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The use of ICT in Disaster Risk Management: A Case Study of Nema Borno State

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Abstract

The survey examined the use of ICT in disaster risk management a case study of NEMA Borno state. The objectives of the study are: to ascertain the use and level of application of ICTs for disaster risk management, to Identify the types of ICT NEMA uses for disaster risk management, assess the specific areas of ICT application for disaster risk management, to examine the effectiveness of effective of the use of ICT in disaster risk management, to Identify the challenges in the application of ICT for disaster risk management in NEMA. The study was situated within diffusion of innovation theory and reviewed related literature thematically. The entire staffs of NEMA (90) formed the population of the study. Purposive sampling technique was used in selecting 60 samples out of the population for analysis as it is needless and time wasting to study the whole population. The study found that NEMA like any other disaster risk management agencies globally is not left out in the effort towards adopting and utilization of ICT in disaster risk management in its own domain. Some of the ICT facilities such as digital camera, Computer and mobile phones have gained effective penetration in terms of utilization by the Agency for disaster risk management. Interestingly, even sophisticated technology like the GIS is been used by the Agency, which is a positive development in terms of being up to date facility wise. Although there are several challenges bedevilling NEMA in effectively utilizing ICT for disaster risk management, the challenges have not hindered the use of available technology for disaster risk management. This goes to show that the use of ICT for disaster risk management in the 21st century is a necessity for purpose of efficiency and timely disaster risk management. Much needs to be done to ensure that NEMA fully benefits from the several opportunities tied to ICT in disaster risk management. The study recommends that Government should adequately fund and meet ICT requirements of NEMA to enable it effectively deploy ICT for disaster risk management. The agency should constantly train its staff and organise refresher courses for its staff on the latest ICT and there uses for disaster risk management.

***Keywords*:** disaster management, ICT, NEMA, technology

INTRODUCTION

Information is an indispensable part of the existence of humankind. Disaster risk management globally is information-driven. Information is pertinent and a necessity just as water, food and medicine during disaster. Information and Communication Technology (ICT) is thus among the lifelines which helps to save lives and resources. The importance of information has compelled nations and organizations to adopt various information and communication technology to ensure effective information management at various levels of disaster risk management.

Yap (2011) [1] observes that responding effectively to disasters demand rapid

access to reliable and accurate data. Thus, speedy communication to appropriate stake holders is essential in order to organize and mobilize resources and coordinate response activities amongst agencies involved. Therefore, information sharing and integration of communication is critical [2 &3].

ICT plays a very important role in various aspect of disaster risk management. At present there is a growing awareness of the importance of ICT for disaster risk management. Disaster risk management through ICT aims to reduce the damage caused by natural and manmade hazards like earthquakes, floods, droughts and cyclones epidemics, wars and ethno-religious and political conflicts. The use of ICT can facilitate the management of disasters by providing information on disaster prevention, early disaster prediction, communicating and disseminating disaster information to residents, and ensuring a speedy communication system before, during and after the disaster to both government and non-government agencies for relief materials [3 &4].

Through ICT and in particular the Internet, GIS, remote sensing, satellite-based communication links, effective disaster risk reduction measures can be simple. For example, there are available statistics about some zones in Nigeria that are prone to natural disasters and there is a GIS-based system that contains the spatial information about Nigeria in general. However, the level of integration and usage is what cannot be readily ascertained [5].

Nigeria established the National Emergency Management Agency (NEMA), and was saddled with the primary responsibility of coordinating and facilitating disaster management efforts in Nigeria with a view to reducing loss of lives and property and to protect lives from hazards [5]. The specific responsibilities include: Disaster mitigation; preparedness and Notifying, activating, mobilizing, deploying staff and setting up the necessary facilities for response; Evaluating and assessing disaster damage and requests; Managing Disaster Management funds; Public Information and Enlightenment; and Formulating policy/guidelines for Disaster Management in the country [5].

Occurrences of disasters cannot be totally eliminated, but they can be effectively abridged. The proper management of disaster circumstances merits adequate and careful planning, channelled response, and excellent efforts coordination in the disaster management cycle. Experts saddled with the task of coordinating disaster response encounter countless difficulties during disasters. Managing priorities, capacities, locations, and the expectations of governments and the public is a complex and dynamic endeavour. Also, due to the unsettled nature of disaster circumstances, professionals and systems at disaster risk management outlets gets entangled to information overload, which often distort accurate and timely resolution. Information and Communication Technologies (ICTs) can be used to support the practice of disaster risk management (DRM) in times of crisis, as well as in times of planning and in times of reconstruction.

The ground-breaking possibilities of ICTs fundamentally depends on their ability to promptly link gigantic complexes of personalities and formal establishments across boundless terrestrial detachments, and to simplify fast flows of ideas, information, funds, individuals and products. ICTs are essential mechanisms for mutual aid and cooperation. Emergency activities depends on fast response, reliable access to existing data, up-to-date field information, integration and distribution of information among various stakeholders [6].

Nigeria as a nation is not isolated from disaster and thus has set up agencies to manage disaster. Information is a key element in facilitating and accomplishing a greater part of their duties. Considering the importance of information and the role of ICT in effectively managing information before, during and after disaster all over the world, this study examines the application of ICTs for disaster risk management by. The NEMA zonal office of the National Emergency Management Agency in Nigeria.

STATEMENT OF THE RESEARCH PROBLEM

Information is key in disaster risk management and ICT is important for gathering, processing information dissemination on disaster risk management issues globally. Studies around the world (for example Douglas, 2009) have shown that the application of ICT by disaster risk management agencies e.g India Disaster Resource Network (see: retrieved on 29/3/2016 www.idrn.gov.in) is an important aspect of part of their disaster risk management operations. Although Nigeria has an agency that manages disaster related issues, i.e. NEMA, there is according to Shaba (2009) [5]. Documented studies on the level of ICT application by NEMA therefore this study fills the gap in knowledge respect in to how NEMA is applying ICT in their disaster risk management activities. The goal is to determine the level of ICT application in Disaster risk management by the N.E zonal office of NEMA.

