eDROMIS: ENHANCING DISASTER RESPONSE THROUGH MONITORING AND INFORMATION MANAGEMENT WITH GIS INTEGRATION

Czarina Ancella Guasa Gabi[1*], Cyrille Ford Mulaan[2], Vanessa Larita[3]

Abstract – *The electronic disaster response operations monitoring information system is a web-based platform designed to help collect, consolidate, organize, and present post-disaster data. It aimed to address the increasing need for accurate and timely data as a reference for decision-makers in disaster response operations. The iterative waterfall model was used to develop the system. ISO 25010 software quality evaluation results indicate that the system has met the users' needs and requirements and improved their productivity, job performance, and effectiveness. The high ratings for user acceptance indicate high acceptability. To enhance the developed system, integrating short messaging system notifications for aid requests is recommended to facilitate timely receipt and prompt response. Moreover, expanding this functionality to encompass a broader scope, including regional and national levels, can further optimize disaster response efforts.*

Keywords: disaster response, geographic information systems (GIS), ISO 25010, OpenStreetMap.

I. INTRODUCTION

The Philippines is one of the countries most susceptible to the effects of climate change and natural disasters [1]. The government has experienced significant loss of life, displaced thousands of individuals, and damaged the economy due to floods, typhoons, volcanic eruptions, and earthquake [2]. Southern Leyte, Philippines, is among the provinces most susceptible to earthquakes due to an active volcano and the Philippine fault line crossing the eastern part of the province. Moreover, due to its geographical location facing the Pacific Ocean, numerous weather disturbances are experienced annually. In 2021, the onslaught of super typhoon Odette, internationally known as typhoon Rai, in the province resulted in 13 deaths and massive destruction, rendering thousands of families homeless, with over twenty-eight thousand individuals temporarily residing in evacuation centers [EC] [3].

The frequency and intensity of disasters have heightened the need for efficient and effective disaster response operations. The availability of timely and accurate information for disaster response is essential [4]. Information systems (IS) have played a vital role in the information exchange that local governments need [5]. IS also improves situational awareness, which is critical for effective decision-making and coordination during disaster response operations [6, 7]. The advancements in IS include the integration of geographic information systems (GIS), which provides tools for map generation, data integration, and support during the various phases of a disaster, including the identification of the best evacuation routes, the distribution of aid to the affected communities, and monitoring response efforts [8]. OpenStreetMap (OSM), a free and open geospatial data crowd-sourced mapping tool, has revolutionized how data is collected, shared, and presented and has proven great potential in disaster management [9, 10].

Republic Act No. 10121 [11] defines disaster response as the 'provision of emergency services and public assistance during or immediately after a disaster to save lives, reduce health impacts, en-

[1,2,3]Southern Leyte State University, Philippines
*Corresponding author: cgabi@southernleytestateu.edu.ph

Received date: 03rd July 2024; Revised date: 17th September 2024; Accepted date: 26th September 2024

sure public safety, and meet the basic subsistence needs of the people affected. Disaster response predominantly focuses on immediate and short-term needs and is sometimes called 'disaster relief' [11]. To effectively provide for the necessities of the affected families, the Department of Social Welfare and Development (DSWD), through Memorandum Circular No. 20, series of 2019 [12], provides a disaster response operations monitoring center (DROMIC) reporting guideline that serves as a crucial roadmap for disaster response in the Philippines. This reporting guideline aims to standardize data collection, reporting, and dissemination procedures throughout the disaster management cycle.

Despite the country's vulnerability and susceptibility to disasters, limited information technology (IT) solutions were developed for disaster response to provide DSWD with a tool to facilitate prompt and efficient delivery of immediate needs to the affected communities. One is the community-based management information system (MIS) for disaster management in the Philippine setting [13]. This study developed MIS, comprising modules like community registration, emergency evacuation, search and rescue, donation management, weather forecasting, live data visualization, and GIS. While this study offers an innovative solution, the data collected from individuals does not align with the DROMIC reporting guidelines, a reportorial requirement of DSWD.

In the remote province of Southern Leyte, Philippines, the Municipal Social Welfare and Development Office (MSWDO) in Bontoc, responsible for disaster response operations, still relies on the traditional method of collecting data with paper and pen, followed by manual entry into spreadsheet software. This methodology poses significant challenges as it is prone to errors and lacks scalability [14]. This method is also susceptible to the risk of misplacement or damage, which can compromise the integrity and availability of the data. Additionally, retrieving needed data from physical documents can be time-consuming, impeding timely decision-making and response efforts [15].

