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RESEARCH ARTICLE

Leveraging ICT for Effective Disaster Management in Abuja, Nigeria: The Role of E-Governance Tools

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Abstract
The increasing frequency of disasters in Nigeria's Federal Capital Territory (FCT) has exposed limitations in traditional disaster management strategies. The integration of Information and Communication Technology (ICT) offers opportunities to improve preparedness and responsiveness. This study examined the impact of Information and Communication Technology (ICT) on disaster management in the Federal Capital Territory Emergency Management Agency (FEMA), using the disaster management cycle, mitigation, preparedness, response, and recovery, as the analytical framework. A survey design was employed, and 310 questionnaires were purposively distributed to 122 FEMA personnel and 188 community members in disaster-affected areas. Data were analyzed using the independent samples t-test, and the study was anchored on Rogers' Diffusion of Innovation Theory. Findings revealed moderate mitigation efforts hindered by limited adoption of e-governance tools and outdated infrastructure. Preparedness was weakened by conventional training methods, and disaster response was constrained by poor ICT facilities and a lack of skilled personnel. The study recommends the adoption of emerging technologies such as drones, rescue robots, Doppler radar, and Incident Management Systems (IMS), along with continuous ICT-based training and community education. Strengthening web-based disaster platforms and enforcing safety regulations are also essential to enhance resilience in the FCT.

Keywords: ICT; Disaster Management; Abuja; E-Governance; Nigeria

Introduction

In recent decades, the frequency and severity of disasters, both natural and man-made, have significantly increased, posing threats to lives, infrastructure, and economies across the globe. These events, which include earthquakes, floods, fires, and explosions, transcend national boundaries and affect both developed and developing nations alike. Disasters such as the earthquakes in the Middle East, floods in Europe, and recurrent environmental crises in countries like Nigeria, Cameroon, and Chad underscore the urgent need for proactive and technology-driven disaster management strategies (Enenkel, Guha-Sapir & Zaitchik, 2024; Reuters Reports, 2024). Studies specific to Nigeria show that flood-prone urban centres suffer severe impacts due to inadequate infrastructure, poor planning, and insufficient integration of ICT-based mitigation tools. This is exemplified in the work of Onugba, Onugba, and Bamigboye (2022), who reviewed resilient infrastructure options for flood risk management in Nigeria. The World Health Organization (2007) defines a disaster as an event that disrupts the normal living conditions of a population and exceeds the capacity of the affected community to cope. While the unpredictable nature of disasters renders their complete prevention difficult, the strategic application of

Information and Communication Technology (ICT) offers promising tools for reducing their impact. ICT facilitates key functions such as mitigation, early warning, preparedness, response, and recovery. Across the world, governments are increasingly turning to e-governance technologies—including Geographic Information Systems (GIS), thermal imaging, mobile apps, and satellite communications—to improve the effectiveness of their disaster management operations (Djoumessi & Mbongo, 2022). For example, evidence from ICT-based disaster education in Indonesia illustrates how mobile and web-based technologies significantly enhance community preparedness and responsiveness (Uchida et al., 2021).

E-governance, in the context of disaster management, refers to the use of digital tools to enhance the delivery of public services and foster efficient coordination between government agencies and the public (Abasilim, Gberevbie & Ifaloye, 2017). When properly integrated, e-governance systems enable real-time access to data, facilitate early warning communication, and allow for coordinated and transparent stakeholder engagement. These tools are particularly relevant in rapidly urbanizing regions like Abuja, Nigeria's Federal Capital Territory (FCT), which has witnessed a variety of disaster incidents in recent years, including floods, building collapses, and market fires. According to Aghav, Solanki, and Palwe (2022), GIS-based e-governance systems can support location-specific emergency services and coordination in dense urban areas, making them highly suitable for Abuja's context. The Federal Capital Territory Emergency Management Agency (FEMA), established in 2013 under the National Emergency Management Agency (NEMA) Act of 1999, is the agency responsible for coordinating disaster risk reduction and emergency management in Abuja. FEMA's mandate spans the four critical phases of disaster management: mitigation, preparedness, response, and recovery (FEMA Handbook, 2022). In fulfilling this mandate, FEMA has implemented several e-governance initiatives, such as GIS mapping, dedicated emergency websites, satellite monitoring, and social media alert systems. These initiatives are designed to modernize disaster management and reduce the vulnerability of residents to both environmental and human-induced hazards. However, as noted by Rane et al. (2024), the success of such systems often hinges on adequate local capacity, sustained ICT funding, and institutional alignment, factors that are frequently lacking in developing regions. Despite these efforts, the Federal Capital Territory continues to experience significant and recurrent disasters, raising questions about the effectiveness of FEMA's e-governance strategies. Notable incidents—such as the 2014 Nyanya bombing, frequent floods in Lokogoma and Trade-more Estate, and repeated fire outbreaks in areas like Kubwa—have exposed several systemic weaknesses. Public complaints about delayed emergency responses, inaccessibility of hotlines, limited early warning systems, and inadequate recovery support suggest that digital tools are not yet optimally deployed or utilized. A comparative review by Syukron et al. (2024) emphasizes that disaster response systems combining mobile apps, geospatial mapping, and real-time alerts perform significantly better in urban crisis environments. Given this context, this study critically examines the role and performance of e-governance initiatives within FEMA's disaster management framework in the FCT. Specifically, it explores whether these digital tools have improved FEMA's capacity to mitigate disaster risks during the pre-disaster phase. It also investigates the extent to which e-governance has enhanced preparedness efforts, enabling FEMA to anticipate and reduce the impact of potential hazards. Furthermore, the study assesses whether these initiatives support timely and effective response operations in the post-disaster phase, as well as their ability to facilitate recovery and rehabilitation processes following disasters. By exploring these dimensions, the study contributes to a deeper understanding of how ICT-driven governance mechanisms influence disaster risk management in urban Nigeria. It aims to provide practical insights that can inform policy and improve the resilience of public emergency systems, especially in rapidly growing cities like Abuja.