AIM AND OBJECTIVES OF THE RESEARCH

The aim of this study is to examine the application of ICT for disaster risk management by NEMA. The study has the following objectives:

1. The use and level of application of ICTs for disaster risk management.
2. Identify the types of ICT NEMA uses for disaster risk management
3. Assess the specific areas of ICT application for disaster risk management
4. Examine the effectiveness of effective of the use of ICT in disaster risk management
5. Identify the challenges in the application of ICT for disaster risk management in NEMA

RESEARCH QUESTIONS

1. Does NEMA apply ICT for disaster risk management?
2. What types of ICT does NEMA use for disaster risk management?
3. What specific areas does NEMA deploy ICT for disaster risk management?
4. What is the effectiveness of ICT in disaster risk management?
5. What challenges does NEMA face in application of ICT for disaster risk management?

SCOPE OF THE STUDY

The study centred on the application of ICT by the N.E zonal office of Maiduguri. The use of ICT facilities by some relevant staff of NEMA which include information managers in NEMA, field officers, the zonal director NEMA North East). The choice of the north east zonal office of NEMA because was informed by the find that the N.E zonal office has been the busiest NEMA office due to the Bokoharam insurgency at its peak since 2009 as a result of the insurgency issues.

SIGNIFICANCE OF THE STUDY

It will provide academic reference materials. In issues of policy, it will help in respect of understanding the place of ICT in disaster risk management so as to guide policies formation and implementation in disaster risk management.

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

Conceptual Framework

This study is situated within the framework of Diffusion of Innovation concept. The Diffusion of Innovations is a philosophical guide that illustrate in clear terms how, why, and the rate at which fresh ideas and technology widespread via cultures. Everett Rogers propagated this theory in his book, Diffusion of Innovations, published in 1962. He notes that diffusion is "the process by which an innovation is communicated through certain channels over time among the members of a social system. The key elements in diffusion research are: the innovation, types of communication channels, time or rate of adoption, and the social system which frames the innovation decision process [7].

Innovation-decisions amidst diffusion of innovations are premised under three phenomena. An individual or an organization/social system alien's with a type of decision on whether an innovation is adopted/rejected. The three phenomena or types of innovation-decisions are: Optional innovation-decisions, collective innovation-decisions, authority innovation-decisions. Non-compulsory (optional) Innovation-Decision: This choice is prepared by an individual who is in a way different from others in social strata. Collective (communal) Innovation-Decision however consensually made by persons that belong to the same social system. Authority Innovation-Decision: This decision is made for the entire social system by few individuals in positions of influence or power. In the context of this research the decisions are made by Federal Government through the NEMA Nigeria who design blueprint and provide enabling environment for ICT-based disaster risk management.

Diffusion (circulation) of an innovation transpires via a five–step defined process. The five steps as categorized by Rogers (2003) [7] are; awareness, interest, evaluation, trial, and adoption. He post it that an individual may likely discard an innovation at any time during or after the acceptance course. In subsequent editions of the Diffusion of Innovations, Rogers modified the terminology of the five stages to: knowledge, persuasion, decision, implementation, and confirmation.

Knowledge: this stage exposes the individual to the innovation but deficient of adequate information about the innovation. At this stage the individual has not been inspired to find more information about the innovation. It would not be out of place to point out that Nigeria has gone beyond this stage, considering its embrace of the digital technologies as part of it drive towards global competitiveness as stipulated in it information technology policy [8]. Emergency agencies in Nigeria are aware of the numerous benefits of the ICT and what it entails to harness the benefits.

Persuasion*:* this is the stage of conviction where the individual shows interest in the innovation and enthuse stoically pursues/search for information/detail about the innovation.

Decision*:* at this stage, the individual decide after adopting the concept whether to accept or reject the innovation by weighing the advantages/disadvantages. However base on distinctive nature of this stage Rogers' posits that it is the toughest stage to acquire realistic confirmation [7].

Implementation*:* In this stage the innovation is employed by the individual but on a changeable degree depending on the situation. During this stage the individual determines the usefulness of the innovation and may search for further information about it. Nigeria is at this stage. This is evident in the adoption of ICT by many organizations in Nigerians.

Confirmation: at this stage the individual finalizes their decision to continue using the innovation and may use the innovation to its fullest potential.

Diffusion theory argues that adoption of new technology and innovation starts with enthusiastic innovators and early-adopters and then moves to use by the early and late-majority when the innovation is better supported and more reliable [7]. Comparatively, one could argue that Nigeria falls among the late majority, especially when compared to what obtains in developed countries. The conspicuous nature of digital divide, by implication places many Nigerians among the late-majority.

LITERATURE REVIEW

A collective term encompassing all aspects of planning for and responding to disasters risk, including both the pre and post-disaster activities. It refers to both the risk and consequences of a disaster [11].

Disaster Management is defined by the Disaster Management Act 57 of 2002 as a continuous and integrated multi-sectoral, multidisciplinary process of planning, and implementation of measures, aimed at preventing or reducing the risk of disasters; mitigating the severity or consequences of disasters; emergency preparedness; arapid and effective response to disasters; and post-disaster recovery and rehabilitation [12].

Disaster risk management refers to the systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters [13].

Disasters are both a humanitarian as well as economic issues. The cost of relief, rehabilitation and reconstruction comes in addition to the human and economic loss caused by a disaster. Disaster losses can be reduced by reducing exposure or vulnerability to the hazards present in a given area [11] & [13]. Therefore, according to Ostinsvig (2006) [11] Dilley et al. (2005) [13] reduction of disaster risks and vulnerability are key components for sustainable development).

PIOJ (2005) [14] pointed out that some effects of this are loss of live and property, displacement of residents, pollution of water resources, and sanitation and health problems. According to Benson and Clay (2004) [15] the costs created by disasters are an extra burden, particularly in hazard-prone countries. This can put an extra financial pressure on the government's mitigation and preparedness activities in hazard-prone countries, which often constitute the poorer nations especially in the developing countries.

Communication has a fundamental role in disaster risk management. For example, building trust and maintaining relationships are key component that are achievable through effective communication among stakeholders [16] & [17].

