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Note: This Executive Summary captures the main achievements, challenges and recommendations of the Action Line during the 10-year period of WSIS Implementation; this has been submitted by the Action Line Facilitator in response to the request by the participants of the Third WSIS+10 MPP meeting.

10-Year WSIS Action Line Facilitator's Reports on the Implementation of WSIS Outcomes

WSIS Action Line – C7: E-environment

Lead Facilitator: WMO. Co-facilitators: UNEP, ITU

Executive Summary

1. Background: Action Line C7, e-Environment

The impact of human activities on the environment is one of the greatest challenges facing our planet. At the same time, information and communication technologies (ICTs) present a unique solution to tackling these problems in a coordinated, interconnected fashion. This unique role of ICTs was recognized in the Geneva Plan of Action of the WSIS process, which defined the following goals for its Action Line C7, e-environment:

- a) *Objective 1:* Use and promote ICTs as an instrument for environmental protection and the sustainable use of natural resources;
- b) *Objective 2:* Initiate actions and implement projects and programs for sustainable production and consumption and the environmentally safe disposal and recycling of discarded hardware and components used in ICTs;
- c) *Objective 3:* Establish monitoring systems, using ICTs, to forecast and monitor the impact of natural and man-made disasters, particularly in developing countries, LDCs and small economies.

The following executive summary presents an overview of the main activities related to the implementation of this action line over the past ten years, highlighting the main achievements and challenges faced over this period, categorized according to each of the three goals. The document puts special emphasis on the projects submitted under this action line in the WSIS Stocktaking Platform¹, and concludes with a set of recommendations proposed by the action line facilitator, WMO, and co-facilitators, UNEP and ITU.

2. Achievements in the Implementation of this Action Line

2.1. *Objective 1: ICTs for environmental protection and sustainable use of natural resources*

Information and communication technologies (ICTs) have a unique potential to tackle environmental challenges and improve the use of natural resources, in particular by reducing resource consumption

through the use of smart technologies, such as smart grids, smart buildings or intelligent transport systems, by reinforcing the monitoring of environmental conditions and goals through the use of satellite imagery and wireless applications and by supporting information exchange on sustainability, allowing better decision making and improve assessment of progress towards meeting environmental targets.

A number of relevant projects were submitted to the WSIS stocktaking database under this objective. These projects have demonstrated the use or promotion of ICTs as instruments for environmental protection and the sustainable use of natural resources, particularly in terms of collecting, managing and disseminating information related to ecosystems, natural resources, land use, climate and weather as well as sustainable development.

Overall, these projects have shown how ICTs can be utilized for the advancement of long-term decision making by improving knowledge and assessment of impacts on the environment and natural resources: (1) collecting real-time data to make informed decisions on a sound scientific and technical basis; and (2) educating and improving access to information by centralizing and disseminating information to governments, citizens and institutions. Projects that employ ICTs for real-time data collection were also applied to a diverse set of ecosystems, such as deserts, forests and fisheries. These projects include mapping, monitoring changes in weather, climate and development as well as identifying vulnerabilities of sensitive areas to promote sound management practices and decision-making. Web Information Portals, databases and information systems were also established to enhance access to information, educate the public and promote public-participation and sound policy decision-making.

ITU has worked extensively on this domain, in particular through the publication of over 20 new reports and the organization of over 40 high level symposia, workshops and seminars on this topic, covering sub-areas such as climate change adaptation, mitigation and monitoring, e-waste or energy efficiency, to name a few. A key deliverable achieved since the adoption of the WSIS outcomes is the approval of new ITU-T recommendations, such as the L.1400 series, which provide standardized methodologies for assessing the environmental impact of ICTs, the allocation of spectrum for climate monitoring and meteorological applications and the provision of direct support governments to build further capacity on the use of ICTs to adapt to the effects of climate change, in particular to implement early warning systems for natural disastersⁱⁱ.

