Mitigating Errors and Delays: Enhancing Emergency Response in Naga City Through Advanced Incident Recording Systems

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ABSTRACT

Efficient emergency response depends on timely and accurate incident documentation, particularly in disasterprone urban settings. In Naga City, emergency response operations continue to rely on a predominantly manual incident recording system, which has proven increasingly inadequate during high-impact disaster events. The operational challenges of this system became evident during Tropical Cyclone Kristine, when a surge in emergency calls exposed delays, documentation errors, and coordination constraints that affected response effectiveness.

This study examined the limitations of the existing manual incident recording system and explored the potential contribution of advanced digital incident recording technologies in improving emergency response operations. A descriptive–exploratory mixed-methods approach was employed, combining structured online surveys and focus group discussions with emergency responders, communication center personnel, and supervisory staff (n = 18). Quantitative data were analyzed using descriptive statistics, while qualitative inputs were examined through thematic analysis.

Findings indicate that manual incident recording contributes to delayed response actions, data inaccuracies, and inconsistencies in information sharing, particularly under high-demand conditions. Respondents identified real-time data entry, mobile accessibility, system integration, and automated error detection as critical features of an improved incident recording framework. Despite limited prior exposure to advanced systems, most participants expressed readiness to adopt digital tools, provided that adequate training, technical support, and institutional backing are in place.

The study concludes that transitioning from manual to digitally enabled incident recording systems can significantly enhance emergency response efficiency and coordination at the local level. The findings provide practical insights for local government units seeking to strengthen disaster preparedness and response through system modernization and capacity development.

Keywords: emergency response; incident recording systems; disaster risk reduction and management; digitalization; local government units

INTRODUCTION

Efficient emergency response is a critical component of disaster risk reduction and management, particularly in urban areas exposed to recurrent natural hazards. Timely decision-making, effective coordination, and accurate information flow are essential for minimizing loss of life and property during emergencies. At the core of these functions is incident recording, which serves as the primary mechanism for documenting, tracking, and coordinating emergency response actions across agencies and response units.

Naga City, a major economic and administrative center in the Bicol Region of the Philippines, experiences frequent hydro-meteorological hazards, particularly flooding associated with tropical cyclones. Despite

sustained investments in disaster preparedness and emergency response mechanisms, the city continues to rely largely on a **manual, paper-based incident recording system** within its emergency communication and operations centers. While this system provides a basic means of documentation, it has become increasingly misaligned with the growing complexity, volume, and speed of emergency response demands in disaster situations (Naga City Government, 2016).

The limitations of manual incident recording became particularly evident during **Tropical Cyclone Kristine**, when a sudden surge in emergency calls overwhelmed existing documentation and coordination processes. Reports from the event indicated delays in logging incidents, inconsistencies in recorded information, and challenges in tracking response actions in real time. These constraints negatively affected operational efficiency and highlighted systemic vulnerabilities in emergency response information management during large-scale disasters (Mendoza, 2020; GMA News, 2024).

Globally, advances in emergency management increasingly emphasize the integration of digital and automated systems to enhance response efficiency and coordination. Technologies such as real-time incident tracking platforms, mobile-based reporting applications, and artificial intelligence–supported dispatch systems have demonstrated potential to improve data accuracy, reduce response delays, and strengthen inter-agency communication (Chang, 2020; Johnson et al., 2017). In high-risk and time-critical environments, digital incident recording systems have been shown to reduce human error and support more informed decision-making under pressure (Amundson, 2020; De Vos, 2018).

Within the Philippine disaster management context, however, the adoption of advanced incident recording technologies at the local government level remains uneven. While national frameworks emphasize preparedness, coordination, and the use of information systems, operational practices at the city and municipal levels often continue to rely on manual processes due to resource constraints, technical capacity limitations, and institutional inertia (Garcia, 2017; Reyes, 2018; Santos, 2019). This gap between policy intent and operational practice underscores the need for empirical, context-specific studies that examine how incident recording systems affect emergency response performance at the local level.

Against this backdrop, this study investigates the limitations of Naga City's manual incident recording system and explores the potential role of advanced digital incident recording technologies in improving emergency response operations. By drawing on the perspectives of frontline responders and emergency management personnel, the study seeks to generate practical insights that can inform system modernization efforts, capacity development, and policy decisions aimed at strengthening local disaster preparedness and response.

METHODOLOGY

Research Design

This study employed a descriptive–exploratory mixed-methods design to examine the limitations of Naga City's manual incident recording system and assess the potential value of advanced digital alternatives in emergency response operations. The design enabled the integration of quantitative insights from surveys with qualitative perspectives from focus group discussions (FGDs), providing a comprehensive understanding of operational challenges and system improvement opportunities.

Study Participants and Sampling

The study involved 18 participants composed of emergency responders, communication center personnel, and supervisory or management staff directly engaged in emergency response and incident documentation. A purposive sampling technique was used to select respondents based on their direct involvement in incident recording and response coordination during disaster and non-disaster situations. This approach ensured that data were gathered from individuals with firsthand operational experience relevant to the study objectives.