Tourish and Hargie described communication as having a primary role in maintaining consistency between management decisions and behaviour. Cross organizational communication is a vital component of programme planning and organizational success and breakthroughs. The tension and challenges involved in relief operations and other disaster risk management activities could be properly managed with effective Stakeholders (intra- and inter-organizational) communication [18]. Minear (2002) [19] noted that communication can facilitate effective coordination in respect of disaster risk management. Coordination such as a strategic planning, gathering data and

managing information, mobilizing resources and assuring accountability, Coordinating a well-designed division of work in the field, designing and sustaining an operative structure with host politically aware authorities; and the provision of governance" [19].

Information and Communications Technology

ICT are electronic methods of tracking, processing, saving and spreading information.

"New ICTs*:* Computers, satellites, wireless one-on-one communications (including mobile phones), the Internet, e-mail and multimedia generally fall into the New ICT category [11] & [20].

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. However, majority of these and almost all are new in respect of version and are based on digital communication.

Years to years ICTs such as *Radio*, television, land-line telephones and telegraph fall into the old ICT sort. For many decades they have been in use by so many generations throughout the world. Traditionally, these technologies have used analogue transmission techniques, although they too are migrating to the now less expensive digital format.

Typically old ICTs such as books, Newspapers and libraries also belong to this group. They have been in existence and use for countless decades.

Information and communication technology refers to: - Information channels such as World Wide Web, online databases, electronic documents, management and accounting systems, intranet, etc.

- Information dissemination channels such as email, electronic discussion platforms, e conferences and the use of mobile phones etc.

- Hardware and software used to generate, prepare, transmit and store data, such as computers, radio, TV, computer programs/tools, etc." [11] [20] & [21].

The unprecedented impact of Information and Communication Technologies (ICT) on nearly every facet of human endeavour has continued to attract interests, individual and organizations to explore these technologies for specific cause. ICT is increasingly being used in promoting democracy and human rights issues: to mobilize and strengthen solidarity, increase communication among interest groups and share information more quickly. There is no doubt that ICT deployment in Nigeria and other developing countries has sparked growth in citizens' ability to communicate and share ideas [22].

The enormous benefits of ICT lie in what it can be used for and how it can be used for the management of information one of the benefits of ICT usage is its capacity to integrate information from different part of an organisation. The key of consideration is not in which technology to implement, but rather than how to use and combine it with other channels of communication" [23].

The use of technology in disaster management is expanding; "Communications media, including the Internet, cell phones, radio and television, have witnessed astronomical growth People often listened to their radios, watched their televisions and awaited word on what they should do during and after disaster. For example was harmonised with the use of cellular phones within the communities. Radio and television broadcasts were also often used to keep the public abreast during and after disaster [11] [13] & [24].

New developments in information and communications technology are given credit for both improved risk assessments

and real-time disaster management, "including applications of satellite remote sensing, Global Positioning Systems (GPS) and Geographical Information Systems (GIS) (Smith 2004) [25] For example, Montalvo (2002) pointed out that the of GIS data-sets that can be used for activities such as planning, policy making, and monitoring with regard to natural and other types of resources and infrastructures such as transport networks, telecommunications networks, and waterways. Ostinsvig (2006) [11] noted that the data-sets can be produced from a combination of spatial and socio-economic data.

Maiers et al (2005) [18] noted that technical communications have a key role to play in the future of humanitarian relief. They stressed the possibilities for development of well-planned information and communication systems that would enhance organizational capacity, especially in challenging areas like coordination, strategic planning, preparedness, accountability, lessons learned, training, research, and education.

Over the years, countries have been experiencing several forms of disaster. For example in the Asia Pacific region, there were Typhoon Ketsana hitting the Philippines; a tsunami affecting Samoa, American Samoa and Tonga; two massive earthquakes striking the Indonesian island of Sumatra; and most recently a devastating earthquake hitting the Qinghai province of China, devastating flood ravaging cities and towns in Nigeria (UN-APCICT/ESCAP, 2010).

The series of events are obvious reminders that development efforts are increasingly at risk. Disasters, when they occur often leave devastating effects. For example the March 2011 tsunami in Japan above was reported to have left over three thousand dead and millions affected. Properties and infrastructure were destroyed, livelihoods were affected, and access to health and education services was impeded (UN-APCICT/ESCAP, 2010) According to UN-APCICT/ESCAP (2010) report, the social and economic cost of disasters has increased in recent years due to population growth, change in land use patterns, migration, unplanned urbanization and environmental degradation. Statistics indicate that one person in twenty has been affected by disasters in any given year since 1990.

The urgency to reduce disaster risks, therefore, is very rapidly being recognized internationally, especially with climate change threatening to further increase the frequency and severity of natural disasters (UN-APCICT/ESCAP, 2010).

Hence the global approach to managing disaster has become key in the global arena. For example, the drive towards tackling the likes of climate change, desertification etc has gained a global standpoint. In all of the global effort, one important point of interest is the adoption and application of ICTs for disaster risk management globally.

Information and communication technology (ICT) has made incredible leaps in utility, applications and capacity. The revolutionary potential of ICTs lies in their ability to instantaneously connect vast networks of individuals and organizations across great geographic distances, and facilitate fast flows of information, capital, ideas, people and products. With the ICT, in particular computers, the Internet and mobile phones, the constraints on the place and time for interaction have eased considerably.

Because of the potentials of ICT in every sector of the society, nations worldwide are working towards ICT capability. Nigeria is not left out in this effort. Ibikunle (2008) [10] ICT initiative in Nigeria started in the 1950s with focus on

print and electronic media. He notes that no major policy or result was achieved because of government's strict control of all productive sectors. The print media were the major means of information dissemination that attained early and reasonable vibrancy in Nigeria. The electronic digital computer made its first appearance in Nigeria in 1963, in connection with the analysis of the 1962/63 national population census data. Between 1963 and 1973, the total computer population in the country stood at 20-25, with 6 or so of these being associated with the multinational companies [10].

