International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 03 | Mar 2022 www.irjet.net p-ISSN: 2395-0072

An Overview of Advanced Techniques Used in Disaster Management

Khushi Nitinbhai Zota[1], Prof. Jagruti Shah[2], Dr. J. R. Pitroda[3]

[1]M.Tech. (Civil) Construction Engineering and Management, BVM Engineering College, Vallabh Vidyanagar, Gujarat
[2]Assistant Professor, PG Coordinator Infrastructure Engineering, Civil Engineering Department, BVM Engineering College, Vallabh Vidyanagar, Gujarat
[3]Associate Professor, PG Coordinator Construction Engineering and Management, Civil Engineering Department, BVM Engineering College, Vallabh Vidyanagar, Gujarat
ORCID: 0000-0002-2869-3158

Abstract - *Disaster management necessitates near-real-time information distribution in order to deliver emergency services to individuals as soon as possible. With the rapid progress of information and communication technologies (ICT) , real-time data may be easily gathered from a variety of sources. Information and communication technology implementations at various stages of disaster management are investigated. Existing solutions are investigated, as well as the investigation of incorporated new networks, services, and applications in the field of information and communication technology. Various evacuation mechanisms are investigated. Following a comparison of several ICT-based technologies, the evacuation model is developed. This article looked at essential terminologies, issues in disaster management from a technological standpoint, and numerous sorts of disasters, ICT tools that can be utilized in disaster response and management, with Web 2.0 being the most recent technology that harnesses the power of social media and social networks. The analysis closes by recommending the implementation of an effective E-Government infrastructure that supports various disaster-related ICTs.*

***Key Words*: Disaster management, Early warning systems, Information and communication technology (ICT), Remote sensing.**

1. INTRODUCTION

Web 2.0 is a cutting-edge technology that harnesses the power of social media and social networks for disaster response and management. The research concludes by recommending the development of a robust E-Government infrastructure capable of supporting a wide range of disaster-related ICTs. Due to carbon dioxide emissions in the atmosphere, temperature variance, unequal rainfall distribution, and unpredictable weather patterns, unexpected weather threats (climate change, unpredictability, and disasters) contribute to climate change. Climate change's consequences have been extensively researched and published, as seen by recent publications.[1] A disaster is an event that causes harm to a community by killing people, causing environmental damage, or causing economic loss that is beyond the community's ability to respond to. Disaster management refers to the protection of a large number of people and property when a disaster happens, whether it is man-made or caused by natural events. In India, natural disasters abound, including earthquakes, fires, floods, droughts, illnesses, cyclones, landslides, hurricanes, and other natural disasters because of the geo-climatic conditions, this is the case. Some of them are unavoidable. As a result, risk management, which includes a number of tactics to be applied at various moments throughout the disaster management cycle, is required.[2]

Following figure shows the disaster management cycle.

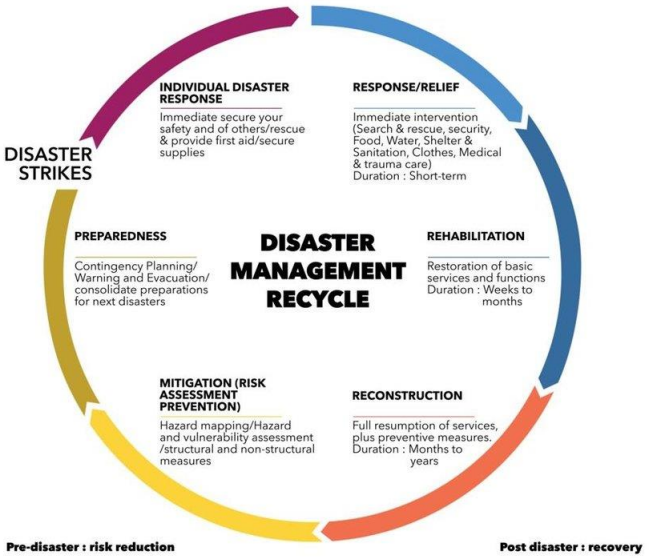

Fig -1: Disaster Management Cycle

There are three parts to the disaster management cycle. Disaster mitigation during the Pre-disaster preparedness includes disaster mitigation, as well as post-disaster rehabilitation and reconstruction following significant failures. Although it is difficult to prevent hazards, they can be mitigated by using information technology-based communication, which combines telecommunications, computers, software and storage to access and transmit data.

