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Managing Climate Change in Rural Areas using ICT with reference to Thiruvallur District, Tamilnadu

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Abstract— Census 2011, states that 68.8 percent of rural population in India depends on climate susceptible sectors for their survival. India is one of the vulnerable country in the world exposed to climate-related disasters as 65 percent of India is drought prone, 12 percent flood prone, and 8 percent sensitive to cyclones. As a result, Climate Change is likely to challenge the livelihoods and causing damage to the natural resources. With this backdrop, this paper attempts to analyze with support of ICT, how it specifically help the rural life of the people in the study area to take appropriate decisions when there is poor awareness on the importance of sustainable natural resources time of climate change can be helpful for the poor to use ICT for their own needs at the time of degradation of natural resources rather than receiving information in the form of messages from government/NGOs? The study area is a suburb to Chennai, Ambatur Taluk (village) in Thirvallur district in the state of Tamil Nadu. This particular village population engaged in both the agricultural sector and in the allied activities. Based on the empirical evidence it is identified that rural people aware of the information related to weather and the use of ICT will help to identify their needs for their sustainable livelihood during climate change.

Key Words— *Information and Communication Technology (ICT), Climate Change, Weather.*

1. Introduction

In India nearly 700 million rural population directly depend on climate based production and primarily involves in agriculture, forests and fisheries, the natural resources such as water, biodiversity, mangroves, grasslands are for their survival and livelihoods. According to the National Communication Report of India 2004 to the United Nations Framework Convention on Climate Change (UNFCC) states that Climate Change is likely to affect all the natural ecosystems as well as socio-economic systems, developing countries like India are facing the burden of climate change (MAIN, 2013). Climate Change is build up of Green House Gases (GHG) in the atmosphere. In broader term Global Warming means "Climate Change" and refers to increase in the average temperature of the air near earth's surface and oceans are the serious global environmental concern. For the past two decades India is facing environmental challenges. The impact of climate change in India on the natural resources have significant and unsympathetic effect on agriculture on which 58 percent of the rural population still depends for livelihood, water storage and habitations. Climate change will also cause increased frequency of extreme events such as floods, and droughts. These in turn will impact India's food security problems and water security (Economic Survey, 2012-13, pp. 256-57). There is significantly difference between *weather* and *climate*, *weather* is the actual atmospheric conditions for shorter period of given time and location, whereas *climate* refers to weather averaged over a longer period of time, often carries for 30 years.

This paper analyses the emerging trends in the delivery and exchange of climate information in rural areas for success in production and its productivity through Information and Communication Technologies for development efforts which have a rural–agricultural focus. Such an analysis aims to give a clearer indication of how best the future investments in sharing climate change information with rural resources. The analysis covers only the Ambatur Taluk in Thiruvallur District of Tamil Nadu state which is a suburban to Chennai city. The critical potential impacts in this area are to focus on rural knowledge on climate change.

2. Development of ICT for Climate Change in India

Information and Communication Technologies (ICT) as a whole refers to an expanding electronic technologies that are use to handle information to communicate with the help of communication-aid such as hardware, software, media for collection, storage, processing, transmission and presentation of information in any format like voice, data, text and image through computer, internet, CD-Rom, email, telephone, radio, Television, video and digital cameras etc. India being one of the developing countries in the world

had included in the Indian Constitution act under the article 48A on the environmental protection state that 'the State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country'. Likewise, Article 51A (g) makes it compulsory for every citizen of India, 'to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures.' Although the India's information towards the contributions to greenhouse gas emissions are very small, the Government of India taking measures to develop the situation in protecting the environment. In the year 1945, India Meteorological Department (IMD) with the help of All India Radio, broadcasted the weather services for farmers in the form of Farmer's Weather Bulletin (FWB) and later in 1976 IMD started Agro-Meteorological agricultural Advisory Service (AAS) in collaboration with Agriculture Departments of the respective state Governments and provided services to the farming community which faced lot of drawbacks in the system. In view of that in the year 2007 IMD launched Integrated Agromet service in collaboration with different organizations/institutes to help farmers for the better use of their land more effectively (Balaji & Craufurd, 2011). Agromet advisories and tailored weather forecasts allow farmers to optimize the timing of sowing, planting, fertilizer application, irrigation, harvesting, and spraying of pesticides and herbicides, and improve cropping pattern selection. Ultimately, such improvements will help to increase production, reduce losses and decrease production costs.