Literature Review

E-Governance and Its Relevance to Disaster Management

Globalization, technological advancements, demographic shifts, and evolving political demands are transforming the functions of governments and public sector organizations. In response, governments are adopting more innovative, efficient, and citizen-centered approaches. One such strategy is e-governance, which offers a viable solution for improving public administration, enhancing service delivery, and promoting inclusive governance. E-governance refers to the use of information and communication technologies (ICTs) to support and improve governmental processes and citizen engagement. The OECD (2003) defines it as the application of ICTs to ensure transparency, accessibility, and responsiveness in government operations. Similarly, the World Bank (2012) emphasizes its role in transforming relationships between governments, citizens, businesses, and other institutions. Scholars like Oseni & Dimgley (2014) and Palvia & Sharma (2007) highlight their administrative value and potential to enhance interactions between public servants and society, while Bannister & Walsh (2002) extend the concept to include civic participation and democratic governance. Extending this scholarship, Chima & Victor (2023) demonstrate how demand-side factors—such as digital literacy and broadband costs, directly condition effective e-governance uptake in Nigerian localities, showcasing the real-world constraints underlying theoretical frameworks.

In practical terms, e-governance encompasses a range of digital functions, including e-registration, e-taxation, e-service delivery, e-education, e-participation, and e-policing (Danfulani, 2013). These digital interventions are central to promoting the principles of good governance, such as transparency, accountability, equity, and citizen engagement (Adeyemo, 2013). A particularly transformative domain of e-governance is disaster management, where ICT systems—such as Geographic Information Systems (GIS), mobile messaging platforms, and web-based portals—enhance governments' ability to issue timely warnings, identify high-risk zones, and coordinate emergency responses. As Cleverley (2001) and Backus (2001) observe, such tools facilitate real-time communication between authorities and the public, thereby increasing institutional responsiveness and public trust during crises. Nonetheless, the application of these technologies in developing contexts like Nigeria remains uneven. The effectiveness of e-governance in disaster management hinges on institutional readiness and infrastructural resilience. For instance, Chima and Ojochegbe (2022) report that systemic obstacles—including limited ICT skills among public officials, inadequate funding, and low public digital awareness—can significantly undermine the success of e-governance initiatives aimed at emergency coordination and public safety. These findings are reinforced by Chima and Victor (2023)**,** who emphasize the persistence of digital divides, such as high broadband costs and limited connectivity, which constrain citizen participation in digital public services like disaster alerts and emergency reporting systems (DOI: 10.56556/jtie.v2i4.656). Collectively, these challenges reflect broader structural issues prevalent across sub-Saharan Africa, where infrastructural deficits and technological inequalities compromise governance performance, especially under crisis conditions.

However, the trajectory is not entirely discouraging. Evidence from Chima and Oluwaseun (2020) presents a more optimistic outlook, illustrating how the successful deployment of ICT tools in Nigeria's Integrated Payroll and Personnel Information System (IPPIS) has strengthened accountability and reduced corruption within the public sector. This case underscores the broader potential of transparent, ICT-enabled systems—not only in financial management but also in enhancing the credibility, efficiency, and traceability of disaster-related logistics and emergency interventions.

E-governance is often conceptualized within the Government-to-Citizen (G2C) model, which allows citizens to access public services and information conveniently and equitably (Miller & Walling, 2013). This model also

supports participatory governance by enabling citizens to monitor projects, evaluate service delivery, and hold institutions accountable (Palvia & Sharma, 2007). In Nigeria, e-governance has gained strategic attention. The National Information Technology Development Agency (NITDA) was established to drive ICT development and digital governance (Adeyemo, 2013). Initiatives include online portals, mobile apps, and digital platforms supporting poverty reduction, gender equality, environmental protection, and disaster response (Olufemi, 2012; Adeyemo, 2013). However, implementation remains constrained by several challenges: limited digital literacy, high internet costs, slow connectivity, and weak inter-agency integration (Olufemi, 2012). Corroborating these challenges, Paul Chima's study on e-governance adoption at the University of Abuja identifies inadequate funding, low awareness, resistance to change, and staff training gaps as significant inhibitors **(**Chima & Ojochegbe, 2022**),** highlighting systemic constraints shared across public institutions. Addressing these issues is essential to realizing the full potential of e-governance in Nigeria and other developing countries. Especially in disaster management contexts, a robust G2C platform must overcome infrastructural, institutional, and capacity barriers to deliver real-time risk communication, facilitate coordination, and support recovery. Integrating academic insights from Paul Chima and other peers anchors our understanding in Nigeria's policy reality and emphasizes the importance of context-sensitive approaches going forward.