2.2. Objective 2: Sustainable consumption, production and safe disposal of ICTs

As ICT devices become more ubiquitous and applications and services based on ICTs continue to grow, managing the associated environmental impacts of ICT policy and projects is a necessity. The ICT sector is responsible for 2% of global carbon emissions and, even if efficient technology developments are implemented, this figure is expected to grow by 6% each year until 2020. Additionally, sharp increases in electronic waste (e-waste) are expected, especially in developing countries that do not have the infrastructure and capacity to manage the toxic materials used to manufacture goods. The increase in emissions and improper management of e-waste are contributing to climate change and are negatively impacting environmental systems and human health.

Projects submitted to the WSIS stocktaking database under this objective are targeted toward environmentally safe management and the minimization of e-waste. These projects seek to build capacity of local communities through education, training and sharing of best practices, specifically by promoting international cooperation and agreement on transboundary hazardous waste, by implementing concrete projects for sound waste collection and end-of-life solutions and by promoting the adoption of green ICTs.

As co-lead of this action line, the UNEP Secretariat of the Basel Convention has implemented a range of programmes and projects that support the sustainable consumption, production and safe disposal of ICTs. This was reflected in the theme for the eighth meeting of the Conference of the Parties to the Basel Convention, held from 27 November to 1 December 2006, "Creating Innovative Solutions through the Basel Convention for the Environmentally Sound Management of Electronic Waste". The event contributed to the adoption at the conference of the Nairobi Declaration on the Environmentally Sound Management of Electrical and Electronic Waste and decision VIII/2.

Recognizing the urgent need of developing countries and countries with economies in transition, a Partnership Programmeⁱⁱⁱ has been established under the Basel Convention that, to date, has included two initiatives in its framework: the Mobile Phone Partnership Initiative (MPPI)^{iv} and the Partnership for Action on Computing Equipment (PACE)^v. Both initiatives provide a forum for governments, industry, non-governmental organizations and academia to tackle the environmentally sound management, refurbishment, recycling and disposal of used and end-of-life computing equipment and mobile phones.

Benefits will also be gained from the establishment of pilot collection schemes and treatment schemes for used and end-of-life mobile phones and computing equipment in developing countries and countries with economies in transition. Based on the Nairobi Declaration, several activities and projects addressing this waste stream have now been implemented under the Basel Convention, Basel Convention regional centres, UNEP, UNIDO, NGOs and other organizations worldwide^{vi}. This includes awareness raising activities; detailed inventories; initiation of pilot schemes on collection and segregation of e-wastes, including take-back schemes; initiation of pilot repair, refurbishment and recycling schemes; and training of customs and enforcement officers to control or verify export or import of electrical and electronic wastes and work on the identification of electronic wastes in the Harmonized System of the World Customs Organization. Notably, many e-waste projects are being implemented under the auspices of the Basel Convention, particularly in the Asia Pacific region^{vii} since 2005, in Latin America since 2006 and in Africa^{viii} since 2009.

To complement this work, ITU is contributing to reducing the carbon footprint of the ICT sector, and setting up the foundations to enable low carbon development through the use ICTs. For example, ITU engages with the ICT industry and other parties in the process of the elaboration and adoption of methodologies developed by ITU's Standardization Sector (ITU-T) in order to increase energy efficiency of ICTs. Such work includes the development of a Toolkit on Environmental Sustainability for the ICT Sector^{ix} and the development of recommendations for: an environmentally friendly universal charger for laptops as well as other portable devices; green batteries for smart phones and other handheld ICT devices; and a standardized methodology for manufacturers to report the quantity of rare metals contained in their ICT devices – all of which could equate to preventing the production of 300,000 tonnes of e-waste annually.

ITU has also helped to advance the implementation of the administrative agreement signed in 2012 with the Secretariat of the Basel Convention to improve UN system coordination in the area of e-waste, including the launch of a joint survey on e-waste by ITU, UNEP, UNU, SteP, CEDARE and the Secretariat of the Basel Convention (the results of which were announced in 2012). Additionally, ITU has organized several collaborative events to address e-waste, including the ITU/UNEP session on Environmentally Sound Management of E-Waste at the WSIS Forum (held on 14 May 2013 in Geneva, Switzerland) and the ITU/CITEL Workshop on Environmentally Sound Management of E-waste (held on 9 October 2013 in Mendoza, Argentina).

