Emerging Technologies and Disaster Management in Radio Ishingiro: A Descriptive Study of Digital Anthropology in Tandem with Social Communication

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Abstract: *This study aimed at examining the emerging technologies used by Radio Ishingiro in disaster management. The study used the descriptive research design. The target population under this study included employees of Radio Ishingiro and some stakeholders in their coverage zone of Gicumbi. The sample size under this study was made up of 20 respondents determined through the purposive sampling technique. As far as the data collection is concerned, the primary data were collected from the field using questionnaire, interview, and observation techniques; while the secondary data were collected using documentation technique. Concerning the data analysis, the quantitative data were analyzed by statistical technique, while the qualitative data were analyzed using content analysis technique. The study found out that the use of emerging technologies by Radio Ishingiro improved the disaster management in Gicumbi District, as 25% of the respondents stated that Radio Ishingiro improves its role in disaster management by broadcasting more educational programs on disaster preparedness; 25% of the respondents assert that Radio Ishingiro improves its role in disaster management by feature interviews with local experts and community members; 20% of the respondents stated that Radio Ishingiro improves its role in disaster management by providing clear instructions; while 15% of the respondents argue that Radio Ishingiro improves its role in disaster management by increasing its reach to remote areas. The study concluded that emerging technologies contribute positively in improving disaster management in rural areas of Gicumbi District.*

Keywords: *Emerging technologies, Disaster Management, Radio Ishingiro, Digitalization, Anthropology, Social Communication*

List of Acronyms and Abbreviations: *AI-Artificial Intelligence, DM-Disaster Management, IoT-Internet of Things*

1. INTRODUCTION

Gicumbi District as a mountainous area faces the disasters like floods, landslide, and drought. In fact, those disasters have negative effects on the communities like the loss of human lives, injury or other health impacts, property damages, loss of livelihoods, social and economic disruption, or environmental damages (Kumar& Jan 2018). Those effects are encouraged by the poor information about disaster management influenced by inappropriate social communication. Moreover, the disaster management is not well known by the community due to limited use of emerging technologies on disaster management.

Despite the disasters occurred in Gicumbi, disaster management (DM) has received little attention from the interdisciplinary accounting community (Wallace &Balogh, 2018). A key aspect of DM theory and practices is related to the information systems such as Internet of Things (IoT), machine learning, artificial intelligence (AI), remote sensing, cloud computing, social media communication (Goolsby2010), used to support decision-making and to measure, manage and report the performance of the whole DM cycle.

In Rwanda, community radios like Ishingiro Radio play a key role in informing the community and developing their capacities of copying with digital information. The exchange of information and cooperation at the household level is the core idea of emerging technologies (Cottle 2014). The

quality and characteristics of the information communicated is determined by the medium of transmission. The digitalization of information plays a stellar role in building disaster resilient communities through encouraging the community participation and providing a chance to be change-makers.

2. MATERIALS AND RESULTS

The target population of this study was made of employees of Radio Ishingiro and some stakeholders in their coverage zone of Gicumbi District. The research took a sample of 20 respondents who were available during the period of data collection, selected through the purposive sampling technique. In addition to the questionnaire distributed to the respondents, we also conducted the interviews to collect the primary data on the field.

The technique of documentation with analytical method were carefully used to understand and analyze the secondary data and their link with the primary data.

Corroborating with Holdaway (Holdaway 2001), data processing referred to the transformation of the respondents 'views and the secondary data into the meaningful information. In this research, both quantitative and qualitative methods were used in data analysis.

2.1. Digital Anthropology and Emerging Technologies

Digital anthropology, being a study of the relationship between humans and digital era technology, in this research Radio Ishingiro and its beneficiaries were targeted. Since emerging technologies can have different meanings when used in different areas, such as media, business, science, or education (Adner & Levinthal 2021), in this study, it was considered only in media and social communication. Disaster management on the other side can be understood as how we deal with the humans, material, economic or environmental impacts of said disaster. In this study, we took into consideration the technologies used in social communication in the process of how we "prepare for, respond to and learn from the effects of major failures" (Adner & Levinthal 2021).