Disaster Management

The concept of disaster has been widely explored in both academic and policy literature. Its origin can be traced to the French word "desastre," which translates to "bad star," connoting misfortune or ill fate. A disaster is defined as a serious disruption of societal functioning that surpasses the coping capacity of the affected community (United Nations, 2014). At the heart of disaster discourse lies an interconnected triad: hazards, vulnerability, and capacity. Hazards may be natural, such as floods, earthquakes, or pandemics, or man-made, including technological accidents or environmental degradation. Vulnerability relates to how exposed a population is to such hazards, shaped by factors like urban density, poverty, infrastructure quality, and access to basic services. Capacity encompasses the physical, social, and economic resources communities have to anticipate, cope with, and recover from disasters. A recent systematic review by Banda, Mwale, and Tembo (2024) highlights the importance of coupling community-based vulnerability reduction with technology-enhanced capacity building, particularly in Southern Africa. Disaster management is a multi-stage process that includes mitigation, preparedness, response, and recovery (Lindsay, 2012). Mitigation involves long-term strategies—such as urban planning, building codes, flood mapping, and zoning laws—to reduce disaster impact. Khaspuria, Das, and Pandey (2024) argue that this phase is most effective when supported by integrated data systems and early-warning models that proactively build urban resilience.

Preparedness focuses on readying individuals, institutions, and systems to manage emergencies through planning, training, resource stockpiling, and public education (IFRC, 2000). According to FEMA's 2022–2026 Strategic Plan, equitable preparedness is critical, as the agency states that "underserved communities often suffer disproportionately from disasters," and that building a more resilient nation requires "proactively prioritizing actions that advance equity for communities and identifying groups that have historically been underserved" (FEMA, 2021). Response encompasses immediate actions taken to protect lives and property during and after a disaster (Gupta et al., 2011). Although global attention increasingly emphasizes prevention, a swift and organised response remains crucial for reducing losses and suffering. Recovery involves restoring services, infrastructure, and social systems. In IT contexts, it includes backups, disaster recovery-as-a-service (DRaaS), snapshots, and virtual recovery platforms (Google Cloud, 2024). Raj, Sharma, and Taneja (2025) note that emerging AI and big-data tools, such as predictive flood maps and resource optimization algorithms, are transforming recovery

planning and logistics. The integration of ICT and e-governance has significantly enhanced disaster management. Technologies like drones, GIS, satellite communication, thermal imaging, and mobile alerts are now vital for early warning, damage assessment, and inter-agency coordination (ITU, cited in Ostinsvig, 2006). Raj et al. (2025) further confirm that AI/ML and simulation platforms are becoming core tools across all disaster phases. Conclusively, disaster management is an inherently complex, multi-phase process that depends on coordinated planning, technological innovation, real-time communication, and human capacity. The effective synergy of mitigation, preparedness, response, and recovery, with inclusive governance and sustained investment, remains essential to managing both natural and human-induced disasters effectively.

Theoretical Framework

This study is anchored on the Diffusion of Innovation (DOI) theory, originally developed by sociologist Everett Rogers in 1962. The theory provides a foundational lens for understanding how new ideas, technologies, or practices spread within a society or organization. It explains not only how and why innovations are adopted, but also the rate at which they disseminate across different social systems over time. A central feature of the theory is the emphasis placed on the role of communication in the adoption process, as outlined by Rogers in his updated work in 2003. According to Rogers, the diffusion of any innovation typically follows a five-stage process: awareness, interest, evaluation, trial, and finally, adoption or rejection. Within this process, three critical elements interact to influence the outcome. The first is the innovation itself defined as any idea, practice, or object perceived as new by a person or group. The second is the communication channel**,** which refers to the means, whether formal or informal through which information about innovation is shared. The third is the social system**,** comprising the network of individuals, organizations, or communities through which the innovation is introduced and spread. The theory also identifies five specific attributes of an innovation that affect how quickly and widely it is adopted. These are relative advantage (the extent to which the innovation is perceived as better than what it replaces), compatibility (how well the innovation fits with the existing values, needs, and experiences of the target group), complexity (how difficult it is to understand or use), trialability (the ability to test the innovation on a small scale before full adoption), and observability (the degree to which the results of the innovation are visible and measurable to others). These attributes collectively shape the perceptions and behaviors of potential adopters within any given social system.