2.3. Objective 3: Climate monitoring systems

ICTs are reducing the economic and human impact of natural disasters through the detection, forecasting and warning of severe weather phenomena such as local storms, tornadoes, hurricanes or extra-tropical and tropical cyclones. In the Stocktaking Platform, governments and international organizations have submitted projects highlighting the value of ICTs as a mechanism for reducing risk and responding to natural disasters. These projects promote the use of ICTs in local planning to ensure sound development that considers vulnerability to natural disasters. ICTs are used to increase scientific and technical data, improve access to information and build regional networks and cooperation.

The World Meteorological Organization (WMO) works collectively with its 192 Members, UN sister agencies and many international agencies to provide an authoritative voice on the Earth's climate system^x. These efforts have led to the implementation of several products that provide regular information on the status of the global climate system, including products that monitor the occurrence of extreme weather and climate events. The following highlights areas of achievements that are most relevant to WSIS.

First, the WMO Information System^{xi} (WIS), which is now in operational use, builds on the routine exchange of weather information that has been in place for half a century, retaining the core attributes of fast and reliable delivery of critical information. WIS allows authorised users to download data on demand or to issue a request for the information to be supplied whenever it is updated. WIS also introduces alternative

methods of transporting information, making it possible for research institutes, for example, to deliver information routinely without needing a direct connection to the (expensive) core network that is used to exchange critical information^{xii}.

Another relevant programme on this action line is the WMO Integrated Global Observing System (WIGOS), designed both to increase the quantity of weather, water and climate observations and to improve their quality and confidence in that quality^{xiii}. Furthermore, the Severe Weather Forecasting Demonstration Project^{xiv} is providing developing countries in southern and eastern Africa as well as island states of the southwest Pacific with information needed to make better decisions on mitigating the impacts of severe weather. ICT is crucial to the success of the project: global observations of the weather underpin the approach; numerical weather forecasts produced by the most advanced weather services are made available to the forecasters in the affected nations (who are also supported with training in how to interpret the forecasts); and the forecasters work closely with the decision makers using relationships that are built up during the project^{xv}.

To complement this process of better decision-making, WMO is taking a leading role in the Global Framework for Climate Services^{xvi} to ensure that nations are able to develop and apply science-based climate information and prediction to planning, policy and adaptation practices, supported by ICT. To uphold the flow of information in support of climate services, WMO is preparing a data policy to encourage exchange of information related to climate services.

Another service provided is the WMO Weather Information Service^{xvii} hosted by Hong Kong (China), which delivers authoritative web-based weather forecasts for cities around the world using information provided from the national weather service of each participating country. Accompanying smart phone applications^{xviii} were updated in 2013, and the main web site is being reviewed to improve functionality^{xix}.

To reinforce the concept of authoritative sources of information used to support emergency responses for all, not just for major organizations which prioritize particular recipients of information during times of crisis, WMO is promoting the use of the Common Alerting Protocol^{xx} by weather services, and has run workshops to allow national weather services to provide their warnings in this form to supplement more traditional ways of distribution.

Similarly, ITU continues to provide support to Member States to build capacity and to use ICTs for climate change adaptation measures by helping in the development of National Emergency Telecommunications Plans and implementation of early warning systems. For example, ITU continues to work in the context of the ITU/WMO/UNESCO/IOC Joint Task Force (JTF) to investigate the potential of using submarine telecommunication cables for ocean and climate monitoring and disaster warning^{xxi}. Another area in which ITU has worked to implement early warning systems and to provide support in the re-establishment of communications in areas affected by natural disasters is in the advancement of the use of radio-communication services in climate monitoring.

3. Main Challenges

3.1. Objective 1: ICTs for environmental protection and sustainable use of natural resources

The issue of environmental protection and the sustainable use of natural resources continue to be one of the main global challenges. In the last 40 years progress has been made in incorporating environmental sustainability into international agreements and national policies. According to UNEP most countries have signed at least 9 of the 14 main multilateral environmental agreements, with a total of 60 countries signing them all. This is a positive indicator of the relevance of the environmental agenda at the international level. Despite this global framework of agreements the reality indicates that more effort is still needed to implement these agreements and to incorporate sustainability into national policies, in particular into non-environmental sectoral policies.