The research found that 50% of the respondents were between 31 and 40 years old; 45% of the respondents were between 20 and 30 years old; while 5% of the respondents were between 41 and 50 years old. This means that the majority of respondents were mature enough to provide relevant information about the topic.

The research found that 60% of respondents were males; while 40% of respondents were females. This implies that both men and women had the complementary opinions.

The research found that 5% had the master' degree, 40% of the respondents had the bachelors' degree (A0); while 55% of the respondents had the certificate of secondary school education (A2). Based on these qualifications, the respondents could provide relevant information.

2.2. Radio Ishingiro in Digitalization and the Use of Emos in Disaster Management

Social communication is a crucial aspect of disaster management, involving the active participation of communities in preparedness, response, and recovery efforts (Kumar & Jan 2018). Radio stations and their embedded technologies (Meier 2015) play a pivotal role in this process by disseminating information, fostering community engagement, and coordinating responses.

In this study, 25% of our respondents believe that broadcasting more educational programs on disaster preparedness improved the station's effectiveness. This approach helped raise awareness and educate the community on how to respond to various types of disasters. In addition, 20% of respondents emphasized the importance of providing clear instructions during broadcasts. Clear and concise instructions are crucial during emergencies to ensure that community members know exactly what actions to take (Meier 2015). 15% of respondents noted the need for increasing the station's reach to remote areas. Extending the broadcast range of Radio Ishingiro would ensure that even the most isolated communities receive timely and relevant information which is vital for effective disaster management (Luna 2015). The role of radio in disaster management has evolved significantly with the advent of emerging technologies. Traditional radio broadcasting (Adger 2006), once limited to simple audio transmissions, now integrates various advanced technologies to enhance social communication, information dissemination, and disaster management. The following are the emerging technologies used by Radio Ishingiro in their social communication and mainly used in disaster management.

2.3. Digital Broadcasting and Narrowcasting

Digital broadcasting technologies have revolutionized how radio stations operate during disasters. Digital Audio Broadcasting (DAB) in radio Ishingiro allows reaching the community with higher audio quality of information (World DAB, 2020) what increased the social communication services. Narrowcasting, which involves targeting broadcasts to specific geographic areas (Reed 2019), ensured that relevant information comes from a tour of a certain area towards the central services.

2.4. Internet Radio and Streaming

Internet radio and streaming services used by radio Ishingiro fosters the social communication. Internet radio via smartphones (Limbu 2016) combined with WhatsApp and YouTube disseminated messages and videos which reach even lower people in rural areas via oral communication. The integration of social media and mobile applications with internet radio platforms (Saragih&Arif 2019) brought the information related to disaster management to the community in a while of time.

2.5. Mobile Radio Apps

The development of mobile radio applications has significantly enhanced the ability of radio stations to manage disasters. With the social media communication, live streaming, disseminated timely information (Graham 2018) to the community. Video and photos taken from the field, sent and disseminated through smartphones facilitate the social communication and anthropologically, even people unknowledgeable in ICT were involved with the knowledgeable ones.

2.6. Radio Frequency Identification (RFID) and Geographic Information Systems (GIS)

RFID technology and GIS embedded in radio stations (Yin et al. 2015), contributed in disaster management. The feedback from the beneficiaries, interviews from the fields have been coordinated to the headquarters from the remote areas (Goodchild 2020).

2.7. Artificial Intelligence (AI) and Machine Learning

Radio stations have been empowered by AI and played a key role in disaster management. These technologies analyzed vast amounts of data from various sources, such as social media, weather reports, and sensor networks, to enhance the disaster management (Berawi et al. 2020). AI-driven analytics of weather stations produced reports and shared them with radio stations so that they can provide the most relevant and timely information, improving community awareness of disaster management.