Application of the theory to this study

The DOI theory is particularly relevant to this study, which explores the adoption of e-governance innovations in disaster management in Abuja, Nigeria. In this context, tools such as online platforms, mobile applications, Geographic Information Systems (GIS), and digital communication channels are considered new and transformative innovations within the disaster management cycle, which includes mitigation, preparedness, response, and recovery. E-governance offers a clear relative advantage by enhancing the efficiency, transparency, and coordination of disaster management efforts among stakeholders such as government agencies, emergency responders, and local communities. For instance, GIS technology allows authorities to identify and map high risk zones prone to flooding or structural collapse. Mobile applications enable real-time alerts and support community-based reporting of hazards. Similarly, online portals streamline the distribution of aid and improve coordination during emergencies. These innovations directly address the shortcomings of Abuja's traditional disaster response systems, which have often been overwhelmed by challenges such as urban flooding and inadequate infrastructure (Basahuwa, 2017).

The communication strategies employed to disseminate these innovations are crucial to their success. Government-led campaigns using television, radio, social media, and grassroots community workshops serve to educate stakeholders and build trust in new technologies. These platforms not only raise awareness but also foster interest and engagement, which are key steps in the innovation adoption process (Heeks, 2006). Patterns of adoption in Abuja mirror the adopter categories described by Rogers. Innovators and early adopters**,** such as the Federal Capital Territory Emergency Management Agency (FEMA) often lead the way by experimenting with and championing new technologies. They are followed by the early majority**,** which includes local government units and non-governmental organizations (NGOs) that become involved after the benefits of innovation are demonstrated. However, the late majority and laggards**,** who may be less digitally literate or more skeptical of government-led technologies, tend to adopt only after prolonged engagement and proof of effectiveness.

In applying the five innovation attributes to the context of Abuja, it becomes evident that each one plays a role in shaping outcomes. Compatibility is vital; the new systems must align with existing local infrastructure and practices to be accepted. Innovations perceived as overly complex or technical can hinder adoption, especially in low-literacy environments, making it essential to design user-friendly platforms that offer local language support. Trialability is also important; pilot testing in disaster-prone communities allows for the demonstration of real-world benefits before full-scale implementation. Finally, observability reinforces the adoption process, as visible improvements in response times and resource use increase confidence and encourage broader acceptance (AlAwadhi & Morris, 2009; Rogers, 2003). The role of the social system in this process cannot be overstated. The collective participation of government agencies, civil society organizations, community leaders, and the private sector creates the enabling environment for successful diffusion. Through visible government leadership, consistent stakeholder engagement, and collaborative efforts, trust and legitimacy are built, which are essential for the long-term sustainability of e-governance tools in disaster management (Heeks, 2006). The Diffusion of Innovation theory offers a robust framework for analyzing how and why e-governance tools are adopted within Abuja's disaster management landscape. It not only explains variations in the pace of adoption but also highlights the importance of aligning technological innovations with local realities and effective communication strategies.

Methodology of the Study

This study adopted a combination of survey research design and documentary sources to gather data. The survey research design, as described by Obasi (1999), involves collecting data from a defined population through questionnaires or interviews and analyzing the results statistically to conclude. This approach was considered suitable due to its empirical nature, allowing the researcher to examine the relationships between variables under investigation. By using this method, the study effectively explored people's experiences, attitudes, beliefs, and behaviors regarding the use of e-governance in disaster management in Abuja. The research was conducted within the Federal Capital Territory (FCT), which lies between latitudes 8°25' and 9°20' North and longitudes 6°45' and 7°39' East, covering approximately 8,000 square kilometers. Established by Decree No. 6 in 1976, the FCT was carved out from Niger, Plateau, and Kogi States. Initially divided into nine development areas, it was later reorganized into six Area Councils: Abaji, Gwagwalada, Kuje, Kwali, Bwari, and Abuja Municipal. The FCT experiences three major weather conditions: a humid rainy season, an extremely hot dry season, and a short harmattan period. Vegetation includes various savannah types and patches of rainforest, especially in the Gwagwalada plains.

The study population consisted of 528 individuals, including all 175 staff of the FCT Emergency Management Agency (FEMA) across departments such as Administration, Forecasting, Response and Mitigation (FRM), Relief and Rehabilitation, Monitoring and Special Duties, Information and Technology, and Account and Audit.

The second category comprised 353 households affected by disasters across the six Area Councils of the FCT. To select a representative sample, both probability and non-probability sampling techniques were employed. Stratified random sampling helped divide the population into strata, while purposive sampling was used to select individuals with the most relevant experiences to answer the research questions. Using Taro Yamane's (1964) formula at a 5% margin of error, a sample size of 310 was determined, comprising 122 FEMA staff and 188 disaster-affected community members. Proportional allocation based on strata size was used to determine the number of respondents from each department and community.

Data collection relied on a structured questionnaire and relevant publications. The questionnaire, based on a five-point Likert scale (Strongly Agree to Strongly Disagree), was designed to gather both demographic information and insights into the application of e-governance in disaster management. A total of 310 questionnaires were administered to respondents. To ensure validity and reliability, the instrument underwent expert review for content validation, aligning the items with the research objectives. Reliability was tested using Cronbach's Alpha, yielding a coefficient of 0.84, indicating high internal consistency. The findings were further supported by existing literature.