The recent Rio+20 conference recognized in its outcome document -“The Future We Want” - the unique contribution of ICTs to promote knowledge exchange, technical cooperation and capacity building for sustainable development, highlighting the need to work towards improved access to ICT, in particular to

broadband networks and services as an action required to advance the sustainable development agenda. The Future We Want also highlights the role of ICTs to facilitate the flow of information between governments and the public, improve agricultural productivity and sustainability through the voluntary sharing of knowledge and good practices, empower farmers, fishers and foresters to choose among diverse methods of achieving sustainable agricultural production, improve the capacity of education systems to prepare people to pursue sustainable development and empower women to access economic resources.

These are some of the challenges and opportunities that may need to be considered at the WSIS+10 review process with regards to action line C7 e-environment.

3.2. Objective 2: Sustainable consumption, production and safe disposal of ICTs

Within the past three decades, citizens in countries around the world have rapidly gained access to computer technology, representing important progress in the achievement of the United Nations Millennium Development Goal of making available the benefits of new technologies, especially those related to information and communications. As markets continue to expand and more communities gain access to information technology^{xxii}, many countries, especially developing countries and countries with economies in transition, face new challenges in managing used and end-of-life computing equipment and other electronic products.

Sooner or later, all these electronics and personal computers (PCs) must be discarded and, quite often, this takes place sooner rather than later as PCs are usually taken out of use well before they cease to operate, which is particularly the case in many industrialized countries^{xxiii}. When such computing equipment reaches the end of its life, products either become available for refurbishment and reuse or become e-waste. According to UNEP, 20 to 50 million metric tonnes of e-waste are generated worldwide every year, comprising more than 5% of all municipal solid waste.

In recent years, international transboundary movement has evolved so that PCs and associated hardware, used electronic equipment and used cellular telephones are now being transported across borders to allow for the removal of usable parts, for refurbishment and reuse and for processing the recovery of raw materials. Transboundary movement of these goods is forecasted to increase significantly as more and more countries produce electrical and electronic equipment, so it becomes necessary to tighten control over acceptable disposal methods, adopt processes to recover valuable constituents and use safe practices to deal with the hazardous constituents in e-wastes (e.g. cadmium, lead, beryllium, CFCs, brominated flame retardants, mercury, nickel and certain organic compounds). Otherwise, these hazardous substances can have a negative impact on our environment.

While offering some economic benefits, massive import of e-wastes, coupled with the generation of the same wastes locally, is creating a heavy health and environmental burden, in particular for developing countries^{xxiv}. Huge amounts of wastes, both hazardous and solid, are burned or dumped, for example in rice fields, irrigation canals and along waterways. The open burning and toxic dumping activities pollute the land, air and water, thus exposing men, women and children to poisonous emissions and effluents. The health and economic costs of this trade are neither borne by the developed countries nor by the waste brokers who benefit from the transaction.

Numerous obstacles have been identified by developing countries in regard to their ability to manage e-wastes in an environmentally sound way. These include: lack of easily accessible information (on flows, quantities, available technology, legislative/trade requirements of countries importing new products and requiring increasingly strict standards for minimization and re-use, recycling and recovery); lack of trained personnel; inadequate policy and regulatory frameworks (including legal definitions and informal sector coverage) and enforcement; inadequate infrastructure for collection, recycling and recovery of ICT-waste in line with best available technologies and best environmental practices; lack of public awareness; poor health and labour conditions of those involved in the informal recycling practices; and lack of economic alternatives to activities carried out by the informal sector and small family repair shops. Inter-agency cooperation on environmentally sound management of ICT-waste as well as the implementation of the relevant existing legislation is another challenge faced at the national level.