2.8. Emerging Technologies in Disaster Management

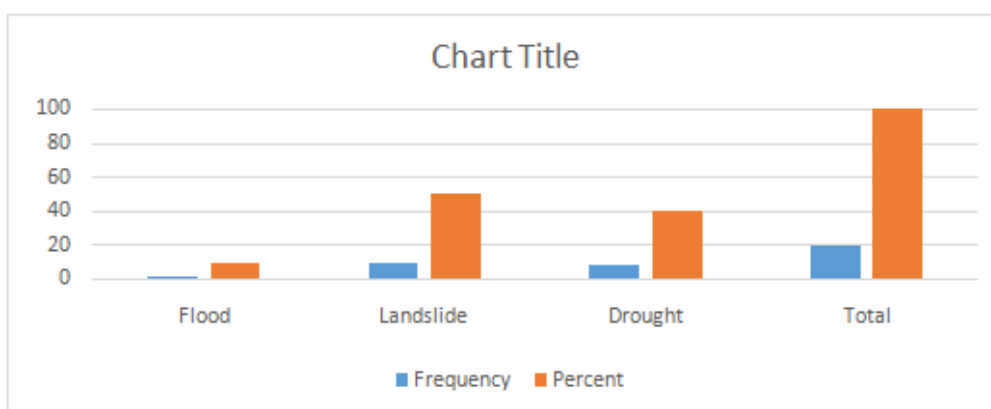The following graph shows the types of disasters experienced in Gicumbi District.

**Fig1.** *Disasters mitigated by Emerging technologies of Radio Ishingio*

The findings illustrate the types of disaster experienced in Gicumbi District. The research found that 40% of the respondents mentioned drought; 50% of the respondents asserted that landslide is the disaster experienced in Gicumbi District; and 25% of the respondents mentioned flood.

Emerging technologies used by radio Ishingiro play significant role in disaster management through promoting preparedness, warning and rehabilitation programs before (Adner & Levinthal 2021), during and after any disaster in community what increased at the same time the digital knowledge of

people (Adger 2006). Being informed about the disaster, young people from some areas form volunteer groups (Alexander 2014) and work with radio stations spreading information, through social media (mainly WhatsApp and twitter), of how the situation is on the field.

2.9. Emerging Technologies and Social Communication

The Radio Ishingiro improved its services requiring the new technologies and EMoS. Specifically, in disaster management, the programs of Radio Ishingiro often involved interactive communication where the audience can call asking questions or providing their comments. Radio stations also organize live broadcasts from community which not only have the purpose of raising the digital awareness related to social communication but also encourage active participation in disaster management (Reuter & Kaufhold 2018).
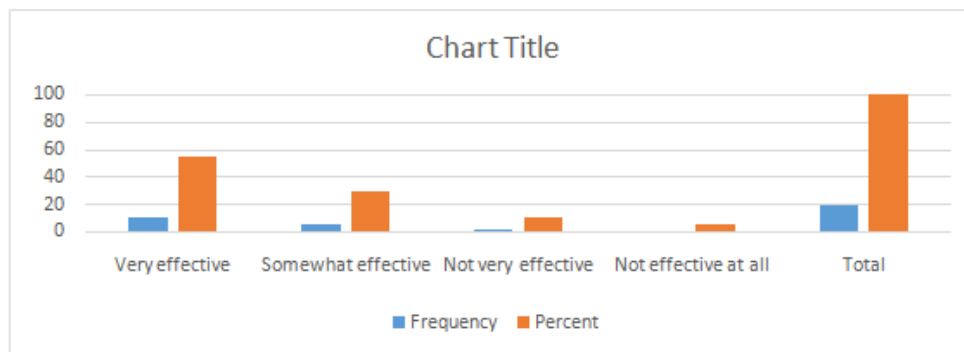

Fig2. *Effectiveness of Radio Ishingiro and its technologies*

The findings from the graph 2 illustrate the effectiveness of Radio Ishingiro with its embedded emerging technologies in mobilizing the community during disaster. From these results, 55% of the respondents agree that Radio Ishingiro is very effective in mobilizing the community during disaster; 30% argue that Radio Ishingiro is somewhat effective in mobilizing the community during disaster, while 10% of the participants say that Radio Ishingiro is not very effective in mobilizing the community during disaster. 5% of the respondents said that Radio Ishingiro is not effective at all in mobilizing the community during disaster. This is because in remote areas, some people don't have the radio devices.

