

# Assessing Mobile Disaster Risk Management system

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## Abstract

People of San Mateo, Isabela nowadays are lack of information, awareness and preparedness about disaster risk management that causes lot of casualties and wide affected areas in times of calamities. During typhoon Rosita, the Municipality of San Mateo has reported 1,461 Families and 5,765 Individuals are affected. The LGU San Mateo is making attempts to address climate change and disasters at various levels. Thus, a Mobile Disaster Risk Management System (M-DRMS) was conceptualized to reduce the response time during disaster and calamities. This study aimed to model the response on incidents and to offer model-derived strategies for improved rescuing situation in times of attack of disasters and calamities. This study is an added literature to the development and validation of the disaster risk application as rescuing and mapping tool. The R&D and AGILE model methodologies were selected by the researcher as study and software development methodologies respectively. Descriptive statistics was employed particularly mean and standard deviation in order to analyze the data with regards to the assessment of IT Experts and Households on the effectiveness of the M-DRMS. The T-Test for concerning means of independent samples was also utilized to determine the significant difference between the IT Experts and Households assessment. It was found out that the M-DRMS is compliant to ISO 25010 in terms of Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability. Moreover, a positive feedback towards strengths of the M-DRMS was identified by the respondents including the limitations that may consider for future references.

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## INTRODUCTION

Disaster is a "sudden or great misfortune" such as accident or natural catastrophe that causes great damage or loss of life. Disaster risk reduction is a concept of reducing disaster risks through systematic approach to identify, analyze and assess the exposure and vulnerability of the people and property from hazards. The main reason for practicing and implementing the Disaster Risk Reduction Management is to increase the awareness, preparedness and implementation of the community and to reduce the damage caused by natural calamities like earthquakes, floods, droughts and cyclones. The Philippine Disaster Risk Reduction and Management Act upholds the

people's constitutional rights to life and property by addressing the root causes of vulnerabilities to disasters, strengthening the country's institutional capacity for disaster risk reduction and management, and building the resilience of local communities to disasters including climate change impacts. It adopts a disaster risk reduction and management approach that is holistic, comprehensive, integrated, and proactive in lessening the socioeconomic and environmental impacts of disasters including climate change, and promote the involvement and participation of all sectors and all stakeholders concerned, at all levels, especially the local community. Furthermore, recognizes the local risk patterns across the country and strengthens the capacity of

LGUs for disaster risk reduction and management through decentralized powers, responsibilities, and resources at the regional and local levels. Besides, it aims to develop and strengthen the capacities of vulnerable and marginalized groups to mitigate, prepare for, respond to, and recover from the effects of disasters. Lastly it provides maximum care, assistance and services to individuals and families affected by disaster, implements emergency rehabilitation projects to lessen the impact of disasters, and facilitates resumption of normal social and economic activities (RA 10121 Section 3, 2010). Likewise, people nowadays required to be well-oriented on disaster risk reduction management in order to be prepared in times of calamities and increase the chance of survival and limiting the damages. However, the people of San Mateo, Isabela lack information, awareness and preparedness about disaster risk management that caused several casualties in widely affected areas in times of calamities. The Municipality of San Mateo reported 1,461 families and 5,765 individuals affected during typhoon Rosita last October 30, 2018. When it comes to infrastructures, they reported 1,273 houses are partially damaged and 253 houses are totally wrecked. Peoples have phones and they are bringing it wherever they go, but apparently, accidents are unpredictable and may happen anytime, anywhere. With this, they are not knowledgeable about the emergency hotlines and nearest emergency units; there is no interaction between the concerned citizens and the emergency units; There is also no notifications/alarm for emergency teams in times of incidents; there is no notification about the victims whether they are responded during these incidents; and Lastly, emergency units/teams cannot locate the incident area and most of the time, they received prank calls.