A sustainable e-waste management system will require an adequate financing scheme, a level playing field and appropriate market incentives. It is thought that, similar to policies in OECD countries, e-waste recycling systems in developing countries may be developed under the principle of Extended Producer Responsibility (EPR), in that producers and importers could be given the responsibility to manage the waste generated from their products. While the regulatory framework needs to be clear and precise in defining the obligations for the main actors, it should give producers and importers some flexibility in choosing their preferred approach to implementing a sustainable system.

Designing EPR policies in developing countries, where the producer is not represented, requires a definition of the actors who should bear the cost of e-waste management. In doing so, it is important to consider the socio-economic impacts of the informal e-waste recycling sector. Establishing recycling facilities in a developing country which operates in accordance with international standards and practices and which could partner with producers would be vital when developing EPR systems.

3.3. Objective 3: Climate monitoring systems

Weather, climate and water have a significant global impact on sustainable development and human well-being. Given the right conditions, they provide safety, food, health and an abundance of other amenities. However, weather and climate extremes can cause destruction, famine and economic disaster. The infrastructures upon which we depend for food, water, energy, shelter and transportation are sensitive to high or low values of meteorological variables^{xxv}.

Changes in extreme weather and climate events are among the most serious challenges to society when coping with a changing climate. Indeed, “confidence has increased that some extremes will become more frequent, more widespread and/or more intense during the 21st century” (IPCC, 2007, 2013). As a result, the demand for information services on weather and climate extremes is growing. It must also be noted that, although weather information is available from a large number of sources, the end user often has little indication of the origins of the information. Nevertheless, the quality and consistency of the information becomes crucial during a weather emergency^{xxvi}.

The developing world is not benefiting fully from the progress made in ICT applications in weather and climate monitoring and warnings due to a lack of suitable ICT infrastructure for quasi real time access to relevant information. Other challenges to the use of ICT collaboration tools include: great variability of the ICT infrastructure available between nations; low uptake of tools that are not part of the daily working environment of the collaborators; and security constraints within organisations’ ICT infrastructures that restrict access to collaboration web sites.

4. Recommendations for the WSIS+10 Review Process

The WSIS+10 review is an opportunity to review the role that the information society can play to address the new environmental challenges of our time, such as climate change, the loss of biodiversity, land degradation or the acidification of oceans. Learning from the achievements and challenges previously highlighted, the facilitators for this action line would like to provide the following recommendations to be considered in the WSIS+10 review process.

Revision of scope and goals of action line C7, E-environment:

- Analyse if action line C7, E-environment should be reviewed to broaden its scope into e-sustainability. This change would allow for more flexibility to the areas that have been brought to the attention of this action line.
- Incorporate into the WSIS+10 process the issues of putting more emphasis on climate change adaptation and using ICTs to promote disaster risk reduction.
- With regards to energy consumption, place more emphasis on measuring performance and establishing reduction goals. Agreeing on a common set of methodologies, such as the ones produced within ITU, and engaging the private sector to adopt these standards are two important steps that need to be further promoted.

Promote further collaboration among all stakeholders:

- Encourage and/or further enhance inter-sectoral cooperation between the ICT community and the environmental community, the meteorological community and other groups working around sustainability. This collaboration should take place at the international, national and regional levels.
- Encourage communities to be actively involved in the application of ICTs to address sustainability issues, in particular climate change. While ICTs are critically important, the challenge of climate change can also be fully met through stronger political will.

Technical recommendations:

- Ensure the availability of communication spectrum for climate change monitoring and for the development of more accurate climate data, and protect the available spectrum and satellite orbits to maintain and continue developing new ICT-enabled applications for meteorology. The use of ICTs in climate monitoring should be seen as an “end to end” system from observations to predictions. This is especially important for developing countries, and leads to better weather forecasting.
- Review the environmental footprint of the ICT sector, and explore ways to continue reducing negative impacts, improving energy efficiency and tackling the e-waste problem. The ICT sector should adopt a lifecycle approach. Relevant organizations, such as ITU, should continue to undertake work around the collaboration between the ICT sector and the renewable energy sector.
- Assess how the use of ICTs improves the environmental footprint of other sectors, looking into emerging technologies, such as smart grids.