Despite the above statistics, building community resilience is a long-term goal of social mobilization activities conducted by radio stations. This involves educating the public about disaster risks and emerging technologies, preparedness measures, and resilience strategies. Radio programs focused on resilience building often include information on constructing disaster-resistant homes, creating emergency plans, and understanding climate change impacts (Cozzolino Rossi &Conforti 2012). Collaborative efforts ensure a unified approach to disaster management, enhancing the overall effectiveness of social mobilization (Yates & Paquette 2011).

In addition, the respondents were asked how can Radio Ishingiro further improve its role in social communication for disaster management in Gicumbi District as indicated by the graph below:
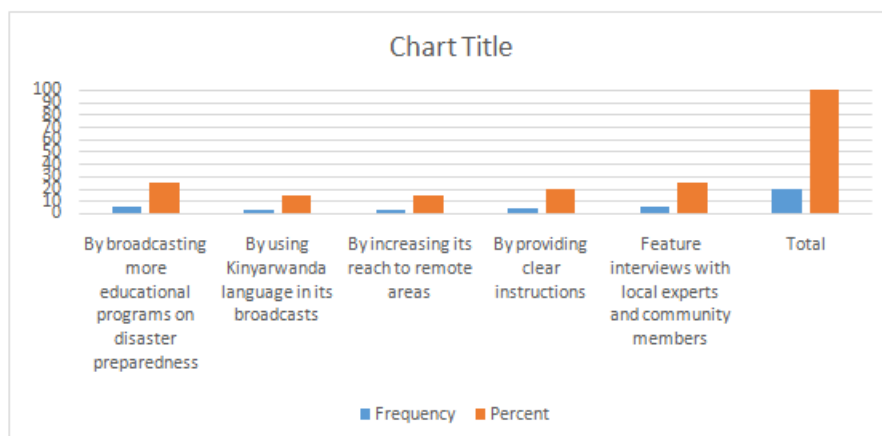

Fig3. *Digital social communication*

The findings from the above graph illustrate how Radio Ishingiro further improves its role in social communication for disaster management in Gicumbi District. According to the results, 25% of the respondents argue that Radio Ishingiro improves its role in disaster management by broadcasting more educational programs on disaster preparedness; 25% of the participants stated that Radio Ishingiro improves its role in disaster management by featuring interviews with local experts and community members. 20% of the respondents said that Radio Ishingiro improves its role in disaster management by providing clear instructions; while 15% stated that Radio Ishingiro improves its role in disaster management by using Kinyarwanda language in its broadcasts. 15% of the respondents acknowledge that Radio Ishingiro improves its role in disaster management by increasing its reach to remote areas. Thus, these results show that Radio Ishingiro with its digital equipment improves its social communication in disaster management.

Besides, during the interviews one community leader noted, "Radio Ishingiro has been instrumental in keeping us informed about weather warnings and safety measures during floods and landslides." Another resident added, "The station broadcasts in our local language, which ensures everyone understands the instructions." Disaster management officials praised the radio for its role in coordinating relief efforts, stating, "The radio station helps us reach remote areas quickly and efficiently, mobilizing volunteers and resources." Additionally, the interactive programs and call-in segments allow residents to share real-time updates and concerns, fostering a sense of community and collective action. Overall, the integration of emerging technologies in Radio Ishingiro has significantly enhanced the digital awareness in terms of disaster preparedness, response, and recovery efforts in Gicumbi District.

2.10. Digital Challenges Faced by Radio Ishingiro in Social Communication during Disasters

Radio stations broadcast educational programs that provide listeners with information on how to prepare for disasters, developing family emergency plans, and identifying safe locations (Silver, B. 2014). By consistently broadcasting these messages, radio stations helped build a culture of preparedness within the community (Vieweg et al. 2010).

