Mobile Accessibility in Disaster Environments

Assessing the role of Mobile Technology in Crisis Management in Ghana

Raul Ferrer Conill

Faculty of Economic Sciences, Communication and IT
Information Systems | Global Media Studies
Master's Thesis | Karlstad University Studies | November 2013
Abstract

In the age of the risk society, when several actors at an international, national, and local level converge in order to find solutions that help mitigate the global effects of natural disasters, there is a need to study the patterns for communicating and interacting with the public that eventually feel the impact of crises.

In the richer parts of the world ICTs have facilitated a framework for having instant information regarding threats that make crisis management a discipline that is centered more in preparing and planning, rather than mitigating actual crises. In developing countries, the contextual idiosyncrasies of each nation provide a fragmented array of settings that prevents a rapid flow of information in the event of natural disasters. The phenomenal growth of mobile telephony use and its rapid diffusion in developing countries offers a game changing scenario where crisis managers could benefit from new applications and functionalities of mobile devices.

In a confluence of multidisciplinary nature, this study aims to explore the role of mobile technology and internet in crisis management, as well as the state of accessibility of mobile technology when addressing the general public in Ghana.

This study follows a three-pronged approach with the aim of answering its research questions. First, a qualitative study of the communication processes between crisis managers and the public and the role of mobile technologies during those processes. Second, a quantitative study of the uses of mobile internet and the current mobile internet infrastructure. Finally, a study on the accessibility level of Ghana’s national crisis management organization’s website.

Several conclusions can be drawn from this study. Mobile technologies have an important role in the communication process of crisis managers and the public, however the use of internet still has no part in the flows of communication due to deficits in infrastructure and socio-economic factors, leading to a disconnection between international risk policy requirements and local needs. The lack of resources is seen as the biggest challenge for crisis managers; a challenge that leads to issues of trust in the public and non-compliance. Finally, while there have been improvements in accessibility efforts, there is still a wide gap between international web accessibility best practices and the one provided by authorities in Ghana.

Keywords
Crisis Management, Mobile Technology, Mobile Telephone, Development, Accessibility, Internet, ICTs, ICT4D, M4D, Ghana’s Disaster Management.
Acknowledgements

They say there are times in life when people must know when not to let go. This was one of those times.

This thesis, and the master it concludes, followed a tortuous path. The fieldwork in Ghana reframed it and reshaped it, as my preliminary conceptions proved to be completely flawed.

I want to particularly thank Bengt Häggren. Without him, this thesis and all the opportunities that came after it, quite literally, would not have been possible. I would also like to thank my advisor, Prof. John Sören Pettersson for believing in me when others would not, and for his endless patience, and to Monika Magnusson, whose feedback during my defense of this thesis taught me more than she could ever imagine.

My appreciation and gratitude go to Diana Boakye, for welcoming me into NADMO and arranging the meetings for the interviews, and to Prof. Samuel Mensah at the University of Cape Coast for his tips and info about Ghana. To the group of respondents and everyone I met during the fieldwork in Ghana, thank you for your time, your engagement, and opening my eyes.

To HumanIT and SPIDER (the Swedish Program for ICT in Developing Regions), my gratitude for awarding with one of their field research grants allowing me to travel to Ghana, to conduct my field work.

Additional thanks go to James Pamment, Charu Uppal, and Patrick Burkart. Your advice and guidance was a serious stepping stone for me.

And finally, huge thanks to my parents, who gave me everything I have, and yet I still write in a language they cannot understand. I love you both, madly!

This thesis is financed in part by Spider. The opinions conveyed are not necessarily shared by Spider. Responsibility for the contents lies exclusively with the author.
“It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so.”

Mark Twain
Table of contents

1 Introduction ........................................................................................................... 1
  1.1 Background and problem area .............................................................................. 2
  1.2 Aim, purpose, and target group ............................................................................. 5
  1.3 Study overlook and research questions ................................................................. 6
  1.4 Information needs and research design ................................................................. 8
  1.5 Boundaries and limitations ................................................................................... 9
  1.6 Current body of knowledge .................................................................................. 10
  1.7 Terms and definitions ......................................................................................... 11
  1.8 Disposition of the thesis ...................................................................................... 13

2 Contextual description of Ghana ...................................................................... 15
  2.1 Socio-economic and demographic conditions ................................................. 15
  2.2 Natural disasters in Ghana .................................................................................. 16
  2.3 Causes of flooding in Ghana ............................................................................... 17
  2.4 Crisis management in Ghana – NADMO ............................................................... 17
  2.5 Implementing the Hyogo Framework for Action .............................................. 20
  2.6 Infrastructure and accessibility ........................................................................... 21
  2.7 Internet and mobile telecommunications overview ........................................... 22
    2.7.1 Telephone services ......................................................................................... 22
    2.7.2 Internet services ............................................................................................ 23
    2.7.3 GoTa System ................................................................................................ 25

3 Theoretical discussion: Risk, communication and accessibility ......... 26
  3.1 The problem of risk ............................................................................................ 27
  3.2 Where risk becomes threat: chaos, crises, and disasters .................................. 29
    3.2.1 Vulnerability, threats, and global risk .......................................................... 29
    3.2.2 Risk, trust, and development ..................................................................... 31
    3.2.3 The environment of crises ......................................................................... 33
  3.3 Crisis communication: strategies and informing the public ............................ 34
    3.3.1 Detailing communication strategies .............................................................. 35
    3.3.2 The role of ICT and Mobile technology in development countries - ICT4D & M4D 37
    3.3.3 Diffusion of innovation and the issue of (in)equality ................................... 39
  3.4 Accessibility: increasing awareness .................................................................... 41
    3.4.1 Contextualizing accessible interaction ....................................................... 42
    3.4.2 Internet accessibility and standards compliance ........................................ 43
4 Methodology ........................................................................................................51
  4.1 Research methods .........................................................................................51
    4.1.1 Current state of mobile communications in Ghana .........................53
    4.1.2 Information flows and ICTs in crisis management in Ghana ..........54
    4.1.3 Accessibility status in the crisis front ..............................................56
  4.2 Data sources and materials .........................................................................58
  4.3 Methods for analysis ....................................................................................59
    4.3.1 Interview data analysis .................................................................60
  4.4 Validity and reliability ..................................................................................61

5 Data collection and empirical research ..........................................................63
  5.1 Semi-structured interviews .........................................................................64
    5.1.1 Sampling and introduction of the respondents ...............................66
  5.2 Short interviews ..........................................................................................67
  5.3 Mobile internet speed test ..........................................................................69
  5.4 NADMO’s website analysis .......................................................................69

6 Empirical data and analysis ............................................................................72
  6.1 Emerging themes from NADMO ...............................................................72
    6.1.1 Theme 1: Disaster management context .......................................73
    6.1.2 Theme 2: Hierarchical channels .....................................................76
    6.1.3 Theme 3: Interaction & accessibility ............................................79
    6.1.4 Theme 4: Interaction & trust .........................................................83
    6.1.5 Theme 5: Information and communication technologies .............86
    6.1.6 Theme 6: Challenges .................................................................90
    6.1.7 A final note on ICTs .................................................................93
  6.2 Responses to the short interviews ..............................................................94
  6.3 Results on the mobile internet speed tests .................................................95
  6.4 NADMO’s website accessibility analysis ...............................................96
    6.4.1 Website time frame .................................................................96
    6.4.2 HTML & CSS validation .........................................................97
    6.4.3 WCAG 1.0, WCAG 2.0, & Section 508 ....................................98
    6.4.4 Loading times, uptime, and access ..........................................100

7 Discussion and conclusions ............................................................................103
  7.1 Conclusions from the analysis .................................................................103
  7.2 Answers to the research questions .........................................................107
7.2.1 RQ1: What are the challenges, if any, for NADMO in terms of communication? How can those challenges be overcome? .................................................. 107

7.2.2 RQ2: What is the role of mobile technologies (and mobile telephony especially) in the process of managing crises at NADMO, both internally and externally? .................................................................................................................................................. 108

7.2.3 RQ3: Which technological advances must be implemented in mobile technology in order to increase accessibility in a crisis environment? ................. 109

7.2.4 RQ4: Could mobile telephony, taking into consideration its accessibility challenges, still be the most accessible ICT for the Ghanaian population? .......... 109

7.2.5 RQ5: Is the current context of Ghana ready for a nation-scale implementation of a mobile Internet-oriented crisis management system? ........... 110

7.2.6 RQ6: Which technological advances can lead to a more efficient information system that meets the needs of NADMO and the accessibility standards? 110

7.3 Concluding remarks .................................................................................................................. 111

7.4 Academic contribution .............................................................................................................. 112

7.5 Practical contribution ................................................................................................................. 113

7.6 Future research .......................................................................................................................... 113

References ...................................................................................................................................... 115

Appendix 1 – Interview Framework ............................................................................................... 125

Appendix 2 – Short interviews responses ..................................................................................... 126

Appendix 3 – Mobile internet speed tests ..................................................................................... 127

Appendix 4 – Total Validator Tool results output ........................................................................... 129
List of figures

Fig. 1 NADMO’s organizational structure ......................................................... 19
Fig. 2 Mobile voice WiMAX in Ghana (AICD, 2010) ........................................ 23
Fig. 3 ICT backbone and mobile footprint in Ghana (AICD, 2010) ..................... 24
Fig. 4 Map of the south of Ghana and field work itinerary ............................... 64
Fig. 5 W3C HTML validation results .............................................................. 97
Fig. 6 W3C CSS validation results ................................................................. 98
Fig. 7 Total Validator Tool interface ............................................................... 98
Fig. 8 Total Validator WCAG 1.0 results summary ......................................... 99
Fig. 9 Total Validator WCAG 2.0 results summary ......................................... 99
Fig. 10 Total Validator Section 508 results summary ....................................... 100
Fig. 11 Yslow overall results ......................................................................... 101
Fig. 12 Yslow pageload weight statistics ......................................................... 101

List of tables

Table 1 – Technical advisory committees of NADMO .................................... 19
Table 2 - Respondent Interview Overview ...................................................... 67
Table 3 - Theme 1: Disaster management context ........................................... 74
Table 4 - Theme 2: Hierarchical channels ....................................................... 77
Table 5 - Theme 3: Interaction & accessibility ................................................ 81
Table 6 - Theme 4: Interaction & trust ............................................................ 84
Table 7 - Theme 5: Information & communication technologies ...................... 88
Table 8 - Theme 6: Challenges ..................................................................... 91
Table 9 – Responses to the short interviews (summary) .................................. 94
Table 10 – Results from the mobile internet speed tests (summary) ................. 95
List of abbreviations and acronyms

ADSL – Asynchronous Digital Subscriber Line
ADRC – Asian Disaster Reduction Center
CDMA – Code Division Multiple Access
EDGE – Enhanced Data Rates for GSM Evolution
GOTA – Global Open Trunking Architecture
GSM – Global System for Mobile
GRPS – General Packet Radio Service
HDI – Human Development Index
HFA – Hyogo Framework for Action
HHD – High Human Development
HSDPA – High Speed Download Packet Access
HSUPA – High Speed Upload Packet Access
IAEA – International Atomic Energy Agency
IDNDR – International Decade for Natural Disaster Reduction
ICT – Information and Communication Technologies
ICT4D – Information and Communication Technologies for Development
IS – Information Systems
IT – Information Technologies
LHD – Low Human Development
LIC – Low Income Countries
LTE – Long Term Evolution
M4D – Mobile for Development
MHD – Medium Human Development
MIC – Middle Income Countries
NADMO – National Disaster Management Organization (of Ghana)
PRB – Population Reference Bureau
UMTS – Universal Mobile Telecommunications System
UNDP – United Nations Development Programme
UNESCO – United Nations Educational, Scientific and Cultural Organization
UNFCCC – United Nations Framework Convention on Climate Change
UNISDR – The United Nations Office for Disaster Risk Reduction
VHHD – Very High Human Development
W3C – World Wide Web Consortium
WAP – Wireless Application Protocol
WCAG – Web Content Accessibility Guidelines
WiMAX – Worldwide Interoperability for Microwave Access
1 Introduction

The purpose of this chapter is to set the scene for this thesis, in terms of introductory statement to the problem in hand, as well as the formal disposition and terminology used in the text. The intention is to introduce the characteristics of the problem area as a confluence of four different disciplines. It continues by defining the research questions that the study intends to answer, as well as the information needs, and the research design to the study. Finally, the chapter ends presenting the purpose of the study and expected results, providing the disposition of the thesis along with a list of terms and definitions, and discussing the boundaries and limitations of the study.

In the age of the risk society, the needs to aptly convey information to the potential victims of a crisis situation have become one of the most important tasks to mitigate the possible effects of this type of situations (Beck, 1992).

Gathering, selecting and transmitting the right information can be a difficult task, where time is pressing, there is a plenty of information to consider, and there is a large amount of actors involved. Information technologies can provide the agility and speed to reach the part of the population in danger or that is already enduring a disaster situation.

The phenomenal growth of mobile telephony and its rapid expansion among the public have altered the way people access the Internet. With the characteristic of mobility, this type of technology appears to be a great solution to raise awareness and to deliver the information needed to manage a disaster situation. In the context of developing countries, these benefits derive not only from telephony services per se, but also from Internet access through mobile technology, due to its lower infrastructure costs and cheap terminals.

It is with this acknowledgement that mobile technology offers new potential uses within crisis management area. In a disaster situation, transmitting the message and connecting with the population as broadly and fast as possible are basic for successful crisis management (Coombs, 2012). Nevertheless, the introduction of mobile technology in disaster management efforts raises a serious challenge in terms of accessibility (Hellström, 2007). People with disabilities (cognitive or physical), groups with language disparities (like immigrants or minorities), and segments of population with reduced access to technology (senior citizens, low income citizens, etc.) face the risk of being left out of these initiatives. Just as any governmental enterprise, the notion of inclusion needs to be a top priority. From
the media perspective, if accessibility on any governmental website or digital media is to be ensured by law (Frank, 2008), a similar approach must be taken into consideration in crisis management, following accessibility standards and guaranteeing that all citizens are included in such initiatives (cf. United Nations convention on “Rights of Persons with Disabilities”; Utrikesdepartementet SÖ 2008:26, e.g. Articles 9 and 11). From the geographic perspective, the accessibility challenges posed by limited infrastructure play a major role in crisis management (McConnell, 2003).

1.1 Background and problem area

This thesis studies the role of mobile technology and internet in crisis management, as well as the state of accessibility of mobile technology when addressing the general public in the development context of Ghana.

At first sight, the mix of the four areas (accessibility, crisis management, mobile technology, and development) is in itself a challenge of considerable proportions. But even when studied single-handedly, each area treated in the study poises difficulties that need to be addressed in the following chapters.

Accessibility to information and crisis management are becoming a recurrent theme in academia, and the binomial mobile technology and development has started to boom in the research field in the last years (Hamel, 2010). However, the combination of these subjects has not been addressed on many occasions, which is rather puzzling, as data clearly shows that developing countries suffer a considerably higher rate of human loss in natural disasters. Between 1975 and 2007 the number of casualties derived of natural disasters ascends to roughly 2.35 million. Of these 2.35 million, only a 2.98% were population of the so-called developed countries. The rest, a 97.02% of casualties were suffered in developing countries (ADRC, 2007).

According to the United Nations Development Program (UNDP, 2011), the way to measure whether a country is developed, or if it is still developing, is done by combining the following four factors: life expectancy at birth, mean years of schooling, expected years of schooling, and gross national income per capita. These factors derive into the Human Development Index (HDI), which is expressed as a value between 0 and 1, where 1 is the higher level of human development and 0 is the lower. The countries ranked by HDI are divided into four groups (quartiles is the term used by the UN), Very High Human Development (VHHD), High Human Development (HHD), Medium Human Development (MHD) and Low Human Development (LHD). The group of countries in this last quartile is also often referred as LDCs, or Least Developed
Countries. To be listed as an LDC, according to the UN, a country must meet three criteria, in terms of poverty, human resource weakness, and economic vulnerability. Even though the dichotomy of the term of "developed/developing" country is highly contested, misleading, and condescending, it is widely accepted that those countries marked as VHHD (roughly an HDI above 0,785) are "the developed countries" of the planet. As of 2012, 47 countries are considered developed countries. This means that according to the Human Development Index, there are a total of 140 developing countries distributed in the other three HDI quartiles (UNDP, 2011).

The rank of countries according to the HDI is done in quartiles, that means a percentage of countries; however, this does not reflect the distribution of population. If the group of VHHD represents about the 25% of the countries in the index, in terms of global population it only accounts for the 18% of the population (in 2008), and is estimated to represent only the 14% by 2050 (PRB, 2008). But even if this development gap is widening and the percentage of population of developed countries is shrinking, it is not enough to explain why the fatalities caused by natural disasters are so uneven, with only 2,98% of those fatalities being from developed countries. The reason lies in the strong relationship between the HDI and the impact and damage done by disasters, as death ratios and people affected are much higher in countries situated on the LHD quartile of the HDI (Guha-Spair et. al, 2003). Admittedly, the links between level of development and the capabilities for preparedness planning, disaster reduction, management and mitigation are obvious, so the higher the HDI, the better equipped a country is to manage disasters (Kar, 2009). It is in developing countries that inefficient warning systems, limited resources for emergency responses, and poor preparedness go hand by hand with difficult connectivity to affected areas, deficient housing quality and unplanned urbanization in potentially dangerous areas.

Already in the 1990's, the UN acknowledged this problem and began planning what is considered to be the modern strategy towards natural disasters, especially in developing countries, deeming it the "Decade for Natural Disaster Reduction" (IDNDR). Recommendations for disaster prevention, mitigation, preparedness and relief were made to all countries in the Yokohama Strategy and Plan of Action for a Safer World, in 1994 (UN, 1994). This planning was enhanced and adjusted in the Geneva Mandate of 1999 (UN, 1999), and later in 2002 with the Johannesburg Plan of Implementation of Sustainable Development (UN, 2002). These adjustments focused on larger funding for prevention and recovery, but mostly encouraged nations to improve international coordination to alleviate the effects of natural disasters, especially in developing countries.
These UN efforts lead to the current status in global risk reduction, the Hyogo Framework for Action 2005-2015, a 10-year plan that explains, describes and details the necessary tasks to reduce disaster losses that need to be carried out by all different sectors and actors (UNISDR, 2005). The Hyogo Framework for Action (HFA) was adopted by 168 Member States of the United Nations at the World Disaster Reduction Conference in Hyogo, Japan, 18 to 22 January 2005.