Mobile Disaster Risk Management System (M-DRMS) had been used by the community and Local Government Unit (LGU) Officials. It has been used to support the needs of the community in times of accidents and natural calamities. It serves as an early warning messages to full touch-screen enabled 'hazard maps' (Grémillet, 2015), provides a map view of the Philippine 'Area of Responsibility' (Xairylle,

2013), improve risk communication in case of disasters by integrating process of exchange information and data on risk among risk evaluators, risk managers, and other interested parties (Shin & Kim, 2014), serves as a feasible route for disaster communications (Sung, 2011), and determines the optimum route along different geographical locations that the volunteers and rescuers need to take in order to serve the most number of people and provide maximum coverage of the area in the shortest possible time (Fajardo & Oppus, 2010).

The demands on Mobile Alert App had increased tremendously because it showed that both communities, rescuers and volunteers were using Mobile Alert App that makes the disaster recovery more efficient, both in monitoring the scope of the damage and in coordinating appropriate recovery and relief missions (Goncalves, Silva & Morreale, 2014), that be able to gather information from multiple sources and locations including from the point of incident, be able to make effective strategies and decisions to propagate the information to vehicles and other nodes in real-time (Alazawi, Altowaijri & Mehmood, 2011), and be able to support emergency units to strengthen managing skills and enhance performance and productivity at all stages of crisis management operations (Mansourian, Rajabifard, Zoej & Williamson, 2006). Geographic Information is essential for a wide range of public and privately-owned agencies responsible for disaster management tasks (ERHARUYI & FAIRBAIRN, 2003).

Thus, the researchers find it necessary to develop a Mobile Disaster Risk Management System (M-DRMS) by coining GIS and Decision Supports using android platforms. It is then the main purpose of this study is to develop, validate and to test the effectiveness of M-DRMS.

## METHODOLOGY

The research was undertaken following the Research and Development (R&D) methodology. It is a process intended to validate educational output so that this can be utilized and extended over a wide area. The model use to develop the Mobile Disaster Risk Management System is the

Agile Iterative Model which is adapted to [HarinathMallepally](#) (2016).

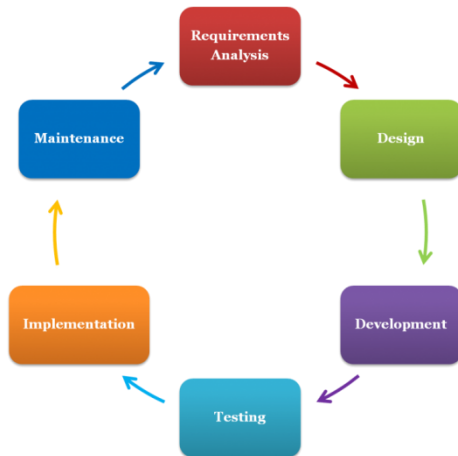


Figure 1. Diagram showing the steps in the development and validation of M-DRMS following the AGILE Model

**Requirement Analysis.** It is in this process in which the researcher will conduct a personal interview with the MDRRMO Staff who normally supervises and monitors the overall activities of the MDRRM Office. Interview will also be conducted among the Households around the vicinity of San Mateo, Isabela, Philippines. The researcher will also float questionnaires on 30 random household users on the problems encountered on the existing system. All gathered information will be analyzed by the researcher to come up with a complete idea for the designing and developing of the M-DRMS of San Mateo, Isabela, Philippines.

**Design.** The researcher will choose the appropriate programming software and hardware to be utilized. The researcher will use a creative skill styles in designing to make it better for the proposed system.

**Development.** In this process, after (GUI) was completed, the coding begins. The researchers will use XAMPP as the emulator for coding the program and MYSQL will be the back-end of the software. For the hardware, the researcher will be using any available android phones for testing the accessibility of the M-DRMS of San Mateo, Isabela.