The following graph presents the digital challenges faced by Radio Ishingiro in reaching the community during disasters in Gicumbi District.
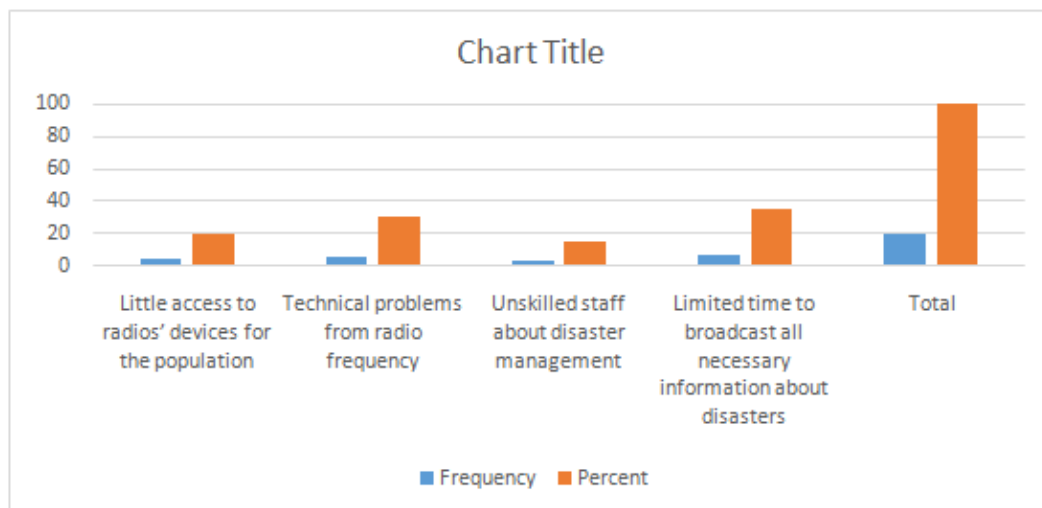
Fig4. *Digital challenges faced by Radio Ishingiro*

The graph above presents the challenges that Radio Ishingiro faces in reaching the community during disasters. The findings show that 35% of the respondents stated that Radio Ishingiro had limited time to broadcast all necessary information about disasters; 30% argue that Radio Ishingiro faced technical problems from radio frequency. 20% of the respondents said that Radio Ishingiro experienced little access to radios' devices for the population; while 15% of the respondents stated that Radio Ishingiro had not enough skilled staff about disaster management. This implies that Radio Ishingiro faced several digital challenges when managing disasters, and therefore, the outcomes of digital anthropology were limited.

Despite the challenges, Radio stations play a key role in issuing timely warnings and providing continuous updates (Shklovski et al. 2008). The principle of timeliness ensures that communities receive the information they need to make immediate and informed decisions (White et al. 2009) during a disaster.

2.11. Scarcity of Technologies in Reaching the Community during Disasters

One of the fundamental principles of social communication is inclusivity, ensuring that all community members are informed (Comfort et al. 2012). Radio stations achieve this by broadcasting in multiple languages and dialects, making information accessible to diverse populations.

The most prominent challenge, noted by 35% of respondents, is the limited broadcasting time available to disseminate all necessary disaster-related information. This constraint hindered the station's ability to provide comprehensive coverage and timely updates, essential during emergencies. Additionally, 30% of respondents highlighted technical problems with radio frequency, which impeded the clarity and reach of broadcasts, especially in remote or difficult-to-access areas. These technical issues resulted in critical information not reaching those in need, thereby reducing the effectiveness of disaster communication (Gao et al. 2011). Despite the above problems, emerging technologies tried to help in forecasting availability of disaster like heavy rain and emerging technologies helped in continue linkage with government control room (Westerhoff, et al., 2018) through its weather stations.