The HFA is structured around 5 Priority Actions, which serve as motivational point of departure for this dissertation, in particular Priority Action 2, 3 and 5, which aim to identify, assess and monitor disaster risks, and enhance early warning (PA2); use knowledge, innovation and education to build a culture of safety and resilience at all levels (PA3); and strengthen disaster preparedness for effective response at all levels (PA5). By identifying these priorities, their underlying challenges and systemic problems, it was decided to lay the focus in understanding the flows of information and communication of risk managers in developing countries, as a medium to set a proportionate cause of action, tailored for the idiosyncrasies of their actual needs and possibilities. The need to communicate and disseminate information is of outmost importance to enhance preparedness, to raise awareness and to mitigate the impact of a disaster once it strikes. This takes an even more important role in a developing country, where infrastructures are not set to withstand the damages caused by natural disasters, and where a large number of the population can suffer a limited or non-existent access to information.

The gap in infrastructure, so common in developing countries, is the main reason behind this study’s focus in mobile technology to enhance the current crisis management strategies, as mobile technologies require less infrastructure, less electricity, have a much shorter learning curve and are cheaper to acquire. Mobile technology is the current ICT that has the most promising chance to increase the inclusion of all members of society regardless of the exclusion causes (Matotay & Furuhol, 2010). Accessibility both from the spectrum of usability, but also in the spectrum of social inclusion is an inherent trait to mobile devices, as technology keeps moving towards devices that are easily customizable and developed to overcome most of the difficulties that a disabled user would encounter. The accessibility standards are usually detached of the technology-oriented spectrum and apply, instead, the human interaction experience with the intention of overcoming certain challenges.

It is with this perspective where the four disciplines meet. A developing country could benefit enormously from mobile devices in order to reach as much population as possible in the event of a natural disaster.
1.2 Aim, purpose, and target group

The aim of this study is to explore the role of mobile technology and internet in crisis management, as well as the state of accessibility of mobile technology when addressing the general public in Ghana. This assessment is primarily focused on the role of mobile technology in order to disseminate information to the general public and the exchange of information among the teams responsible for managing natural disaster situations.

Undoubtedly, it is only through the prism of the local reality that strategies, plans and policies can be understood. Aiming to create or plan a unilateral model that will help developing countries to successfully manage and reduce the impact of natural disasters, from the perspective a developed country, not only is naive, but will also prove ineffective and potentially damaging in the long run.

Through the lens of the contextual background of Ghana, this study also focuses on studying the suitability and potential enhancements of mobile technology to increase the levels of accessibility of information to as much of the population as possible (especially for those in risk of exclusion and isolation) before, during and after a natural disaster. This includes the study of how crisis managers can benefit from mobile technology in the roles and functions within their respective organizations.

The purpose of this thesis is to study the feasibility for a developing country to draw its efforts in Mobile Internet in order to conduct public awareness programs, activate early warning systems and preparedness schemes, and deployment of information as major means of coordination, in relation to crisis management.

In order to fulfill these goals and understand the process of a disaster management situation and the flow of information and awareness of the citizens at risk, this study investigates the status of mobile technology and the situation of crisis management in Ghana. This includes studying the efforts and operations of the National Disaster Management Organization of Ghana (NADMO) and how their members manage the flows of information between themselves, and especially towards the Ghanaian population. It also includes an assessment of the current telecommunications’ field situation, both from a technical and a human perspective, to assess whether it can sustain a system that relies on mobile technology. By understanding the actual current situation of a developing country, the suitability of mobile technology and the potential benefits that it can bring in relation to crisis management can be assessed.
The target group of this study are natural disasters crisis management officers, particularly those who deal with development settings; researchers that are interested in the application of global policies into local areas; and researchers that are interested in mobile communication and accessibility.

1.3 Study overlook and research questions

This research study is set to be the resulting thesis of a Global Media Studies master program from the Information Systems orientation. Thus, the study is a multidisciplinary approach that combines media and development studies, mobile technology and crisis management.

As it has been pointed out before, one of the main areas of interest is to understand the context of the developing countries. The social, cultural, and organizational culture are as important as the resources, infrastructure and real needs of the society, especially in terms of ICT in a developing country. An attempt to generalize circumstances and strategies in the developing world would be misguided, condescending, and would lead to a skewed portrayal of reality. However, in terms of this study’s scope, there was a need to narrow down the area of action into one country that could set the frame to that particular context.

Ghana was chosen as the focus of the study and center of the field work. This West African country has a regular record of natural disasters (mostly flooding) that, while not extremely severe, still claim lives every year, providing a historical record of previous crisis management actions. Also, Ghana has a well-established crisis management organization (NADMO) that perfectly fits the role as a main source of information. Finally, Ghana has a leading outlook on long standing peace and has one of the longest-standing democracies in Africa, which allows for proper national/international policy making that allows its government to focus on disasters instead of armed conflicts.

The preparations for this study took place during the months of March, April and May of 2012. The actual field work research was done during two weeks in June. During this period 9 interviews were conducted, 22 short surveys were done and over 100 mobile internet speed tests were measured along 5 of the 10 regions of Ghana. The analysis of data was done in different intervals in summer and fall of 2012. The writing of the final report occurred during summer and fall of 2013.

There are three critical terms in emergency management: communication, coordination, and control. These imply an interdependent, evolving process of
organizational management (Comfort, 2007 p.191). The overarching aim of this thesis focuses on the first term, communication. This central aspect is reflected in the way mobile technology is used and the amount of people that it can reach.

On that note, one of the main goals of any crisis management initiative is to reach the widest audience possible, both in the prevention and mitigation stages (Boin & ‘t Hart, 2010). Acknowledging that mobile phones are now the primary form of telecommunication in developing countries and that they play the same role as landline phone networks did in Europe and North America in the 20th century (Mendes et al. 2007), the research questions regarding communication in crisis management are:

RQ1: What are the challenges, if any, for NADMO in terms of communication? How can those challenges be overcome?

In order to start understanding the flows of information in crisis management in Ghana, there is a need to understand whether communication is exposed to challenges and how they can be overcome.

RQ2: What is the role of mobile technologies (and mobile telephony especially) in the process of managing crises at NADMO, both internally and externally?

Knowing the role mobile technologies allows for an assessment of the current and immediate future of crisis management communication and the ICTs involved in the field.

One of the challenges in crisis communication is the looming risk of failing to include everybody in the chain of communication, excluding those more vulnerable. Even more so in a developing country, where the poor and uneducated have very limited access to technology and where infrastructure is unevenly deployed. These risks pertain also to mobile technology. This issue would raise the following questions:

RQ3: Which technological advances must be implemented in mobile technology in order to increase accessibility in a crisis environment?

Regardless of the role of mobile technology, there is a need to aim for inclusion in crisis management. For that reason, aiming for increasing accessibility motivates the third research question.

RQ4: Could mobile telephony, taking into consideration its accessibility challenges, still be the most accessible ICT for the Ghanaian population?

Question four merges both fields. The use of mobile phones as a growing technology in developing countries, but with accessibility standards in mind.
Finally, based on the exponential growth of the access to the Internet via mobile devices in Europe and even in higher rates of growth in developing countries, the last two research questions are brought forth:

RQ5: Is the current context of Ghana ready for a national-scale implementation of a mobile Internet-oriented crisis management system?

Any implementation of internet-oriented system is dependent on the local context in order to be successful. Hence research question five.

RQ6: Which technological advances can lead to a more efficient information system that meets the needs of NADMO and the accessibility standards?

The final research question looks in the possibility of improving the current information systems of NADMO and the ways to do it.

1.4 Information needs and research design

In order to properly map out the design of the research project it is necessary to set the parameters of what type of information are relevant to successfully carry out the study.

These types of information are different. From mobile technology implantation in developing countries to new standards for creating accessible content in mobile devices. From the concepts of ICT4D and accessibility regulations to the information and crisis management initiatives that take place in disaster areas.

The first factor to be identified, the actual use and penetration of mobile technology in Ghana, sets the starting scene for the thesis. It is studied in two steps. First by establishing the developing context of Ghana in terms of socio-economic and demographic conditions, natural disasters and crises management, infrastructure and accessibility, and finally in terms of internet and mobile telecommunications. Second by studying the patterns of mobile technology use by citizens of Ghana.

The second factor to be studied is the concept of risk, its applications in crisis management, and especially, its evolution towards natural disasters in developing countries. To find the guidelines used in crisis management in order to reach the population and raise general awareness in the event of a disaster situation is essential for this study. It is here where the contact with NADMO will become important, as the main source of information lies in its crisis managers, who know from experience the flows of information and channels of communication they use in the organization and to reach the Ghanaian citizens.
Finally, the third factor to be studied is the current standards and policies in web accessibility and mobile web best practices by looking at the implementation of strategies and techniques to enhance accessibility by NADMO, but also about the actual enhancement of inclusion of particular pockets of society that usually would be secluded from the information flows in regular situations, for various reasons.

As described in the methodology section, this research project has a three-pronged approach using different methods for data collection, both qualitative and quantitative.

The first phase aims to do a thorough assessment of the status of ICT in Ghana, and in particular mobile technology. During this phase the standards in mobile accessibility and its relation with crisis management are studied, along with crisis management and development theory.

The second phase consists of the fieldwork in Ghana. The field work centers on the visit to NADMO’s headquarters and regional offices to learn, first-hand, which is the information they usually deploy to the population in a disaster situation, as well as the channels they use in order to spread that information. Following the steps of Hamel (2010), this study also discusses the role of government policy and investment in ICTs as key factors in successful development strategies. During this phase, an assessment of the use of mobile internet by a small group of Ghanaian citizens is made, as well as measurement of mobile internet transfer speed offered by the local providers in several points of the Ghanaian geography. As a complementary example, the state of NADMO’s website is analyzed, as the current only mobile ICT deployed to the Ghanaian population.

The final phase of the study consists of data analysis extracted from the transcription of the recordings and interview notes, speed tests, and web analysis; followed by write-up of the final report.

1.5 Boundaries and limitations

A multidisciplinary study like this one carries along a varied set of limitations and boundaries. At first glance, the complexity of the concept of crisis management in developing countries can prove to be a difficult theme. The difficulty is twofold: in one hand, crisis management is not a homogenized discipline, and it is often shaped after the local context; on the other hand, there are convergent international forces that try to apply a global set of crisis management policies. Furthermore, when these policies are applied in
developing settings, the dichotomies between local and global become even more apparent, as the inherent limitations of developing countries hinders the application of such policies.

Another limitation is the difficulty of finding the proper target group to study. The idiosyncrasies of crisis management imply a two-sided focus. On one side the individuals involved in organizations that manage crises. On the other side the individuals that are subjected to the possible effects of natural disasters. For this particular study, the choice was taken in order to focus on the managing forces rather than the general public.

Thematically, this study operates within the boundaries of crisis management, crisis communication, mobile technology, and accessibility. While mass media are mentioned briefly, no research efforts per se have been dedicated to study the ways in which crisis managers address the population through those means. Similarly, the notions of coordination and control within the NADMO organization have a support role in this study. They are contributing factors to provide a holistic picture of communication within the hierarchies of crisis management, but they do not offer a clear translation into the general population. In terms of accessibility, there has been a conscious decision to keep the aspect of physical accessibility as a mere supporting aspect related to isolated communities. When discussing risk, the focus is placed on manufactured-risk. When discussing crises, the focus is placed on natural disasters. When discussing crisis communication, the focus is placed on the interactions between the management organizations and the public.

Geographically, the regions covered during the field trip were chosen by considering the infrastructure connecting each destination to Ghana’s capital, and in relation to the time and budget available to cover them, as well as having a NADMO office available to visit. For that reason, only the South and Mid-South of Ghana were covered.

Finally, it is worth mentioning that the respondents to the short interviews follow purposive sampling within the frame of the service industry, and as such, are not intended to offer a direct representation of Ghana’s society. Similarly, the NADMO officers and managers that were interviewed for this study were selected by a high-rank NADMO officer, and were not a pondered choice.

### 1.6 Current body of knowledge

There is a considerable amount of research done in the fields of crisis management, development, accessibility, and mobile technologies. However,
there seems to be a lack of attempts to research their intersecting points. The difficulty of comprising such extended fields of research might be behind this lack of joint body of knowledge.

There are, however, several studies that can be related to this thesis, as they cover at least some of the fields covered here. The most relevant study may be Web 2.0 and internet social networking: A new tool for disaster management? – Lessons from Taiwan by Huan, Chang & Hyder (2010), on which they explore mobile technologies and internet as a potential tool for crisis managers. While the setting is placed in Taiwan and does not cover the issue of development, it does take into consideration the issue of accessibility. Laituri & Kodrich’s (2008) Online disaster response community: People as sensors of high magnitude disasters using internet GIS, also covers crisis management, and takes on the field of accessibility.

Other approaches that include accessibility and mobile technologies usually look into e-government or education. Noteworthy studies of following this approach are Bertot, Jaeger & Grimes (2010) Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies and Chu et al. (2012) Information technology and its role in anaesthesia training and continuing medical education.

Finally, a noteworthy study in the field of development are Wicander’s (2011) doctoral thesis, Mobile Supported e-Government Systems - Analysis of the Education Management Information System (EMIS) in Tanzania, which looks at the uses of mobile technology for e-government and education in the development setting of Tanzania.

1.7 Terms and definitions

As mentioned in Chapter 1.2 Purpose, target group, and expected results, this study is directed mainly to natural disasters crisis management officers and researchers within the framework of development, mobile communication, and accessibility. For that reason, the main consideration is that most of the terms used in this study are well known to the reader. However, for the sake of clarity, four definitions of key terms are given here as means of introduction.

Crisis Management

Rosenthal, Boin, and Comfort (2001) define crisis as a dynamic process on which a community of people, an organization or governmental structure perceives one or more threats to core values or life-sustaining functions which must be dealt
with under conditions of uncertainty. This particular situation occurs in the prelude or the aftermath of a disaster or a catastrophe.

A disaster is defined by the United Nations as a serious disruption of the functioning of a society, and a catastrophe refers to disasters causing such widespread human, material, or environmental losses that they exceed the ability of the affected part of society to cope adequately, using only its own resources (Hiltz, Diaz, & Mark, 2011).

Thus, crisis management refers to the efforts to prevent, mitigate, prepare, and respond to a particular crisis. As Carr (2008, p.221) clarifies, it is worth noting that the ways a community reacts to such a situation is determined by its culture, determination, and leadership, as well as the speed, scope, complexity, and violence of the disaster itself. To Carr’s statement, the author of this study would add the importance for resources as an important influence to how a community reacts to natural disasters.

**Mobile technology**

Mobile technology, as a major component of the current plethora of ICTs, offers a wide range of definitions. The main features that define a mobile technology are their capability of mobility due to a battery-power system, and a wireless type of communication technology (Feldmann, 2005).

In this particular study, mobile technologies will mostly refer to the most common of mobile phones: feature phones, and smartphones. Other devices, such as tablets, wearable computers, or ultra-mobile PCs will have not a significant appearance, with the exception of the GoTa system.

In developing countries, mobile phones are playing the crucial role that land-line telephony played in western countries in the 1970s and 1980s (Ashraf et al., 2010). Additionally, spurred by the limited need for infrastructure, mobile phones are substituting land-lines phones, instead of complementing them, rapidly becoming the main sort of communication technology used (Wicander, 2010).

**Accessibility**

Accessibility is an extremely atomized concept. From linguistics to architecture, the idea behind the notion of accessibility is to extend the usage of a product or service to a wider audience, particularly to those with some kind of preventive condition, impediment, or socio-economic hindrance.
For the purpose of this study, the notion of accessibility is approached both from the geographical perspective, and the communication perspective. In particular through the prism of information systems, mobile phones, and web applications.

At the most basic level, Web Accessibility is about people being able to get and use web content, according to their needs and preferences (Thatcher et al, 2002). On a much more specific note, Web Accessibility can be regarded as the efforts, techniques and technologies directed to making websites accessible to users with disabilities.

Transmitting a message or making website content available to a larger audience is accessibility’s ultimate goal, thus filling the gap that ICT web systems have had when it comes to reach to all types of audiences.

Development

The definition of development tends to carry a socio-cultural context that is often misused, or abused. It is a widely contested term as it is widely accepted as a discipline that aims for a positive socio-economic transformation of poorer regions of the globe (Sumner & Tribe, 2007) however, whether the “positive” effect needs to be an outcome or merely the initial intention is unclear.

The fallibility and often short-term standpoint of development argues for a cautious approach. This study takes a neutral view towards development. The intentions and outcome of each developmental initiative are so varied that is difficult to conceive a term that can refer unanimously to all of them (Chambers, 2004). With great caution, development is referred to as a purely socio-economic growth of a society, regardless of the perceived positive effects that it might bring to a particular region, as that brings a gray area of measurement.

1.8 Disposition of the thesis

Chapter 1 - Introduction sets the background and rationale that supports the study. A quick exposure of the importance of crisis management within a developing context is given in order to set a starting point for the study. The research questions are presented, as well as the information needs and research design, the purpose of the study and expected results, and the boundaries and limitations that delimit the study. Finally, the first chapter ends with a list of terms and definitions that might be valuable to the reader, as well as the disposition of the thesis.

Chapter 2 – Contextual description of Ghana provides an in-depth look into Ghana’s current situation in terms of socio-economic and demographic conditions, natural disaster status, main causes of flooding in the country,
infrastructure, and an internet and mobile telephony overview. This chapter also introduces the crisis management panorama in Ghana as well as the implementation process of the Hyogo Framework of Action in the country.

**Chapter 3 - Theory and literary review** offers the theoretical foundations of this study. The outline follows the initial problematization of risk, the notions of vulnerability, threats and global risk, and the risk and trust within a development context. The chapter continues by discussing crisis communication, and the role of ICTs and mobile technology in social development. Finally the chapter looks at mobile accessibility and the compliance of policy and accessibility standards.

**Chapter 4 - Methodology** brings forth the methodology used in order to collect and analyze data that should lead to answering the research questions that motivate the study. The research methods are directly linked to the information needs established in the first chapter. This chapter also mentions the data sources and makes a note on validity and reliability.

**Chapter 5 - Data collection and empirical research** describes the process on which the data was collected, how the study was performed, and how the methodological framework was applied. A brief description of the field work is given, as well as an introduction to the group of interviewees, a description of the data speed tests, and the settings of the web analysis.

