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An Analysis of the Information and Communication Technology Role in Flood Disaster Management strategies for Pakistan

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Abstract

Information and Communication Technology (ICT) plays significant roles in the flood disaster prediction and on its management strategies. In time flood prediction and effective information are highly desirable by the government and other humanitarian organizations those involved in the decision making process and rescue operations. It contributes in the domain of disaster management and implementation of a wide range of technology during all the disaster phases. It can be observed the role of ICT to underline risk areas. Disaster management has been substantiated for technology advancement in the form of Geographical Information Systems (GIS), Early Warning Systems (EWS), Global Positioning Systems (GPS), Remote Sensing and satellite communication. This can help in an excessive deal for the integrated system of hazards. By GIS we can empower the assessment; on the other hand, remote sensing is a very effective towards identification of hazard areas based on real time and communication satellites can become timely relief measures. Pakistan is facing major disasters like earthquake, flood, drought, glaciers melting land and snow sliding. However, in the last decade floods are one most destructive disaster. Due to unpredicted heavy monsoon rainfall and melting of being the most common causes which results massive losses of life, property, agricultural land damages as well as in livestock. There is an urgent need in the adoption of technology integration to identify the challenges using ICT for overall estimates of disaster prediction and its management to prevent the big losses. In this study, we explore ICT role in flood disaster prediction and its strategy management through spatial analysis of hazard for the resilience and redundancy in the District Mianwali, Punjab, Pakistan.

Keywords: Earth; Desctruction; Disaster; Management

Introduction

Disaster means "bad star" in Latin language, is defined as a severe disturbance of operations of a community or a society which involves notable human suffering, material, economical losses or worse environmental impacts; that's treated whole community in the same mode and disturb routine life matters. This drops negative effects on the human life, social structure and exceeds their ability of survival. On the other hand, disaster disturbs the capacity of a local population to meet social aspects of the life. In this situation the substantial subsystem no longer allows community to pursue their work, for recreation and other basic activities. Disaster prediction / prevention is the concept of reduce risk of disaster through the systematic effort. To analyze and manage the unintentional factors and exposures to hazards where people could be prepared for the adverse effects. Disaster management is an approach adopted by the administration and operational organizations to implement the strategies, policies and improve capacities to lessen the possibility and their adverse impact of the hazard. The timely activities and measures can be useful for the prevention, mitigation and preparednessto reduce the effect. In all over the world occurrence and intensity of disasters have been increased in the last few decades and the frequency is increasing day-by-day. The whole world is facing many types of major disasters. Pakistan is susceptible to numerous adverse natural events and has experienced a wide range of disasters over the past 40 years, including floods, earthquakes, droughts, cyclones, and tsunamis. These hazards are due to an active floodplain fed by snow and glacial melt from three mountain ranges (Himalayas, Karakoram, and Hindu Kush), a predominantly semi-arid landmass located on a seismically active geological plate, and a coastline frequented by cyclonic events. Exposure and vulnerability to hazards are further exacerbated by rapid population growth, high population density along the floodplain, the fastest urbanization rate in South Asia, extensive environmental degradation and shifting climatic patterns that can result in the occurrence of increasingly severe natural disasters. Over the past decade, damages and losses resulting from natural disasters in Pakistan have exceeded USD 18 billion. As the population and asset base of Pakistan increases, so it's done economic exposure to natural disasters. Punjab's population, geographic location, and climatic conditions make it more vulnerable to natural disasters. Over the past 30 years, 66.6% of all people affected by natural disasters in Pakistan were residing in Punjab. Floods remain the dominant hazard in Punjab, despite a history of other disasters in the province, such as earthquakes, tornadoes, and droughts. Floods in 1992, 1994, 1997, 2010, 2012, 2013 and 2014 have led to the loss of precious human lives and caused significant damage to public and private property. Floods in 2014 resulted in 286 deaths, with approximately 100,000 houses damaged and 2.47 million people directly affected due to inundation and displacement. Similarly, floods in 2013 and 2012 affected almost 800,000 and 900,000 people respectively. These disasters have led to the disruption of economic activity and service delivery, in addition to burdening the public exchequer with relief, recovery and rehabilitation expenditures. A flood is generally known as Hydrological hazards where water overflows outside its actual

