Technology Fact Sheet for Adaptation

B. Early warning system (EWS) and Information and Communication Technologies (ICT) [i]

Sector : Agriculture and Water	
Subsector : all subsectors	
Technology characteristics	
Introduction	Early warning (EWS) system is based on weather forecast, actual data gathered from agro- meteorological stations, scientific knowledge and Information and Communication Technologies (ICT) to assess and disseminate information to vulnerable communities.
Technology characteristics/highlights	- Weather forecast is based on satellite images and remote sensing. - Meteorological stations register and measure climatic features (i.e. precipitation, temperature, atmospheric pressure, humidity, wind speed, etc.). They require: a rain gauge, a thermometer (min/max), a barometer, a hygrometer, an anemometer with a wind vane. Advanced stations may have also devices to measure the degree of cloud cover/sunny hours, solar radiation intensity and evapotranspiration. - Bio-indicators (fauna activities, flora aspect…) are in many cases very useful to predict weather changes during the season by local communities. - Such data are used by scientists in different domains (Integrated Pest Management, Irrigation or flood management, etc.) as well as by insurance companies (weather index insurance) to assess the risk magnitude, and on a later stage eventually the area affected by certain damage. - Information Technology enables not only modeling of the risk (climate index or pest) and assessing the scale of it and the eventual damage, but also enables disseminating the warning system through the internet or phones to the concerned researchers, extension service, technicians, farmers and communities. - EWS and ICT are essential technologies for Integrated Pest Management (IPM), agriculture practices management (irrigation, date of sowing, land preparation, harvesting…), water harvesting, snow monitoring, disaster prevention and index insurance. Both are related and considered as tools for other sciences and technologies for adaptation to climate change in both agriculture and water sectors.
Institutional and organizational requirements	- The Lebanese Meteorological Service (LMS) is mandated to deliver weather forecast reports on a daily basis. The Lebanese Agriculture Research Institute (LARI) is currently deploying Agro-meteorological stations all over the country. These stations shall provide the necessary data for early warning systems. - This service has been initiated to farmers by LARI nevertheless, further organizational requirements are necessary to deliver a better quality service, widen its applications to other technologies (water efficient use, insurance, etc.) and to ensure the sustainability of the service through

	an appropriate funding mechanism. - MoUs between all stakeholders are required (MoA, LARI, LMS, Internet service providers, IT companies, Mobile phone companies, farmer groups…) to establish the institutional and organizational frameworks.
Operation and maintenance	Hardware equipments of the meteorological stations require energy to operate, periodic maintenance and protection. Software technologies need to be developed and upgraded to ensure data processing.
Endorsement by experts	Early warning systems have been adopted in several countries since several decades, namely in countries with advanced remote sensing and forecast technologies. In some countries (i.e. France) Early warning systems is developed along with plant protection and extension services to deliver information to farmers. Currently, such systems are of higher potential among the technologies that are promoted for adaptation (URC/UNEP, UNDP, University of Manchester, World Bank, FAO…) under specific conditions and for many weather aspects.
Adequacy for current climate	Since climate extremes seldom occur, EWS and ICT are adequate for current and future climate.
Scale/Size of beneficiaries group	Depending on the selected weather indicators and the crops, as well as the agricultural practices benefiting from EWS and ICT (i.e. IPM, Irrigation management…), the scale of the beneficiaries may vary from a specific region to national coverage.
Disadvantages	- Agro-meteorological stations have a high cost and require maintenance. - The efficiency of the station is reduced to the watershed or agro-climatic zone in which it exists. - Many weather features such as drought or prolonged cold period build up progressively which masks the risk which makes the EWS less efficient. For instance, drought is a cumulative process combining temperature and cumulative evapotranspiration that is not directly measured by the weather station. Hence, prediction of damage on crops is difficult in such cases. - The data gathered requires processing, which is time-consuming and even more complex when the concerned area integrates a larger number of crops. - Farmers are not willing to pay for the service which makes the funding mechanism to sustain EWS and ICT depending on external resources.
Capital costs	
Cost to implement adaptation technology	- The cost includes the equipments, software, operation, maintenance, training technicians, data processing, and information dissemination. The cost of technology relies mostly on the type of measurements, the type of climatic impact and the number of crops involved. The information processing varies accordingly. - Information dissemination to individual farmers and communities through mobiles and internet is an additional significant cost which depends on the area covered by the system, the number of registered farmers and the frequency of the risk.
Additional cost to implement	- Estimated budget to install a typical weather station (with the devices

adaptation technology, compared to "business as usual"	mentioned above) is 52000$ One text message through mobile phones costs 0.1$
Long term cost (i.e. 10, 30, or 50 years) without adaptation	N/A
Long term cost (i.e. 10, 30, or 50 years) with adaptation	- 25000$ as annual operating cost per station.
Development impacts, direct and indirect benefits	
Direct benefits	- Increases the readiness and resilience of farmers to climate change. The crops are less vulnerable to climate adverse. Damages are minimized and hence the revenue of farmers is maintained if not increased. - The system is also efficient for all the community (i.e. local authorities…) and even at higher decision-maker level, to better plan and organize to cope with climate change. - EWS and ICT enable a wider application of other technologies such as IPM and Index insurance.
Reduction of vulnerability to climate change, indirect	EWS enables risk assessment. Mapping of risk assessment would also be useful to both public sector and farmers to adapt their programs and project investments according to the eventual risk occurrence. EWS and ICT when properly provided to farmers and local community enables them to manage their farm and water resources in a manner to adapt to climate change and reduce vulnerability.
Economic benefits, indirect Employment Growth & Investment	 ESW and ICT will require the employment of technicians. Investments are needed for these technologies for both deployment and operation. Moreover, such technologies would mobilize investments in IPM, Index insurance and both agriculture and water sectors in general.
Social benefits, indirect Income Education Health Environmental benefits, indirect	 If the impact of climate is reduced, agriculture damages are spared, hence enabling farmers to sustain and even increase their income. On the long term farmers will be aware of climate variability, crop vulnerability to climate change, they will acquire knowledge in increasing their resilience as well as the importance of adopting other technologies such as IPM and Index insurance. Monitoring water resources and IPM will have a positive impact on human and animal health. Not applicable except if the EWS and ICT serve as tools for other technologies (flood management, water resources management, IPM…)
Local context	
Opportunities and Barriers	- Absence of a well-sustained institutional or organizational mechanism so far - Lack of confidence of the Lebanese farmers in such system. - Difficulty of access of farmers to ICT (illiterate, lack of knowledge in mobiles, weak connection, and absence of internet…). - Enhance capacity building for researchers, technicians and farmers to promote the use of IPM, embed Index insurance, enables local

	communities to understand more the impact of climate change on both agriculture and water sectors on the local scale and finally increase the awareness of all decision makers on integrating climate consideration in their development plans.
Market potential	EWS and ICT will enhance market potential for other technologies.
Status	A set of agro-meteorological stations is being deployed by LARI, under ADP project with MOA. Moreover, some NGOs such as Arc-en-Ciel in collaboration of LARI have initiated a mechanism to disseminate the information to farmers and promote IPM in Akkar with the help of GIZ/EFL. Further, MoA is aiming at strengthening LARI in sustaining EWS and ICT and broaden this service to a larger scale.
Timeframe	Medium to Long Term
Acceptability to local stakeholders	All national stakeholders are aware of the importance of these technologies. Nevertheless, finding an optimal mechanism to ensure operation, maintenance, information dissemination and finance remains the major challenge to overcome.

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