Both primary and secondary sources of data were used. Primary data came from the questionnaire, while secondary data were sourced from books, journals, newspapers, official FEMA reports, and relevant publications on ICT and disaster management. This dual approach ensured comprehensive data collection. For data analysis, both descriptive and inferential methods were used. Responses were tabulated and simple averages computed. Additionally, tables and diagrams were used for clarity. An Independent Two Sample T-test was employed to test the hypotheses and identify any significant differences in responses across the sample groups.

Data Analysis

Test of Hypotheses

In this section, four statistical hypotheses were tested using the Independent Samples t-test**.** This statistical technique was employed to determine whether there were significant differences in the mean responses between two independent groups, FEMA staff and members of disaster-affected communities in the FCT regarding the use of e-governance tools in disaster management. Specifically, the analysis examined variations in perceptions across the four key components of the disaster management cycle: mitigation**,** preparedness**,** response**,** and recovery**.** Data analysis was conducted using IBM SPSS Statistics (Version 25)**,** ensuring accuracy and robustness in hypothesis testing.

Hypothesis one

H_0 There is no significant difference in the mean rating of FCT Emergency Management Agency (FEMA) staff and the affected communities' opinions regarding the application of e-governance initiatives and Mitigation measures in the pre-activity phase of FEMA in FCT;

Table 1: T- test Result of FEMA Staff and Community Members' Opinion on E-governance and Mitigation of Disasters in FCT

Group	Total	Mean	Std. dev.	T- test Result	$t_{critical}$	D.F.	P – Value
FEMA Staff	122	3.38	.3926	3.681	1.96	310	0.00
Community	188	2.97	1.088				

SOURCE**:**Author computation from SPSS (Version 25)

Interpretation of Results

An Independent Samples t-test was conducted to assess whether there was a statistically significant difference in the mean responses of FEMA staff and members of affected communities regarding the effectiveness of FEMA's e-governance tools in enhancing disaster mitigation efforts within the Federal Capital Territory (FCT). The results revealed a statistically significant difference in the opinions of the two groups. The mean rating of FEMA staff (M = 3.38, SD = 0.39) was notably higher than that of the affected community members (M = 2.97, SD = 1.09), resulting in a mean difference of 0.41**.** This suggests that FEMA staff generally agreed that e-governance tools have improved disaster mitigation efforts, whereas affected community members expressed less agreement. The t-test yielded a calculated t-value (t_{310}) **=** 3.681**,** which exceeds the critical t-value of 1.96 at the 0.05 level of significance. Additionally, the p-value = 0.000, which is less than the significance threshold of 0.05, further confirms the statistical significance of the result. Given these findings, the null hypothesis (H_0), which stated that there is no significant difference in the mean responses of FEMA staff and affected communities is rejected. Consequently, the alternative hypothesis (H_1) is accepted**.** This result implies that there is a significant divergence in perception between FEMA staff and disaster affected community members regarding the role of e-governance initiatives in disaster mitigation within the FCT. While FEMA personnel view these digital tools as effective in reducing disaster risks, the community members appear less convinced of their impact or effectiveness.

Hypothesis two

H_0 There is no significant difference in the mean rating of FCT Emergency Management Agency (FEMA) staff and the affected communities' opinions regarding the application of e-governance initiatives and Preparedness measures in the pre-activity phase of FEMA in FCT

Table 2: T- test Result of FEMA Staff and Community Members' Opinion on E-governance and Preparedness activities in FCT

Group	Total	Mean	Std. dev.	T- test Result	$t_{critical}$	D.F.	P – Value
FEMA Staff	122	3.10	.7218	9.84	1.96	310	0.00
Community	188	2.10	.9148				

SOURCE**:** Author computation from SPSS (Version 25)

Interpretation of Results

An Independent Samples t-test was conducted to examine whether a significant difference exists between the mean responses of FEMA staff and members of affected communities regarding the influence of e-governance on disaster preparedness in the Federal Capital Territory (FCT). The analysis revealed a statistically significant difference in the perceptions of the two groups. The FEMA staff reported a higher mean score (M = 3.10, SD =

0.72) compared to the affected community members (M = 2.10, SD = 0.91), resulting in a mean difference of 1.00**.** This suggests that FEMA personnel strongly believe that e-governance initiatives have enhanced disaster preparedness in the FCT, whereas the affected community members expressed considerable skepticism. The test produced a calculated t-value (t_{310}) = 9.84**,** which is well above the critical t-value of 1.96 at the 0.05 level of significance. Additionally, the p-value = 0.000**,** which is significantly less than 0.05, confirms the result's statistical significance. Based on these findings, the null hypothesis (H_0) which posited no significant difference between the two groups' responses is rejected, while the alternative hypothesis (H_1) **is** accepted**.** This result indicates a significant divergence in opinion between FEMA staff and disaster-affected communities regarding the effectiveness of e-governance tools in promoting disaster preparedness. While FEMA staff affirm the positive impact of such digital governance mechanisms, affected community members appear to hold contrasting views, potentially highlighting a gap in awareness, trust, or inclusiveness in preparedness strategies.

Hypothesis three

H_0: There is no significant difference in the mean rating of FCT Emergency Management Agency (FEMA) staff and the affected communities' opinions regarding the application of
e-governance initiatives and Response measures in the post-activity phase of FEMA in FCT.