A wide variety of channels and modes are used to disseminate climate information to farmers, with conventional mass media continuing to play the primary role. The India Meteorological Department has dedicated Agro-Meteorology Division that has a long history of operating agro-advisory services, and ICAR (Indian Council for Agricultural Research) runs the All-India Coordinated Project on Agro-Meteorology. Although agromet advisories are also made available via the internet, there is no effort by the promoters of Indian ICT for development initiatives to link the various sources of data and information to create new services for the farmers (Balaji & Craufurd, 2011). Still it appears to possess any well-organized, institutionalized agromet systems or ICT-mediated agricultural development efforts to manage agromet data and deliver to rural areas for location-specific weather and seasonal climate forecasts, products and advisory services.

Although mobile telephone use continues to grow rapidly in all over the nation, internet use remains limited. Looking at the overall state of the internet and ICT access and use in agricultural research and development, at the regional and national levels, some initiatives exist on the use of ICT in agriculture and environment. These relate to early warning systems, disaster reduction, and adaptation to climate change, bringing weather services to rural areas, and ICT in the economics of climate change. Results from these initiatives are not yet available. The United Nations Framework Convention on Climate Change (UNFCCC) National Adaptation Programme of Action to Climate Change (NAPA) has several projects which are related to food, agriculture and environment, but none of this focus on ICT or ICT mediated information dissemination or unaware of the farmers in the nation.

Almost two decades ago, there was much hope that agromet advisory services would expand to become a key category of ICT for development project. This hope has failed to materialize. However, there has been some recent investment in the revitalization of institutional extension services. Some of this investment has been directed towards gathering and storing weather data for use in advisory formulation and ICT-enabled delivery to frontline agencies. There has not yet been a comprehensive assessment of the results of such investments. Two of the critical disasters in India – drought and flooding – are caused mostly by climate factors. Both have significant impacts on food production and on the well-being of farming communities. In 2008, the Disaster Management Authority of India accepted the need for science-based forecast and delivery systems to work on both macro and micro scales, but noted that these were not available.

In India, the agromet advisories are given to farmers at the scale of agro-climatic zones (of which there are 127 in India) on the basis of quantitative medium-range weather forecasts. The economic value of the agromet information, which is in the form of advisories, can be evaluated in terms of its impact in saving farm inputs, increasing crop yield and bringing economic benefits to the farming community (Balaji & Craufurd, 2011). IMD, in collaboration with organizations such as ICAR, Federal and State Ministries of Agriculture, and state agricultural universities, issues AAS bulletins twice a week. It also promotes cooperation between national agro meteorological institutions and those involved in the transfer of agromet information and advisories. Besides setting up an agromet observation network, IMD has developed numerical weather prediction methods to prepare district-specific five-day weather forecasts. It has also set up a network of 130 agro meteorological field units, which translate weather forecasts into district-specific agro advisories. These units are based at Indian institutes of technology, state agricultural universities, ICAR institutes and other organizations working in agricultural science. Advisories are disseminated using a multimedia approach involving conventional modes of communication as well as emerging technologies such as mobile phones and the internet. Messages are also sent by SMS (Short Messaging Service) as well as voice mode to farmers who subscribe to services

offered by private companies.

2.1 Use of ICT for Climate Change in Thiruvallur District

Both agromet divisions of Tamil Nadu Agricultural University, Coimbatore, and the M.S. Swaminathan Research Foundation, Pondichery are the major ICT-enabled development programme pioneering at ICRISAT to maximize the use of natural resources for increasing crop production, and given the high degree of weather variability, farmers benefit from weather information with seasonal forecasts before the start of the cropping season. Short and medium-range weather forecasts based on agomet advisories help farmers stabilize yields through appropriate management of agro-climatic resources as well as other agricultural inputs such as irrigation, fertilizers and pesticides. The agromet service contributes to crop and livestock management strategies and to operations dedicated to enhancing crop production and food security. The emphasis of the AAS system is to collect and organize information on soil and crops and amalgamate them with weather forecasts.