Data Collection Methods

Online Survey

A structured online survey was administered to respondents to assess their experiences with the existing manual incident recording system and their perceptions of advanced digital alternatives. Survey items focused on operational challenges, accuracy and timeliness of documentation, coordination efficiency, and desired features of an improved incident recording system. Responses were collected using closed-ended and limited open-ended questions.

Focus Group Discussions

Focus group discussions were conducted with selected participants to obtain deeper qualitative insights into system limitations, technology adoption challenges, and perceived impacts of digital incident recording on emergency response efficiency. FGDs also explored institutional, technical, and organizational factors influencing the potential integration of advanced systems within the Emergency Operations Center.

Data Analysis

Quantitative survey data were analyzed using descriptive statistics to summarize trends related to system efficiency, data accuracy, and user preferences. Qualitative data from FGDs and open-ended survey responses were analyzed through thematic analysis, allowing recurring patterns and key operational issues to be identified and organized into analytical themes. Findings from both data sources were triangulated to strengthen the validity of results.

Ethical Considerations

Participation in the study was voluntary, and informed consent was obtained from all respondents prior to data collection. No personally identifiable information was recorded, and all responses were treated with confidentiality. The study posed no physical or psychological risk to participants and was conducted in accordance with ethical standards for social science research involving human participants.

RESULTS

Eighteen emergency response personnel participated in the study, all of whom were directly involved in incident documentation and response coordination either as frontline responders, communication center staff, or supervisory personnel. At the time of data collection, all respondents reported that the primary incident recording system in use was a manual, paper-based method, with no formal digital incident recording platform operational within the emergency response system.

Respondents' assessments of the manual incident recording system revealed mixed perceptions of its effectiveness. In terms of accuracy, responses were distributed across neutral, effective, and very effective ratings, indicating that while the system is capable of capturing essential incident information under routine conditions, its reliability is not consistently perceived as high. Similar patterns were observed with respect to speed, where the system was generally viewed as adequate during normal operations but less effective when demands increased. These findings suggest that the manual system functions within limited operational thresholds and becomes strained during periods of heightened emergency activity.

Awareness of advanced digital incident recording systems among respondents was generally low. Most participants reported that they were not familiar with formal digital platforms designed for incident documentation and response coordination. Despite this limited awareness, willingness to adopt digital systems was notably high. A majority of respondents indicated that they would be willing or very willing to transition to a digitally enabled incident recording system, provided that sufficient training, technical support, and institutional backing were made available.

When asked about features that would be essential in an improved incident recording system, respondents consistently emphasized the importance of real-time data entry. This feature was perceived as critical for improving both the accuracy and timeliness of incident documentation during emergency situations. Mobile accessibility was also frequently highlighted, reflecting the operational need to document incidents while in transit or at the scene. In addition, respondents underscored the value of integrating an incident recording system with other emergency response and dispatch platforms, as well as ensuring a user-friendly interface to facilitate ease of use under high-pressure conditions.

Overall, the findings indicate that while the existing manual incident recording system remains functional at a basic level, it does not adequately support the demands of complex and high-volume emergency response operations. The combination of limited system effectiveness under stress, low awareness of digital alternatives, and strong readiness for technological adoption underscores a clear opportunity for system modernization within Naga City's emergency response framework.

Category	**Key Findings**
Existing system	100% paper-based incident recording
Awareness of advanced systems	Majority not aware
Willingness to adopt digital systems	Majority willing or very willing
Perceived effectiveness (accuracy)	Mostly neutral to effective
Perceived effectiveness (speed)	Mostly neutral to effective
Top desired feature	Real-time data entry
Other priority features	Mobile accessibility, system integration, user-friendly interface

Table 1: Summary of Survey Findings on Incident Recording Systems (n = 18)

DISCUSSION

The findings of this study underscore the critical role of incident recording systems in shaping the effectiveness of emergency response operations at the local level. In Naga City, the continued reliance on a manual, paperbased incident recording system has contributed to delays, data inaccuracies, and coordination challenges, particularly during high-impact disaster events. These findings are consistent with existing research that highlights the limitations of manual documentation in time-sensitive and high-risk environments (Chang, 2020; Johnson et al., 2017).

Implications of Manual Incident Recording in Disaster Response

The results indicate that manual incident recording is poorly suited to the demands of disaster situations characterized by high call volumes and rapidly evolving conditions. Delays in documenting and transmitting incident information constrained the ability of response units to prioritize actions and allocate resources efficiently. Similar patterns have been observed in emergency response and healthcare settings, where manual reporting systems increase the likelihood of human error and slow decision-making under pressure (Amundson, 2020; De Vos, 2018).

Inaccuracies and inconsistencies in incident records further weakened operational coordination. Without standardized formats and real-time updating mechanisms, incident information became fragmented, limiting situational awareness across response teams. This finding reinforces the argument that incident recording should be viewed not merely as an administrative task, but as a core operational function that directly influences response outcomes.

Digital Incident Recording as an Enabler of Coordination and Efficiency

The expressed preference for real-time data entry, mobile accessibility, and system integration reflects an operational need for incident recording systems that support dynamic, multi-agency response environments. Studies on digital incident management platforms demonstrate that real-time information sharing enhances interagency coordination, reduces duplication of effort, and improves response timeliness (Chang, 2020; Johnson et al., 2017). The informal use of digital tools reported by some respondents in this study further suggests that responders recognize the practical advantages of digital documentation, even in the absence of a formalized system.