**Chapter 6 - Empirical data and analysis** contains the empirical data of the study and the subsequent analysis of the data. A description of the themes emerged from the content of the interviews, the results of the speed tests, and the content of the web analysis are presented. This chapter combines a condensed presentation of empirical data with an analysis of the data itself.

**Chapter 7 - Discussion and conclusions** presents observations on the analysis of the data and provides a set of answers to the research questions outlined in the first chapter. The chapter then continues with a concluding set of remarks, followed by the academic and practical contributions of the study. As a final note, a few suggestions on future research are offered.

The body of this thesis is completed by a list of references on which this study is built upon, and a set of appendixes that comprise the framework used to conduct the interviews, the results of the short interviews, the results of the mobile internet speed tests, and the accessibility test results output.
2 Contextual description of Ghana

The intention of this chapter is to provide information about Ghana as a contextual foundation in order to understand the setting of the study. It also introduces the organization upon which a large body of this study is based: NADMO.

As previously discussed, the concern of the international community towards natural disasters has been increasing, resulting in the implementation of the Hyogo Framework for Action in 2005. Ghana is one of the 168 signing members of the HFA in order to reduce risk, increase the efficiency of response to crisis environments, and secure a level of sustainable development that is not endangered by natural disasters.

2.1 Socio-economic and demographic conditions

Ghana is a mid-sized country (238.533 km²) situated in West Africa, by the Gulf of Guinea. Its widely ethnically-diverse population is about 25,241,998 people, which makes it a scarcely dense country at roughly 105 people per km², however, the larger proportion of Ghana’s inhabitants live in the south of the country. Almost 10% of the population lives in the capital, Accra, however Ghana still has a majorly rural population (CIA, 2012). The country is divided into ten regions.

In comparison to other West African countries, Ghana has one of the highest GDP per capita. Its main exports rely on primary resources, such as gold, timber, cocoa, diamonds, and several minerals. Five years ago a large oilfield under Ghanaian soil was discovered. However, despite the exuberance of natural resources, more than the 25% of the population of Ghana lives below the poverty line (AICD, 2010).

According to the UNDP, Ghana ranks in number 135 in the HDI list, with an index of 0.541. It is enlisted, so, in the quartile of the Medium human development countries. The fact that Ghana is not an LHD country is particularly appealing for this study, as it ensures a historical evolution of ICT infrastructure in the country.

Spreading information in Ghana is a complex task. Ghana has at least 79 living languages (particularly atomized in the northern and western regions of the country) of which 10 are native government-sponsored languages. However only English, introduced by the British colonialism, is the common language to all Ghanaians and has official status (Owu-Ewie, 2006).
The educational system is free and mainly in English, to accommodate the multilingual characteristics of Ghanaian population. It requires 6 years of obligatory schooling during the Primary School stage, however, only about 75% of children enroll or attend primary school. The net level of enrollment and attendance to secondary grades drops below the 40% mark (UNESCO, 2008). Higher educational enrollments remain low at about 6.000 a year.

2.2 Natural disasters in Ghana

Ghana suffers a recurrent set of disasters, especially floods, epidemics and in a minor degree, drought and fires. The characteristics of the country make that these disasters are intrinsically interconnected, deriving in thousands of affected people and dozens of casualties year after year. The dramatic results often end in displaced population and difficulty to obtain basic necessities such as food, shelter, clothing, and medical care.

The statistics from 1980 to 2010 regarding crises leave a dramatic number of 29 events considered as a natural disaster, with a total of 1.133 deaths and a total of 16.254.250 people affected. This means an average of 37 casualties and about 524.331 affected per year (CRED, 2012). The estimated economic damage caused by these disasters rises up to 33.5 million US dollars, which signifies a massive strain on an already debilitated national economy. Floods alone have claimed the lives of 392 people, affecting 1.832.190 people.

In terms of vulnerability and risk, Ghana has a high vulnerability index, which is the estimated number of people killed per year, for floods and a very high one for landslides. When it come to the risk absolute (average killed per year), risk relative (killed per million per year) and the mortality risk index (average of risk absolute and risk relative), the rank drops to medium for floods and low for landslides (UNISDR, 2009).

During the month of September of 2011, epidemics alone took the life of 101 people by a cholera outbreak. However, flooding is the most recurrent natural disaster in Ghana. In the span of 5 years between 2007 and 2011, every year, a state of emergency for flooding that claimed lives has been declared (10-Aug-2007, 56; Aug-2008, 8; 6-Jun-2009, 16; 17-Sep-2009, 24; 20-Jun-2010, 45; Sep-2010, 18; 22-Jul-2011, 6; 26-Oct-2011, 14;).
2.3 Causes of flooding in Ghana

The common causes of flooding in the country are intense seasonal rainfall runoff combined with extended periods of drought, dam-burst leaks (both from Ghana and Burkina Faso) and, in the coast line, from tidal waves.

The orographic nature of the territory has defined a pattern of recurrent flooding areas. The Odaw River in Accra, the Pra river and Ankobra river in the Western region, the White Volta in the Northern Region, the Black Volta in the Upper West region, and the Afram Plain in the Eastern and Ashanti regions are the ones with higher number of floodings in Ghana.

However, treating disasters as something unique that developed from particular natural characteristics and that requires its own special focus, carries a danger. It often becomes too easy to strip "natural" disasters from the social context that influence how hazards affect people, hence weighing too much emphasis on the natural hazards themselves, and not nearly enough on the surrounding social environment (Wisner et al., 2004).

In addition to the natural course of rainfall of a tropical country, the impact of men has helped to aggravate the situation. In the 1960's, the creation of the Lake Volta, the world's largest artificial lake by surface area, modified the rainfall patterns of the area. This had a severe impact on agricultural activities, deforestation, dried up rivers, and pushed more people towards Accra, generating unplanned urban areas of poor-quality housing, normally built in fluvial paths. The newly dried rivers increased the risk of flash floods, and the new settlements are often build in the path of those flash floods, which now are more likely to claim lives as they occur. On top of that, the occasional spills from the Bagre Dam in Burkina Faso, and the Akosombo Dam in Ghana, combined with garbage disposal in water paths, make the problem of flooding even more endemic.

According to Karley (2009, p.40), the fundamental problem is that water courses are being blocked as a result of human activities such as building houses on river beds and across water courses, the lack of adequate drainage infrastructure, and the siltation of limited drainage systems.

2.4 Crisis management in Ghana – NADMO

The National Disaster Management Organisation (NADMO) was created under the legislative ACT 517 of September of 1996 with the distinct task of being "responsible for the management of areas affected by disasters and similar
emergencies, for the rehabilitation of persons affected by disasters and to provide for related matters” (NADMO, 2006).

The organization's mission was set to manage disasters by coordinating the resources of Government institutions and developing the capacity of voluntary community based organizations to respond to similar emergencies. This mission was shaped by the tasks to be carried out by the organization. These tasks can be summarized as:

- Coordination of the activities of various bodies in the management of disasters (Coordination);
- Rehabilitation of persons affected by disasters (Relief);
- Social mobilization, especially at the community level to support various Government programs, such as the poverty reduction program as well as those aimed at the management of disasters (Education).
- Ensuring that the country is prepared to prevent disasters and manage them well when they occur (Preparedness & Monitoring).

NADMO’s organizational structure is a highly hierarchical and complex one. It is run under the oversight responsibility of the Ministry of Interior, and its governing body is the National Security Council, which is responsible for determining the policies and functions of the organization. The Nation Security Council is also responsible to appoint committees, and the ruling committee of NADMO is the National Disaster Management Committee, which is widely referred as the National Committee. The National Committee is formed by the Minister of Interior (who is the Chairman), a representative from 10 other Ministries, and the National Coordinator of the NADMO, who also acts as the secretary to the National Committee. This National Coordinator, appointed by the President, is the chief executive of the organization and is responsible for the day to day management of the NADMO. The position of National Coordinator of NADMO is currently filled by Mr. Kofi Portuphy. The structure of the organization, as shown in Figure 1, is completed by Regional and District coordinators aided by ten Technical Advisory Committees, distributed at a National and Regional levels. The staff of the organization consists of professionals, experts, consultants, officers and employees of public institutions and non-governmental organizations. However, any person who has attained the age of sixteen years or more and is resident in Ghana may volunteer to register as a member of NADMO.
Fig. 1  **NADMO’s organizational structure**

Additionally, **Table 1** shows the various advisory committees and their competencies.

**Table 1 – Technical advisory committees of NADMO**

<table>
<thead>
<tr>
<th>Technical Advisory Committees</th>
<th>National Level</th>
<th>Regional Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geological</strong></td>
<td>(Earthquakes, Landslides, and Tsunamis)</td>
<td><strong>Natural Disasters/Hazard</strong></td>
</tr>
<tr>
<td><strong>Hydrometeorological</strong></td>
<td>(Floods, Windstorm, and Drought)</td>
<td><strong>Man-Made Disasters/Hazards</strong></td>
</tr>
<tr>
<td><strong>Pest and Insect Infestations</strong></td>
<td>(Anthrax, Large Grain Borer, Armyworms, African Swine Fever)</td>
<td></td>
</tr>
<tr>
<td><strong>Disease Epidemics</strong></td>
<td>(Cholera, Cerebrospinal Meningitis, Yellow Fever)</td>
<td></td>
</tr>
<tr>
<td><strong>Man-Made</strong></td>
<td>(Wars, Conflicts, Lake/Boat Accident, Oil Spillage, Aviation Accidents)</td>
<td></td>
</tr>
<tr>
<td><strong>Radiological</strong></td>
<td>(Nuclear and Radiological Accidents)</td>
<td></td>
</tr>
<tr>
<td><strong>Fire and Lighting</strong></td>
<td>(Wild/Bush/Forest Fires, Domestic/Industrial Fires, Lighting)</td>
<td></td>
</tr>
<tr>
<td><strong>Relief and Reconstruction</strong></td>
<td>(for all emergencies or disaster types)</td>
<td></td>
</tr>
</tbody>
</table>
The organization has a network of offices that are established throughout the country from the national to the district and to the zonal level. NADMO is funded by the Parliament of Ghana and by grants, donations and contributions.

Externally, the organization works over 60 organizations, hundreds of volunteer groups and thousands of community leaders.

2.5 Implementing the Hyogo Framework for Action

As stated earlier, in September of 2005 Ghana adopted the HFA, a 10-year plan to make the world safer from natural hazards. The framework was designed and accepted multilaterally by a large group of actors involved in disaster risk reduction, unifying efforts to homogenize a common system of coordination.

The system outlined by the HFA is composed by five priorities for action with the main goal of reducing, by 2015, casualties, economic impact, and environmental losses derived of disasters by building resilience of nations and communities to disasters. In order to device guiding principles and practical means for achieving disaster resilience, the HFA defines the following five priorities (UNISDR, 2005):

Priority Action 1: Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.

Countries that develop policy, legislative and institutional frameworks for disaster risk reduction and that are able to develop and track progress through specific and measurable indicators have greater capacity to manage risks and to achieve widespread consensus for, engagement in and compliance with disaster risk reduction measures across all sectors of society

Priority Action 2: Identify, assess and monitor disaster risks and enhance early warning.

The starting point for reducing disaster risk and for promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic and environmental vulnerabilities to disasters that most societies face, and of the ways in which hazards and vulnerabilities are changing in the short and long term, followed by action taken on the basis of that knowledge.

Priority Action 3: Use knowledge, innovation and education to build a culture of safety and resilience at all levels.

Disasters can be substantially reduced if people are well informed and motivated towards a culture of disaster prevention and resilience, which in turn requires
the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities.

**Priority Action 4**: Reduce the underlying risk factors.

Disaster risks related to changing social, economic, environmental conditions and land use, and the impact of hazards associated with geological events, weather, water, climate variability and climate change are addressed in sector development planning and programs as well as in post-disaster situations.

**Priority Action 5**: Strengthen disaster preparedness for effective response at all levels.

At times of disaster, impacts and losses can be substantially reduced if authorities, individuals and communities in hazard-prone areas are well prepared and ready to act and are equipped with the knowledge and capacities for effective disaster management.

### 2.6 Infrastructure and accessibility

Infrastructure (roads, power, water, sanitation, sea and airports, ICTs) is a fundamental stepping stone for economic growth and development. The production capacity and the growth of GDP are tightly intertwined with the state of the national infrastructure.

When compared with other developing African countries, Ghana has an advanced infrastructure. The country’s coverage levels for rural water, electricity, and GSM signals are impressive (Foster & Pushak, 2011). However, the current estimates delivered by the World Bank show a need of sustained annual investment of 2.3 billion US dollars for a period of ten years in order to bridge the current infrastructure shortcomings, compared to the current spending of 1.5 billion. This is one of Ghana’s biggest challenges today.

About 75-80% of the national traffic of products is handled in the ports (mostly exports of raw materials), particularly the Accra port, the Takoradi port (which exploits the preliminary extractions of new-found oil in the coast of Ghana), and Tema port (which established the so-called Free Zones, offering reduced tax havens for foreign investors).

The country’s road sector is also well developed. There are 95 paved and 81 unpaved networks in good or fair condition, connecting major urban areas. This is not coincidental, as 97% of human transport in Ghana occurs by road. However, Ghana is still considered to have a predominantly rural population relatively dispersed in the territory (GIPC, 2013). This sets the scene for a large
amount of population that has not direct access to main roads, and thus has a
disadvantage in terms of mobility and limited access to most of Ghana’s services.

The biggest challenge though, is placed in the ever-growing demand of the
electricity sector. The Akosombo Dam in Lake Volta has capacity for energy
production of 2.000 MW and it is planned to improve to 5.000 MW by 2020. The
electricity generated is used internally, but power is also exported to Togo, Benin,
Cote d’Ivoire, and Burkina Faso. Apart of the hydraulic power, Ghana produces
electricity through thermal power, and there are plans for solar and wind power
production. Despite of Ghana’s outstanding electricity production, the country’s
capacity is still facing serious shortfalls. Power outages alone led to a 1.9% of the
GDP in economic losses in 2012 (GIPC, 2013).

Nevertheless, the infrastructure situation is seen with optimism. The finding of
oil pockets off the coast of Ghana have boosted international and national
investments, and 70% of the oil revenue is committed to infrastructure and
physical expenditure, like roads, hospitals, and schools.

2.7 Internet and mobile telecommunications overview

Up to 1996 the telecommunications sector in Ghana was a monopolized sector
run by the Post and Telecommunications Corporation. The new liberalized and
reformed sector is regulated by the National Communications Authority (NCA)
with the main objective of managing and regulating the provision of
communication services in Ghana.

2.7.1 Telephone services

The growth of telephone consumption has been exponential as commercial
services have managed to secure an infrastructure backbone with a GSM signal
extension that has the potential of reaching 99% of the territory.

Telephone penetration is currently at an all-time high of 67% of which 99% is
mobile phones and only a 1% is landlines (GIPC, 2013). This is a particularly high
number in comparison with other Low Income Countries (LIC), which average at
a 15% penetration, and not far from the average for Middle Income Countries
(MIC), which is 87%. Virtually all (98%) of landlines are operated by Vodafone
Ghana. The other 2% is operated by service provider Zain.

The mobile market is much more disputed. There are currently six major mobile
network operators in Ghana with varying degrees of market share: Scancom
Ghana Limited (MTN) – 45%, Vodafone Ghana Limited – 21%, Millicom Ghana
Limited (Tigo) – 14%, Airtel Communication – 13%, Globacom Ghana Limited (Glo) – 6%, and Expresso – 1% (GIPC, 2013).

While market penetration has been increasing and the sector still offers strong investment opportunities for service providers, there are several problems within the infrastructure, as the mobile voice signal is extremely fragmented where different territories are serviced only by one or two providers, leaving the territory divided in terms of actual coverage (AICD, 2010).

Figure 2 shows two maps of Ghana. The first one provides the existing coverage of mobile voice signal and the market efficiency gap, which means that not all commercial actors are involved in all the territories equally. The second one shows the coverage of limited performance broadband (WiMAX) in Ghana.

![Mobile voice signal vs Limited performance broadband (WiMAX)](image)

**Fig. 2 Mobile voice WiMAX in Ghana (AICD, 2010)**

### 2.7.2 Internet services

In the mid-1990s, Ghana was one of the leading countries to connect to the internet adopting ADSL technology.

Internet usage has increased dramatically, with figures of actual bandwidth usage multiplying by ten only in the years between 2005 and 2009 (AICD, 2010). However, hindered by power outages, internet penetration has remained particularly low, at an only 4%, driven mostly by the private sector.
The growth of use can be explained by the decision of deploying mobile WiMAX network in Ghana, in 2006, as well as a sub-variant of the High Speed Downlink Packet Access (HSDPA) technology, which has already been rolled out by mobile carrier giants, MTN and Airtel under the generic label 3.5G (Agyekum, 2012). Poor DSL access and weak infrastructure backbone made the decision for a wireless broadband system much more appealing in the region.

The WiMAX technology is a broadband wireless solution that enables convergence of mobile and fixed broadband networks through a common wide area broadband radio access technology and flexible network architecture (WiMAX Forum, 2006). It is based on the IEEE 802.16-2004 Air Interface Standard providing internet access within fixed broadband wireless metropolitan area networks. It allows for broadband connectivity beyond individual buildings to provide coverage to an entire area (Ofori-Dwumfu & Salakpi, 2011).

Figure 3 shows the current ICT backbone and the estimated mobile internet coverage in Ghana. It is worth pointing out that GSM coverage shown in the map is inaccurate or at least unreliable, as shown by this same study.

Public commercial licensing for WiMAX has been rather limited and it remains widely inefficient. Thus, in the summer of 2012 the National Information Technology Agency (NITA), decided to shift from WiMAX technology to LTE 4G stations, upgrading the 30 WiMAX towers into LTE in a partnership with Chinese telecommunications giant Huawei. It is uncertain when 4G will be
commercially distributed in Ghana, nor which is going to be the range for mobile broadband internet in the country.

2.7.3 GoTa System

The Global Open Trunking Architecture (GoTa) is a digital trunking communication system developed by Chinese telecommunications corporation ZTE. It is based on 3G wireless communication using CDMA networks, and can deliver voice and network resources, with fast access and high privacy. The idea behind a trunking communication system is to provide network accessibility by sharing a set of frequencies. This allows the system to provide services such as one-to-one and one-to-many communications, paging or groupings.