Disintermediation or the direct ICT allows the transmission of information from one person to another. The main target of the Millennium Development Goals (MDGs) for 2015 was to ensure that appropriate disaster management could be attained using ICTs for development (ICT4D). Technology aids in the strengthening of relief efforts in order to reach the greatest number of people as quickly as possible.[3]

ICT tools can be utilized to give awareness training during the preparedness stage. ICT, such as the internet, systems engineering, data mining, and so on, are particularly effective for establishing knowledge warehouses and when integrated with GIS and satellite-based communication, they may play a significant role in disaster risk reduction measures at all levels.[4]

There are two key areas where ICTs can be used in disaster management. The first is concerned with having knowledge of risks, being aware of them, and having information about risks in order to mitigate them as quickly as possible. To improve forecasting, ICT applications are deployed. The second category focuses on catastrophe alerting, response and rescue operations coordination, and project management using ICT tools such as the Internet, phones, television, and radio.[5]

1.1 Objectives of study

The study's goals are listed below:

i. To assess the specific applications of ICT in catastrophe risk management.
ii. To manage disaster to manage disaster by locating and identifying emergency problems with the help of GIS.

1.2 Need of study

Following are the need of the study:

i. The study centred on the application of advanced techniques and ICT in disaster phases. ICT are electronic methods of tracking, processing, saving and spreading information.
ii. The ideas upon which these technologies are built are not new in particular, but the rare and inexpensive use of them makes them new and uncommon.

2. LITERATURE REVIEW

Following are the literature reviews related to study:

2.1 Advanced Techniques

K S Jagadish et al., (2003) Author explained the hardness in disaster prone area because in earthquake-prone Kutch, the brittle nature of masonry constructions is the significant cause of building collapse and casualties, there is a need to implement corrective measures in the construction of such structures. The horizontal bands are useful for keeping vertical breaches and in-plane shear cracks are mitigated by joining the walls at junctions.[7]

Lee Bosher et al., (2007) The author presents the findings of a UK-wide questionnaire survey, semi-structured interviews, and a validation exercise including construction, planning, insurance, disaster management, and governmental agencies.[9]

Daniel Mandl et al., (2008) The objective is that by offering the basic open tools for accessing satellite data and models, users would be able to design their own data products, speeding up access to new data and lowering the cost of disaster management.[12]

O. D. Cardona et al., (2008) In this publication, the author developed a potentially disastrous risk model to assess factor examination such as the Based on probability Maximum Loss and the expected Average Annual Loss of exterior and interior portfolios, while accounting for seismic hazard and geotechnical site effects, as well as the structural vulnerability of numerous building classes in urban areas.[8]

Munib ur Rahman et al., (2016) ICT and Wireless Sensor Networks are employed in a variety of disaster management applications. The following are the details: ICT-based Disaster Management, Earthquake Prediction Using an Animal Monitoring System, Ground Water Pressure Monitoring System, Radon Emission Check.[11]

M.F.M Firdhous et al., (2018) Authors tried to convey proper disaster management initiatives by minimizing both human and economic losses. ICT has advanced at a breakneck pace in recent years, infiltrating practically every element of human life. ICT is a technology that can be used to bridge the gap between societies.[10]

Abul Quasem Al-Amin et al., (2019) three major concerns were identified by the author: (i) flood disaster vulnerability, (ii) flood catastrophe scale, and (iii) proactive flood integration. They also stress the significance of integrating a flood risk management system that is flexible. The TPB risk perception module employs quantitative research to assess the incorporation of adaptive flood vulnerability management in order to reduce hazard exposure; the Theory of Reasoned Action (TRA).[6]

Chao Fana et al., (2021) provide for cross-disciplinary collaboration in the realm of crisis management Disaster management using information and communication technology (ICT). Improve scenario evaluation, decision-

making, and coordination among multiple stakeholders by incorporating AI algorithms and techniques.[13]

2.2 Related to ICT

Ayo C. K. et al., (2011) author proposed the application of information and communication technology (ICT), specifically the application of modeling and virtual reality to long-term physical planning and property management in order to carry out future growth projects at a lower cost of compensation. They also looked into creating a Mobile Ad Hoc Network (MANET) for disaster response and management in the built environment.[14]