Priority groups for future work:

- Give increased focus on how vulnerable communities can benefit from the ICT revolution and its applications in climate, weather and water, and how to better engage the private sector and NGOs to become privileged partners in filling gaps. The aim is to improve access to time critical information (such as warnings and advisories relevant to weather, climate and water) for the largest possible number of people.
- Support developing and least developed nations and small island developing states to benefit from the full range of ICT–weather/climate related services including satellite data and high speed internet access, and update smart phone weather and climate applications based on extended communication bandwidth .

Annex – End Notes

ⁱ Further information about the WSIS Stocktaking Platform is available at <http://groups.itu.int/stocktaking/HOME.aspx>

ⁱⁱ Further information on ITU activities is available at www.itu.int/climate

ⁱⁱⁱ Developing countries will benefit from these Partnerships considering that the guidelines produced will be useful in helping them achieve the environmentally sound management of mobile phones and computing equipment. The guidance documents on the environmentally sound management of used and end-of-life mobile phones and computing equipment developed under the mandate of the Conference of the Parties to the Basel Convention provide substantial guidance for setting up legal and policy frameworks for the environmentally sound management of e-waste.

^{iv} The MPPI was launched in 2002, during the sixth meeting of the Conference of the Parties to the Basel Convention, when 12 manufacturers signed a Declaration entering into sustainable partnership, with the Basel Convention and in cooperation with other stakeholders, to develop and promote the environmentally sound management of end-of-life mobile phones. Guidelines and documents developed under the MPPI are available on the MPPI website: <http://www.basel.int/industry/mppi.html>

^v PACE was launched at the ninth meeting of the Conference of the Parties to the Basel Convention, which took place in Bali in June 2008. Details of partnership are provided on the PACE website: <http://www.basel.int/industry/compartnership/index.html>

^{vi} Details of the e-waste programmes and projects are available on the Basel Convention website: <http://www.basel.int/Implementation/TechnicalAssistance/EWaste/tabid/2576/Default.aspx>

^{vii} The following Asian countries have supported and are participating in the project activities: Cambodia, China, India, Indonesia, Malaysia, the Philippines, Singapore, Sri Lanka, Thailand and Viet Nam. In addition, the South Pacific Regional Environment Programme has completed a regional e-waste inventory for the Pacific island countries. Activities involving detailed inventories of e-waste in Cambodia, Malaysia, Thailand and Viet Nam are also being carried out. Under the leadership of the Basel Convention Regional Centre for South East Asia, two sets of technical guidelines were completed, namely on (1) the methodology of e-waste inventory and environmentally sound management and (2) the “3Rs” (reduce, reuse, recycle) of end-of-life e-products.

^{viii} For the E-waste Africa project, a comprehensive set of activities has built local capacity to address the flow of e-wastes and electrical and electronic products destined for reuse in African countries and will augment the sustainable management of resources through the recovery of materials in e-wastes. The project was implemented by the Basel Convention Regional Centres based in Nigeria and Senegal, in cooperation with partners including the Swiss Federal Laboratories for Materials Science and Technology (EMPA), the Oko Institute, the European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL) and PACE.

^{ix} The Toolkit on Environmental Sustainability for the ICT Sector was developed with over 50 ICT members and academia and provides plenty of detailed support on how ICT companies can build sustainability into the operations and management of their organizations, through the practical application of international standards and guidelines.

^x The world communities (WCC-3, 2009) recognized the increasing importance of observing, monitoring and predicting the climate system at various space and time scales. In addition, WMO Member states (WMO Congress, 2011) stressed the importance of high-quality climatological observations and data sets for understanding and monitoring climate variability and change, and agreed collectively to enhance climate monitoring capabilities and related observing and information systems for the generation of new and improved products and services.

^{xi} Further information about the WMO Information System (WIS) is available at http://www.wmo.int/pages/prog/www/WIS/overview_en.html

^{xii} This delivers the twin benefits of operational meteorology delivering more accurate information through the availability of additional types and volumes of observations and product information, and allowing a wider range of services through the combining of weather information with that from other disciplines.