Efforts in respect of ICT deployment was further boosted by setting up the National Policy on information technology. The Federal Executive Council approved a National Information Technology policy in March 2001 and the implementation started in April with the establishment (through the Ministry of Science and Technology) of the National Information Technology Development Agency (NITDA), charged with the implementation responsibility. NITDA is to enter into strategic alliance, collaboration and joint venture with the private sector for the actualization of the IT vision, which is to make Nigeria an ICT-capable country as well as using ICT as an engine for sustainable development and global competitiveness. It is harnessed for the facilitation of education, job creation, poverty reduction and eradication, wealth creation and global competitiveness. The focal point of emphasis is to be placed on the development of National Information Infrastructure Backbone (NIIB) and the human resource development. In addition, Information Technology Parts are to be developed in Abuja and in each of the six geo-political zones (National Information Technology Development Agency [8].

Nigerian ICT status has enjoyed some remarkable improvement. Besides the massive importation of ICT facilities such as computers, compact disc players, digital video disc players, mp3 and 4 players, iPod set, the country has in recent years experienced improvement in telecommunication services. Ndukwe (2011) [9] notes that Nigeria has had a Telecom revolution that has seen the Code Division Multiple Access (CDMA) technology develop side by side with the Global System for Mobile Communications (GSM) technology. Just as Nigeria currently has the largest number of GSM connections on the continent it also true that Nigeria has the largest number of CDMA connections in Africa.

Shaba (2009) [5] lists the following as the wide range of hazards in Nigeria: frequent oil spills; pipe line vandalisation, increasing levels urban industrial pollution and waste, rise in the number and severity of floods, especially in Jigawa, Kano, Sokoto, Kebbi, Zamfara, Gombe and Southern States.

Threat of desertification & pest infestation as in quell birds and locusts in Sokoto and the Yobe - Borno axis the not too long reported outbreak of the dreaded avian influenza H5N1 (bird flu) leadingto loss of livelihoods droughts and general land use degradation. Gully erosion traditionally in South Eastern states and becoming pronounced in Auchiand Bida, wind storms in the northern parts of the country, the rampant air crashes of 1992 to & especially 2005/2006,fire disasters especially market infernos, cases of collapsed buildings, ethno-religious conflicts and threat to oil/gas explorations by the militants in Niger Delta.

Mohammed (2010), stated that for Nigeria, earlier seismic findings have shown that the location of the country as not being among the earthquake prone zones or other natural hazards, especially Volcano and

the Tsunamis. But in recent times some signs have called for concern by some scientists. He further noted that preliminary geo-hazard maps show some areas that are vulnerable to natural hazards in Nigeria, which include Zungeru, Ijebu-Ode, Kanganye, and Abeokuta, where in the past, either earthquakes or tremors had occurred. These are information that are generated by ICT facilities.

Over the years, Nigeria has experienced a devastating drought with socio-economic consequences that caused the nation loss of lives and property. This led to the establishment of National Emergency Relief Agency (NERA) by Decree 48 of 1976, charged with the task of collecting and distributing relief materials to disaster victims. The current National Emergency Management Agency (NEMA) was established in March 1999 via Act 12 of 1999 as amended by Act 50.The Agency was saddled with the responsibility of coordinating disaster management activities for the country [5].

Given the huge impact of natural disasters on society, comprehensive national disaster risk management strategies have grown in importance around the world. These strategies address disaster preparedness and relief, as well as disaster prevention and mitigation. Technological development has over the years has made ICT an important component of disaster risk management.

ICTs have shown to be fantastic accelerator of social and economic progress. ICTs have contributed to economic growth by enhancing access to information and services, and by driving process efficiency and cost-cutting in businesses. Practical survey on the effect ICTs found a positive correspondence between business performance and the use of ICTs measured by work productivity. Innovative use of ICTs in various development sectors have also contributed to more effective delivery of services in agriculture, education, energy, government and health care UN-APCICT/ESCAP (2010).

According to Shaba (2009) [5] disaster management (also called disaster risk management, DRM or disaster risk reduction, DRR) involves preparing, warning, supporting and rebuilding societies when natural or manmade disasters occur. Information and Communications Technology (ICT), especially in the information age we live in, plays a vital role in disaster prevention, mitigation and management.

The ICT covers both traditional media (radio, television) as well as new media (cell broadcasting, Internet, satellite radio, etc), which play a major role in educating public on the risks of a potential or imminent disaster. Remote sensing for early warning is made possible by various available technologies such the telecommunication satellites, radar and meteorology [5].

Furthermore, ICT plays a critical role in facilitating the reconstruction process and in coordinating the return of those affected by disasters to their homes and communities. Adequate access to relevant infrastructure is a precondition for individuals and organizations to adopt and use ICTs. Over the past decade most countries have put in place some form of ICT infrastructure, and have allowed various ICT tools to become more accessible and affordable for many developing countries. Moreover, the convergence11 of these technologies is leading to greater possibilities for use by different sectors and stakeholders UN-APCICT/ESCAP (2010).

The diverse digital technologies and their exploration for the reduction of disaster risks are explained below. This is not meant to be an exhaustive list of ICTs but

provide highlights of some key ICTs that have proved indispensable to disaster risk management. They include spaced based technology such as: geographic information system (GIS) remote sensing and satellite communication, and different types of radios, including community radio and satellite radio. Others are mobile technology, the Internet and Web 2.0 tools, UN-APCICT/ESCAP (2010).

Similarly, UNESC (2008) noted that ICT is an important tool for assisting in all stages of disaster risk reduction activities, which cover mitigation, preparedness, response and recovery from disasters. The technologies used for the aforementioned include spatial information systems such as disaster risk assessment and modelling, information integration and analysis, mitigation and response planning. Remote sensing include; monitoring and data gathering; the internet, websites and portals; information sharing, warehousing, knowledge hubs; communication systems; television, radio, satellite and cellular mobile, broadband and ICT applications disaster management system.

Information and Communications Technology in Disaster Risk Management

UNESC (2008) and Ostinsvig (2006) gave details on the various application of ICT for disaster risk management and noted that information and communications technology (ICT) is taking up more and more of the information sharing process of disaster management. At the same time, there are lots of areas for improvement. ICT uses in relation to disaster risk management are:

Radio usually used as the main means of information sharing within communities. Radio is actively used by agencies in disaster. For example: in Jamaica the Office of Disaster Preparedness and Emergency Management (ODPEM) and the Prime Minister, when a disaster is threatening the country. Those agencies are given free airtime to address the nation. When the radio issues a warning to the nation, an emergency signal has been developed to be used in advance of the news update with the warning, to raise people's awareness of the impending disaster. Almost everyone has access to a radio especially in developing countries and it can be run by batteries or solar energy. Ostinsvig (2006) [11] noted that one of the benefits of AM/FM services is that it can reach areas far away. Radio can be helpful in the facilitation of organizing relief operations in areas impacted, especially when other services are indispensable and not operational.