**Testing.** It is in this process that the researcher will float questionnaires to 10 random IT Experts and 30 random Household Users to assess the extent of compliance of the M-DRMS to ISO 25010 and determining the Strengths and limitations of the developed application in which it serves as a basis for the modification and redesign of the system. Additionally, this will also use as reference for the acceptability of the household users and MDRRMO Staff as a tool in times of calamities or any disaster risks that will happen around the municipality of San Mateo, Isabela.

**Implementation.** The researcher will implement the system in the municipality of San Mateo, Isabela. The system will be installed in the MDRRMO after it undergone to a Multiple Testing.

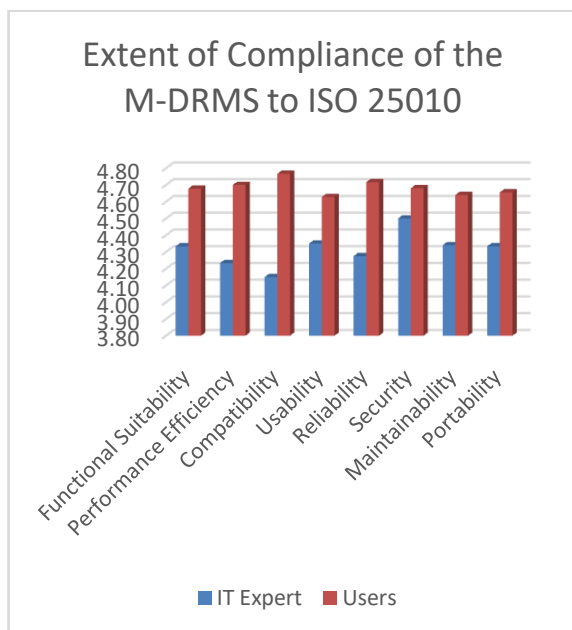
**Maintenance.** Since it is 24/7 running, in this step, the researcher will keep track and monitor the system if it is working as it is expected. If there is such future errors and bugs, the researcher will find solutions to fix them.

## RESULTS AND DISCUSSION

### Table 1. Problems/issued encountered in the existing system

The data shows that the respondents had encountered problems/issues in the existing system of Disaster Risk Management. This means that the possibility to introduced Mobile Disaster Risk Management System (M-DRMS) using Android Platform is evident.

### Table 2. Assessment on the extent of compliance of the developed application toISO 25010 Software Quality Standard



The assessment of IT Experts and Users on the M-DRMS shows that both groups strongly agree that the developed application is highly extent on the compliance to ISO 25010 in terms functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. Therefore, it can be inferred that the M-DRMS is highly approved, valid, and a powerful tool in disaster risk management plan and retrieval operations.

The result confirms the study of Huang, Chan, et al (2010) that this can bring significant benefits to governments, communities, responders and residents faced with threats of natural disasters.

PROBLEMS	MEAN
No Programs/Software Available	4.72
Lack of training on the program	4.88
No Experience(s) on the Program	4.8
Doesn't know how to operate the software	4.7
No financial support	4.46
Lan-based and Not accessible online	4.86
Exclusive only for the municipality officials	4.86
Doesn't generate report	4.66
Doesn't update real-time situation	4.55
Doesn't provide emergency route plan	4.59
Consumed too much time in retrieval operation	4.86
<b>MEAN</b>	<b>4.722</b>

**Table 3. The independent samples t-test of significant difference on the assessment of the IT Experts and Users on the extent of compliance of the developed application to ISO 25010**

ISO 25010	IT Expert	Users	IT SD	User SD	Concerning Means of Independent Samples	Remarks

(1) Functional Suitability	4.33	4.68	0.07	0.07	-3.47	Rejected
(2) Performance Efficiency	4.23	4.70	0.22	0.06	-2.98	Rejected
(3) Compatibility	4.15	4.77	0.17	0.10	-4.32	Rejected
(4) Usability	4.35	4.63	0.05	0.03	-3.51	Rejected
(5) Reliability	4.28	4.72	0.06	0.05	-5.02	Rejected
(6) Security	4.50	4.68	0.02	0.02	-3.41	Rejected
(7) Maintainability	4.34	4.64	0.07	0.03	-3.28	Rejected
(8) Portability	4.33	4.66	0.10	0.05	-2.99	Rejected
Degree of Freedom	38					
Critical Value (two-tailed)	2.021					