place, usually on the dry land. In Pakistan mostly flooding consists in urban flooding, Monsoon floods and flash floods. This happens in multitude ways, including heavy rainfall, snow melting and timing of water from its drainage magnitude. Floods are capable to damage of the whole infrastructure and causes injuries and losses of life. The flash floods commonly result in intense of storm dropping, heavy rains with-in a short time of period and occurs with slightly & zero intimation that could reaches in full-peak only in limited hours. Floods have a negative impact that damages assets of country in term of awful losses of crops, property damages, land and peoples: which paralyzed routine activities of local habitants. Peoples become victims and depends upon the help from the external for the gratification of their basics need e.g. Food, shelter, drinking-water, and treatment of medical. According to the annual reports of National Disaster Management Authority (NDMA) Pakistan in 2010, at least 1985 people died and, above 11 million peoples affected due to flood in Indus and Chenab rivers. In 2011, at least 520 people were killed in the monsoon period with heavy rainfall and nearby 4.0 million people being displaced: from their residence.

Literature Review

In 2012, more than 571 people deceased, and thousands of homes destroyed. In 2013, more than 333 people died. From 2014 to 2017, Due to the massive rain about 1029 people died. In 2018, 135 peoples expired during the monsoon season. During the current year more than 110 died due to rain, flood, storm and casualties are increasing (Annual Reports National Disaster Management Authority Pakistan). It is an understandable reality that most developing countries inhabits are major affected communities due-to disaster like flood because they didn't have enough disasters management strategies, poor-coping capability and less resources. The ICT is a vast collection of digital tools and resources to support the diverse communication, publicize, store and implement information management between diverse stakeholders. The role of ICT in disaster prediction and its managing has been proven to be superb in the carrying risk identification, rescue and relief operations and restoration work for the disaster community. Generally, through ICT we can accentuate risky areas for possibly pretentious inhabitants and its management by means of implementation of ICT (such as Geographical Information System (GIS), Global Positioning System (GPS), Early Warning Systems (EWS), remote sensing and satellite communication) to minimize the impact of disaster. ICT empowered organizations and mechanism for helps the dissemination of information, time to time updates in the disastrous consequences. ICT provides a platform for deployment of rescue operations in time of disaster and transferring preventive procedures to the affected community. The ICT present key role in the supportive decision making and disaster management strategies tend to be mapped more easily, and the societies who will potentially be affected can be predicted before the time from the identification of the vulnerable areas where disaster going to occur. The geographic technology supports all aspects in Disaster; this paper presents the role of ICT in the states of GIS, GPS, EWS, Remote Sensing and Satellite technologies for disaster predication and management. The power of GIS and its combination with GPS and remote sensing lies the ability to integrate the spatial and nongeographic data into one incorporating platform and this display spatial graphed patterns for the risk and a communal operational scenario. GIS system allows a real time monitoring for the emergency warning as-well-as demonstrating of possibilities occurrence. The remote sensing enables quantitative base for the relief operation and prediction possible disaster to be made.

These systems, mostly able to access and mapping of the risk and hazard area's for the emergency camping's and evacuation routes. After all this integrated data and mapped displays a common operational picture, response and priorities recognized. The satellite data could be effective for monitoring of flood inundated areas, its assessment of damage and flood hazard zoning at highest risk. In overall ICT plays a key role in the flood disaster management strategies and instructions for action to be taken prior, during and after the impact of the disaster. It is highly exposed to floods, which occur on a regular basis. The floods occur as a consequence of the summer weather system, which develops in the Bay of Bengal during the monsoon months of July–September. Floods normally occur in July to September when the precipitation water input is augmented by snowmelt and causes severe damages to the infrastructure, livelihood and human life. District Mianwali is also flood prone District as Major River Indus passes through the District and effects major part of the district during flood season. Flood commonly effects 101 Mauzas of Tehsil Isa Khel, Mianwali and Piplan along with the Indus River belt on both banks. Riverine floods impact human lives, infrastructure, crops, livestock, housing and other livelihoods of local communities. Therefore, we have selected District Mianwali for the analysis of the hazard & Risk assessment mapping in disaster management.

It is obvious the historical trends for facts about flood is a major and most destructive disaster event in the country. Live losses, infrastructure, crops and livestock damages are unbearable results. The rehabilitation takes years to return the effects their normal life. Information technology plays a pivotal role in managing the disaster in the all stages of hazard. However, it is difficult to integrate flood disaster management strategies, but through the knowledge of ICT, the GIS mapping makes it quite easier. There are three main aspects to integrate this: The hazard map plays a vital role in the identification of the risk of the disaster and it's an effective tool in the disaster risk management. The risk map displays the disaster vulnerabilities.The historical occurrence provides the clearest picture of the geographical distribution of the potential of hazard. These maps provide stronger, motivational contributions to the proper planning and resource allocation for the disaster preparedness and its management [1-7].