Table 3: T- test Result of FEMA Staff and Community Members' View on E-governance and Response activities in FCT

Group	Total	Mean	Std. dev.	T- test Result	$t_{critical}$	D.F.	P – Value
FEMA Staff	122	3.67	.6873	14.86	1.96	310	0.00
Community	188	2.36	.8763				

SOURCE: Author computation from SPSS (Version 25)

Interpretation of Results

An Independent Samples t-test was conducted to evaluate whether there is a significant difference in the mean responses of FEMA staff and members of affected communities regarding the influence of e-governance on disaster response in the Federal Capital Territory (FCT). The analysis revealed a statistically significant difference between the two groups. FEMA staff reported a significantly higher mean score (M = 3.67, SD = 0.69) compared to the affected community members (M = 2.36, SD = 0.88), yielding a mean difference of 1.31**.** This indicates that FEMA personnel believe that e-governance initiatives facilitate timely and effective disaster response, while the affected communities do not share this perception. The calculated t-value (t_{310}) = 14.86 exceeded the critical t-value of 1.96 at the 0.05 level of significance, and the associated p-value = 0.000 was well below 0.05. These results confirm that the observed difference is statistically significant. As such, the null hypothesis (H_0) which stated that there is no significant difference between the perceptions of FEMA staff and affected community members is rejected. The alternative hypothesis (H_1) is therefore accepted. This finding implies a considerable perceptual gap between the implementing agency (FEMA) and the disaster-affected population regarding the responsiveness of FEMA's e-governance mechanisms. While FEMA staff affirm that digital tools have improved the agency's capacity to respond promptly to disasters, the affected communities appear to perceive a lack of adequate or timely intervention.

Hypothesis four

H_0: There is no significant difference in the mean rating of FCT Emergency Management Agency (FEMA) staff and the affected communities' opinions regarding the application of
e-governance initiatives and Recovery measures in the post-activity phase of FEMA in FCT.

Table 4. T- test Result of FEMA Staff and Community Members' Opinion on E-governance and Recovery activities in FCT

Group	Total	Mean	Std. dev.	T- test Result	$t_{critical}$	D.F.	P – Value
FEMA Staff	122	2.83	1.173	9.64	1.96	310	0.00
Community	188	1.70	.9769				

SOURCE**:** Author computation from SPSS (Version 25)

Interpretation of results

An independent samples t-test was conducted to examine whether there is a significant difference between the mean responses of FEMA staff and affected community members regarding the influence of e-governance on disaster recovery activities in the Federal Capital Territory (FCT). The results indicated a statistically significant difference between the two groups. FEMA staff reported a higher mean response (M = 2.83, SD = 1.17) compared to the affected community (M = 1.70, SD = 0.98), with a mean difference of 1.04**.** Notably, both groups expressed disagreement with the notion that FEMA's e-governance tools effectively facilitate disaster recovery activities in the FCT, although FEMA staff's responses were relatively more positive. This difference in perceptions was statistically significant, as the calculated t-value **(**t_{310} = 9.64**)** exceeded the critical value of 1.96 at the 0.05 significance level, and the p-value **(**p = 0.000**)** was less than 0.05. Consequently, the null hypothesis (H_0)**,** which posited no significant difference between FEMA staff and affected communities' views on e-governance and recovery activities, was rejected, and the alternative hypothesis (H_1) accepted. This outcome suggests that while both FEMA staff and affected community members perceive limitations in the effectiveness of e-governance for disaster recovery, there remains a significant divergence in the extent of their views. The findings underscore the need for further investigation and potential enhancement of e-governance strategies to improve recovery efforts and align perceptions between the agency and the community.

Discussion of Findings

This section critically analyses the findings derived from the research questions, organized around four key dimensions of disaster management: mitigation, preparedness, response, and recovery, with a focus on the role of E-governance initiatives by FEMA in the Federal Capital Territory (FCT). The discussion synthesizes the perspectives of both FEMA staff and the affected community, revealing critical disparities and areas for enhancement in the deployment and effectiveness of digital governance tools in disaster management.
E-governance Initiatives and Mitigation Activities (Pre-activity Phase**)**: The comparative analysis using an independent two-sample t-test reveals a statistically significant difference in perception between FEMA staff (mean = 3.38) and affected community members (mean = 2.97) regarding the effectiveness of FEMA's E-governance tools in disaster mitigation. FEMA staff generally hold a more favorable view, indicating institutional confidence in the existing systems, whereas the affected community remains comparatively skeptical. This disparity highlights a critical disconnect between governmental perceptions and grassroots realities. While 63%