Integrated Agromet Advisory Service (IAAS) project are being disseminated to the farming community in India through SMS and Interactive Voice Response technology (IVR). Under the IVR system, the information from Agromet Field Units for each state are collected and stored, then converted into voice form. Cultivators of various farming in rural areas can call to receive information. A number of private firms are also disseminating IAAS-generated agromet advisories through SMS and IVR. At present 16 states – Delhi, Uttar Pradesh, Punjab, Haryana, Rajasthan, Madhya Pradesh, Orissa, West Bengal, Gujarat, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Bihar, Maharashtra and Himachal Pradesh – are covered under this service. The ultimate aim is to disseminate advisories to the farmers in real-time to help them save farm inputs, increase crop yield and ultimately increase economic benefits to the farming community.

2.2 About the Study Area

The study was conducted in Arakambakam, Veerapuram and Kolumedu villages of Thiruvallur District in state of Tamil Nadu, India. The villages are well known for the agriculture. These three villages are located in northern part of Thirvuallur District and it falls under the North Eastern Agro Climatic Zone of Tamil Nadu. The soils found in these villages are sandy and very suitable for cultivation and Horticulture. Though it is very near to the Chennai City 50% of main activity in these villages is still agriculture and allied activities. The major crops grown in the villages are rice, cumbu - ragi, green gram, and groundnut. Apart from this, certain horticultural crops like mango, guava and vegetables have also been cultivated successfully. Thiruvallur is a coastal district. The ground water levels are good in Arakambakkam and Veerapuram village farmers are able to cultivate 2 to 3 crops in a year. The Kolumedu Village depends on rain and lake water for cultivation because the ground water level in this area is poor.

Even though Chennai city is closer to these villages to create a good market potential for the agricultural products, it also becomes a major threat and weakness for the development of Agriculture in these three villages. Due to rapid growth in industrialization around Chennai city the land value has increased manifold so farmers feel it is profitable to sell the lands instead of cultivating crops. Moreover the Chennai city has encouraged the real-estate developers to purchase large tracts of land for the construction of residential buildings so the land available for Agriculture is shrinking day by day. A large quantity of good quality ground water is pumped and transported to Chennai city daily by many private authorized and unauthorized agencies. So the groundwater potential is being depleted in the villages near Chennai city. As most of the industries are intense around Chennai labourers to work in their industries, rural educated people in these villages find it more remunerative working in industry rather than in agricultural operations and few uneducated people enrolled in Government hundred days work schemes. So there is a scarcity of labourers to carryout agricultural operations in these villages which result in waste land.

2.3 Climate and Weather Impact in the Study Area

Climate is a weather averaged over a longer period whereas Weather is the actual atmospheric conditions for a shorter time. Climate change is already occurring in the villages Climate variability or variations being experienced by the farmers, in summers for the past three year they feel hotter, and in winter sometimes they feel colder. For the future it is projected that the variability of the climate will increase. Problems associated with extreme weather events can serve as an important orientation to determine the vulnerability of the community regarding possible future impacts of climate change. Therefore it is essential for climate change adaptation to include local community experiences and knowledge on community's experiences and vulnerability with regard to climate change. The following two climate change provides an extreme weather experiences in three villages during survey.

1. *Cyclones, Heavy Rain and floods*: The main problems caused by this climate impact are unable to cultivate, loss of employment and no source of income. Stalinization of land and ground water, communicable infection and other health related problems. Also Livelihoods affected worst such as damages to property, Electricity failure, migration to nearby city.
2. *High Temperature:* Major problems faced by this climate impact are lack of community participation

spirit - stay inside their home when ever decrease in temperature people work in their field till late evenings, skin diseases, scarcity of drinking water, changes in quality of water and cultivation areas being reduced due to drought, lack of labours.