This study described the use of Geo-spatial technologies are the best for analysis and effective decision making during the flood hazards. There is a need to integrate flood disaster management strategies to GIS mapping so that experts can have value to extract information to execute disaster.

The study reveals a hazard condition in detail. Based on data regarding surface elevation have a vertical scale to allow the point of determination in 3D form. To the other side, the elevation refers to the height above the sea level. This map is important for consideration for the flood disaster risk because they portray the surface of the earth in detail and steepness of slopes. Floods can be predictable, every disaster management mechanism having some predication / forecasting models for the flood disaster. When a flood hazard risk is predicted there is a need to issue warning to the high-risk community for taken any possible arrangement of saving their lives, belongings and livelihood.

In Pakistan real time vulnerability is flawed. To strengthen the flood forecasting and disaster management in Pakistan, we need emphasis to reduce the human and socioeconomic impact of flood through the mitigation to move foster safer human settlements near to the save area. To get rid-off from this emergency, we are suggesting GIS based flood vulnerability assessment map of the study area. Flooded water

and nearby villages. This map shows the high-risk union councils in the bank of the Indus River. The approximate nearby villages are also highlighted those are likely to be affected in case of river water increase from 3.75-05 Lac Cusic. District Administration can navigate through this GIS based map towards the safe places. Necessary action can be taken place by these official to minimize or avoid damage and losses. The further information can be utilized in pre-planning and development before and during the disaster period [8-11].

Risk assessment of the risk management combines the risk analysis and its evolution. The risk of the disaster is the product of collaboration between the physical process and its vulnerable condition of the risk exposed features. The elements of vulnerability assessment are an important undertaking. Generally, a risk map shows the distribution of risk in the area of concern. These aspects are to assist decision makers taking actions toward avoidance or mitigation and response to the local habitants. For instance, a risk map shows expected result of likely events. Mostly, risk assessment maps don't have a risk value which is due to the settlements at risky locations. To understand the significance of the risk, we have added the risky villages and nearby settlements for the predication of the disaster. probability of occurrence been analyzed through the Risk Area Situational Analysis. The event area marked with the detail of the developing threat hazard or descriptive information regarding the disaster. According to the study area, we have found 20 villages are at high risk if water flow lies between 3.75 to 05 lac Cusic. In 20 villages, further, we analyzed and found 33 settlements, 08 mosques, 05 schools, 174 km road infrastructure metaled and non- metaled, 01 police stations, 06 bridges / culverts and 02 Basic Health Unit (BHU) etc. If emergency response applied to undertake the current visualization and prevention measures taken according to the hazardous event these can be a crucial factor for successful prediction and managing disaster. The proposed information can be utilized planning and development. Peoples can navigate towards the safe places. Necessary action can be taken by the District Administration and Disaster management officials can formulate preparedness, mitigation, response and possible recovery need to avoid and minimize loss and damage.

Conclusion

In this paper, we have presented an analysis on the role of ICT in Flood Disaster Management strategies for Pakistan. As already discussed, ICT plays a pivotal role in flood disaster in managing in the all stages of hazard. The study proposed advancement in ICT through GIS and Remote Sensing that's offers high potential analysis, which can help the community as well as disaster management authorities to prevent and minimize damages and losses against flood disaster also deals with planning and Implementation during disaster. We adopted remote sensing technique to get the elevation of the study area as District Mianwali towards the surface of the earth in detail, steepness of the slopes and floodplain. The GIS is used for the identification of the hazardous area as the Flood Vulnerability Assessment Map. This map shows the possibility Vulnerability Assessment under the 3.0-

kilometer buffer area from the riverbank to point out the villages to be affected. Flood Risk Exposure Assessment Map present the possible settlements to be affected in case of hazard occur. Finally, the Risk Area Situational Analysis info graph shows the analytical key feature within the area for dynamic monitoring and possible arrangements for the disaster management. As we see through an integration of ICT in disaster management the technology makes it extremely powerful assessment to identify indicators of the potential disaster. Information sharing through GIS mapping reduces data acquisition, time and thus providing an efficient way to carry out the real time disaster prediction and management for the flood hazard. There should be more emphasis on the role of ICT in disaster management for the real time disaster prediction brings better management, reduction in hazard damages and timely estimation of damages through improved decision making to mitigate the impact of the future disaster and its management.

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