In Ghana, the National Security Information System adopted the GoTa system as an ambitious communication system that would provide nationwide coverage to the ten regions and with a total capacity of 50,000 subscribers. The project is done in two phases. Phase I installed 70 base transceiver stations (BTS) with 24,000 subscribers in the ten regions’ capitals and all Greater Accra region. Phase II will add 110 BTS and 26,000 subscribers for all 128 district cities.

According to ZTE (2007), the benefits of the GoTa system are many. The network can provide fixed wireless access, mobile communication services like voice, data, SMSs, push-to-talk technology, but most importantly, it can interoperate with the networks of other regular mobile operators. It allows for a higher frequency efficiency, easier network planning, better voice quality and bigger capacity based on 3G technical platform. Being a dedicated network, it ensures security and privacy. The GoTa system carries its own proprietary terminal that has access to those functionalities.

Interestingly, ZTE’s description offers the following statement:

“GoTa meets the requirements of current and future mobile communications, driving the growth of trunking radio communications and satisfying the current and future requirements for government public security and coalition emergency response” (ZTE 2007, p. 11).

Whether the GoTa system can deliver “the future” requirements is obviously an exaggeration fruit of a commercial pitch. However, Ghana’s government has adopted it as its own internal communication system and thus, it is particularly relevant for this study.

It is worth pointing out that for the foreseeable future, the GoTa system is not expected to have a commercial distribution towards Ghana’s general public.
3 Theoretical discussion: Risk, communication and accessibility

Setting the theoretical point of departure in Beck’s Risk Society, this chapter allows for a theoretical exploration on the issue of risk. It maps the distinction of various concepts related to crisis management and their relationship with the concept of development. It also draws from the main theories of crisis communications, and provides an introductory look into mobile accessibility and best practices.

The needs to communicate and disseminate information are of utmost importance to enhance preparedness, to raise awareness, and to mitigate the impact of a disaster once it strikes. This factor takes particular relevance in a developing country, where infrastructures are not set to withstand the damages caused by natural disasters, and where a large number of the population can suffer a limited or non-existent access to information.

The wide array of actors and stakeholders surrounding crisis management has different influence over the policies adapted locally, often dependent on international ruling, national means, and local predisposition. As Palm and Ramsell (2007) propose, policy development enforces co-operation and open networks, so decision making will not be legitimate just by being so within one organization or institution. Legitimacy emanates from the interplay between legal interpretations, common understanding, and trust within a network.

This legitimacy is thus a matter of perspective, and therefore it is perceived differently and cannot be easily enforced. This has wide implications in the flows of trust that transpire into the public, as policies have unclear intentions from external origins and offer vague channels of applicability. When international forces drive the global policies in crisis management, the meaning of risk becomes intangible.

’t Hart et al (2001) identify three main evolutions in crisis management practice, to which crisis management associations and crisis managers need to adapt. The first one, discussed in the following section, is the societal evolution from industrial to risk society. This development, the problem of risk, is addressed by Ulrich Beck (1992). The second is the development from hero to besieged crisis response as a result of the mediatization of crisis management and the panoramic scrutiny by the governing powers and the general public, on an almost immediate timing as a crisis unfolds. This particular development generates the issue of trust, as it will be discussed later on in this chapter. Finally, the third one
is the change from episodic to continuous crisis management, as the international politicization of crisis management pressures national organizations to confront crises as a constant threat to society, by constantly planning (and expecting) the eventuality of a crisis, reacting when a crisis strikes, applying relief strategies afterwards, and learn from the experience as preparations start for the next strike in a never-ending continuous cycle. In order to succeed at such an approach it is necessary to keep a constant dialogue with the public in order to raise awareness and preparedness among the population. This development is discussed in Chapter 3.3 Crisis communication: strategies and informing the public.

3.1 The problem of risk

The nature of risk is a problematic one. Its bonds with society are deep, and thus it is attached to the perspective of the social framework that it derives from. In a way, the concept of risk has evolved hand in hand with the evolution of societies, and for this reason, risks have been, are and will be different according to the societal context and geographical disposition.

According to Beck (1992), the transition from modern societies to reflexive modernity tries to accommodate the essential tension between human indeterminacy and what is considered to be inevitable. A knowledge-based society suddenly tries to objectify and naturalize its institutional and cultural structures. Beck's idea of a Risk Society is based on reflexive modernization (a new evolution of modernism where the growth of knowledge has created a ubiquitous 'manufactured uncertainty' such as the risk of ecological disaster, so that scientific expertise is increasingly called upon to alleviate the effects of earlier applications of science) and the issue of risk. The reflexive modernization pushes society to ponder about the outcome of techno-economic development and the impact of human-constructed problems in nature (Aiken, 2000). According to Beck (1992), risks are defined as the probabilities of physical harm derived of technological processes, and thus can be bound to an agenda or a predefined discourse. However, risk cannot be reduced to the product of probability of occurrence multiplied by the intensity and scope of potential harm. It is a socially constructed phenomenon in which some actors have a greater capacity to define risks and indirectly enforce them unto others (Beck, 2006).

Following the steps of Beck, Anthony Giddens (1999) distinguishes hazards from risks. While hazards and dangers are experienced as a given, and inherent to the earthly surroundings or of godly devise, risks are bound with the aspiration of control, prediction, and handling of future events. Giddens identifies two typologies or risk: external risk, which consists of events that occur unexpectedly, but that strike with enough regularity and frequency that can be predictable by a
population, reasonably well-calculated, and thus that can be insured; manufactured risk, which finds its origins by the advances of science and technology, and that apply to environments that offer little or no previous historical experience. Therefore, manufactured risk cannot be calculated accurately nor predicted in a detailed degree.

Social empowerment and welfare, the advancements in medicine and the technical innovations allow for societies and states to reduce and minimize hazards and to prevent and prepare for external risks. Once social structures can afford to decrease efforts to prepare against hazards, there is a shift of attention towards uncertainty, towards the events that may or may not happen. In a way, risk is tightly related to safety and security, but also to responsibility (Boin & Lagadec, 2000). The nature of this responsibility is different depending on the governments, distributed in the individual, in the collective society, and the political structures. There is also a clear connection between secularization and risk. Indeed, if responsibility no longer falls on the hands of a deity, then it is upon to society to take action.

But if all these improvements induce a considerable contention of hazards and external risk, globalization, the increase of social mobility, and easier diffusion of technological innovations allow for a constant increase of manufactured risk. As Giddens (1999, p.4) explains, manufactured risk is risk created by the progression of human development, especially by the progression of science and technology. The global trends of interconnectivity create new opportunities for developing countries to achieve higher social and economic progress. At same time, increased trade and better technology is usually pressed by the more industrialized countries unto developing regions. Globalization carries along standardization, but there is a constant uncertainty about the benefits and effects of such standardization. There has been no real indication that improvement will be shared widely across individuals, ethnic groups, societies and countries (Holzman & Jorgensen, 1999). On the other hand, it is clear that the constant incorporation of industrialized countries interests in developing regions merges economic spheres, creating interdependencies that carry inequalities between the strong economies and the vulnerable societies. As discussed above, the western governments and powerful economic actors define risks, and as long as their interests lay in developing countries, or their profits are affected by the status of developing countries, those risks are enforced in the policies of those countries, such as the Hyogo Framework for Action.

To reflect this, Beck (2006) introduces the theory of world risk, which points that modern societies are formed by new types of risks, but their foundations are shaken by the global anticipation of global catastrophes. Such perceptions of
global risk are characterized by three features: de-localization (spatial, temporal and social), incalculableness, and non-compensability. The incorporation of new risks that happen offshore, in other modern societies or in developing societies, have a mirroring effect. It shapes both societies, but the risks are not assimilated reciprocally. A global risk affects all equally, but it is not experienced equally because not all territories and societies are equipped to adopt it.

This is the problem of risk. It is a man-made construct that spawns from industrialized and wealthy areas that have been able to reduce hazards and dangers, but it is enforced in areas where it is experienced differently, and where the assimilation is not simple for various reasons, such as culture, wealth, and policies (Cottle, 1998). With the immersion of risk in a society, it is experienced as omnipresent. Beck identifies three possible reactions: denial, apathy, or transformation. However, he does not address the levels of transformation endured when a society has other needs and priorities but still is urged to transform and adapt to the new risk, the infrastructures are not sufficient, budget is insufficient for it and hazards are still at a high-level.

### 3.2 Where risk becomes threat: chaos, crises, and disasters

#### 3.2.1 Vulnerability, threats, and global risk

Following of Beck’s theory, the idea of risk is indirectly self-inflicted. Risks are generated by the nature of social, political, and economic organizations, deriving from the development of techno-scientific technologies (Jarvis, 2010). As globalization defies the current concepts of territoriality and sovereignty of the nation-state, international patterns emerge trying to capture trade and markets, steer mobile human capital and to impose policies that ensure the dominance of political economics of uncertainty and risk. As Beck points out, threats create society, and global threats create global society (Beck 2000, p.38). But what once were unexpected and unavoidable threats, such as plagues, natural catastrophes, and wars, turned into foreseeable risks during the industrial society and have finally transformed into artificial disasters of unknown outcomes and difficult anticipation. It has become increasingly difficult to distinguish between the natural and human origin of disasters, as the nature of disasters often is intertwined by both ends of the chain. It is unequivocal that human development has large effects in the course of nature and vice versa.

This becomes an argumentative problem, based on the notion of human development as a global term. However, development is not equally distributed across the globe, and thus risks interact with modern societies differently. As mentioned before, there is a clear inequality in the disaster mortality in low-
development countries. The answer lies in the vulnerability that developing countries suffer in many sectors, combined with the low adaptive capacity to climate variability, climate change, and other existing developmental challenges like low GDP per capita, endemic poverty, and low levels of education and health care (UNFCCC 2007; Thomalla et al. 2006). Within the framework of the UN’s IDMDR, vulnerability assessments are used to determine the potential damage and loss of life from extreme natural hazards (Cutter 1996).

The causes for vulnerability in developing countries do not only relate to climate factors, but also to the interactions between environmental, demographic, social, economic, institutional, cultural, and technological processes. The state and dynamics of these processes differ according to location and create varying degrees and typologies of vulnerability. Therefore, different societies that might be exposed to the similar phenomenon might suffer a different impact (Leary & Kulkarni 2007). The increased vulnerabilities of developing countries are the cause for a higher number of threats. If threat is to be considered as the indication of a possible danger or harm combined with the capacity to respond to that danger, then the level of vulnerability is positively related to the number of threats that a community is exposed to. Therefore, a vulnerable country is exposed to a higher number of threats, and a safe country with few vulnerabilities has fewer threats to deal with. On the other hand, considering Giddens' (1999) definition of risk, it is clear that external risk also increases (as the probability or potentiality that threats become real). However, the interest of this study lays on the manufactured risk. If manufactured risk is a man-made construct of wealthier societies, and it is generated through the evolution of socio-economic and technological advances, then, this type of risk is inferior in developing countries. Nuclear disasters are a good example of manufactured risk. Only 13 of the 31 countries that currently produce nuclear power are considered developing countries, but only three of those 13 (Russia, Ukraine and China) have a considerable amount of megawatt capacity. This means that the risk of nuclear fallout is only expected in richer countries (IAEA, 2013). However, history proves that effects can be global. Further in this reasoning, it could be argued that a richer country, due to a reduced number of vulnerabilities, has fewer threats and is able focus efforts to prepare for manufactured risks. A developing country, on the other hand, has to use its resources to face threats due to its vulnerabilities, and manufactured risks have a secondary focus.

The genius of Beck’s theory is the introduction of global risk. As a social construct, the manufactured risk is created by western countries. However, due to globalization, the possible effects carry a global aspect that cannot be quantified or predicted easily. For this reason, richer countries try to enforce
policies onto developing countries. The economic dependencies on global forces of interaction, for labor, raw material, or even tourism, make a case for a necessary monitoring from the west.

3.2.2 Risk, trust, and development

The discussion above draws certain parallels between risk and development, however, a clearer connection between the global aspect of manufactured risk and how this affects developing countries needs to be made. As interacting spheres, international organizations and national organizations (and eventually the public) need to rely on the important role played by trust in public adoption or opposition of particular policies (Comfort, 2007). The nature of trust in risk management and the relations between trust, risk perception, and cooperation have been explored by a growing number of empirical studies (Earle, Siegtrist & Gutscher, 2010).

It is clear that natural disasters have a macroeconomic impact on developing countries (Strobl, 2009). However, from a global perspective, the main actors of a capitalist international trade have consistently been drawn towards developing countries for newer markets, cheap resources and labor, while profiting from the inequalities of welfare and environmental standards (WCSDG, 2004). Countries at similar levels compete to either attract or push trade, most of the time exploiting national and local development policies that stress short term goals. As Schipper & Pelling (2006) point out, these policies can lead to greater disaster risk as development increases exposure to hazards with irresponsible use of coastal fringes, unsafe urban slopes or dried water passages. As development increases, as it has been pointed out earlier, the manufactured risk increases. The problem is that manufactured risk is shared, and most of the times misunderstood or underestimated. The development efforts have to be accompanied of awareness and understanding of these risks to support sustainability. In developing countries, even the best risk management and mitigation measures can lead hazardous outcomes due to the characteristics of their vulnerabilities and the different nature of risks and threats.

The recent interest of the international community in prevention, reduction and mitigation of natural disasters stems directly from this premise. The IDNDR and the Hyogo Framework for Action can only be understood through the prism of globalization. The EU’s (2012) communication on trade, growth and development states that, for the first time in recent history, developing countries as a whole account for more than half of world trade. Globalization has introduced the developing economies in the cycles of international trade to such an extent where the wealthier countries also suffer the impact of setbacks on those economies.
The macroeconomic aspect of disasters in developing countries incentivizes the wealthier countries to mitigate the effects of possible disruption. The Trade and Development Communication offers a clear image of this:

“Natural disasters can have major disruptive impacts on supply chains, trade and economic activity. [...] In future, we will seek to use the temporary derogations to rules of origin requirements for crisis-affected countries in the new GSP rules of origin. To improve preparedness for natural disasters, we will seek to factor trade vulnerabilities into the needs assessments undertaken in the context of EU humanitarian aid policy” (EU, 2012, p. 15).

It continues on to making the following statement:

“Our absolute priority must be to preserve and strengthen the multilateral trading system” (EU, 2012, p. 18).

The motivations behind the international humanitarian aid are purely economic. Conversely, this interdependency of international markets is usually translated into international risk reduction policy (as for example, the Hyogo Framework of Action) championed by western countries and often imposed to developing countries. Discouraging as it may be, global pressures should not only be interpreted as negative. The ebb and flow of international trade, supply chains and economic activity can add to globalization a rarely positive aspect, the institutionalized co-operation at a global scale, facilitating greater co-operation at a national and local levels (Pellig & Uitto, 2001).

Precisely as international policy making, the concept of trust carries along a co-operation and familiarity that affects its nature. It is clear that trust operates at various levels, from the individual, group, and societal level. Similarly to risk, trust is a human construct that tries to relate to others in a multi-dimensional level (Barber, 1983).

These multiple dimensions, are embedded on the definition of trust offered by Mishra (1996); “trust is one party’s willingness to be vulnerable to another party based on the belief that the latter party is 1) competent, 2) open, 3) concerned, and 4) reliable” - four dimensions that are rooted and attached to the notions of vulnerability, expectations, and beliefs (Luhmann, 1979; Moorman et al., 1992). As Granovetter (cited in Mishra, 1996) points out, the ties of trust with vulnerability inevitably carry along the potential for loss in higher levels than those for gain, and places that being trusted in a vantage point where the power can be abused in regards of the ones who have to trust.
The enhanced vulnerability posed by developing countries, as well as the potential damage of the threats they face, places their societies in a disadvantaged situation against developed countries, turning them in trust holders towards the wealthier countries. This becomes clearer in Moorman et al. (1993, p. 82) statement; “without vulnerability, trust is unnecessary because outcomes are inconsequential for the trustor”. Here the four dimensions of trust become more apparent, as the vulnerable party must believe in the competency, openness, concern, and reliability of the other party in order to generate trust.

Interestingly enough, Vihalemm, Kiisel and Harro-Loit (2012) conclude that in order to strengthen the response efficacy, it is advisable that certain individuals (those known as non-regular followers of media) spread the information regarding crises and the strategies to follow. This strategy works especially well among the segment of public who do not trust the public institutions.

### 3.2.3 The environment of crises

Under the course of history, one the common traits of human civilizations and societies is the general exposure to hazards, threats, risks which eventually would lead to dramatic events such as disasters, revolts or wars. The historical translation of those dramatic events into crises has evolved along with societies. The extent that war or epidemics affected societies in the Middle Ages is completely different as the hardships suffered by populations today. The environment of crises constantly shifts with time and space, adapting to the characteristics of each situation.

The social nature of crises adds to the concept a degree of perspective (Wallerstein, 1988). What constitutes a crisis is a matter of judgment, not a matter of fact. It is connected to peoples’ perceptions of the scale and importance of the problem in question, and the severity of effect that it can have on them (McConnell 2003). Therefore, the concept of crisis is covered intensively throughout the crisis management literature. Rosenthal, Boin and Comfort (2001) define crisis as a dynamic process on which a community of people, an organization or governmental structure perceives one or more threats to core values or life-sustaining functions, which must be dealt with under conditions of uncertainty. Causes and effects of crises fall under a large array of factors distributed in various levels of concretion. Furthermore, it is clear that the response (and eventually the effects) is clearly connected to the causes that generate a crisis and the experience connected to them.

The typology of crises is also a matter of perspective. From the perspective of time, McConnell (2003) describes three types of crisis: sudden crisis, creeping crisis, and chronic crisis. Other typologies offer different perspectives, like
avoidable and unavoidable crises; normal and abnormal crises; and from the perspective of origin, man-made and natural crises (Gundel, 2005). It is this last perspective that this study looks into. As the human foot-print becomes more apparent in the planet, man-made and natural risks are increasingly more difficult to differentiate.

Another important notion is the concept of severity applied to natural crises, which is used rather loosely across the literature. Hede (2011) distinguishes five stages of severity: emergency (everyday contingency that one can be prepared for); crisis (threat to core values, deep uncertainty); disaster (loss of life, severe damage); catastrophe (most large-scale events); and extraordinary event (urgent action). According to this gradation, there should not be a lax interchangeability between crisis and disasters, or disasters and catastrophes.