To meet the increasing demand for precise and up-to-date information, there is a need to ensure that the DROMIC reports are prepared correctly and efficiently. Thus, the electronic disaster response operations monitoring system (eDROMIS) was designed to establish a web-based platform to collect data on affected individuals within and outside the evacuation centers. The data collected include the names of household heads and their members and their demographics (age, sex, solo parent, pregnant, IPs, lactating mother, senior citizen, PWD, 4Ps beneficiary, and others). eDROMIS streamlines searching and updating records as needed, even before a calamity strikes. Furthermore, the system generates various informative reports, including lists of affected individuals by barangay, impacted residences, lifeline statuses, and vital statistics, aiding in informed decision-making and resource allocation. Additional system features include recording and distributing received donations and soliciting necessities for affected families. Local weather data available on the internet is also integrated into the system. Moreover, visualizing data through map overlays and integrating datasets such as evacuation centers and essential data onto OSM empowers local authorities to access critical metrics via a dashboard, facilitating monitoring and aiding in planning and decision-making processes.

II. METHODS

A. Research design

This study employed the developmental-evaluative approach, as outlined by Patton [16]. This approach leverages systems thinking to foster innovation by collecting and analyzing real-time data. It supports informed, iterative decision-making throughout the design, development, and implementation stages, ensuring continuous improvement and responsiveness to emerging needs.

The study utilized the modified waterfall model (Figure 1) as the software development

lifecycle methodology for this study. This approach followed the phases, including requirement gathering, design, implementation, testing, and operation and maintenance. This improved version solves the limitations of the traditional waterfall model and allows developers to return to previous phases of development to make adjustments should the need arise.

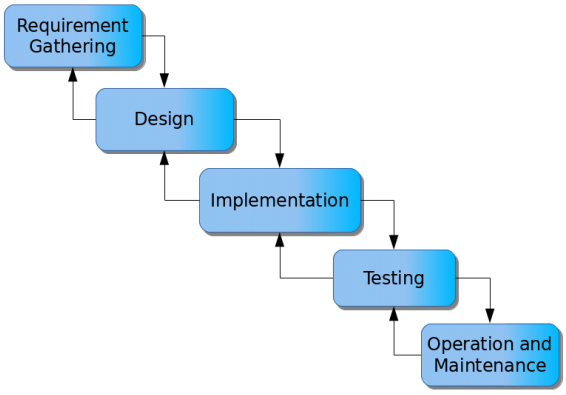

Fig. 1: Modified waterfall model

The first phase of the model is the requirement gathering. This phase involved identifying the software and hardware prerequisites for the system's functionality. To gain valuable insights into disaster response operations, informal interviews were conducted with MSWDO personnel, and sample reports were collected. Furthermore, the researchers used the DROMIC reporting guideline to identify the data to be collected for the system's functionality.

The next phase, design, established the foundation for the project by creating a comprehensive blueprint. It included detailed descriptions of procedural design, data dictionary, user interface design, and other relevant diagrams. Figure 2 illustrates the functional decomposition diagram of eDROMIS, delineating the system into smaller components and the functionalities for each type of user. Following this, the implementation phase involved the actual development of eDROMIS based on the requirements and designs specified in the earlier stage. It involved translating the design specifications into executable code, building and configuring the software components, integrating various modules, and conducting testing to ensure the system functions as intended.

The testing phase came next which included the conduct of unit testing with each component of eDROMIS tested for correctness. The MSWDO personnel and IT experts systematically tested each component using crafted test scripts. These scripts provided detailed instructions and scenarios to assess the functionality of individual units within the system to ensure that all components perform correctly and identify defects early in the development process. Furthermore, system testing ensured that all components or modules worked harmoniously as a unified system.

The final phase, operation, and maintenance, involved the deployment of eDROMIS. Currently, efforts are underway to formalize the adoption and utilization of eDROMIS. To maintain the system's smooth operation and address unforeseen errors during earlier development and testing stages, the system will undergo regular monitoring and maintenance. This ensures the system's reliability and provides opportunities for periodic updates and enhancements to improve eDROMIS over time.