Use of telephone and land-line for disaster risk is a popular device in present age. The mobile network has been expanded greatly worldwide. Terrestrial fixed services, satellite communications including satellite mobile phones, as well as mobile and wireless services make possible voice and information exchange between different relief teams, for planning and coordination of relief activities.

Use of Television for disaster risk management is another major means of information sharing with people living in the communities. Coordination of relief activities is multidimensional therefore, terrestrial broadcasting services, if still functioning can facilitate coordination by disseminating information from relief planning teams to the population. Television broadcast the same message ensures a broader reach and enables confirmation and validation of the message as it is received multiple times.

Use of Computers for disaster risk management are used mainly to produce reports; needs lists or operation reports. Some agencies use databases to record

information coming in and going out, to keep track of actions needed and those already taken. Computers are also used for presentations and to present data/information visually at meetings.

The use of Internet for disaster risk management is a good source for information sharing, as long as the network is up. Weather forecasts, online newspapers and situation reports are among issues of relevance to disaster preparedness and response. These are all available online. Some agencies also use the Internet for online databases, sharing information with their international counterparts and sponsors.

Use of E-mail for disaster risk management is used for Information sharing; mainly at the agencies managerial level. It varies both in availability and use. Head offices tend to have access to e-mail and use that as a natural means of communication.

Use of managing information system for disaster risk management (MIS) is used by some agencies. For example in Jamaica the Office of Disaster Preparedness and Emergency Management are developing their existing system to function as an interactive information sharing system for the key agencies in disaster operations. This system, if based online, can be logged into from various sights and can provide information to donors around the world and staff/volunteers in the field.

Use of Fax for disaster risk management is used for inter-agency communication especially, in exchange of documents

Use of CB radio systems for disaster risk management is used by many of the agencies; however, their use is declining. Some agencies are still using the old radio system internally, while others have stopped using it altogether. At this time, the majority of the national agencies depend on the police radio system in instances where mobile or land-line networks were not working.

Newspapers Are also used, but warnings are often issued too late for the public to react in time. The printed media is a good source for preparedness information provided by different agencies, e.g. Red Cross and ODPEM. The online version of newspapers was available though in a simplified format in the midst of the Hurricane Ivan situation.

Use of Geographical information systems for disaster risk management (GIS) is making its way into the disaster management system. Some agencies use it to facilitate interagency exchange data. The adoption and use of Earth observation satellite service, for providing current and past geospatial Information, simplifies assessment and planning of relief activities.

UNESC (2008) noted that usually, the first ICT tools deployed after a disaster are satellite mobile systems, as they are immediately useable and are scalable from small to larger networks. Nevertheless, satellite mobile systems have some drawbacks. First, the cost of usage is high and, generally, could not be sustained; a multiband radio frequency could allow a single radio device to operate on all public safety radio bands. Thus, the emergency is responders even for the medium term. Secondly, laxity and incapacity to simultaneously handle calls is inadequate even with the availability of new satellite phones capable of terrestrial GSM wireless service. While voice transmission is traditionally viewed as the most immediate need when providing assistance during or immediately after a disaster, data access is also of primary importance.

Geospatial information facilitates the assessment of damage and the planning of relief activities, and the use of ICT applications, such as disaster management systems, enables better coordination between all the relief actors. Disaster management system that is ICT-based can address the common coordination when the need arises during disaster, from managing aid, volunteer and locating missing persons.

Challenges Associated with the use of ICT for disaster risk management

According to Shaba (2009) [5] despite the significant roles of the ICT in disaster management and response, if communities that are susceptible to disaster are deficient in terms of the ICT abilities required for disaster management and response, these roles could not be effective. Similarly, interventions and support from governments, NGOs and donor agencies could be more meaningful and effective if and when made on the basis of an assessment of the ICT related abilities of the target communities. For these reasons, there is a need for ways of assessing communities and subsequently placing them according to ranks or degrees in relation to their deficiencies in these of ICT for disaster management purpose. There is already what is called the Networked Readiness Index (NRI) of the World Economic Forum, which measures the propensity for countries to exploit the opportunities provided by ICT, but there is a need for a simple index suitable for relatively small communities, and understandable to social workers and other stakeholders [5].

ICT can create difficulties for disaster management operations. Powell (1999); Ostinsvig (2006) [11] & [23] note that some of the potential disadvantages that information dissemination would could be very difficult in situations when ICT facilities are destroyed during disaster. For example, when communication mast are destroyed by flood, strong wind or even humans (the insurgents in Northern Nigeria). In hurricane winds, telephone landlines and cell phone repeaters would probably not survive. The Internet, which also depends on national ICT grid, would also not be accessible [24].

The impact of disasters is quite enormous and innumerable a few include; damage to telecommunications systems and networks, which often vitiate or intersect services. During the disaster response to a foremost emergency, telecommunications infrastructure in affected regions may be loaded. The damage, degradation and overload may have major consequences for both the emergency response and public safety.

Mitigation of the impact of disaster on ICT infrastructure is the best policy choice (UNESC, 2008). Further to the possible technical shortcomings; social aspects also play a role in the efficiency of technology usage in disaster operations. Field workers do not see direct benefits, in fact they generally experience IT initiatives as reducing their effectiveness and therefore technology is often seen as a distraction from the primary mission of reducing human suffering [11] & [18].

Making the ICT infrastructure more resilient is an important part of disaster preparation. In the current liberalized telecommunication serenities, rebuilding networks independently by private operators may not be obtainable when disasters occur: the question of funding reconstruction arises. When the administration does not unswervingly regulate the infrastructure, authorization and concession deals should possess unambiguous/assessable requirements concerning cynical ground work.