Finally, it is worth mentioning the lifecycle of crisis and disaster, as developed by Faulkner (2001), in order to understand the approach of a holistic crisis management strategy. The first stage would be considered the Pre-event, on which a risk is acknowledged, and planning on possible eventualities is done. The second stage is the Prodromal stage on which it becomes apparent that a crisis is no longer evitable. Emergency is the third stage, on which the effects of the disaster are tangible and damage to people and property has occurred. The Intermediate stage occurs when sporadic short-term needs, as well as quick restoration of normality are required. The fifth stage is the Long term (recovery) stage, where repair, relief and reinvestment take place while aiming for complete normality. The final stage is called Resolution, on which routine is completely restored with a new set of improved tactics to address in future situations. This life-cycle offers a richer exposure to the nature of crises, rather than the three-stage approach proposed by Coombs (2012) precrisis, crisis response, and postcrisis segmentation.

3.3 Crisis communication: strategies and informing the public

There are several approaches to what crisis communication as a discipline should cover. There are several definitions (a few discussed in the Chapter 1.7 Terms and definitions) available, but definitions usually attempt to briefly conceptualize a discipline in a few sentences. For that matter, it seems more suitable to define crisis management through the tasks that it is supposed to accomplish.

Boin (2009) identifies five executive tasks that crisis management needs to address: preparing in the face of indifference; making sense of an emerging and evolving crisis; managing large response networks; offering credible answers; and learning under pressure. Accidentally, these tasks suit perfectly the stages of
a disaster lifecycle discussed earlier, and they all incorporate a need to communicate with the public or retrieve information from it.

During the process of introducing a long-term strategy of crisis management, at the moment of managing disasters, or while organizing post-disaster initiatives, there are several different areas of interaction that pose difficulties in the communication process: information exchange within the organization, with other organizations, from organizations to the public, from the public to organizations, and within systems of organizations (Quarantelli, 1988). As it is to be expected, the complexity of crisis management increases, as the communication process (or processes) is vital during the complete life-cycle of a crisis in all those areas of interaction.

All of those interactions are particularly important, especially considering that NADMO’s nature is that of coordinator of all the stakeholders involved in crisis management. But the failure to establish successful organizational relationships, both internally and externally, will eventually have an impact on the general public. For that reason, the focus of this study remains on the interactions between the management organizations (e.g. NADMO) and the public.

### 3.3.1 Detailing communication strategies

Crisis management literature stresses the importance of creating a detailed communication plan that keeps the flow of information between the public and the crisis managers fluent at all points of a disaster (Barton, 1994; Ritchie, 2004). Crisis communication’s main task is to provide the correct information to the public, but it is far from the only one. That would take a simplistic approach of a one-way communication system.

In order to properly coordinate all stakeholders, it is clear that a two-way communication on the strategies to follow and the tasks to conduct, not only facilitates the organization of those strategies, but clarifies the responsibilities of those involved, and reassures the public. Failures in the communication process tend to create confusion and can derive into an aggravation of the damage done by a disaster (Coombs, 2012).

Communication, in the sense of conveying and retrieving information to and from the population, should be present throughout the whole of the disaster lifecycle. It is worth mentioning, that as ‘t Hart et al (2001) mention, the adoption of a continuous crisis management approach, communication should be present constantly. This makes sense if we consider crisis management as a holistic discipline that does not only look at disasters as a unique event, but as an organizational and societal continuous effort. The main responsibility is placed
on the crisis management organization, as communication with the public is one of its main functions.

For that matter, during the **pre-event stage**, there is a need to identify hazards that could potentially affect communities, as well as the vulnerabilities and capacities of those communities. Hazards could not necessarily be within the national borders (as massive rainfall in a neighboring country could lead to flooding within the confines of the country), and disasters in neighboring countries could have effects on the national communities (as massive fires in a neighboring country could generate displaced migrants that seek refuge within the national borders). It is at this point where hazard mapping can be conducted, as well as education strategies and awareness campaigns. Fostering prevention and reaction behaviors can help decrease the effects of a disaster.

This particular stage should cover the first task identified by Boin (2009), preparing in the face of indifference.

During the **prodromal stage** communication strategy loses the long-term nature of the previous stage, aiming for a much more concrete, quick two-way communication. At this point warning signals are required, channels to receive information from the public must be operational in order to optimize responding times to actual contingencies.

During this stage, the task to be fulfilled should be making sense of an emerging and evolving crisis.

The **emergency stage** offers the biggest challenges for organizations. At this stage chaos and confusion tend to be the norm, and thus, clear and concise information needs to be disseminated to the public. At this point is when a one-way communication from the organization to the public is most effective. The general media cannot be neglected for two reasons: in the first place, the media is usually the way the public can obtain information in a quick, clear and homogenous way; secondly, if the crisis team does not collaborate with the media to fill the needs of information, the media will speculate providing contradictory information and diminishing the authority of the crisis teams (Coombs, 2012).

At this point, the task to be performed should be managing large response networks.

During the **intermediate stage** communication needs to regain the two-way flow, as crisis managers need to estimate the damage and find the needs of the communities and other organizations to plan mitigation and relief initiatives, and start the restoration process. It is vital to deliver a consistent message to all stakeholders and the public in order to reaffirm the hierarchies of authority, and
to build credibility and an image of competency in the public eye (Coombs, 2012). Failing to do so can damage the image of the crisis managers and lead to distrust and compliance issues.

Offering credible answers should be the task covered during this stage.

During the long term stage the flow of communication needs to be reversed, where the crisis managers retrieve more information than they put out. The idea behind this is to collect data from the public and the stakeholders that provide a clear image of the response given through the crisis. By doing so, the public is reassured as an important part of the process of management, and a report of the successes and shortfalls of the management initiatives can be created.

As Boin & ‘t Hart (2010) point out, the evaluation of the crisis response performance needs to be done in two levels: the strategic level, and the tactical and operational level. The first level should derive in the development of the managing organization itself, and should remain internal. The second level provides an image of the external actions of the organization. This should be shared with the public and stakeholders.

Finally, during the resolution stage the crisis should be resolved and the life-cycle feeds back into the pre-event stage. It is at this point that crisis managers need to approach stakeholders and the public providing the data studied in the previous stage, weaving new strategies that improve the things that went wrong, and pointing out the things that went well in order to legitimize the organization. This is particularly important, as mobilizing private and public resources through collaborative networks strengthen the capacities to cope with large-scale disasters (Chen et al. 2013).

The last two stages should be concentrated on covering the last task of crisis management identified by Boin (2009), learning under pressure.

3.3.2 The role of ICT and Mobile technology in development countries
- ICT4D & M4D

There are several IS models and systems in current research that used advanced ICT innovation to quickly respond to crises. There are several examples such as the Wireless Mesh Networks system proposed by Portmann & Pirzada (2008) or the system developed by Almer et al. (2007), but they usually require a level of infrastructure or equipment beyond the reach of developing countries.

The application of ICTs in crisis management in developing countries started several years after richer countries introduced them, around the mid-1980s (Yap, 2011), and even though several initiatives have fulfilled their goals, there is a
large sense of skepticism against ICT and mobile phones for development (hereafter ICT4D and M4D) in the broad spectrum of development (Ganiul Zadid, 2005), not only crisis management.

In the wake of the new conceptualization of ICT4D (2.0), which requires new technologies, new approaches to innovation, new intellectual integration, and above all, a new view of the world’s poor (Heeks, 2008 p. 85), there are still many doubts on the role or benefits from ICT4D. The World Bank counts up to a 70% failure rate with ICT4D projects to increase universal access (IEG, 2011). With a large amount of failing projects, increasing number of voices raise to criticize the approach and concept of ICT4D.

The main critique to ICT4&D lays on that, as any other type of initiative for development, it is too tied to the wealthy countries, and thus, with recessions and financial crisis like the recent one, the budgets tend to decrease, reducing the intensity and efforts on projects for developments. The dependency on the wealthier countries limits the outcome for the developing regions.

The impact of the technology is still very limited and mixed, considering the difficulties of applying a holistic approach where infrastructure, content and capacities are combined.

The digital divide is increasing rather than decreasing, as the newest ICT innovations always derive from richer parts of the world, where funding, infrastructures and, above all, economical profitability are higher. On the contrary, developing countries not only will receive what donors and organizations send there, but also will get equipment on the brink of obsolescence in developed countries (Ganiul Zadid, 2005). Without economical profit, there is no possible scenario, in the current capitalist system, that will deploy the latest ICT innovations equally around the globe, nor would it be of particular help if developing societies are not prepared to use them.

Thus, the digital divide is a deeply misleading discourse: the divide is not digital but socio-economic, but representing the divide in technical terms suggests technical solutions (Pieterse, 2010 p.176). In the same manner, the access to technological innovations on its own does not suffice to ensure economic development towards a “more developed society”. It is vital to develop the capacities and skills of the population in order to use those technological innovations. Only through education there is a possible real integration of ICT into developing countries (Van Dijk & Hacker, 2003).

But the digital divide is only one of the many challenges that the field of ICT4D and M4D face. Among these challenges, also appear: the rush to adopt the new
technologies in education; the focus on technology rather than on education; lack of adaptability to each region’s needs; lack of flexibility to adapt to the users’ knowledge; lack of balance between technology and the traditional systems of communication; the strain that new technological knowledge play on crisis managers; the difficulty in assessing the content to be used in ICT-based strategies (Swarts, 2008).

On a video interview from the ICT4D Poverty Reduction Summit at Winneba, Ghana, Dr. Clint Rogers (2011) gives the seven reasons why most ICT4D projects fail. These seven reasons are: results not directly tied to improving economic condition of end user; not relevant to local contexts, strengths, or needs; not understanding infrastructure capacity; underestimating maintenance costs and issues; projects supported only by short-term grants; solutions are not looking at the whole problem; and projects built on condescending assumptions.

As Yap (2011) points out, there are grounds for optimism as the development of new wireless technologies, and the convergence of voice, data, computing and networks are advancing as prices decrease, making them relatively operational in developing countries. However, an extended effort from a national and international level needs to be in place in order to properly adapt technologies and international policies to the local and contextual background of each community that is involved in an ICT4D or M4D initiative. Without a deeper change of approach there is very little that ICTs can do for crisis management (or development for that matter) in the poorer countries of the world.

3.3.3 Diffusion of innovation and the issue of (in)equality

The contextual description of Ghana presented in Chapter 2.7 Internet and mobile telecommunications show that while mobile technology, particularly mobile phones, are widely accepted and used in the country, there are several market inefficiencies leading to network fragmentation and network coverage gaps. However, the overall result is a well-established technology used by 67% of the population and 99% of national territory covered (GIPC, 2013).

On the other hand, internet, and especially mobile internet is still far away from mirroring the extensive adoption and diffusion that it has shown in the wealthier regions. The explosive growth of internet is spreading unevenly, as a multidimensional phenomenon, and is itself in a process of transition (Park, 2010).

There are several perspectives that dictate the uneven adoption of internet use. Rogers (2003) in his Diffusion of Innovations theory identifies four aspects that affect the diffusion process. First of all, the innovation itself with its
characteristics has an important role on how it is spread. A new technology that relies heavily on infrastructure or that is particularly expensive will see different patterns of diffusion. The second element is the communication channels on which knowledge and persuasion over the new innovation can be transmitted. Time is the third element, as the decision, implementation and confirmation about a particular innovation requires a time frame as information settles in giving room for the adopters’ judgment. Finally, the fourth element is precisely the social context of those potential adopters. Rogers (2003) acknowledges the importance of the social system and how this system perceives a particular innovation in order to adopt it.

Rogers’ (2003) theory is applicable in developing countries precisely because it includes the social aspect of innovations. However, Hoffmann (2011) identifies two major shortcomings, inherent to the social aspect, affecting the diffusion of innovations. These shortcomings of diffusion research are the pro-innovation bias and the issue of equality, and they have a stronger effect on developing countries, where socio-economic disparities tend to be larger (Pieterse, 2010).

The “pro-innovation bias”, clarifies Hoffmann (2011) is the implication that an innovation should be rapidly diffused to and adopted by all members of a social system, without re-invented or rejected components. This carries a larger set of problems apart of a rural/urban dichotomy, as well as the skilled/unskilled citizens divide.

The issue of equality takes a deeper look at the socio-economic gaps among the member of a social system, as these gaps are usually widened as a result of the spread of innovations. The issue of equality, rooted in socio-economic characteristics is also affected by the different characteristics that define different socio-economic groups within a society (Norris, 2001). In this respect, Norris’ research shows that the pattern of inequalities affect all ICTs in a similar manner, which hints to a problem rooted in the endemic social stratification of modern societies. This means that bridging the gap of skills or providing affordable prices does not solve the problem, as the digital divide lies in broader patterns of social stratification that go beyond access, such as participatory action or habit internalization.

Applying Beck’s (2006) notion of Global Risk to the diffusion of innovations, a globalized societal system provides an even stronger set of inequalities. Imagining Roger’s diffusion of innovations at a global scale is a far too complex task.

On the other hand, real-life applications of e-commerce, e-learning, and e-governance are gaining traction and might help reduce some of those socio-
economic gaps. As Warschauer (2004) mentions, this new approach aims for social inclusion offers a more optimistic view than the plain techno-determinist approach. The shift presupposes an emerging new information economy and network society; where ICTs play a critical role in all aspects of the new economy and society, and that access to those ICTs can help determine the difference between marginalization and inclusion in the new globalized era.

3.4 Accessibility: increasing awareness

It has been mentioned earlier that accessibility carries a large component of applicability in multiple fields, some of which, take even more relevance in the context of developing countries.

The theoretical approach to accessibility done in this section, however, is taken from the communication perspective, particularly within the disciplines of information systems, mobile phones, and web applications.

Even though in its origins and in further development, accessibility has been regarded as a subset of the wide spectrum of usability, the current approach towards accessible systems has become a separate discipline in ICT development of its own. The reason for this factual disassociation between usability and accessibility is the introduction of standards and regulations (including legislative requirements), that have relegated accessibility as a process bound to technical processes that can be automatically evaluated while completely disregarding the usable aspect of the concept (Murphy & Persson, 2009).

Theoretically, the dividing line that distinguishes usability from accessibility is the target group at which each discipline is addressed to (Thatcher et al, 2002). While usability tries to solve problems that impact all users equally regardless of their abilities, experiences or background, accessibility tries to solve problems faced by users with disabilities, trying to bridge all disadvantages that are only experienced by that particular target group.

Making digital content available to a larger audience is accessibility’s ultimate goal, thus filling the gap that ICT systems have had when it comes to reach to all types of audiences.

Data vary on each country, and the numbers are dated differently, but on average, the amount of population with some kind of disability is between 15% and 25% (UN, 2006). The World Health Organisation (WHO) estimates the disability rate of Ghana to be between 7% and 10%, which equates approximately 1.55 – 2.2 million people in the country. The disability rate is the same for males and females, higher in rural areas than in urban areas and is lowest in the 0 to 5
years age group and highest for persons who are 50 years of age or older. The relatively small percentage of disabled citizens in Ghana may be explained by the high percentage of young people.

The major categories of disability types are: visual (blindness, low vision, color-blindness), hearing (deafness), motor (inability to use a mouse, slow response time, limited fine motor control) and cognitive (learning disabilities, distractibility, inability to remember or focus on large amounts of information). Only by acknowledging and understanding these disabilities can systems and websites that function optimally and homogeneously regardless of the type of user that accesses the website be created.

In order to design inclusively, designers and developers need to consider the widest range of possible users and environments using assistive technologies, guidelines and standards available to improve the accessibility of a particular system.

Assistive technologies are technologies that make it easier for users with disabilities to access and navigate a site (Jon Duckett, 2005). Their first and most important goal is to cover the special needs for these users, but these technologies not only help developers to understand the experiences of users with disabilities, they also helps them develop systems that work well when used with these technologies, serving as testing environments as they receive the input exactly as the target user would.

The most common assistive technologies are screen readers, braille readers, screen magnifiers, ergonomic keyboards, foot control mice, and eye or head movement tracking systems and speech-to-text software. Each assistive technology aims to solve the problems produced by a particular type of disability.

### 3.4.1 Contextualizing accessible interaction

One of the long-standing problems with building accessible technology systems and websites is that developers, designers, and content creators have very little hands-on experience working with people with disabilities in order to understand their true needs and how to avoid putting accessibility barriers in their way (Adams et al, 2007). To bridge this problem, designers and developers can use both assistive technologies and evaluation tools, as access to users with disabilities is not always an option.

With such a diverse target group and with the added difficulty of mimicking the real difficulties that a user with a disability must endure when accessing a website, a designer usually falls into the paradox of creating a website without
having a first-hand perspective on all the potential users of the project. Thus, the
designer often opts to design a website for him/herself and his/her basic setup
according to the client and project’s requirements, then make the technical
adjustments to different resolutions and web browsers, and finally try to adapt
the product to as many as possible sets of disabilities as possible. It is often
forgotten that while access to people with disabilities is the primary focus of
accessibility, it also benefits people without disabilities, and organizations that
develop accessible products (Henry, 2007).

The lack of awareness of the environment’s scope that surrounds each disability
proves to be a real challenge to those with the task of designing inclusively. For
that reason, there has been an effort to adapt the concept of Universal Design to
accessibility for information and communication technologies.

“Universal design is the process of creating products (designs, environments, systems and processes) which are usable by people with
the widest possible range of abilities, operating within the widest possible range of situations (environments, conditions and circumstances), as is commercially practical.” (Vanderheiden & Tobias, 2000)

Universal Design then, focuses on the process, and not on the product. For that
reason, by adopting and predicting those environments and abilities that the
possible target user has within the design process, the efforts to make a system
more accessible are drastically reduced, as the efforts to create with requirements
in mind is much easier and natural than trying to “adapt” a finished product to a
new set of specifications of a potential group of users.

By bringing Accessibility into the design process (or designing inclusively), we
not only aim directly to a wider audience, but introduce natively and naturally
elements to bridge the disabilities of a part of the audience, making both testing
and upgrading a much less taxing process. However, in order to manage to
include Accessibility in the design process, the designers must have a proper set
of rules or guidelines to have in mind, as mimicking all environments is virtually
impossible. This is precisely why the needs for accessibility standards arise.