Gilbert Gilibrays Ocen et al., (2016) as natural disaster occurs frequently like never before so authors described ICT should be used to minimize that effect on natural environment as well as on humans. They explained about emerging technology that is Web 2.0 which is more reliable platform for data sharing.[1]

Justin Wilson et al., (2018) NEMA is a disaster risk management agency which works globally to utilizes ICT in disaster risk management. They used some kind of appliances like- Smartphone, digital camera, personal computers, etc. Those devices give efficient work in the field of disaster risk management. That agency used complex tool like- GIS for disaster risk management, too. [5]

Pooja Mohan et al., (2020) during disaster techniques which relay on wire were destroyed at that time ICT can be very helpful to the survival activity. 'Big data' like technologies support the management efficiently by speeding up their work. Thus, saves the more lives in less time. When ICT tools can be used effectively it will enhance risk reduction.[3]

2.3 Related to disaster

Jaziar Radianti et al., (2014) author said about a revolutionary smart phone-based communication platform for disaster-specific machine learning approaches that intelligently process sensor signals and turn them into relevant information for crisis responders A powerful content-based publish-subscribe mechanism lies at the heart of the system. It enables the sharing of sensor data and computing outputs in a flexible manner.

Abul Quasem Al-Amin et al., (2019) author drawing an attention towards In Malaysia, there are no flood protection activities. This presents three major concerns: (i) natural disaster vulnerability propensity rate; (ii) natural disaster devastation magnitude rate; (iii) economic growth rate and how it influences public risk perception of climate change catastrophes.[6]

2.4 Related to disaster risk management

Brian M. Tomaszewskiet al., (2020) author suggested and evaluated an innovative method empowers national entities to evaluate GIC statistically and identify important capacity-building needs in order to improve disaster risk management systems. They established a university in order to teach the public about GIC. The GIS workforce will grow, and GIS may be incorporated into catastrophe risk management at a national level organizations.[15]

Ikram Shah et al., (2020) author drew an attention that in Pakistan they make an effort to DRM a national and community level priority. Capacity building, enhanced capabilities, appropriate resource allocation, and the establishment of independent offices at the district level are all things that the national government has to do to strengthen the bottom tier of disaster governance.[16]

2.5 related to risk assessment

Jintao Zhao et al., (2011) author suggested there are three parts to the disaster management cycle. Disaster mitigation during the disaster to reduce damage, and post-disaster rehabilitation and reconstruction following major losses are all part of pre-disaster preparedness. Although it is difficult to prevent hazards, they can be mitigated by using information technology-based communication, which combines telecommunications, computers, software, and storage to access and transmit data. Disintermediation, or the direct flow of information from one person to another, is facilitated by ICT.[18]

LIU Gang et al., (2014) author obtained some factor like-The components of hazard, elements at risk, and susceptibility all play a role in determining the risk of urban disasters. The city of Guangzhou is used as a case study to conduct a regional risk assessment, and the results are consistent with objective reality, demonstrating that the model is operational.[17]

3. ADVANTAGES

Following are the advantages of using advanced techniques in disaster management:

i. Disruptive technologies can spread critical information more quickly.
ii. Improve understanding of the causes of disasters.
iii. Enhance early warning systems.
iv. Assess damage in new ways.

v. Add to the knowledge base of the social behaviors and economic impacts after a crisis strikes.
vi. Information systems aid disaster risk reduction by storing data.

4. CONCLUSION

In a crisis, technology is critical for livewire communication routes that enable rescue and humanitarian services. The goal of modern ICT technologies is to eliminate breakdowns when even basic services fail. Disaster victims require critical resources to survive, and ICT plays a role in this. It assists the community in becoming prepared to deal with the problem in the event of a future disaster. When utilized properly, ICT tools can help reduce risk, but they must have the cooperation of everyone in the business to be really effective. In catastrophe risk management, information and communication technology (ICT) is critical. Some ICT facilities, such as digital cameras, computers, and mobile phones, have seen significant adoption by the Agency in terms of disaster risk management. Surprisingly, the Agency employs sophisticated technology such as the Geographic Information System (GIS), which is a beneficial development in terms of facility upkeep. The risk map and regional integration map of the combined disasters risk were created using GIS.