N1=10

N2=30

\*p < 0.05

The significant difference in the mean of IT Experts and Household Users assessment on the extent of compliance of the developed application was tested using the t-test. The computed t-value indicates that all of the ISO characteristics have a significant difference between the mean of IT Experts and the mean of Household Users assessment on the extent of compliance of the developed application at 0.05 level of significance of two-tailed test. It appears that the Reliability and Compatibility issues were the two highest significant difference occurred in the assessment test on the implementation of the developed application with regards to ISO 25010 Software Quality Standards.

This result implies that the Reliability issues on the developed application is influenced by the limited and variable bandwidth of networks which is common obstacle for mobile applications that encountered by the IT experts (Longoria,

2001) and since it is more on the technical aspects that the IT Experts have to test and assess its operation and accessibility despite the presence of hardware or software faults. However, Compatibility issues also occurred in the assessment of the developed application with regards to the extent on the compliance to ISO 25010 that both groups agreed that it can exchange information with other android devices despite of its hardware specification differences, and/or perform its required functions, because 86% of developers concern that Android fragmentation is a serious problem (W. Powers, 2011). Fragmentation problem demands a developer to port each mobile application under development over a particular device and to spend much time and efforts for testing accurate process (HyungKil Ham and Young Bom Park, 2014).

**Table 4. Strengths and Limitations of M-DRMS.**

STATEMENT	MEAN
<b>Strengths</b>	
(1) Accessible Online	4.96
(2) Provide Route for Nearest Evacuation Area	4.25
(3) Provide Route for Nearest Hospital/Clinic	4.7

(4) Can Seek help for other users	4.94
(5) Track other users seeking for help	4.94
(6) Notified on real-time updates	4.41
(7) Capture events on real-time situation	
<b>Limitations</b>	
(1) It needs internet connection	4.96
(2) Accessible for android devices only	4.22
<b>OVERALL MEAN</b>	<b>4.673</b>

This reveals the strengths and limitations of the M-DRMS with a grand mean of 4.673. This means that the M-DRMS have lots of strengths with minimal limitations towards the needs of the communities in times of Disasters. Likewise, it can be concluded that M-DRMS is a powerful tool material in disaster risk management plan through decision support system.

The M-DRMS as a Disaster Risk Route Map and Alert App for android is an innovative tool in Disaster Risk Management Plan that positively influences the community awareness, preparedness and implementation.

## CONCLUSIONS

The researcher concluded that the existing system for the MDRRMO can be enhanced. The existing practices in the disaster risk management system can be improved specifically in monitoring and managing the incidents situations.

The web-based and mobile application of M-DRMS is ready for full implementation use by its intended users as shown by its very high extent of compliance with ISO 25010 Software Quality Standards in terms of Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Maintainability, Security and Portability. As recommended in ISO 25010, the developed application satisfies the stated and implied needs of the users as it provides accessibility anytime and anywhere. However,

internet connection must consider for the implementation as it was one of the limitations of the developed application.

The Disaster Risk Mapping Decision Support System is fully compliant with the extent of the ISO 25010 Software Quality Standard and therefore ready for deployment and implementation. The full compliance with accepted software quality standards meant that the developed application are valid and effective disaster risk route map and alert app in times of calamities that could enhance the awareness, preparedness and implementation of the community; and an innovative tool in disaster risk management plan that help the community for decision support.

This further extends the Emergency Team's ability to monitor and manage the incidents situation in a way that suits them. In this way, the real-time situation and up to date information is just on a fingertip.

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