3.4.2 Internet accessibility and standards compliance

The Internet is useful for crisis management in multiple ways. For starters,
organizations have access to a vast amount of data that can be analyzed in order
to detect hazards or threats long before they become crises. Secondly, computer-
mediated communication has the potential to quickly deploy decisions and
information within the organization, but also externally to stakeholders and the
public (Perry, Taylor, & Doerfel, 2003). Thirdly, it can be a source of data input from the public in order to get feedback much faster.

In order to make the internet useful to all users during a crisis, a deeper look into the standards or web accessibility must be done.

Web accessibility has been an important topic for as long the Internet left the military and academic threshold in the 1990’s. The World Wide Web Consortium (W3C) established the Web Accessibility Initiative (WAI) which “develops guidelines widely regarded as the international standard for Web accessibility, support material to help understand and implement accessibility and resources, through international collaboration” (cf. www.w3.org/WAI).

However, it wasn’t until 1998 with the amendment to the Workforce Rehabilitation Act of 1973, widely known as the “Section 508”. This piece of legislation required that electronic and information technology that is developed by or purchased by the Federal Agencies of the USA to be accessible by people with disabilities (Thatcher et al., 2006). Section 508 incorporated a binding and enforceable set of standards and guidelines that for the first time made accessibility a liable mandatory discipline in IT systems development (USAB, 2010).

Following to this, in May 1999 the W3C released the Web Content Accessibility Guidelines (WCAG 1.0) as a recommendation; however, this recommendation has become the industry’s good practice and standards for most designers and developers. In December 2008, the W3C released the second version of the WCAG (WCAG 2.0), which is the current recommendation by the W3C.

Finally, another set of established standards was also released by the International Organization for Standardization (ISO). These guidelines for accessibility of World Wide Web user interfaces (ISO 9241-151 Ergonomics of human-system interaction - Part 151: Guidance on World Wide Web user interfaces) provides guidance on the human-centred design of software with the aim of increasing usability. Web user interfaces address either all Internet users or closed user groups such as the members of an organization, customers and/or suppliers of a company or other specific communities of users.

**WCAG 1.0**

The Web Content Accessibility Guidelines 1.0, published by the W3C’s Web Accessibility Initiative, was released in May 1999 and has been adopted by many countries.
These guidelines try to set the foundation on how to create and lay Web content while making it accessible to people with disabilities. Web designers and content developers can use these guidelines as a tool to evaluate if they meet the accessibility requirements recommended by the W3C. By establishing a set of guidelines, the efforts of making web content available to all users regardless of which user agent they use, are reduced and unified setting the foundation of accessibility Standards of which all (designers and users) can benefit from.

The WCAG 1.0 contains a set of 65 checkpoints (grouped together under a set of 14 general guidelines) that a site must meet in order to be considered accessible. There are three different priority levels for the checkpoints in the WCAG guidelines:

Priority 1 - Checkpoints that must be satisfied. Otherwise, one or more groups will find it impossible to access information in the document. Satisfying this checkpoint is a basic requirement in order for some groups of people to be able to use web documents.

Priority 2 - Checkpoints that should be satisfied. Otherwise, one or more groups will find it difficult to access information in the document. Satisfying this checkpoint will remove significant barriers to accessing web documents.

Priority 3 - Checkpoints that may be satisfied. Otherwise, one or more groups will find it somewhat difficult to access information in the document. Satisfying this checkpoint will improve access to web documents.

Of the 65 checkpoints, there are 16 priority 1 checkpoints, 30 priority 2 checkpoints, and 19 priority 3 checkpoints. If a website applies these guidelines, it is likely to conform to the WCAG, with three corresponding levels of conformance:

- Conformance Level “A” - All priority 1 checkpoints are satisfied.
- Conformance Level “Double-A” - All priority 1 and 2 checkpoints are satisfied.
- Conformance Level “Triple-A” - All priority 1, 2, and 3 checkpoints are satisfied.

After nine years of its appearance, the WCAG 1.0 was supposed to be relegated by its newest and second version. However, the lack of public consensus on the validity of the WCAG 2.0 and its difficulty of application makes the version 1.0 to be still valid for many developers and organizations.

WCAG 2.0
WCAG 2.0 was published as a W3C Recommendation on December 11, 2008 after 9 years of production.

WCAG 2.0 has 12 guidelines that are organized under 4 principles: perceivable, operable, understandable, and robust. For each guideline, there are testable success criteria, which are at three levels: A, AA, and AAA. The schema goes as follows:

Principles - At the top are four principles that provide the foundation for Web accessibility: perceivable, operable, understandable, and robust.

Guidelines - There are 12 guidelines providing the basic goals that authors should work toward in order to make content more accessible to users with different disabilities. The guidelines are not testable by automatic means, but provide the framework and overall objectives to help authors understand the success criteria and better implement the techniques.

Success Criteria - For each guideline, testable success criteria are provided to allow WCAG 2.0 to be used where requirements and conformance testing are necessary such as in design specification, purchasing, regulation and contractual agreements. A success criterion is a testable statement that is not technology-specific and that will be either true or false when applied to specific Web content. In order to meet the needs of different groups and different situations, three levels of conformance are defined: A (lowest), AA, and AAA (highest).

Sufficient and Advisory Techniques - For each of the guidelines and success criteria in the WCAG 2.0 document itself, there are a wide variety of techniques documented. The techniques are informative and fall into two categories: those that are sufficient for meeting the success criteria and those that are advisory. The advisory techniques go beyond what is required by the individual success criteria and allow authors to better address the guidelines. Some advisory techniques address accessibility barriers that are not covered by the testable success criteria.

All of these layers of guidance (principles, guidelines, success criteria, and sufficient and advisory techniques) work together to provide guidance on how to make content more accessible. Authors are encouraged to view and apply all layers that they are able to, including the advisory techniques, in order to best address the needs of the widest possible range of users.

The W3C is keen to remark that even content that conforms at the highest level (AAA) will not be accessible to individuals with all types, degrees, or combinations of disability, particularly in the cognitive language and learning areas. Authors are encouraged to consider the full range of techniques, including
the advisory techniques, as well as to seek relevant advice about current best practice to ensure that web content is accessible, as far as possible, to this community. Metadata may assist users in finding content most suitable for their needs.

Differences between WCAG 1.0 and WCAG 2.0, and how to bridge them

According to the W3C and the WCAG 2.0 Working Group, the WCAG 2.0 has become a new standard that will help web designers and developers create sites that better meet the needs of users with disabilities and older users. Drawing on extensive experience and community feedback, WCAG 2.0 improves upon W3C’s groundbreaking initial standard for accessible Web content, applies to more advanced technologies, and is more precisely testable. It applies more broadly to different types of Web technologies and to more advanced technologies. It is designed to apply as technologies develop in the future.

The WCAG 2.0 requirements are supposed to be more precisely testable with automated testing and human evaluation, thus allowing the guidelines to be more easily used where specific requirements and conformance testing are necessary, such as in design specifications, purchasing, regulation, and contractual agreements. They were developed in coordination with international efforts to harmonize a single standard for Web content and released with extensive support material with guidance and examples, making it easier to understand and use (cf. http://www.W3C.org). The strength here has been one of the defining requirements, to make it testable. This does not necessarily mean that it has to be tested with only tools, but also human evaluation is still necessary for some testing (RNIB, 2007).

While WCAG 1.0 is organized around guidelines that have checkpoints, which are priority 1, 2, or 3 and these checkpoints lay the base for determining conformance to the WCAG 1.0. The second version of the Guidelines is organized around four design principles of Web accessibility. Each principle has guidelines, and each guideline has testable success criteria at level A, AA, or AAA. These success criteria lay the base of conformance for the WCAG 2.0.

It is worth noting that the WCAG 2.0 builds on WCAG 1.0. The fundamental issues of Web accessibility are the same, though there are some differences in the approach and requirements between WCAG 1.0 and WCAG 2.0. The accessibility efforts carried for the WCAG 1.0 will be useful for meeting WCAG 2.0. Websites that meet WCAG 1.0 will already be a long way to fulfilling WCAG 2.0. In most cases only minimal work will be needed, and sites should not require significant changes in order to meet to WCAG 2.0. Some sites will not need any changes at
all. However, it does take some time to understand the different approach in WCAG 2.0 (W3C).

But the most important change and part of the big controversy that generated is the crucial approach taken by the “W3C” in order to limit the expiration date of the WCAG 2.0 as the version 1.0 became outdated rather quickly. The main shift focused on creating the second version a technology-neutral standard, precisely avoiding the caducity that the evolution of technology might produce in the guidelines. Though apparently sensible, the problem of this approach is the release of a set of guidelines that are extremely vague rendering the whole WCAG 2.0 almost unusable due to their generic terminology.

These guidelines are intended to encourage designers to make sure their sites conform to specifications, and in that conformance enable the assistive technologies of disabled users to better interact with the page content. In this way, it was hoped that accessibility could be supported. While this is in part true, guidelines do not solve all problems and the WCAG 2.0 guidelines are surrounded by controversy and intrigue (Harper & Yesilada, 2008).

The first point that brings serious controversy is the length of the documentation and its highly technical approach, completely littered with jargon that other than simply concepts, seems to only confuse the designers and developers, who are the ones who actually have to set the guidelines. But apart from the complexity of the language, the documentation provided by the W3C seems to be utterly out of scope. Four documents are provided: Web Content Accessibility Guidelines 2.0, containing the principles, guidelines and conformance; How to Meet WCAG 2.0, providing techniques to meet the success criteria; Instructions for Developers, regarding technologies, examples and test procedures; and Understanding WCAG 2.0, detailing the benefits to people with disabilities, example scenarios and other resources. These documents take the span of roughly 400 pages made of a mass of links and thick terminology, which render the guidelines almost unusable.

The second point is the deprecation of some guidelines that were deemed more than useful in the WCAG 1.0. Some of these guidelines have their core pointed to the accessibility of content, one of the most sought after by designers, as it is the foundation of a good information architecture and usability, and it is crucial to those learning difficulties and dyslexia as their main disability does not focus on technologies nor physical traits, but the disposition of the content of the website (Clark, 2006).

Finally, the new shift in technology neutrality leads to a set of extremely vague guidelines that aren’t specific enough to use. Furthermore, they introduce a new
concept, the baseline, where webmasters can claim which technologies they assume are supported by the browsers used by visitors. This creates a sense of randomness, as ever designer can conform with all the guidelines as long as they consider a technology part of their baseline, no matter if that technology is inaccessible to many users.

**Section 508 and other international guidelines**

In the United States, a 1998 law called the Workforce Investment Act, which included a major overhaul of Section 508 of the Rehabilitation Act (originally passed in 1973), charged the U.S. Access Board with the task of producing accessibility standards for all electronic and information technologies used, produced, purchased, or maintained by the federal government (Slatin & Rush, 2003).

For the first time in U.S. history, Section 508 sought to create a marketplace incentive for accessible technologies and utilized the power of the Federal government purse to require accessible web design (Thatcher et al., 2006). Due to this milestone, depending on the laws of the jurisdiction, complaints can be filed by users with disabilities against institutions that develop, procure, maintain, or use an inaccessible website.

The Section 508 technical standards specify that a website must satisfy sixteen specific items for web accessibility. The content of these items are development and designed oriented, as tasks to be taken into consideration, so that the content experience of a user with disabilities is similar to the one of a regular user.

The relevance of the Section 508 is not only North American but international. While many countries have adopted the WCAG1.0 as support rules for their jurisdiction, some others (like Australia or Denmark) have also adopted Section 508 requirements.

The European Union acknowledged the importance of web accessibility as early as 1994, but it would not be until 1999, through the eEurope – An Information Society for All initiative, that a Pan-European effort was made to address the accessibility problem in a global and homogenous way among all EU countries.

In 2001 the eEurope initiative stated that Public sector web sites and their content in Member States and in the European institutions must be designed to be accessible to ensure that citizens with disabilities can access information and take full advantage of the potential for e-government (eEurope2002).

In 2005 the European Commission issued an eAccessibility Communication calling for more coordination action to ensure the accessibility of information and
communication technologies accessible to all citizens stating that while continuing to support on-going measures such as standardisation, Design for All (DFA), Web accessibility and Research & Technology Development, the Commission proposes the use of three policy levers available to Member States: to improve the consistency of accessibility requirements in public procurement contracts in the ICT domain, to explore the possible benefits of certification schemes for accessible products and services, to make better use of the “e-Accessibility potential” of existing legislation (i2010).

However, these actions of homogenization have only conveyed to the adoption of level A (Priority 1) of the WCAG 1.0, while each country has had its own agency ruling the legislation that has regulate web accessibility.

In the context of Ghana, the Persons with Disability Act (Act 715) of 2006 deploys the legislation to be enforced in the interaction of Ghanaian citizens with the public sector, as well as their rights within the society. The Act 715 provides information on the spheres of employment, education, transportation, and health-care and facilities. However, there are no reference to digital communications or governmental websites and how they should be applied to users with disabilities. Thus, there is a legislative gap when it comes to digital accessibility in Ghana.
4 Methodology

This chapter brings forth the methods used for data collection as well as the methods used for the analysis of the data. The chapter continues by outlining the sources of data, the materials used in this study, and discusses matters of reliability and validity.

The methodology adopted in a research study is tightly linked to the type of information required to answer the question or questions that motivate the study. The research method defines the researcher’s systems to collect empirical data in order to analyze it, and offering an interpretation of a real setting. The methodology adopted responds to a need of information generated by the research questions. Thus, each method is linked to, and justified through the nature of the information needs identified.

Establishing a nexus between mobile technologies, accessibility and crisis management can be done by assessing and studying an array of heterogeneous factors, such as the implementation of these technologies in the area of the study, their impact and their penetration in the population, and the applications currently adopted by the crisis management stakeholders. In a developing country, some of these factors are subdued to a set of regional and local characteristics that add an extra layer of complexity to the process.

4.1 Research methods

Due to the complexity and different nature of the factors to study, the typology of the research methods can vary greatly. This study uses a complementarity of methods (a mix of qualitative and quantitative research methods when two research strategies are employed in order that different aspects of an investigation can be dovetailed [Bryman, 2012]), as the two types of methods have different, complementary strengths.

The context surrounding this particular study provides the ontological setting of the study, determining the connections with scientific research methodology. The theoretical and variable nature of the concept of risk requests for an approach that is highly contextual and that is tightly connected to the idiosyncrasies of the territory being studied. This calls for the subjective perceptions of individuals who participate in crisis management in Ghana. These personal perceptions need to be interpreted, as they offer certain limitations for quantification. Thus, this study follows a mostly qualitative approach.
However, the inclusion of the current state of telecommunications and mobile technology in Ghana, as well as the level of accessibility of ICTs, provides some room for a quantitative perspective that can complement and support the qualitative data.

Though research methods carry epistemological commitments, and quantitative and qualitative research are separate paradigms (Bryman, 2012), the combination of both types of research methods, in this particular study, occurs in terms of triangulation. As Hammersley (1996) states, the triangulation aspect serves as an enhancement of validity, as the quantitative research is mostly used to corroborate the qualitative research findings. When used together, the two types of methods have different, complementary strengths, and can lead to a more comprehensive understanding of a phenomenon (Moody, 2002).

Epistemologically, this study adopts a critical realist approach. This perspective considers reality as an independent entity of what empirical observation may derive into. There is a physical difference between the concepts studied and the terms used to understand them (Bryman, 2012), as well as deeper structures that lie beneath observable patterns. Similarly to positivism, critical realism can apply the same methods for data collection in natural and social contexts. However, critical realism recognizes that the theoretical terms' validity, even if they are not directly observed in independent settings. As Mingers (2004) concludes, a critical realist approach has a special potential to fit well within the reality of IS as an applied discipline. Additionally, Bhaskar (2002) points out that critical realism transcends the classic dualisms in the social sciences, such as positivism and interpretivism.

This type of hybrid epistemological perspective allows for a rather flexible data collection process. This translates into a methodological approach that is rooted in the aims and scope of the study, providing links to the theory according to the compiled data. A deductive reasoning often starts from theory, proposes a hypothesis, observes a field setting, to then confirm or reject the hypothesis. On the other hand, an inductive reasoning, takes a bottom-up approach, starting from the observation, finding patterns, creating a tentative hypothesis that can lead to theory (Bryman & Bell, 2007). While a deductive approach influenced the empirical design of this study, it is an inductive approach, based on the methodologies in use, the one that relates to the theory discussed.

The flexibility given by this approach frees the researcher from the constraints imposed by strict separated methodologies. While it is true that the theoretical background can shape certain aspects of the research, the subjectivity factor opens a window for multi-faceted themes that emerge from the data and that can
be ultimately connected to an existing theory. The mixed methods used in this study respond directly to the need of information that can help answer the research questions. Each factor of information needs that are identified in Chapter 1.4 Information needs and research design carries its own complexity and nature, depicting a different type of method used to collect data.

4.1.1 Current state of mobile communications in Ghana

The first factor identified as a need of information is the actual use and penetration of mobile technology in Ghana. The aim of this section is to identify not only how mobile telephones are used in Ghana, but also some of the reasons behind the decisions taken by the users. The personal nature of the use of a mobile phone presupposes subjective perceptions of individual users. This is precisely what makes a qualitative method approach more suitable to collect data for these particular needs of information.

A qualitative research can predominantly emphasize an inductive approach to the relationship between theory and research (Bryman 2012, p. 36). If a researcher is observing, studying the way users interact with their mobile phones, from the result of that observation, it can be acquired how the general public can be reached by governmental organizations and vice versa.

For that reason, short interviews were selected as a method, approaching Ghanaian citizens working in the service industry, following a purposive sampling of citizens encountered during the fieldwork, with very short and direct questions about their daily needs and use of internet. The idea behind these micro-surveys was to informally acquire the information without disrupting the individuals' activities. The short informal surveys were chosen because the data collection process is dynamic and interactive, and at the same time is inexpensive and requires minimal background information. The type of information retrieved was of qualitative nature, and even though the survey followed the same short open-ended questions, no physical questionnaire was used in order to induce a relaxed response by the interviewed individuals. Setting up formal interviews with strangers was a feature that deprived the user for a spontaneous and quick response. Similarly, distributing random surveys in the street could lead to low or misguided response.