UN-APCICT/ESCAP (2010) noted that unfortunately, many policymakers, including disaster management authorities, have yet to acquire the knowledge and skills needed to leverage opportunities provided by ICT and integrate ICT applications in their daily work. The hope now is that this publication contributes to a superior comprehension of diverse ways in which ICTs can be used and harnessed for DRR, and in turn, engender prospects for networking, collaboration and implementation of new solutions.

Many disaster risk reduction activists during decision making may not be well acquainted with appropriate good practices of ICT-enabled tools elsewhere, and the prospect such practices may hold for their work. Decision makers may simultaneously lack the procedural ability to assimilate such implements into their daily scheme of work. The affordability and promotion of the use of ICT and related services for the support of disaster risk activities is the responsibility of national ICT stakeholders.

Developing a viable ICT infrastructural base is a fundamental pillar for any country. It plays a critical role in transmitting information and facilitating communication during emergency situations, Regulations that promote the vigour and reliability of ICT substructure are essential more especially when lives are at risk and also to secure the continuity of ICT-enabled services and products when a disaster raids.

The planning and successful implementation of most disaster risk management is achieved with the aid of Information and Communication Technologies in form of Internet, GIS, Remote Sensing, Satellite communication etc. However, the potential of most advanced technologies is required to be harnessed in early warning, preparedness and response systems along with adequate emphasis on building human capacities to use these tools and technologies (National Disaster Management Division (nod).

METHODOLOGY

This Chapter presents the methodology of this research. Under methodology, the researcher presents the procedure he intends to use while conducting the research. Methodology is the systematic study of methods that are, can be or have been applied within a discipline This chapter will be used to discuss the procedures in this research work that will include population of the study, sample size and sampling method, instrument for data collection and the method of data presentation and analysis.

Study Area

Borno State is a state in north-eastern Nigeria. Its capital is Maiduguri. The state was formed in 1976 from the split of the North-East. Not until 1991 the state encompassed the present Yobe State.

The state is subjugated by the Kanuri indigenous group, and is an example of the durability and survival of old-fashioned (traditional) political institutions in some areas of the continent Africa. There, the emirs of the former Kanem-Borno Empire have played a part in the politics of this area for nearly 1000 years. The present empire gained management in the early nineteenth century and was sustained by the British, who disallowed a military conquest for the group and time-honoured a new capital for the dynasty at Maiduguri or Yerwa (as referred to by the natives) in 1905, which remains the capital to this day.

After Nigerian independence in 1960, Borno remained fairly self-sufficient until the enlargement of the number of states in Nigeria to 12 in 1967. Local government reform in 1976 further condensed the extent of influence and supremacy the emirs of the former empire had, and, by the time of Nigeria's homecoming to civilian rule in 1979, the emir's prerogative has been delimited exclusively to cultural and traditional affairs. Today, the emirs still exist, and serve as advisers to the local government.

Population of the Study

Population is made up of all conceivable elements, subject or observations relating to a particular phenomenon of interest to the researcher. Subject or elements are individual items that make up the population; they may be observed or

physically counted. In this case, the researcher needs to clearly state what characteristics should define the elements or subjects that should be included in the population.
Smith (1988) [26] conceives population as the entire members of the target audiences as defined by the aims and objectives of the study. This step is necessary in order to avoid the inclusion of elements or subjects that do not actually belong to the population of interest.

Similarly, population of any study is a census of all items or subjects that possess the characteristics or that have knowledge of the phenomenon being studied [27].

The population of this study is the entire staff of NEMA Borno State their population is 90 it is from this population that the sample was drawn

Sample Size and Sampling Technique
Sample is a sub set of a population that is taken to be representative of the entire population [28]. The sample size for this study is 60 .Because some phenomena exhibit a wide degree of variability in a population while others exhibit limited degree of variability. Therefore, where a phenomenon is desirable and where the variability is lower, a smaller sample is required; in this case 60 key informants were selected using purposive sampling technique for this research questionnaire is significantly appropriate for the study.

The purposive sampling procedure is a technique that includes subject selected on the basis of specific characteristics or qualities and eliminates those who fail to meet these criteria. (Wimmer and Dominick 1987) [28] Notes that it is a method where researchers handpick subject to participate in a study based on identified variables under consideration. The power of purposive sampling lies in picking information rich-cases for detailed scrutiny interrelated to the principal issues being studied. In this study, the key informants were selected based on their knowledge of NEMA ICT-based disaster risk management activities.

Instrument for Data Collection
The instrument of data collection involves measuring some research phenomenon, whether the data is a process, an object or human subject's behaviour. Therefore, the instrument of data collection is questionnaire. The questionnaire was used as instrument of data collection. The questionnaires were administered to 60 staff of NEMA which is the sample size.

DATA PREENTATION AND ANALYSIS
The study relied on questionnaires as instrument of data collection as indicated in chapter three. A total of 60 questionnaires were self-administered to respondents and the 60 were all retrieved and found usable.

Table 1: *Gender of Respondents*

Options	Number of respondents	Percentage
Male	50	83%
Female	10	17%
Total	60	100%

Table 1 shows that male are over represented than female which tells that the percentage of female in the organization low which probably because of the nature of the job that involve a lot of field work and more physical ability.

Table 2: *Use of ICT for Disaster Risk Management.*

Options	Number of respondents	Percentage
Yes	60	100%
No	0	0
Total	60	100 %

Table 2 shows that all the respondents (100%) used ICT for disaster risk management. This is because managing disasters entails myriads of field work which most often necessitates the use of devices such as mobile phone, digital camera and computers for documentation and record keeping respectively hence the use of ICT is integral to the activities of NEMA staff both in the office and on field.

Table 3: *Types of ICT used for Disaster Risk Management by NEMA.*

Number of respondent	Options	Percentage
5	Computer	8%
7	Telephone	12%
3	GIS	5%
1	Digital camera	2%
1	Satellite imaging	2%
2	Internet	5%
3	Remote sensor	3%
38	All of the above	63%

Table 3 Presents that 63% of the respondents explore all the devices listed in the table 4.3 for disaster risk management but specifically 8% use computer, 12% use mobile phone, 5% use GIS, 2% use digital camera, 2% use satellite imaging, 5% use the internet and 3% use remote sensor. This finding is not unconnected to the fact that managing disaster using ICTs is multi-tasking which requires the use of all the devices. However mobile phone appears to be most used device with a response rate of 12% this is so because it is easily accessible and affordable. All respondents have personal or official mobile phone which they use for job related issues. GIS and digital camera have the lowest percentage

because of their rare accessibility hence they are used by few NEMA officials whose work involves geographical positioning and imaging. Digital camera has the lowest percentage because there is an available alternative which is the use of mobile phone for photographic documentation.