REFERENCES

[1] G. Gilibrays ocen, g. B. Mugeni, and m. Davis, "role of ict in disaster response and management: a review study of ict challenges and adoption approaches by developing nations," 2016.
[2] J. Raikes, t. F. Smith, c. Jacobson, and c. Baldwin, "pre-disaster planning and preparedness for floods and droughts: a systematic review," international journal of disaster risk reduction, vol. 38. Elsevier ltd, aug. 01, 2019, doi: 10.1016/j.ijdrr.2019.101207.
[3] P. Mohan and h. Mittal, "review of ict usage in disaster management," int. J. Inf. Technol., vol. 12, no. 3, pp. 955–962, sep. 2020, doi: 10.1007/s41870-020-00468-y.
[4] G. Ma, j. Zhang, w. Jiang, j. Liu, and l. Ma, "gis-based risk assessment model for flood disaster in china."
[5] J. Wilson, f. Wilson, and j. Wilson, "the use of ict in disaster risk management: a case study of nema borno state," j. Remote sens. Gis technol., vol. 5, no. 1, 2018, doi: 10.5281/zenodo.2555630.
[6] A. Q. Al-amin, g. J. Nagy, m. M. Masud, w. L. Filho, and . Doberstein, "evaluating the impacts of climate disasters and the integration of adaptive flood risk management," int. J. Disaster risk reduct., vol. 39, oct. 2019, doi: 10.1016/j.ijdrr.2019.101241.
[7] K. S. Jagadish, s. Raghunath, and n. Rao, "behaviour of masonry structures during the bhuj earthquake of january 2001," 2003.
[8] J. O. Skøien, e. J. Pebesma, and g. Blöschl, "geostatistics for automatic estimation of environmental variables-some simple solutions," georisk, vol. 2, no. 4, pp. 259–272, 2008, doi: 10.1080/17499510802086769.
[9] I. Bosher, a. Dainty, p. Carrillo, and j. Glass, "built-in resilience to disasters: a pre-emptive approach," eng. Constr. Archit. Manag., vol. 14, no. 5, pp. 434–446, 2007, doi: 10.1108/09699980710780746.
[10] M. F. M. Firdhous and p. M. Karuratane, "a model for enhancing the role of information and communication technologies for improving the resilience of rural communities to disasters," in procedia engineering, 2018, vol. 212, pp. 707–714, doi: 10.1016/j.proeng.2018.01.091.
[11] M. U. Rahman, s. Rahman, s. Mansoor, v. Deep, and m. Aashkaar, "implementation of ict and wireless sensor networks for earthquake alert and disaster management in earthquake prone areas," in procedia computer science, 2016, vol. 85, pp. 92–99, doi: 10.1016/j.procs.2016.05.184.
[12] D. Félix, d. Monteiro, and a. Feio, "estimating the needs for temporary accommodation units to improve pre-disaster urban planning in seismic risk cities," sustain. Cities soc., vol. 61, oct. 2020, doi: 10.1016/j.scs.2020.102276.
[13] C. Fan, c. Zhang, a. Yahja, and a. Mostafavi, "disaster city digital twin: a vision for integrating artificial and human intelligence for disaster management," int. J. Inf. Manage., vol. 56, feb. 2021, doi: 10.1016/j.ijinfomgt.2019.102049.
[14] A. C. K, a. A. B, and g. J. A, "application of ict to resource and disaster management," 2011.
[15] B. M. Tomaszewski et al., "developing a geographic information capacity (gic) profile for disaster risk management under united nations framework commitments," int. J. Disaster risk reduct., vol. 47, aug. 2020, doi: 10.1016/j.ijdrr.2020.101638.
[16] I. Shah, n. Eali, a. Alam, s. Dawar, and a. A. Dogar, "institutional arrangement for disaster risk management: evidence from pakistan," int. J. Disaster risk reduct., vol. 51, dec. 2020, doi: 10.1016/j.ijdrr.2020.101784.
[17] Y. Li, h. Song, p. Sang, p. H. Chen, and x. Liu, "review of critical success factors (csfs) for green building projects," build. Environ., vol. 158, no. May, pp. 182–191, 2019, doi: 10.1016/j.buildenv.2019.05.020.
[18] Dalian jiao tong da xue, ritsumeikan daigaku, and institute of electrical and electronics engineers, proceedings of 2017 6th international conference on computer science and network technology : iccsnt 2017 : october 21-22, 2017, dalian, china. .