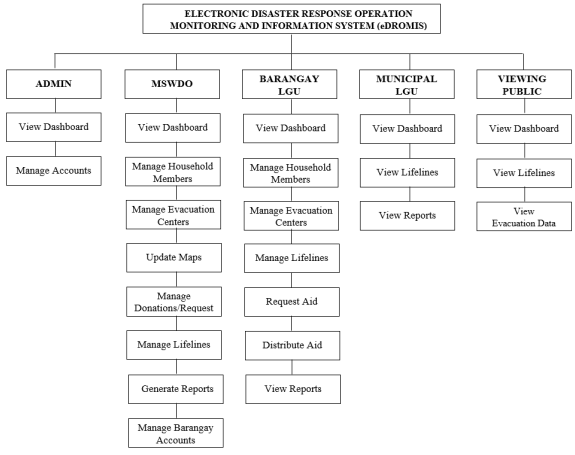

Fig. 2: Functional decomposition diagram

B. Research instrument

The target users evaluated the system using the ISO 25010 quality model as the standard

framework to assess its functionality, efficiency, compatibility, usability, reliability, security, maintainability, and portability. The limits of scale and the qualitative description for the technical evaluation for the developed system was presented from Table 1 to Table 8. In addition to the technical assessment, understanding user experiences and satisfaction is crucial for the successful adoption of eDROMIS. An adapted version of Davis' [17] user acceptance survey was used to gather these insights. This survey evaluated the system's perceived ease of use and usefulness, providing valuable feedback on how effectively eDROMIS meets user needs. The respondents are presented with five responses, ranging from Strongly disagree (1) to Strongly agree (5). Table 9 presents the interpretation guide for the user acceptance evaluation.

Table 1: Limits of scale for functional indicator

Limits of scale	Qualitative description
4.21 – 5.00	Fully functional
3.21 – 4.20	Mostly functional
2.61 – 3.20	Functional
1.81 – 2.60	Slightly functional
1.00 – 1.80	Not functional

Table 2: Limits of scale for efficiency indicator

Limits of scale	Qualitative description
4.21 – 5.00	Very efficient
3.21 – 4.20	Mostly efficient
2.61 – 3.20	Efficient
1.81 – 2.60	Slightly efficient
1.00 – 1.80	Not efficient

Table 3: Limits of scale for usability indicator

Limits of scale	Qualitative description
4.21 – 5.00	Very usable
3.21 – 4.20	Mostly usable
2.61 – 3.20	Usable
1.81 – 2.60	Slightly usable

Table 4: Limits of scale for maintainability indicator

Limits of scale	Qualitative description
4.21 – 5.00	Very maintainable
3.21 – 4.20	Mostly maintainable
2.61 – 3.20	Maintainable
1.81 – 2.60	Slightly maintainable
1.00 – 1.80	Note maintainable

Table 5: Limits of scale for reliability indicator

Limits of scale	Qualitative description
4.21 – 5.00	Very reliable
3.21 – 4.20	Mostly reliable
2.61 – 3.20	Reliable
1.81 – 2.60	Slightly reliable
1.00 – 1.80	Not reliable

Table 6: Limits of scale for portability indicator

Limits of scale	Qualitative description
4.21 – 5.00	Very portable
3.21 – 4.20	Mostly portable
2.61 – 3.20	Portable
1.81 – 2.60	Slightly portable
1.00 – 1.80	Not portable

C. Data gathering

A quantitative approach was utilized to gather data for evaluating eDROMIS. The study involved MSWDO personnel from LGU-Bontoc and IT experts, selected to provide insights into the system's technical performance. Convenience sampling was used to select MSWDO personnel, considering their role as primary users of eDROMIS. For IT experts, purposive sampling was employed to identify individuals with relevant qualifications and experience in IT system management. These participants were invited to contribute to the study based on their expertise. Descriptive analysis was conducted using a mean statistical approach to derive insights from the collected data.

III. RESULTS AND DISCUSSION

A. The developed system

The eDROMIS is web-based system that aims to help improve the needed data by the MSWDO as required in Memorandum Circular 20 series of 2019 of the Department of Social Welfare and Development, Philippines [12]. eDROMIS include the following key features.

Collaborative data acquisition: Streamlines the data acquisition process for MSWDO personnel, with potential support from barangay local authorities for record collection and updates.

