is itself a network of regional and local monitoring resources, but the whole system must be managed and coordinated by the designated National Meteorological or Hydrometeorological Service (NMHS). The NHMS should also share climatic data readily with other relevant national and international organizations, as well as with researchers.
Endorsement by experts	The integrated technology is endorsed by national experts

Adequacy for current climate	It empowers stakeholders at all levels, from national to local, to plan adequately to adapt to current climate variability and future climate change.
Size of beneficiaries group	The technology is beneficial countrywide and across all sectors.
Disadvantages	Disadvantages include the high cost of implementing and maintaining the systems and the requirement for highly trained and skilled personnel across many disciplines and down to the local level to collect, analyse, interpret and disseminate hydrometeorological data and information.
Capital costs	
Cost to implement adaptation options	Costs are high and could exceed US $6,000,000.00.
Additional cost to implement adaptation option, compared to "business as usual" (eg. Fully decentralized system)	
Development impacts, indirect benefits	
Reduction of vulnerability to climate change, indirect	Contributes to reduction of vulnerability to climate change by making critical weather and climate information available in a timely manner for adaptation planning.
Economic benefits Employment Investment Public and private expenditures	 Creation of jobs for people in a wide range of disciplines – climate scientists, meteorologists, agric scientist, socio-economists, support operation and maintenance of water systems and to provide training to users/households and communities. . Reduce public and private expenditures on climate related disaster management.
Social benefits Income Learning Health	 Ensuring availability of weather and early warning information to communities in a timely manner would not only help reduce loss of property and livelihoods in extreme events such as floods and droughts but would also enable communities plan their agricultural and agribusiness activities in a manner that would enhance their incomes.. Training elements from capacity building in operation and maintenance of systems at various levels The early warning systems in particular would enable people prepare for extreme events such as flooding and drought and

	reduce health risks associated with them.
Environmental benefits	Good and reliable climate and weather information would assist in environmentally sustainable development.
Local context	
Opportunities and Barriers	Scientific weather monitoring and short term forecasts (a few days) are already being undertaken in Ghana. As "traditional indicators" of weather (e.g., bird and animal movement, the date and quantity of the first rains, the special forecasting knowledge of diviners and religious leaders, etc) become more unreliable, due largely to climate change, local communities previously relying on such indicators would embrace more and more the scientific systems. Barriers include the high cost, given that there are many competing demands for national resources and the possibility of providing information that the public cannot understand and make use of. Also, local communities that rely on "traditional indicators" for weather and seasonal forecasting may be resistant to the new technology. .
Market potential	Market potential exists in the supply of basic monitoring equipment.
Status	Ghana already has a Meteorological Agency in charge of a wide network of weather monitoring stations throughout the country.
Timeframe	The implementation can start now.
Acceptability to local stakeholders	The technology is acceptable to local stakeholders.

[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment Report – Ghana. You can access the complete report from the TNA project website http://tech-action.org/**