Table 4: *Specific areas NEMA apply ICT for DRM.*

Options	Number of respondents	Percentage
Communicating with stake holders	3	5%
Providing early warning and monitoring extremes weather events	3	5%
Support emergency response through communication sharing	2	3%
For search and rescue operation	0	0%
For data storage and record keeping	1	2%
Identify high risk areas	0	0%
All of the above	51	85%
Other specify	0	0%

Table 4 shows that most of the respondent apply ICT for disaster risk management interestingly the use of ICT for search and rescue operation did not record any respondent using technology for such disaster risk management are sophisticated technology not available for general use but by a few experts for example the GIS technology.

Table 5: *Rate of ICT use by NEMA in Disaster Risk Management.*

Option(Rating percentage)	Number of respondents	Percentage
20	4	7%
40	29	48%
60	12	20%
80	15	25%
100	0	0%

Key: Rating 20% (Poor), 40% (Fair), 60% (Good) 80% Very Good, 100% Excellent

Table 5 shows that ICT is a key component of disaster risk management because it has influence on every aspect of disaster risk management from office duties to field responsibilities. Therefore, in this information age it is expected that rating the use of ICT in disaster risk management ought to be high .However the finding of this study in respect of the rate of disaster risk management indicates that 48% is the highest rate of the use of ICT by NEMA for disaster risk management. This implies that the adoption and use of ICT for disaster risk management by NEMA is still below 60%, which by the rating standard is fair.

Table 6: *Challenges NEMA face using ICT tools for Disaster Risk Management.*

Options	Number of respondents	Percentage
(YES) ICT is effective in disaster risk management	60	100%
(NO) ICT is not effective in disaster risk management	0	0%
Total	60	100%

Table 6 All of the above have the highest and only option which implies that NEMA faces all the listed challenges this could explain while in table 4.5 why the ICT use of ICT rating below 60%.

Table 7: *Effectiveness of ICT usage by NEMA in Disaster Risk Management*

Options	Number of respondents	Percentage
Poor dependability and reliability of internet connection	0	0%
Error in data entry	0	0%
	0	0%
Outdated and not regularly update tools and application	0	0%
Lack of skills of those needing to access information	0	0%
All of the above	60	100%
Others	0	0%

Table 7 Indicate arrears in which NEMA face challenges in the use of ICT for disaster risk management; Poor dependability and reliability of internet connection, Error in data entry, Limited funding to expand, implement and maintain newly available tools and applications, Outdated and not regularly up to date tools and application, Lack of adequate skills needed to access information. All of the above has the highest percentage (100%) and the only option which implies that NEMA encounter all the listed challenges. This explains the outcome of table 4.5 in clear terms and answers the question why the use of ICT based on the rating standard for this survey is below 60%.

DISCUSSION OF FINDINGS

Providing answers to the first research question, Does NEMA apply ICT for disaster risk management? The outcome of table 2 Shows that all the respondents (100%) use ICT for disaster risk management. This is because managing disasters entails myriads of field work which most often necessitates the use of devices such as mobile phone, digital camera and computers for documentation and record keeping respectively hence the use of ICT is integral to the activities of NEMA staff both in the office and on field. This outcome corroborates with the assertion of Shaba, (2009) [5] who noted that Some ICT components such as GIS, remote sensing and internet have been adopted by NEMA for disaster risk management. However, the level of integration and usage is what cannot be readily ascertained. Zlatanova (2015) [6] added that the adoption and use of ICTs for disaster risk management is tied to the fact that ICTs are essential mechanisms for mutual-aid and cooperation during disasters as disaster management and emergency activities largely depends on fast response, reliable access to existing data, up-to-date field information, integration and distribution of information among various stakeholders.

To find out the types of ICTs NEMA use for disaster risk management? This survey ascertained that 63% of the respondents explore all the devices listed in table 4.3 for disaster risk management but specifically 8% use computer, 12% use mobile phone, 5% use GIS, 2% use digital camera, 2% use satellite imaging, 5% use the internet and 3% use remote sensor. This finding is not unconnected to the fact that managing disaster using ICTs is multi-tasking which requires the use of all the devices. However mobile phone appears to be most used device with a response rate of 12% this is so because it is easily accessible and affordable. All respondents have personal or official mobile phone which they use for job related issues. GIS and digital camera have the lowest percentage because of their rare accessibility hence they are used by few NEMA officials whose work involve geographical positioning and imaging. Digital camera has the lowest percentage because there is an available alternative which is the use of mobile phone for photographic documentation. The result here is in tandem with the findings of UNESC (2008) and Ostinsvig (2006), that gave details on the various application of ICT for disaster risk management and noted that information and communications technology (ICT) is taking up more and more of the information sharing process of disaster management. CIVIC (2004); IFRC, (2005); Ostinsvig, (2006). Added that the use of technology in disaster management is expanding more especially “Communications media, including the Internet, cell phones, radio and television often used to keep the public abreast during and after disaster.

In finding answers to the specific areas NEMA deploy ICT for disaster risk management, the study established that most of the respondents apply ICT for

disaster risk management in virtually all the arears listed in the table which gave a response rate of 85%. However, 5% use it in the arear of Communicating with stake holders, 5% for providing early warning and monitoring extremes weather events, 3% for supporting emergency response through communication sharing, 0% for search and rescue, 2% for data storage and record keeping and 0% for identifying high risk arears. Interestingly the use of ICT for search and rescue operation did not record any respondent as technological appliances for such disaster risk management remain sophisticated and not available for general use but by few experts. This outcome is concurrent with the survey of UNESC (2008) and Ostinsvig (2006) that gave details on the various uses of ICT in relation to disaster risk management: they opined that Radio is usually used as the main means of information sharing within communities (creating awareness and mobilization of stakeholders). Radio is actively used by agencies in disaster. For example in Jamaica the Office of Disaster Preparedness and Emergency Management (ODPEM) and the Prime Minister, when a disaster is threatening the country. Those agencies are given free airtime to address the nation. When the radio issues a warning to the nation, an emergency signal has been developed to be used in advance of the news update with the warning, to raise people's awareness of the impending disaster.