Table 7: Limits of scale for security indicator

Limits of scale	Qualitative description
4.21 – 5.00	Very secure
3.21 – 4.20	Mostly secure
2.61 – 3.20	Secure
1.81 – 2.60	Slightly secure
1.00 – 1.80	Not secure

Table 8: Limits of scale for compatibility indicator

Limits of scale	Qualitative description
4.21 – 5.00	Very compatible
3.21 – 4.20	Mostly compatible
2.61 – 3.20	Compatible
1.81 – 2.60	Slightly compatible
1.00 – 1.80	Not compatible

Household management: Collects demographic profile of the residents collected by the MSWDO personnel and/or local authorities. This profiles individuals according to key characteristics (such as senior citizens, solo parents, persons with disabilities, pregnant, and others) that help local authorities understand the unique needs especially those who belong to the vulnerable sectors of the community (Figure 3). This allows data collection and updates to occur preemptively, even before a disaster occurs.

Evacuation center management: Allows plotting of geolocation of evacuation centers in each barangay. Facilities like the availability of toilets, bathrooms, sleeping quarters, water, and others can be added. Furthermore, it allows adding and removing residents who are staying in the evacuation center.

Donation management: Provides a module for recording incoming donations as well as managing the distribution of relief goods. Local authorities (barangay) may request the relief goods that they need. This ensures that their most immediate needs are raised to the MSDWO and that appropriate actions may be undertaken.

Geospatial visualization: Enhances data presentation by integrating OpenStreetMap, overlaying evacuation centers with pertinent data like available facilities and number of residents inside evacuation centers. Additionally, relevant lifeline statuses are superimposed on the OSM interface, providing a comprehensive geographical context and aiding in informed decision-making (Figure 4).

Table 9: User acceptance scoring and interpretation

Range of score	Verbal rating	Qualitative description
4.21 – 5.00	Strongly agree	The system user agrees with the statement without reservations.
3.41 – 4.20	Agree	The system user agrees with the statement with reservations.
2.61 – 3.40	Undecided	The system user cannot decide whether to agree or disagree with the statement.
1.81 – 2.60	Disagree	The system user disagrees with the statement with reservations
1.00 – 1.80	Strongly disagree	The system user strongly disagrees with the statement without reservations

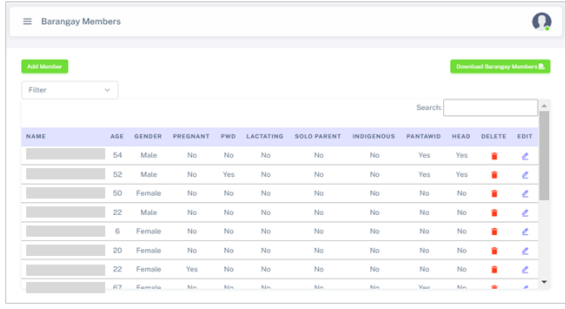

Fig. 3: UI for household management

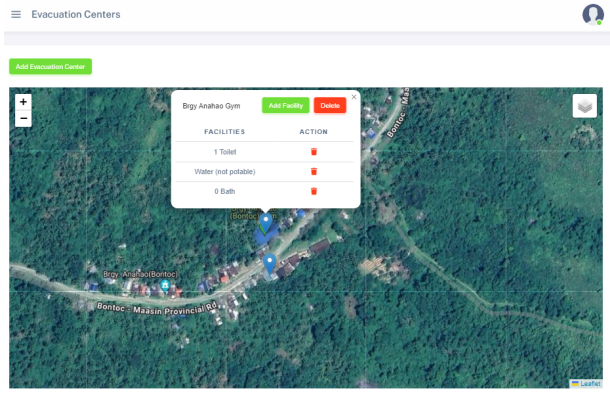

Fig. 4: UI for evacuation management

Reporting and dashboarding: Provides reporting and dashboarding features for tracking key indicators, monitoring response activities, and reporting to stakeholders. Data displayed on the dashboard vary depending on the type of user. The system enables the generation of various reports, including lists of household members both inside and outside evacuation centers, residents belonging to vulnerable sectors, aid details, essential lifeline statuses, damage reports, and other related information. It provides filtering options to refine the data according to specific demographic groups (Figure 5, Figure 6).