^{xiii} WIGOS seeks to involve more scientific communities in the generation and sharing of observations of the environment so that research, operational and end user products can be made more accurate and relevant. WIGOS has entered the detailed planning stage, with tangible results expected by 2015.

^{xiv} Further information about the Severe Weather Forecasting Demonstration Project is available at <http://www.wmo.int/pages/prog/www/swfdp/>

^{xv} The Severe Weather Forecasting Demonstration Project has also delivered improved ways of working between national, regional and global operational centres and experts, and establishing partnerships among these experts and the people who have the responsibility for planning and managing the response to severe weather events. This same approach is near completion, and soon to commence their demonstration stages in two other regions in Asia.

^{xvi} One project developed under the Global Framework for Climate Services (led by WMO and involving GIAR/CCAFA, CICERO, CMI, WHO, WFP and IFRC) is piloting the co-production of information and knowledge to deliver actionable climate services in support of food security, nutrition, health and disaster risk reduction in Malawi and Tanzania.

^{xvii} Further information about the WMO Weather Information Service is available at <http://worldweather.wmo.int/>

^{xviii} The smart phone applications can be found at <https://itunes.apple.com/hk/app/myworldweather/id453654229?mt=8>

^{xxix} Other countries are collaborating with other service providers: (1) In Uganda, the weather service is working with a mobile telephony provider to deliver an SMS warnings service to reduce the loss of life among fishermen on Lake Victoria; (2) Neighbouring Tanzania is building on this experience to provide a similar service to support fishermen, farmers and the transport industry and is also cooperating with community radio to enhance the penetration of messages.

^{xxx} Further information about the Common Alerting Protocol is available at http://www.wmo.int/pages/prog/amp/pwsp/CommonAlertingProtocol_en.html

^{xxxi} The JTF has organized, every year since 2010, the Workshop on Submarine Communications Networks for Climate Monitoring and Disaster Warning, from which it has been agreed that dual-purpose submarine telecommunication cables are technically feasible and JTF members are currently working on how to solve business, legal and economic issues. The JTF is progressing two studies: a) a Functional Requirements Study that will meet the detailed evaluation needs of the industry and b) a Business Model Study to establish the financial basis for the development of the Pilot/Demonstrator Model and the later ongoing decadal Operational Phase. The JTF is also working on publications on the engineering functional requirements and the science and societal requirements for sensors in submarine telecommunication cables.

^{xxxii} Personal computer (PC) sales have significantly increased in all regions from 2000 to 2010, where the use of PCs has grown exponentially from about 170 million units sold globally in 2000 to about 370 million units sold in 2010, and this trend will continue until 2014. It is projected that sales in 2014 will reach an estimated 470 million units. It more than doubled in the last 10 years with the largest growth in the Asia region.

^{xxxiii} UNEP found that PCs generally have a lifespan of less than four years before they are replaced by new ones because their owners want newer features.

^{xxxiv} Altogether, it is roughly estimated that during the past few years, at least 250,000 tonnes of e-waste per annum “illegally” entered the ports of the five selected West African countries, namely Benin, Côte d’Ivoire, Ghana, Liberia, and Nigeria. This number is comparable to the total amount of e-waste generated in small European countries such as Belgium or the Netherlands, and equates to approximately 5% of all e-waste generated in the European Union.

^{xxxv} For example, high precipitation amounts and resulting stream flows affect sewerage systems, dams, reservoirs and bridges. The motivation for analyzing extremes is often, on the one hand, to find an optimum balance between adopting high safety standards that are very costly, and on the other hand, preventing major damage to equipment and structures from extreme events that are likely to occur during the useful life of such infrastructure on the other hand.

^{xxxvi} This has led to the concept within WMO of a “single authoritative voice” for issuing weather warnings and the detailed information associated with them. If the authorities responsible for responding to emergencies base their decisions on differing information, the resulting actions are inconsistent and may work against each other. To remain credible, the single authoritative source within a country has to provide high quality information and has to have the support of the national government.