To ascertain the rate of use and effectiveness of ICT in disaster risk management using the key rating standard designed for this study; 20% (Poor), 40% (Fair), 60% (Good) 80% Very Good, 100% Excellent

The study institute that ICT is a key component of disaster risk management because it has influence on every aspect of disaster risk management, from office duties to field responsibilities. Therefore, in this information age it is expected that rating the use of ICT in disaster risk management ought to be high .However, based on the rating standard established by this study for ascertaining the effectiveness of ICT in disaster risk management. The survey indicates that 48% is the highest rate of the use of ICT by NEMA for disaster risk management. This implies that the adoption and use of ICT for disaster risk management by NEMA is still below 60%, which by the rating standard is fair. Also 100% of the respondent attests to the fact that ICT is effective in disaster risk management. The assertion of UNAPCICT, (2010); Hassan, (2015). Further strengthens the finding of this study. According to them ICT plays a very important role in various aspect of disaster risk management. At present there is a growing awareness of the importance of ICT for disaster risk management. Disaster risk management through ICT aims to reduce the damage caused by natural and manmade hazards like earthquakes, floods, droughts and cyclones epidemics, wars and ethno-religious and political conflicts. The use of ICT can facilitate the management of disasters by providing information on disaster prevention, early disaster prediction, communicating and disseminating disaster information to residents, and ensuring a speedy communication system before, during and after the disaster to both government and non-government agencies for relief materials [5]. Also opined that through ICT and in particular the Internet, GIS, remote sensing, satellite-based communication links, effective disaster risk reduction measures can be simple. For example, there are available statistics about some zones in Nigeria that are prone to natural disasters and there is a GIS-based system that contains the spatial information about Nigeria in general, to this end, ICT is extremely effective in disaster risk management.

To document the challenges faced by NEMA in disaster risk management, the survey Indicate arrears in which NEMA face challenges in the use of ICT

for disaster risk management; Poor dependability and reliability of internet connection, Error in data entry, Limited funding to expand, implement and maintain newly available tools and applications, Outdated and not regularly up to date tools and application, Lack of adequate skills needed to access information. All of the above has the highest percentage (100%) and the only option which implies that NEMA encounter all the listed challenges. This explains the outcome of table 4.5 in clear terms and answers the question why the use of ICT based on the rating standard for this survey is below 60%. This finding showcases certain but fundamental technological inadequacies that affect proper application and the use of ICT in disaster risk management by NEMA officials in Borno but in spite of the hurdles, all the challenges are harnessed to ensure that ICT is applied in disaster risk management; hence ICT is effective and essential.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The research has five chapters. The first chapter gives a background of the topic, statement of problem where it was observed that there is high level of ICT usage for disaster risk management. The research questions which include (i) Does NEMA apply ICT for disaster risk management? (ii) What types of ICT does NEMA use for disaster risk management? (iii) What specific areas does NEMA deploy ICT for disaster risk management? (iv)What is the effectiveness of ICT in disaster risk management? (v) What challenges does NEMA face in application of ICT for disaster risk management? Research objectives which includes, To ascertain the use and level of application of ICTs for disaster risk management, To Identify the types of ICT NEMA uses for disaster risk management, To assess the specific areas of ICT application for disaster risk management, to examine the effectiveness of effective of the use of ICT in disaster risk management, To Identify the challenges in the application of ICT for disaster risk management in NEMA. The scope of the study centre on the application of ICT by the N.E zonal office of Maiduguri. The use of ICT facilities by some relevant staff of NEMA which includes information managers in NEMA, field officers, the zonal director NEMA North East). The choice of the north east zonal office of NEMA because was informed by the find that the N.E zonal office has been the busiest NEMA office due to the Boko haram insurgency at its peak since 2009 as a result of the insurgency issues.

A thorough review of relevant literature touching on ICT in disaster risk management in relevant agencies were reviewed using the following sub-topics information and communications technology, Information and communications technology in disaster risk management, Use of telephone and land-line for disaster risk etc. The study also highlighted the theoretical framework on which the study stood in respect of understanding the theoretical bases of the study.

Methodology, as a key component of any research was clearly explained centring on the research design, which touched on the study population, (entire staff of NEMA Borno State, 90 in count) sampling technique, research instrument (interview) and method of data presentation and analysis followed by presentation and interpretation of the data gathered and discussions of results or findings of the research, which touched on all the specific objectives and research questions as provided by the data. The study further discussed findings of this research explaining how they relate to or differed from other similar studies or contributions from scholars and finally the summary of

the frame of the work followed by conclusion as well as recommendation.

CONCLUSION

ICT plays a vital role in disaster risk management. NEMA like any other disaster risk management agencies globally is not left out in the effort towards adopting and utilization of ICT in disaster risk management in its own domain. Some of the ICT facilities such as digital camera, Computer and mobile phones have gained effective penetration in terms of utilization by the Agency for disaster risk management. Interestingly, even sophisticated technology like the GIS is been used by the Agency, which is a positive development in terms of being up to date facility wise. Although there are several challenges bedevilling NEMA in effectively utilizing ICT for disaster risk management, the challenges have not hindered the use of available technology for disaster risk management. This goes to show that the use of ICT for disaster risk management in the 21st century is a necessity for purpose of efficiency and timely disaster risk management. Much needs to be done to ensure that NEMA fully benefits from the several opportunities tied to ICT in disaster risk management.

Recommendation

Based on the findings of the study, especially in relation to the objectives of the study, especial the following recommendation is presented;

1. Government should adequately fund and meet ICT requirements of NEMA to enable it effectively deploy ICT for disaster risk management.
2. The agency should constantly train its staff and organise refresher courses for its staff on the latest ICT and there uses for disaster risk management.

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