of participants acknowledge the adequacy of government policies and their dissemination through electronic media, the community's relatively lower ratings suggest gaps in trust, accessibility, and meaningful engagement. This aligns with Oruonye et al. (2021), who observe that the presence of ICT policy frameworks alone does not guarantee their effectiveness unless accompanied by practical, ground-level engagement strategies. Notably, FEMA's reported 74% competence in identifying disaster-prone areas reflects a positive application of geospatial and risk assessment technologies. This is consistent with findings by Gancarczyk et al. (2023), who emphasize the role of Web-GIS and Decision Support Systems in mapping hazard-prone zones. However, they caution that the absence of localized implementation strategies and insufficient community involvement often undermines the full potential of such technologies. Further compounding the issue is the widespread dissatisfaction (85% disagreement) among both staff and community members regarding compliance with ICT-related safety protocols and the ineffectiveness of meteorological monitoring. These challenges likely stem from low ICT literacy, weak infrastructural support, and a lack of community-centered approaches—factors that Wolff (2021) identifies as central to the underutilization of participatory GIS and citizen science in disaster governance. Similarly, Chauhan et al. (2020) highlight that effective geospatial vulnerability mapping must be accompanied by deliberate stakeholder inclusion and infrastructural readiness to yield practical results. In this regard, FEMA's efforts, while technologically sound, remain constrained by implementation gaps that limit adoption, trust, and impact at the community level. To enhance disaster mitigation outcomes, FEMA must pivot toward a more inclusive, community-centric approach. This includes improving digital outreach, fostering ICT literacy, and reinforcing early warning systems. Without bridging the implementation and trust gap, even the most advanced e-governance tools will fall short of their intended impact.

E-governance Initiatives and Preparedness Efforts (Pre-activity Phase): The t-test shows a highly significant difference between FEMA staff (mean = 3.10) and community members (mean = 2.10) regarding the perceived role of E-governance in disaster preparedness, with a large mean difference of 1.00. FEMA personnel express strong confidence in ICT tools and capacity-building efforts, while the affected community expresses notable dissatisfaction. A striking finding is the unanimous (100%) dissatisfaction from both groups concerning the adequacy of FEMA's risk assessment and hazard analysis tools, and a similar unanimous concern about the early warning systems. This dual agreement on inadequacy signals systemic weaknesses that transcend perception gaps and point to real infrastructural and operational deficits. These findings are aligned with Ogundele et al. (2013), who documented similar deficiencies in emergency agencies at the state level. Moreover, the split perceptions on disaster monitoring (45% FEMA agreement vs. 73% community disagreement) further highlight insufficient disaster preparedness efforts at local and state levelsThis disparity underscores the need for inclusive planning and robust integration of community feedback into preparedness strategies, reflecting broader challenges observed in regions like Nigeria's South-South market areas. For instance, recent interventions by the Edo State Emergency Management Agency (EdoSEMA) illustrate how people-centred governance, through engagement with market associations, traditional leaders, and grassroots institutions, has enhanced disaster preparedness and risk communication in vulnerable local government areas (The Nigerian Observer, 2025). Such participatory models not only validate the call for localized feedback mechanisms but also demonstrate their viability in addressing systemic deficits in emergency response and ICT trust-building. Recent empirical studies reinforce these concerns. For example, the Inform@Risk project in Medellín, Colombia (UNDRR, 2024), revealed that community trust and the effectiveness of early warning systems improve significantly when ICT tools are co-developed with local residents. This directly parallels the perception gap seen in FEMA's preparedness systems. Similarly, Coulibaly et al. (2020) documented how an impact-based flood early warning system along Niger's Sirba River successfully combined top-down hydrological models with bottom-up community thresholds, enhancing adoption and understanding. Further evidence from Nigussie et al. (2025) in Ethiopia shows that

involving communities in disaster data collection through citizen science substantially increases preparedness, system ownership, and local relevance. These studies validate the view that ICT tools and risk frameworks are only as effective as their social adoption, contextual fit, and perceived reliability among end-users. FEMA should intensify investments in modern ICT tools for hazard mapping, risk communication, and early warning systems. However, these tools must not be developed in isolation. The studies above affirm that capacity-building efforts must be complemented with inclusive, community-tailored training and participatory technology adoption programs. Incorporating citizen voices into both the design and implementation stages of digital preparedness systems is crucial to building resilient and trusted E-governance frameworks.

E-governance Initiatives and Response Activities (Post-activity Phase): Findings indicate a significant difference in perceptions of FEMA's e-governance response capabilities (mean difference = 1.31), with FEMA staff rating their digital response mechanisms higher than community members. While a majority (64%) agree on the effectiveness of FEMA's website for data storage and dissemination, concerns remain regarding the emergency hotline's effectiveness and the promptness of online contact agents, with both groups expressing 64% disagreement about responsiveness. This divergence reveals critical weaknesses in real-time communication and emergency contact facilitation. This aligns with findings by Kasim and Oyerinde (2021), who observed that although Nigeria's National Emergency Management Agency (NEMA) actively posted on Facebook during disasters, it lacked proactive use of social media before emergencies, largely due to insufficient training and institutional policy gaps—mirroring the current findings on hotline inefficacy and slow agent response. Additionally, the consensus on the inadequate presence of ICT-equipped local response units in some area councils suggests institutional bottlenecks limiting decentralized disaster response effectiveness. This is consistent with Tolessa et al. (2024), who found that while decentralization of disaster risk management in Ethiopia's Oromia region enhanced local accountability, it remained hindered by coordination issues and limited capacity at the district level. Despite progress in digital infrastructure, such accessibility and operational delays hamper rapid response, a vital phase where speed is essential. Evidence from Lagos during the COVID-19 pandemic further supports this, as Oni and Peter (2022) show that social media platforms like Twitter and WhatsApp significantly enhanced real-time public engagement and trust when used actively by government agencies and influencers. This underscores the potential for FEMA to boost responsiveness and community engagement by adopting similar mobile and social strategies.