The drawback of this method is a higher probability of sampling error and a relative little value of statistical analysis. For that reason, a purposive sampling aims for a general informational rather than for statistical applicability. This information is directly connected with the ability and affinity of Ghanaians to go online with their mobile devices. The results of these short interviews can be found in the Appendix 2 – Short interviews responses.
Finally, to complete the image of the current state of service and use of mobile Internet in Ghana, over a hundred network speed tests were conducted. The goal of these tests was to determine the network connectivity speeds over the 3G mobile networks in Ghana. The tests were conducted with the mobile application Speedtest.net by Ookla (http://www.ookla.com), on a Samsung Galaxy SII device on Android operative system.

The speed tests consist of three different stages. First a ping is made sending an HTTP request to the nearest local server, with the result being the time (in milliseconds) it takes to get a response. Secondly, a Download Speed is measured by downloading small data packets using up to four HTTP threads to saturate the connection in order to get an accurate measurement. Finally, the Upload Speed is measured in a reversed way, sending packets from the device to the server. Both Download Speed and Upload Speed are measured in kilobytes per second.

By convenience of sampling, all tests were made at arbitrary locations during the field trip in Ghana, both in populated areas and less populated areas, some of which were areas with high flooding risk. The network used was always MNT Ghana and all the telephone processes that could use the network while performing the tests were disabled. The results of the speed tests are shown Appendix 3 – Mobile internet speed tests. For purposes of improving the validity of this study the coverage map offered by the network company was discarded.

The data collected by this quantitative method is particularly useful in order to give a quick overview of the network availability of mobile internet network in Ghana. This relates to the operationalization of the variable of connectivity throughout Ghanaian territory, defining it into a factor that can be measured empirically and quantitatively.

4.1.2 Information flows and ICTs in crisis management in Ghana

The second factor to be studied is the channels of information used in crisis management in order to reach the population and raise general awareness of disaster situations in Ghana. A qualitative method was chosen as a data collection method, in order to understand the reality of crisis situations in real life settings. What has been experienced by a crisis manager can be completely different than other officer according to a large set of variables like location, type of disaster, experience, etc. It is important to recognize the fact that subjects can express themselves and their feelings individually, and therefore, clarify the social and cultural contexts within which they operate (Dalcher, 2003). This qualitative method consisted of semi-structured interviews conducted face-to-face and, except in one case, on a one-to-one basis. It is important to gather data
by allowing the subjects to offer their perspectives in order to get the full picture of the communication processes within crisis management. Accordingly, the qualitative method used to collect data is semi-structured interviews with open-ended questions, in order to secure response rates and deepen the discussion. Furthermore, the flow of the conversation is intended to be bidirectional, allowing the interviewees to expand their answers and engage them in a two-way communication. This way the flexibility needed to probe the subjects into different contexts is ensured.

The strengths of this method are the positive rapport generated by the interviewer and the interviewee; a high validity, as the interviewee is able to talk about the topic in detail and depth; complex questions and issues can be discussed or clarified; it avoids the contamination by the interviewer’s preconceptions; and it is easy to capture the data (Remenyi, 2011). Interviews focus directly on the study’s research questions and provide insights and perceived causal connections, but at the same time they allow to provide information about the context of the interviewee. On the other hand, this method poises some weaknesses too, as it highly depends on the setting and on the skill of the interviewer, who in addition, might give unconscious signals to the interviewee; it is time consuming and it can be expensive; it is not particularly reliable as it can present challenges in efforts of replication; it is also difficult and time consuming to extract and analyze the relevant data (Remenyi, 2011). Besides, there can be weaknesses in the responses, due to lapses of memory or reflexivity, which is a response given by the respondent because he/she thinks that is what the interviewer wants to hear (Yin, 2009).

The interviews were composed of open-ended questions with possible follow-up questions according to the responses of the interviewees. The questions were divided in six overarching themes in order the lead the flow of the interview in a more structured manner. The Appendix 1 contains the question framework used for the interviews.

Nine interviews were conducted to NADMO officers, five of whom work on regional offices and four at the central headquarters in Accra. The aim was always to avoid leading or impose narratives and trying to create a relaxed and comfortable conversation. The sample of interviewees was arranged by Chief Disaster Control Office (CDCO) of NADMO, Diana Boakye, who also kindly arranged the meetings with the officers themselves.

Semi-structured interviews suit this particular study as it intends to understand the officers’ context without tainting their response with own preconceptions that may have emerged from a completely different cultural background. On the
context of this study, semi-structured interviews were also helpful in terms of narrowing down the sample. Going physically and meeting the crisis management officers of Ghana allowed to directly meet with the experts that could expand on the information in question. For this particular section of the study the interests did not rely in a high sample, but a reduced expert one.

As Remenyi (2011) points out, there are important advantages which semi-structured interviews have over questionnaires. The interviewer has the possibility to learn from the first interviews and improve his/her interviewing technique in order to obtain richer data from the following interviewees. Similarly, the researcher can fine-tune questions that might not be clear enough, or that conflict with other questions. Also there is a flexibility to clarify questions, as well as adding probes that can retrieve more in-depth information. The possibility of making field notes that can expand the understanding of the situations being studied is also a great strength of this method. This is of course not possible in a mass data collection technique such as a large scale survey using questionnaires.

The goal with these interviews is to understand which is the status of communication surrounding crisis management in developing settings, and especially to find out which are the channels to reach and deploy the information. A secondary goal is also to understand which are their main concerns in both the preventive and responsive efforts to deal with disaster situations. Having information directly from the officers that need to follow and enforce the national policies in terms of Crisis Management in Ghana is a great source to get valuable data.

The main concern lies in the reliability of the data. The content of the interviews offers personal recollections that are almost impossible to verify. As personal opinions, it is possible that the experiences of the interviewees do not relate with reality, as they are subjective accounts of what really happened. This does not threaten the importance of the study, as this scenario can confirm a misconnection between crisis managers’ experiences, and the data derived from the other methods. This is an important factor that is contemplated in critical realism (Smith, 2005). For this reason, complementing the data with a quantitative method is a good way to try corroborating the interviews’ narratives with quantifiable data.

4.1.3 Accessibility status in the crisis front

Finally, for the third factor to be studied, the accessibility status of ICT in the field of crisis management, a content analysis will be conducted scanning and studying the current policies in web accessibility and mobile web best practices.
This particular quantitative method fits the purpose of the study as it is particularly useful in media research for analyzing content and identifying the characteristics and meanings of content while linking them to their intended effect (Krippendorff, 2004; Wimmer & Dominick, 2010).

The unit of analysis, which is the smallest portion of content taken into consideration in the study, is the communications, as well as the articles and guidelines offered by W3C, governmental agencies and other experts.

The categories used to confine and limit the material analyzed are, HTML and CSS validity, the WCAG 1.0, WCAG 2.0 and Section 508 compliance, server uptime and loading speed, and mobile responsiveness.

The idea behind these categories is to compare, through content analysis, whether those efforts conducted in Ghana, correlate with the strategies used in crisis management in order to reach the population and raise awareness of a disaster situation. This information will help to map the level of accessibility that currently is addressed by NADMO and which are the possible improvements to be made in this area in order to increase accessibility while meeting international guidelines and mobile best practices.

The reason why this method suits this study is due to its ease in terms of selecting the texts to analyze. While it is possible to sometimes get lost in content, being a participant observer allows collecting data unobtrusively according to the categories used in order to select content. In this particular context, the data is distributed online freely, and mostly condensed in a few online hubs, which makes the research inexpensive and relatively straightforward. When the categories are few and well defined, this method can save a lot of time.

On the other hand, a personal definition of categories can lower reliability, as different researchers might choose different categories, and that would lead into different texts, thus it would result in different data collected, and the results would not necessarily be comparable (Bryman, 2012). Another limitation of the method is the strong reliance on the researcher to set the limits of the research. With a limited knowledge or experience on the researcher, it is a risk to have a distorted limit on which content to analyze.

Finally, to round up the area of accessibility a series of tests are conducted on NADMO’s website as it is currently the only internet-centered medium directly offered to the general public of Ghana. The tests aimed to check HTML and CSS (Cascading Style Sheets) validation, WCAG 1.0 and 2.0 conformity, and the performance of the website with a web reader, on a mobile phone, and uptime.
server quality. All these tests were performed with specific software and tools that will be covered in more detail in Chapter 5 – NADMO’s website analysis.

4.2 Data sources and materials

To gather all the information detailed in the previous chapters, a blend of data from primary and secondary sources is utilized.

The key sources for primary materials for the accessibility assessment of NADMO’s website are available on the online archives of the W3C, which are sampled non-randomly to suit the particular field of study. Accordingly, the W3C points to other sources that provide international regulatory policies that regulate accessibility, especially in media produced by governmental institutions. The primary documentary research dwells with the policies and best practices approved by the W3C, especially in terms of Accessibility with the disposition of WCAG 1.0 and WCAG 2.0. Since one of the focuses of this research lays on mobile technologies, the transcendence of these set of guidelines applied to mobile web, like the Mobile Web Best Practices document, provided by a large body of advisors of the W3C.

It is worth mentioning that most of the W3C are simply suggested guidelines aimed to become standardized and industry’s best practices. The W3C has no legislative power per se. However, as the internet’s main institution, some of the W3C documents have become normative documents in several national spheres.

On a similar track, NADMO, and in particular its website are a source of primary data, from official documentation on the role of the organization, like NADMO’s foundational documents and policies, but also in terms of accessibility offered to the public.

For the purpose of this study it is particularly important the Hyogo Framework for Action, document provided by the United Nations, and a primary source from which it can be extracted of the demands, necessities and expectations from the international community towards developing countries. The subsequent follow-up progress reports allows to easily measure the goals achieved and the road still ahead, helping to develop a narrative on the reality of crisis management in developing countries and the huge disparities that occur between those countries and the richer countries.

Admittedly, this study relies heavily on qualitative methods to gather data about the status of NADMO’s channels of information. These personal sources, the interviews and the analysis of the website poise a pivotal part of this study. The respondents have different ranks in the organization and work in different
geographical locations that gave a valuable insight on the function of a rather large governmental institution that tries to fulfill a unique role in Ghana's social services.

These primary sources of data are related to the third factor identified in the information needs (detailed in Chapter 1.4 Information needs and research design), and thus, are meant to help answer RQ₂, RQ₅, and RQ₆.

The personal sources of data are related to the first and second factors identified in the information needs and thus are meant to help answer RQ₁, RQ₂, RQ₄, RQ₅, and RQ₆.

The way in which these sources of data and materials are used is covered in Chapter 5 Data collection and empirical research.

4.3 Methods for analysis

The analysis of the empirical data will be twofold: firstly, an application of the methodology provided by Bogdan and Biklin (1998) within the framework of thematic analysis, to analyze the qualitative data derived from the interviews. According to Braun and Clarke (2006, p.79), thematic analysis is a qualitative analytic method particularly suited for identifying, analyzing, and reporting patterns or themes within data. It minimally organizes and describes data sets in detail to the extent that it interprets various aspects of the research topic. The themes identified tend to capture important features and links that connect the data to the research questions, representing some degree of patterned responses or meanings within the data set.

This particular method suits this study because of the tight relationship between the nature of the raw data and the literature review. As Aronson (1994) points out, by referring back to the literature, the interviewer gains information that gives room to make inferences from the interviews. Once the themes have been defined and the literature has been reviewed, the researcher is ready to formulate theme statements to develop an analysis from the narratives emerging from the data. As it is in this case, when the literature is interwoven with the findings, the narratives constructed are the ones that stand out. A properly developed narrative allows the reader to comprehend the process and motivations of the interviewer.

The qualitative data from the short interviews and the quantitative data from the test speeds are codified into data sheets and quantified as a brief summary presented in plain tabular format.
Finally, the data derived from the website analysis is presented in a summarized form by providing the main findings of each automated test.

4.3.1 Interview data analysis

After conducting the interviews (as described in Chapter 5: Data collection and empirical research) each recording was analyzed and set into a series of 3-4 page interview summarized transcriptions in a converging format each interview. These interview summaries were created in reflection of the interview framework (Appendix 1 – Interview framework), covering the main overarching themes, while identifying the most relevant data provided by the respondents in case new themes arise. This process provided a first familiarization with the data, which is the first phase of conducting thematic analysis according to Braun and Clarke (2006).

The special formatting, discarding verbatim transcription, allows for a faster analysis giving way for an identification of patterns emerging from the data. Thus, only what was considered complete thoughts and experiences that were viewed as useful information were transcribed into the documents. Background noises, interruptions and silences were not transcribed, as the intention of this study is not to judge the readiness or clarity of each respondent, but to analyze their views and experiences. A clear path to an answer with a plausible justification is the main parameter for transcription basis (Braun and Clarke, 2006).

With this preliminary step, the initial level coding phase suggested by Bogdan and Biklin (1998) was already taken care of. The transcription, done within the framework of interview themes, already comprised data into data sets that could be more easily analyzed. This induces an initial data reduction that allows for a more focused coding. Themes were identified and the first units of meaning started to arise. Braun and Clarke identify the next two phases of thematic analysis in generating initial codes and searching for themes.

This focused coding was done on top of the transcribed summaries in order to eliminate, combine, or subdivide coding categories. The intention behind the focused coding is to identify repeating ideas and larger underlying themes that connect codes and categories. This represents the fourth phase, reviewing themes.

The categories utilized in the focused coding derived from the questions posed to the respondents, as well as the industry context, strategies, relationships, and processes embedded in the raw data. Linked to each theme, the data was finally coded in using the framework approach into matrices that combined the
categories, or variables for each theme. These matrices are provided in *Chapter 6: Empirical data and analysis* and try to give a fast overview of the narratives derived from the interviewees. The matrices define and name the themes, which is the fifth phase of Braun and Clarke’s framework.

### 4.4 Validity and reliability

In such a multifaceted study as this one, the matter of validity and reliability bring forth a tangible conundrum. It is widely accepted that the most prominent criteria for the evaluation of social research are reliability and validity (Bryman, 2012). And while the quantitative methods used in this research should easily conform to these tools of standardization, it is not straightforward with the qualitative methods used.

Generally speaking, the reliability of a study relates to the probability of obtaining similar findings by performing the same research. (Priest, 2009). Validity on the other hand relates to the integrity of the conclusions that are generated from a piece of research (Bryman, 2012). In other words, an empirical account must be plausible and credible, and should take into account the evidence used in the study. This means that in a qualitative discipline, which is normally non-measurable, the idea of validity becomes a matter of trustworthiness and authenticity.

Bryman (2012) offers four alternative criteria for evaluating qualitative research, and that are summed up by the concept of trustworthiness. These criteria are credibility (which parallels internal validity), transferability (which parallels external validity), dependability (which parallels reliability) and confirmability (which parallels objectivity). Adapting quantitative research criteria links to the research approach of realism. The accounts are one of a number of possible representations rather than definite versions of social reality. Thus, thick descriptions, respondent validation exercises, and triangulation are strategies that help anchor the axis of realism (Bryman, 2012).

This adaptation of reliability and validity for qualitative research allows the researcher to set a framework as a measuring bar for the quality of the work to perform (McMillan & Schumacher, 1997). In this particular case, there is an actual intent to achieve and fulfill all four criteria to make this study trustworthy and authentic. Accordingly, there is a strive for credibility by following canons of good practice, linking methodology to the theory covered in the study, and aiming for respondent validation by giving scrutiny of the conducted research to those who were interviewed. The thin veil of external validity tries to be overcome by the aim for transferability with the inclusion of a thick description.
of the contextual uniqueness of the settings on which the study was conducted. Data sources are documented and kept with complete records, notes, interview summaries, the original recordings, and other data that originated during the course of the research. In doing so, there is an aim for dependability. Finally, it is intended throughout the whole study to aim for confirmability, meaning that the researcher can be regarded as having acted in good faith (Bryman, 2012). Confirmability is actually one of the main reasons for driving the fieldwork directly in Ghana, conducting the interviews face-to-face instead of by telephone, establishing a real connection with the context of the study.
Data collection and empirical research

This chapter covers the empirical aspect of the study in which the methods discussed earlier are applied in a real life setting. It starts by mapping out the fieldwork and data collection process with a description of how the interviews were conducted. It continues by explaining the sampling process, and the introduction of the respondents. Finally, the chapter ends by providing a clear view of how the speed tests and website analysis were done.

This study draws its conclusions from four different sources of empirical data. The fieldwork to retrieve the empirical data took place, for the most part, during the first two weeks of June of 2012, in Ghana. The empirical data is divided in four main branches, each serving a specific purpose for the information needs detailed in Chapter 1.4 Information needs and research design.

During the span of the fieldwork, the data collection of three types of data happened simultaneously. The first one was retrieved through a set of semi-structured interviews with NADMO officials; the second through short interviews with Ghanaian citizens working in the service industry; and the third was retrieved with the aid of speed tests in different locations of the country. The fourth body of data was gathered through a series of tests done to NADMO’s official website after the field trip, during the last weeks of June, 2012 and once again in May, 2013.

The fieldwork itinerary responds partly to time restrictions and partly to disposition of the NADMO’s officials. The preliminary plans already covered the southern parts of the Ghana. Travelling is a time-consuming endeavor in Ghana, and reaching the northern regions with public transport can take up to 16 hours. Since the fieldwork trip was schedule for two weeks, remaining in the southern half of the country was a conscious decision, motivated as well, by not having scheduled any interviews before reaching the African country. Once in Accra, the contact in NADMO booked interviews with officers that worked in the regions adjacent to the capital, according to their availability and reachability.

Figure 4 shows the map of southern Ghana, including the itinerary followed during the fieldwork. Five regions out of ten were visited during the field work: Greater Accra, Central Region, Ashanti, Eastern Region, and Volta. The method of transport was always public bus or taxi and there was a conscious effort to combine urban and rural areas during the journey.
5.1 Semi-structured interviews

The semi-structured interviews with NADMO officials are the main data sources for this study and took place between June 9th and June 16th, 2012.

The interviews consist of a series of open-ended questions followed by a series of possible probes or follow-up questions that aim for an extended reply or clarification. The questions are divided in six different overarching themes which at the same time can be grouped into three main blocks: background and role of the interviewee, NADMO, and ICT’s in crisis management.

The interview framework itself (as shown in Appendix 1) suffered minor modifications during the interviews. Some of the questions were refined, as they seemed to be unclear in the first encounters.

All interviews took place at NADMO’s offices and were held in person, except for one, which was made by phone due to a sudden emergency. None of the respondents had received the questions before the interviews took place.
Prior to each interview there was a small introduction clarifying the motifs behind the interview, offering an introductory letter from Karlstad University, and requesting permission to record and use the content of the interviews by signing a consent form. The telephone interview offered consent orally.