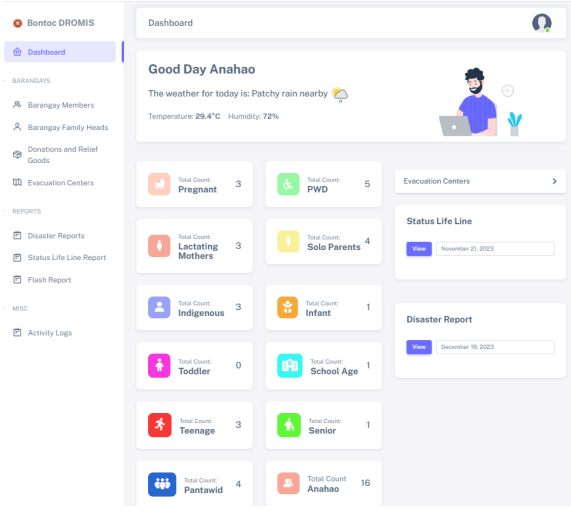

Fig. 5: Dashboard (Barangay level)

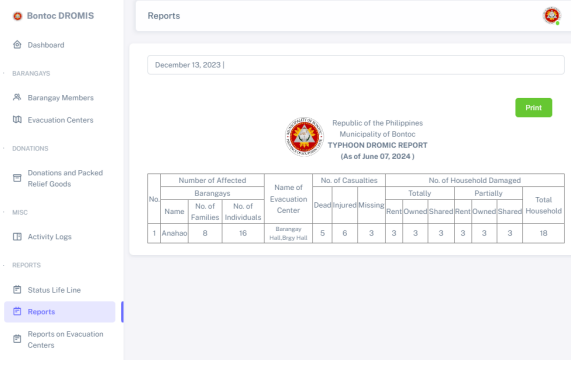

Fig. 6: Damage report (sample)

Offline data synchronization: This feature enables data entry and updates even in areas with limited or no internet connectivity. A user-friendly interface allows users to input data during such periods, which can later be synchronized by uploading the encoded data into the system's database.

Lifeline management: Provides updates on the status of essential services and infrastructure such as communication, energy, transportation, water, and others.

B. Evaluation results

Table 10 reveals the results of the system evaluation. The 5.0 mean under functionality demonstrates that the system performs the required tasks and that it functions as expected. In terms of reliability, the system is rated to be very reliable with a mean of 4.31. This indicates that the majority of the system's flaws have been eliminated over time and that the system is capable of handling errors. Under usability, the mean result suggests that eDROMIS is user-friendly as users can easily navigate, learn, and comprehend the system operations. The system is also considered very efficient since the system responds quickly to the user and the execution time is appropriate. On the other hand, maintainability got a 4.33 mean suggesting that the system continues functioning when changes are made and the software can be tested easily. Under Portability, a mean of 5.0 was computed which indicates that the system can be moved to different environments easily. Moreover, security with a 4.75 average demonstrates that prevents unauthorized access and modification to computer programs and/or data and requires user authentication to ensure data confidentiality. Finally, under compatibility, the 4.25 mean indicates that the system efficiently performs its required functions while sharing a common environment and resources without negatively impacting performance. User acceptance evaluation result in Table 11 shows an overall mean score of 4.62 for perceived usefulness. Perceived usefulness is the degree to which a user believes using a particular system would enhance

Table 10: System evaluation of eDROMIS

Criteria	Mean	Interpretation
Functionality	5.00	Fully functional
Reliability	4.31	Very reliable
Usability	4.88	Very usable
Efficiency	5.00	Very efficient
Maintainability	4.33	Strongly agree
Portability	5.00	Strongly agree
Security	4.75	Very secure
Compatibility	4.25	Very compatible

their job performance and efficiency [18]. The high rating underscores the users' confidence in the system's ability to meet their needs effectively. Moreover, it indicates that the system has notably enhanced users' job performance, effectiveness, and efficiency. Similarly, perceived ease of use shown in Table 12, defined as the ease of grasping or utilizing an innovation [19], garnered a mean score of 4.40. This indicates users' strong agreement that the eDROMIS is user-friendly, simple, and easy to understand. The system's intuitive functionality encourages full adoption by users.

The high scores for perceived usefulness and ease of use demonstrate that eDROMIS is well-received by its users. The system is perceived as a valuable tool that enhances job performance and a user-friendly platform that facilitates ease of operation. These positive perceptions are crucial for the successful adoption and continued use of eDROMIS.