E-governance Initiatives and Recovery Efforts (Post-activity Phase): The significant mean difference of 1.04 between FEMA staff (mean = 2.83) and the community (mean = 1.70) highlights starkly contrasting views on the effectiveness of E-governance in recovery. Both groups share dissatisfaction with the adequacy of ICT personnel and field officers supporting recovery operations (49% FEMA disagreement, 59% community disagreement), signaling a critical shortage of skilled human resources. This concern aligns with Sun et al. (2021), who argue that the effectiveness of disaster recovery is highly dependent on the proactive mobilization of trained human resources, including ICT specialists. There is unanimous (100%) rejection of FEMA's preference for manual search and rescue methods over technology-driven approaches, which runs counter to global trends promoting ICT integration in recovery (Lama & Pradhan, 2018). This position is further supported by Habibi, Ivaki, and Barata (2025), who demonstrate that drone-assisted emergency services and other automated technologies significantly outperform manual search and rescue efforts in speed, safety, and coverage, underscoring the urgency for FEMA to modernize. Further, the division over the effectiveness of digital humanitarian and relief efforts, with 66% FEMA staff expressing agreement contrasted by 71% community skepticism, indicates serious concerns over transparency, equity, and trust. These concerns resonate with Musa, Magaji, and Ibukuoluwa (2025), whose research in the Nigerian context highlights the importance of integrating financial inclusion and digital tracking systems into humanitarian relief to ensure transparency and equitable distribution. These findings

also reinforce Oruonye et al. (2021)**,** who emphasize that FEMA's relief allocation is often reactive and tied to the magnitude of loss. The community's distrust is compounded by differing opinions on digital transparency regarding donor and beneficiary disclosures, echoing Ogundele et al.'s (2013) critique of opaque practices in state-level agencies.

Conclusion

The study reveals a consistent and significant disparity between the perceptions of FEMA staff and the affected community regarding the effectiveness of FEMA's e-governance initiatives across all phases of disaster management—mitigation, preparedness, response, and recovery—in the Federal Capital Territory (FCT). While FEMA personnel generally maintain a favorable view of the agency's ICT tools and strategies, the affected communities tend to express skepticism and dissatisfaction, particularly regarding the accessibility, timeliness, and adequacy of digital disaster management resources. During the mitigation phase, although FEMA staff believe that government policies and communication through e-governance platforms are sufficient and effectively disseminated, challenges remain in fostering citizen compliance with ICT-based safety regulations. Additionally, the agency's capacity for real-time disaster forecasting and meteorological monitoring is still inadequate. To bridge this gap, FEMA should enhance community compliance and ICT usage by initiating targeted education programs and participatory engagement strategies. Such initiatives would improve understanding and adherence to mitigation policies, thereby increasing overall disaster resilience.

In the preparedness phase, a striking divergence of views was observed. FEMA personnel expressed confidence in existing ICT tools and staff training, whereas the affected communities unanimously viewed FEMA's early warning systems and risk assessment mechanisms as ineffective. This gap underscores systemic weaknesses in both capacity and infrastructure. To address this, FEMA must prioritize upgrading its ICT tools and early warning systems by adopting advanced risk analysis technologies, improving early warning communication channels, and conducting continuous training for personnel. These improvements will help align internal confidence with public trust and expectations. Regarding the response phase, FEMA's digital infrastructure, particularly in data storage and dissemination through websites, has shown encouraging progress. Nevertheless, concerns persist about the responsiveness of emergency hotlines, online contact systems, and the adequacy of local response units. These weaknesses point to limitations in the coordination and accessibility of response efforts. Improving digital infrastructure accessibility and establishing well-equipped, ICT-enabled response units across all area councils will significantly enhance timely disaster response and reduce the disconnect between institutional performance and community perception.

In the recovery phase, both FEMA staff and community members voiced concerns about inadequate ICT personnel and continued reliance on manual methods for search and rescue operations. Moreover, a lack of trust in FEMA's digital humanitarian efforts and perceived transparency deficits hinder effective post-disaster recovery. Addressing these challenges requires the integration of transparent digital monitoring and reporting systems for relief distribution. Furthermore, adopting technology-driven recovery methods in place of manual processes will improve efficiency, accountability, and community confidence in FEMA's recovery operations. In summary, the findings highlight the urgent need to improve the integration of ICT across FEMA's disaster management framework. This should be supported by increased investment in digital infrastructure, inclusive stakeholder engagement, enhanced training programs, and a commitment to transparency. Doing so will not only close the perception gap between FEMA personnel and the communities they serve but also strengthen institutional credibility and public resilience in the face of recurring disasters.

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