2.4 Survey Result of Knowledge Information Based on Various Factors

2.4.1 Use of ICT based on Age- Group

The survey was conducted on one hundred male farmers in three villages to know how far the rural people use the ICT of their livelihood, the majority of the farmers were between 22-44 years, and followed by those who are between 45-60 years and above 60 years. Between 16-21 years of age group help their parents in collecting information related to agriculture.

ICT Type	Age			**Total**
	16-21	22-44	45-60	
Radio	-	-	-	-
TV	12	24	12	48
Mobile Phone	-	6	4	10
Internet	-	5	-	05
Newspaper	12	10	15	37
Total	**24**	**45**	**31**	**100**

Table 1: Association between Age Level and use of Climate /Weather Information

In Table-1 it was found that all the farmers in all the age groups know to read and write in their language and educated from SSLC to Degree holders. It was reported that the age group 22-44 has a higher usage of the majority of the ICT tools compared with participants from the age group of 45-60 years.

The 22-44 age groups are considered to be the most active group in rural areas to use various information technologies such as Television, Mobile and Internet. The participants from the 45-60 years age group had a better knowledge of gathering information when compare to younger generation age group between 16-22 years whereas; TV is the mostly used ICT tool in age groups of 42 years and older. Overall, the use of Television was preferred over mobile phones by all the groups generally to know information about climate or weather.

2.4.2 Climate / Weather Information Based on Age Group

The survey based on age groups, found that out of the 100 farmers all have television, radio, mobile phones and few have computers.

Table-2 shows around 53% of the farmers in these villages use various ICT tools to know information about weather forecast. 34% of the rural land owners believe in their own traditional approach towards anticipation of weather for their agricultural products. 13% of these three villages wait for the visit or use to get information and help from the nearby government officials – agri-department for their sowing and cultivation.

Age group	**Climate / Weather Information**			**Total**
	Govt. Officials	Own Experience	Use of ICT	
16-21	02	-	**12**	**14**
22-44	06	06	**23**	**35**
45-60	05	28	**18**	**51**
Total	**13**	**34**	**53**	**100**

Table 2: Association between Age Level and Use of Different ICT

3. Conclusion

The study believes that still rural people are uncertain to distinguish between weather and climate in their rural areas. As mentioned earlier weather is the actual atmospheric conditions prevail for shorter period of time in particular location, whereas climate refers to weather averaged over a longer period of time which continue to affect human livelihoods, bring changes to water availability and crop productivity, the loss of land due to sea level rise and the spread of disease etc. so far in India whether private or public, the ICTs to its farmers disseminate mainly on the weather based information rather than climate based information.

ICTs are all but ubiquitous and their potential uses and impacts on the environment are many and varied. Data must be collected, analysed, interpreted, and transformed into information that enables individuals to make smarter environmental choices. Ultimately these data must be communicated to individuals time to time used to inform, monitor performance, and provide feedback that motivates and rewards individuals and communities for creating sustainable livelihoods. ICTs can provide many strategies for adapting to or mitigating the adverse impact of climate change, as well as for the transfer and exchange of knowledge more generally. The most important roles for ICTs in climate change are likely to be in monitoring and adaptation, rather than mitigation. Examples of adaptation include preparing risk assessments, protecting ecosystems, improving agricultural methods, managing water resources, designing better buildings, constructing settlements in safe zones, developing early warning systems, improving insurance coverage, and developing social safety nets. Effective monitoring can help provide early warning of events whose frequency and severity may increase with climate change, such as storms, droughts, floods, famines and diseases. Without using ICTs, it will be impossible to disseminate information for the farmers. In India, with low educational levels, ICT would be the medium to reach the

vast population at affordable cost. ICT in education is likely to have better assimilation as students are open to the big scale producers as per the survey result. Hence the conclusion is that the farmers who are using ICT to get agricultural information related to climatic conditions may implement better practices and concentrate on climatic change to produce a big variety of agricultural products for their livelihood.

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