Table 11: Perceived usefulness of eDROMIS

Perceived usefulness	Mean
Using eDROMIS in my job would enable me to accomplish tasks more quickly	4.6
Using eDROMIS would improve my job performance.	4.7
Using eDROMIS in my job would increase my productivity	4.5
Using eDROMIS would enhance my effectiveness on the job	4.4
Using eDROMIS would make it easier to do my job	4.6
I would find eDROMIS useful in my job	4.9
Overall mean	**4.62**

Table 12: Perceived usefulness of eDROMIS

Perceived ease of use	Mean
Learning to operate eDROMIS would be easy for me.	4.5
I would find it easy to get eDROMIS to do what I want it to do.	4.4
My interaction with eDROMIS would be clear and understandable.	4.5
I would find eDROMIS to be flexible to interact with.	4.2
It would be easy for me to become skillful at using eDROMIS.	4.4
I would find eDROMIS easy to use.	4.4
Overall mean	**4.40**

IV. CONCLUSION AND RECOMMENDATION

The development of eDROMIS effectively provides a solution to address the challenges encountered by the MSWDO in managing disaster-related data. By transitioning from traditional methods to a digital platform, eDROMIS streamlines data gathering, organization, and presentation processes. This shift improves efficiency, accuracy, and accessibility, empowering MSWDO personnel to deliver timely assistance during crises, and enhancing decision-making capabilities at the local level. It has served as a valuable tool for enhancing disaster risk management and building community resilience. By facilitating better coordination, communication, and decision-making, eDROMIS helps local authorities and communities become better prepared, more resilient, and more capable of responding to and recovering from disasters. With eDROMIS, generating necessary reports becomes easy, streamlining the process and saving valuable time and resources. It minimizes the need for repeated data collection during each disaster event, instead an efficient updating of records is provided. By harnessing GIS technology, eDROMIS can now visualize and analyze data in a spatial context, providing users with dynamic maps that display the locations of evacuation centers, along with relevant information such as capacity, facilities, and accessibility.

The ISO 25010 evaluation result suggests that it has a high potential for adoptability. Adoption

of eDROMIS could bring beneficial effects, particularly in addressing the immediate needs of the affected individuals and barangays, thereby enhancing disaster response effectiveness and community resilience.

Pivotal work on perceived usefulness and perceived ease of use has been widely cited in technology adoption studies [20, 21] which demonstrated a significant and positive association between these factors and consumers' intention to adopt technologies. Thus, it can be inferred that users perceive eDROMIS favorably, given the high evaluation results on its perceived ease of use and perceived usefulness. This suggests that eDROMIS is likely to be well-received and has a strong potential for adoption among its intended users.

To enhance the quality and effectiveness of eDROMIS, incorporating SMS notifications for 'request for aid' can significantly improve response times and ensure prompt assistance. This feature enables quick receipt and response to aid requests, thereby streamlining communication between stakeholders and affected individuals. Moreover, expanding this functionality to encompass a broader scope, including provincial, regional, and national levels, can further optimize disaster response efforts. By enabling seamless communication and coordination across various administrative levels, eDROMIS becomes a comprehensive tool for facilitating rapid and coordinated assistance during emergencies.

ACKNOWLEDGMENT

The authors would like to thank the Local Government of Bontoc, Southern Leyte, Philippines for the help extended in the conduct of this study.

REFERENCES

[1] Narra. *Environmental resilience*. https://www.narraoceania.com/environmental-resilience [Accessed 5^{th} March 2024].

[2] Domingo SN, Manejar AJA. *Disaster preparedness and local governance in the Philippines*. https://pidswebs.pids.gov.ph/CDN/PUBLICATIONS/pidsdps1852.pdf [Accessed 25^{th} February 2024].

[3] Meniano S. *Southern Leyte under state of calamity due to 'Odette'*. https://www.pna.gov.ph/articles/1163328 [Accessed 26^{th} February 2024].

[4] Seppänen H, Virrantaus K. Shared situational awareness and information quality in disaster management. *Safety Science*. 2015;77: 112–122. https://doi.org/10.1016/j.ssci.2015.03.018.

[5] Sakurai M, Watson RT, Abraham C, Kokuryo J. Sustaining life during the early stages of disaster relief with a frugal information system: learning from the Great East Japan earthquake. *IEEE Communications Magazine*. 2014;52(1): 176–185. https://doi.org/10.1109/MCOM.2014.6710081.