Importantly, the high willingness to adopt advanced systems despite limited prior exposure indicates that resistance to technology is not the primary barrier to modernization. Instead, institutional readiness, training, and resource availability appear to be more decisive factors. This finding aligns with research emphasizing that technology adoption in emergency management is fundamentally a governance and capacity issue rather than a purely technical one (Garcia, 2017; Reyes, 2018).

Institutional and Capacity Considerations

While respondents acknowledged the potential benefits of digital incident recording, concerns related to financial capacity, infrastructure readiness, and staff competence were consistently raised. These concerns highlight the importance of phased implementation strategies that align technological upgrades with institutional capacity development. Without adequate training and technical support, the introduction of advanced systems risks creating new operational challenges rather than resolving existing ones.

Political leadership and organizational commitment also emerged as critical enablers of system modernization. Effective implementation requires clear policy direction, sustained budgetary support, and inter-agency collaboration. In the absence of such support, efforts to modernize incident recording systems may remain fragmented or short-lived. This reinforces the need for local governments to embed digital incident recording within broader disaster preparedness and response strategies rather than treating it as a standalone technological intervention.

Implications for Local Disaster Risk Reduction and Management Practice

The findings of this study have practical implications for local government units seeking to strengthen emergency response operations. Modernizing incident recording systems can contribute to improved situational awareness, faster response times, and more coordinated actions during disasters. However, such modernization must be accompanied by investments in training, standard operating procedures, and institutional alignment to ensure sustainable impact.

By focusing on the operational experiences of frontline responders, this study provides context-specific insights that can inform policy and planning decisions related to emergency operations center management and disaster response coordination. These insights are particularly relevant for disaster-prone cities facing increasing hazard intensity and frequency, where effective information management is essential for resilience-building.

Study Limitations and Future Research

This study has several limitations that should be acknowledged. The sample size was limited to a small group of emergency response personnel, which may constrain the generalizability of findings. Data were also based on self-reported perceptions, which may be influenced by individual experiences and recall bias. Future research could expand the sample scope, incorporate performance metrics such as response times, and evaluate pilot implementations of digital incident recording systems to assess their impact empirically.

CONCLUSION

This study examined the effectiveness of Naga City's incident recording system within its emergency response

operations, focusing on the operational implications of continued reliance on manual, paper-based documentation. The findings demonstrate that manual incident recording contributes to delays, data inaccuracies, and coordination challenges, particularly during disaster events characterized by high call volumes and rapidly evolving conditions. These limitations constrain the capacity of emergency response units to act efficiently and maintain situational awareness during critical periods.

The study highlights the potential of digitally enabled incident recording systems to address these challenges by supporting real-time documentation, improving data accuracy, and facilitating information sharing across response units. The strong willingness among emergency personnel to adopt advanced systems suggests that technological resistance is not a primary barrier to modernization. Instead, successful transition depends on institutional readiness, staff capacity, resource availability, and sustained organizational support.

By providing empirical, context-specific insights from frontline responders, this study contributes to the growing body of applied disaster risk reduction and emergency management research that emphasizes the importance of information systems in response effectiveness. For local government units in disaster-prone settings, modernizing incident recording should be viewed as a strategic investment in preparedness and response capacity rather than a purely technical upgrade.

Future efforts to improve emergency response operations should adopt a phased and capacity-oriented approach to system modernization, integrating technological innovation with training, standard operating procedures, and policy support. Strengthening incident recording systems in this manner can enhance coordination, reduce response delays, and ultimately contribute to more resilient and effective disaster response at the local level.

RECOMMENDATIONS

Based on the findings of this study, several strategic recommendations are proposed to enhance incident recording and emergency response operations in Naga City.

First, the local government should pursue a phased transition from manual to digitally enabled incident recording systems within the emergency communication and operations centers. Initial implementation may focus on core functions such as real-time incident logging and standardized data fields to address the most critical sources of delay and inaccuracy identified in this study.

Second, the development or adoption of a digital incident recording system should prioritize real-time data entry, mobile accessibility, and system integration with existing emergency response and dispatch platforms. These features directly respond to operational needs identified by emergency personnel and are essential for improving coordination and situational awareness during disaster events.

Third, capacity-building interventions should accompany any technological upgrade. Regular training, simulation exercises, and refresher courses are necessary to ensure that emergency responders can effectively use new systems under high-pressure conditions. Capacity development should be institutionalized to support sustained system use rather than treated as a one-time activity.

Fourth, the local government should establish clear policies and standard operating procedures governing incident recording, data sharing, and system maintenance. Institutionalizing standardized documentation practices can reduce inconsistencies across response units and strengthen accountability within emergency operations.

Finally, future initiatives should consider conducting pilot implementations and cost–benefit analyses to assess the operational and financial feasibility of advanced incident recording systems. Evidence generated from pilot programs can guide decision-making, support resource allocation, and inform broader system scaling at the local level.

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