The respondents were also asked a question on how Radio Ishingiro overcomes the challenges it faces in reaching the community during disasters. Mitigation aims at minimizing the loss of human lives that would result from a disaster. Both structural and nonstructural measures may be taken (Lettieri & Radaelli 2009).
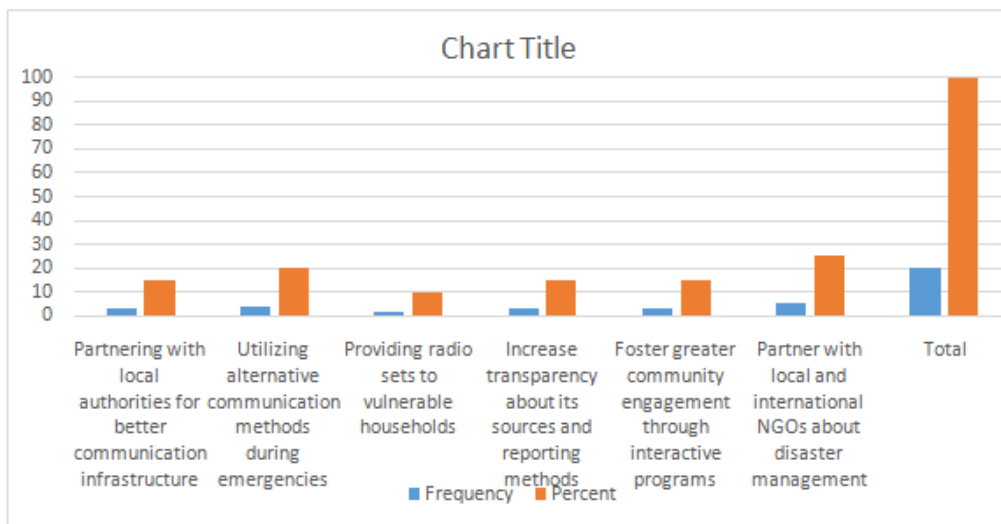
Fig5. *Tentative Solutions to digital challenges*

The graph above presents solutions to overcome challenges faced by Radio Ishingiro in reaching the community during disasters in Gicumbi District. 25% of the respondents stated that Radio Ishingiro partners with local and international NGOs about disaster management; 20% of the respondents asserted that the radio utilizes alternative communication methods during emergencies. 15% of the participants argue that radio Ishingiro work together with local authorities for better communication infrastructure; and 15% said that the radio increases transparency about its sources and reporting methods. 15% of the respondents argued that this radio fosters greater community engagement through interactive programs; while 10% of the respondents asserted that radio station provides radio sets to vulnerable households. Although there were many challenges, Radio Ishingiro tried to find several solutions to overcome them in reaching the community during disasters in the area of our study.

3. CONCLUSION

Disasters in Gicumbi District have deep socio-economic impacts, affecting various aspects of community life. Radio Ishingiro and its embedded emerging technologies have emerged as a crucial

tool in disaster management within Gicumbi District, significantly contributing to social communication efforts. The research found that 25% of respondents recognized the station's role in broadcasting educational programs on disaster preparedness. Effective communication with new technologies is key during disasters, and Radio Ishingiro's ability to provide concise, actionable instructions helped guide community members on safety measures. The reach of Radio Ishingiro to remote areas, as noted by 15% of respondents, ensures that even the most isolated communities receive timely and relevant information.

Despite its significant contributions, Radio Ishingiro faces several digital challenges that hinder its effectiveness in social communication for disaster management. The research identified that 35% of respondents believe the station has limited time to broadcast all necessary disaster-related information. This time constraint led to critical gaps in communication, where not all-essential information reached the community in a timely manner.

Digito-technical problems with radio frequency, noted by 30% of respondents, present another substantial challenge. Additionally, 20% of respondents pointed the limited access to radio devices among the population. This barrier highlights the need for initiatives to distribute radios, especially in underserved and remote communities to raise their digital awareness. Ensuring that all households have access to a radio is crucial for maximizing the station's impact.

To conclude, Radio Ishingiro plays a vital role in mitigating disaster impacts through effective social mobilization, providing education, clear instructions, and fostering community engagement. However, to maximize its potentialities, addressing the challenges of limited broadcast time, technical issues, access to radio devices, and staff training is imperative. By overcoming these obstacles, Radio Ishingiro can enhance its contribution to disaster management, ensuring that all community members are informed on time, prepared, and resilient in the face of disasters.

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