[6] Kedia T, Ratcliff J, O'Connor M, Oluic S, Rose M, Freeman J, et al. Technologies enabling situational awareness during disaster response: a systematic review. *Disaster Medicine and Public Health Preparedness*. 2022;16(1): 341–359. https://doi.org/10.1017/dmp.2020.196.

[7] Patrisina R, Meilani D, Habib M. An information management system for effective disaster relief operations. In: *IOP Conference Series: Earth and Environmental Science, 2^{nd} International Conference on Disaster and Management*. 30^{th} September – 1^{st} October 2020; Indonesia. IOP Publishing; 2021. p.012066. https://doi.org/10.1088/1755-1315/708/1/012066.

[8] Sharma AK, Parkash S, Joshi V. *Geographical information systems for disaster response and management*. https://www.researchgate.net/publication/289538253_Geographical_Information_Systems_for_Disaster_Response_and_Management [Accessed 27^{th} February 2024].

[9] Sehra S, Singh J, Rai H. Assessment of OpenStreetMap data: a review. *International Journal of Computer Applications*. 2013;76(16): 17–20. https://doi.org/10.5120/13331-0888.

[10] Eckle-Elze M, De Albuquerque J. *Quality assessment of remote mapping in OpenStreetMap for disaster management purposes*. https://idl.iscram.org/files/melanieeckle/2015/1218_MelanieEckle+JoaoPortodeAlbuquerque2015.pdf [Accessed 11^{th} March 2024]

[11] Congress of the Philippines. *An act strengthening the Philippine disaster risk reduction and management system, providing for the national disaster risk reduction and management framework and institutionalizing the national disaster risk reduction and management plan, appropriating funds therefor and for other purposes*. Republic of the Philippines: Congress of the Philippines. Republic Act No. 10121, 2010.

[12] Department of Social Welfare and Development. *Disaster response operations monitoring system reporting guideline. Republic of the Philippines: Department of Social Welfare and Development*. Memorandum Circular No. 20, 2019.

[13] Goh JEE, Goh MLI, Baccay MA. Community-based disaster risk reduction and management information system in the Philippines. In: *2019 International Conference on Computational Intelligence and Knowledge Economy (ICCIKE)*. 11^{th} – 12^{th} December 2019; Dubai, United Arab Emirates. IEEE; 2019. p.581–586. https://doi.org/10.1109/ICCIKE47802.2019.9004391.

[14] Manunog MB, Manunog MR, Wales ARF, Balili DA, Togonon JN. Development of a records management system with GIS integration: enabling tool for disaster risk management. *Philippine-American Academy of Science & Engineering*. 2022;15(2): 72–78. https://scienggj.org/2022/SciEnggJ%202022-vol15-no02-p72-78-Manun-og%20et%20al.pdf [Accessed 2^{nd} March 2024].

[15] Manunog M, Flores JB. Optimizing registry of inhabitants' record management: the development of municipal consolidation system for local governance. Philippine-American Academy of Science & Engineering. 2024;17(1): 1–7. https://scienggj.org/2024/SciEnggJ%202024-vol17-no01-p1-7-Manun-og%20and%20Flores.pdf [Accessed 1st March 2024].

[16] Patton M. *Developmental evaluation: Applying complexity concepts to enhance innovation and use*. http://edepot.wur.nl/216077 [Accessed 1^{st} March 2024].

[17] Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*. 1989;13(3): 319–340. https://doi.org/10.2307/249008.

[18] Mathwick C, Rigdon Malhotra NK. The effect of dynamic retail experiences on experiential perceptions of value: an Internet and catalog comparison. *Journal of Retailing*. 2001;78(1): 51–60. https://doi.org/10.1016/S0022-4359(01)00066-5.

[19] [19] Zeithaml VA, Parasuraman A, Malhotra A. Service quality delivery through web sites: a critical review of extant knowledge. *Journal of the Academy of Marketing Science*. 2002;30(4): 362–375. https://doi.org/10.1177/009207002236911.

[20] Elkaseh AM, Wong KW, Fung CC. Perceived ease of use and perceived usefulness of social media for e-learning in Libyan higher education: a structural equation modeling analysis. *International Journal of Information and Education Technology*. 2016;6(3): 192. https://doi.org/10.7763/IJIET.2016.V6.683.

[21] Granić A, Marangunić N. Technology acceptance model in educational context: a systematic literature review. *British Journal of Educational Technology*. 2019;50(5): 2572–2593. https://doi.org/10.1111/bjet.12864.