The interviews started with a relaxed conversation about personal background and the state of Ghana, as well as an explanation of the study. Then the interviews would focus on the main questions shown in the interview framework. This section of the interview would always be recorded with a mobile phone. Finally another unrecorded segment would follow as final conclusion for the interview, were more comments would be made by the respondents. This section was particularly important as some of the interviewees felt more comfortable to extend their previously stated answers. During the complete length of the interviews a series of notes were made in order to complement some of the comments made by the interviewees. The language used during the conversations was English.

The longest meeting lasted for about 1 hour and 20 minutes, and the longest recorded interview lasted 38 minutes and 46 seconds. The shortest meeting was 32 minutes, and the shortest recorded interview was 14 minutes and 37 seconds. In the case of respondent who was interviewed on the phone, the meeting is counted as the same length as the recorded conversation. The mean for the meetings was about 50 minutes with a total of 7 hours and a half. The recorded material averaged in 24 minutes and 22 seconds, with a total of 3 hours, 39 minutes and 18 seconds. Admittedly, the recorded times of the interviews are short, but the respondents seem to feel more at ease when the telephone was not recording them. For that reason, most of the respondents answered the questions from the interview framework rather quickly, but expanded on several of those questions (and other matters) after the recording was over. These comments were captured on notes. This seemed to be of no concern to the respondents.

After the interviews, the audio files were listened several times in order to compress most of the content in 3-4 page summarized transcriptions that compiled the views and experiences of each interviewee. Since there is a lack of need for complete depiction of certain responses and there is an attempt to grab the major narratives of each individual, there was no need for verbatim transcription of the interviews. Summarized responses to the questions, including some worth-noting quotes were included in the summarizing files. This allowed for a much clearer and straightforward comparison, trying to collate similar narratives or pinpoint dissenting trends.
5.1.1 Sampling and introduction of the respondents

The obvious choice of NADMO as Ghana’s national crisis management organization was done from the beginning. The unique perspective of individuals that work enforcing policies and communicating with the public on accounts of actual crises was central to the study.

In this sense, these interviews required purposive sampling, which would provide and establish a good correspondence between research questions and the sampling itself (Watters & Biernacki, 1989). The reason for this choice is rather straightforward. Probability sampling is out of the question, as it would require a certain degree of randomness, and the intentions of the study are not generalizing this study to general population.

Non-probability sampling is a perfect match for this particular segment of the study. However, the choice of actual interviewees was done internally by Chief Disaster Control Office (CDCO) of NADMO, Diana Boakye. The names and contact details of each officer was sent via SMS, upon which all the interviews were booked individually. The initial number of interviewees was ten individuals. One of them could not attend the meeting but offered a telephone interview. The other one had to cancel at last minute and could not fit the interview in his schedule due to an unexpected trip abroad.

Table 2 shows a short summary of the respondents and the interviews. The table shows the name and title of each interviewee, as well as the place and date when the interview took place. Finally, it can also be seen the approximate total time of the meeting and the total time of the recorded interview.

It is not entirely clear whether the respondents volunteered to participate in the study or the interviews were allocated as a task in their work load. Nevertheless, all of them showed heart-warming readiness and availability to book a time, and offered a high level of enthusiasm at the moment of interviews.

The experience in the field of crisis management and the seniority at NADMO vary in each respondent, however, their responsibilities are quite similar even if the scopes are different in terms of proximity. Regional, metropolitan, and municipal coordinators manage and coordinate different actors in the eventuality of crises. From the interviewees, only Anasthasia Bleboo-Boafo and Dr. Kingsford Asamoah have remarkably different tasks and responsibilities within the organization. The first one, as Head of IT, manages all aspects of ICTs within NADMO, from external contractors, to software, from hardware to the official website. The second one, as Head of Research, is currently documenting a risk map throughout the different territories of Ghana’s geography.
Table 2 - Respondent Interview Overview

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Position</th>
<th>Location</th>
<th>Date</th>
<th>Meeting</th>
<th>Recording</th>
</tr>
</thead>
<tbody>
<tr>
<td>David Mensah</td>
<td>Regional Coordinator (Central Region)</td>
<td>Cape Coast</td>
<td>2013-06-09</td>
<td>55:00</td>
<td>27:23</td>
</tr>
<tr>
<td>Dr. Kingsford Asamoah</td>
<td>Head of Research</td>
<td>Accra</td>
<td>2013-06-11</td>
<td>01:07:00</td>
<td>33:54</td>
</tr>
<tr>
<td>Helen Ntoso</td>
<td>Head of Operations</td>
<td>Accra</td>
<td>2013-06-11</td>
<td>43:00</td>
<td>21:39</td>
</tr>
<tr>
<td>Anasthasia Bleboo-Boafo</td>
<td>Head of IT</td>
<td>Accra</td>
<td>2013-06-11</td>
<td>01:20:00</td>
<td>21:58</td>
</tr>
<tr>
<td>Yao Doe-Tamakloe</td>
<td>Chief Disaster Control Officer</td>
<td>Accra</td>
<td>2013-06-11</td>
<td>01:00:00</td>
<td>38:46</td>
</tr>
<tr>
<td>Vivien Akumia</td>
<td>Metropolitan Coordinator (Kumasi Metropolitan Area)</td>
<td>Kumasi</td>
<td>2013-06-12</td>
<td>52:00</td>
<td>18:03</td>
</tr>
<tr>
<td>Kwaku Aninkora-Sie</td>
<td>Regional Coordinator (Ashanti Region)</td>
<td>Kumasi</td>
<td>2013-06-13</td>
<td>32:00</td>
<td>26:19</td>
</tr>
<tr>
<td>Simon Miles Bakar</td>
<td>Regional Coordinator (Volta Region)</td>
<td>Koforidua</td>
<td>2013-06-15</td>
<td>16:39</td>
<td>16:39</td>
</tr>
<tr>
<td>Alex Attakpah</td>
<td>Municipal Coordinator (Keta Municipality)</td>
<td>Keta</td>
<td>2013-06-16</td>
<td>45:00</td>
<td>14:37</td>
</tr>
</tbody>
</table>

5.2 Short interviews

The ideal setting of field work on location allows for a much direct access to complementary information. While the data derived from the semi-structured interviews compose the main body of information that supports this study, the close contact with local mobile telephone consumers derived quickly into a valuable source of data.

In this case, a convenience sample was the natural selection, as the short interviews targeted individuals that were easily accessible, mostly within the service industry, such as taxi drivers, waiters, or hostel employees. As a non-probability sampling technique, the subjects were selected due to their proximity, rather than their representation of Ghanaian society. This type of sampling offers a fast, inexpensive, and easy access to the interviewees.

As such, this sampling technique is particularly helpful in order to document that particular phenomenon occurs within a group (Watters & Biernacki, 1989). On
the other hand, convenience sampling carries a systematic bias that lowers the
generalization and validity of the data collected. The sample is not
representative, and thus, it has a diverse nature from the general population of
Ghana.

The only information looked after was the ways and motivations behind the use
of a mobile phone. For that reason, the context of each individual in terms of
education, age, or sex carried no importance. The only variable that was
considered was the possession of a mobile phone. This is not particularly
different than most Ghanaians *per se*, however, the subjects interviewed belong to
a particular social class of the population. While not entirely poor class, taxi
drivers, waiters, guides, and hostel employees are considered middle-low class in
Ghana. In most cases, their uses of mobile phones (especially in the case of taxi
drivers) can differ greatly from the uses of other pockets of population.
Additionally, all interviewees had feature phones. Only two had smartphones.
This also seems to follow the national pattern, as simple observation confirmed
that most citizens have feature phones, and that only a reduced elite (doctors,
professors, and high-rank government employees) owned smartphones.

Upon interaction, any person that could start a conversation long enough as not
to feel intimidated by a battery of questions was asked whether he or she owned
a mobile telephone. The respondents of the short interviews were not aware they
were part of the study, which raises ethical questions. However, the non-personal
character of the interviews, and the complete anonymity of the respondents
waives the ethical question.

If the response was affirmative, a series of short questions followed. Only four
out of twenty six individuals did not own a mobile phone. The other twenty two
gladly answered the questions without hesitation. No one seemed to feel shy, nor
did anyone request a motivation for the questions.

In order to keep the data homogenous, the same questions were asked to each
individual:

- What do you use your mobile phone for, work or private use?
- Do you call or text?
- Do you ever use it to browse the Internet?
- What do you check online? / Why not?

The complementary nature of this data gives room for a rather flexible way of
conducting the short interviews. None was recorded, but they all were
documented with notes after each conversation. This raises questions of reliability, however, the pieces of conversation that required to be noted down were very concise, which were not easily forgotten, and could be documented right after each conversation.

The Appendix 2 - Short interviews responses shows the data collected through this segment of the study.

5.3 Mobile internet speed test

Directly related to this study is the need to know whether mobile connectivity in Ghana allows for data transfer. The network service providers tend to offer connectivity maps, however, they are highly unreliable.

Similarly to the short interviews, the ability of moving around provided opportunities to gather data. With the aid of a smartphone Samsung Galaxy S2, a SIM card from service provider MTN, and an app called SpeedTest.net (by American company Ookla), more than a hundred tests were made.

Approximately ten tests took place every day of the field work. The locations were always different, ranging from urban areas, main roads, and more remote areas. The locations chosen for each test followed a random approach within the path planned for the fieldwork trip. In this sense, the locations were chosen conveniently, however, they did not follow any other variable rather than being considerably distant from the previous test. If a test failed due to low or no connectivity, two subsequent tests would be made in the same location.

To test the network speeds the application locates a server close to the device’s location, and serves data packets to that server, tracking the time used to ping the servers, as well as the transfer rates for download and upload. Ookla’s Speedtest mobile app tests the performance of modern mobile data connections, such as LTE, 3G, 4G, EDGE and EVDO networks. It does not work for WAP connectivity, which is very limited, but common in legacy feature phones.

The Appendix 3 - Mobile internet speed tests shows the data collected through this segment of the study.

5.4 NADMO’s website analysis

NADMO’s efforts to communicate to the public are vital to the mission of the organization. Due to the characteristics of the country and its population, several media outlets are used, especially radio, television, and written materials. Prior
to the field work, NADMO had no presence in social media, making the organization’s official website the only digital system for public outreach.

There are particular benefits from offering a good website service to the public (Thatcher et al., 2006). In the first place, the website is the only on-demand asynchronous digital media outlet for the Ghanaian population. Updated news, crisis protocols, or even contact details are valuable information that can signify serious changes in a crisis situation. Furthermore, internationally, a website is the main initial source of information about NADMO.

Prior to the field work, the organization’s website offered scarce information, had a particularly alarming amount of down-time, and offered a limited usable experience. A few automatic tests were made on the website in May 2012. HTML & CSS validation tests, as well as accessibility tests for WCAG 1.0 and WCAG 2.0. Due to the characteristics of Ghana’s network, a test on loading times was also done in order to analyze the strain of the content on low-speed or mobile network connections. Non-automatic tests such as mobile suitability, responsive design, and usability were also made.

The tools used for these tests were the W3C Validation Service for the HTML & CSS tests, (http://validator.w3.org), and the Total Validator tool for the tests on accessibility (http://www.totalvalidator.com). The loading time and speed was tested with the aid of the YSlow Firefox plugin (http://yslow.org).

During the field trip, an extensive conversation with the team in charge of the website took place. There was no recorded statistics on the up-time of the server, of number of visits, demographics, devices, etc. After a personal recommendation, Google Analytics (http://www.google.com/analytics) was added to the website. Additionally, a monitor that checks the server’s up-time was configured. This service is offered by Uptime Robot (http://www.uptimerobot.com) and tries to download the homepage and sends a ping to the server every five minutes, offering detailed reports of the uptime of the server.

Some of the data available in this study stems from the aggregated data that Google Analytics provides, as well as the server monitor statistics.

During April 2013, NADMO’s website was rebuilt into a new Content Manager System (CMS), which allows for a much faster content update by non-technical staff. The CMS chosen was Joomla and the new design offers extensive improvements on design, content, and accessibility. Additionally, the server was moved to a centralized governmental server increasing the uptime of the website drastically.
The new design was tested to measure the changes in comparison to the old website. The new set of tests were performed following the same criteria of the first set of tests, and were conducted in June of 2013, roughly a year after the first set of tests.

The results of the tests are analyzed in Chapter 6.4 NADMO’s website accessibility analysis.
6 Empirical data and analysis

The purpose of this chapter is to bring forth the relevant empirical data collected for the study and to conduct a thorough analysis of such data. The chapter opens with the information originated from the qualitative research, distributed in summarizing matrices of the themes derived from the semi-structured interviews. It is followed by the data gathered with the short interviews, the results of the mobile speed tests, and NADMO’s website accessibility status.

By using the methods for analysis described in Chapter 4.3 Methods for analysis, the focus is set to provide the reader with the transcending content extracted from the raw empirical data. The information discussed is by no means all the data collected, but a summarized version of the relevant data. A large amount of information was shared during the interviews, and while all of it was interesting, not all of it was relevant to this study.

The analysis derives directly from the coded transcriptions of the interviews and the resulting comparisons between respondents, analyzing the patterns that may emerge, as well as the matrix with the responses to the short interviews, and the data emerging from the speed tests and web analysis.

The structure of the chapter starts by analyzing each of the six themes identified and the categories connected to them, detailing a description of the category, its relevance towards the study, and the emerging patterns from the experiences gathered in the interviews. Each matrix derived from the thematic analysis is presented and analyzed with a brief summary that aims to engulf all aspects of each theme. It continues by analyzing the content of the short interviews, trying to offer a picture of the use of mobile phones, as well as the current state of mobile internet connectivity in Ghana. The web analysis is presented in order to provide an image of the current accessibility status of the NADMO’s website.

6.1 Emerging themes from NADMO

The data provided by the interviewees is dense and clearly points into an unexpected area. The framework for the interviews (Appendix 1) allowed the interviewees to create their own narratives while trying to keep the conversation within the scope of the study. However, very soon it became clear that some of the responses were a combination of experience in their position and knowledge of the socio-economic context of Ghana. At certain points the narratives provided by NADMO’s workers tend to take a mildly vindictive stand. Often they veer from the question to offer what they consider is a main problem for the
organization and their work, always motivating the reasons behind those opinions. Their years of experience in the field of crisis management have proved a source of valuable data and sound insight as their views complemented the content of interview framework.

The six themes identified are *Disaster management context, Hierarchical channels, Interaction and accessibility, Interaction and trust, Information and communication systems, and Challenges.*

They are presented through matrices with the variables that offer the major patterns within the narratives of the interviews, and afterwards they are discussed briefly.

6.1.1 Theme 1: Disaster management context

The first theme identified is the one regarding disaster management context of NADMO and how the respondents experience its particular characteristics. The three categories identified in this theme are approach taken by NADMO, risk reduction, and education. Table 3 shows the matrix of a condensed general response towards this theme.

This theme shows interesting patterns that all respondents seem to have interiorized. In a broader term, all respondents seem to see very clear that the role of NADMO is one of coordination of all stakeholders that are related to national security and disaster management in Ghana. There is an acknowledgement of a variety of NADMO’s main functions, as planning, mitigation, management, relief, etc. However, there is a clear agreement that the work of the organization is bringing together other organizations in a combined effort to prevent, minimize, and overcome disasters. It is best summarized by Vivien Akumia:

“We are coordinators and work in collaboration with stakeholders and other departments in disaster management [...] the police, the fire department, the army, etc. Then we all strategize how disasters should be managed.” (Vivien Akumia, Metropolitan Coordinator for Kumasi)

The everyday approach of NADMO was greatly affected when in 2009 the organization shifted its focus from *management of disasters* to a stronger *risk reduction* strategy. Some of the respondents link this shift to the Hyogo Framework for Action, some others consider this more of a natural evolution rather than an actual shift.
Table 3 - Theme 1: Disaster management context

<table>
<thead>
<tr>
<th>Approach</th>
<th>Risk Reduction</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>David Mensah</strong></td>
<td>We identify the risks and match them with the experts that can deal with them.</td>
<td>To prepare the population in order to reduce risks or to know what to do after a disaster.</td>
</tr>
<tr>
<td><strong>Dr. Kingsford Asamoah</strong></td>
<td>It's a bottom-up approach, making sure the community is the owner of disaster management.</td>
<td>Our methodology is reducing the hazards and the vulnerability and increasing their capacity, thus reducing the risks.</td>
</tr>
<tr>
<td><strong>Helen Ntoso</strong></td>
<td>To coordinate many agencies, plan before disasters happen, mitigate, and resettlement after disasters happen.</td>
<td>We want to include the public in the process so that they understand their part in the crises.</td>
</tr>
<tr>
<td><strong>Anasthasia Blebo-Boafo</strong></td>
<td>We try to lower the risks in the country by prevention and education.</td>
<td>By investing in risk reduction you don’t have to spend as much in relief and reconstruction as the effects of disasters are lower.</td>
</tr>
<tr>
<td><strong>Yao Doe Tamakloe</strong></td>
<td>NADMO coordinates, manages, prevents, and reduces risks.</td>
<td>When you put all the costs together, it is much more economical to invest in risk reduction.</td>
</tr>
<tr>
<td><strong>Vivien Akumia</strong></td>
<td>We are coordinators, working with stakeholders and other departments in disaster management.</td>
<td>We try to minimize the risk. We know which are the recurrent disasters, so we try to prepare for them and involve the public.</td>
</tr>
<tr>
<td><strong>Aninkora Sie Kwaku</strong></td>
<td>Our idea is to prevent disasters, mitigate the effects of disasters, and rehabilitate after a disaster.</td>
<td>We work with all the stakeholders and coordinate them to reduce risk as much as possible.</td>
</tr>
<tr>
<td><strong>Simon Miles Bakar</strong></td>
<td>We look at how people are affected, so that we can protect them, preventing conflicts.</td>
<td>We check on the conflict areas trying to assess the safety or the area to prepare for the worst.</td>
</tr>
<tr>
<td><strong>Alex Attakpah</strong></td>
<td>We want people to get involved and prepared for disasters, so that they know what to do when disaster strikes.</td>
<td>Our main task is increase prevention. A well prepared community will face disaster with a much better outcome.</td>
</tr>
</tbody>
</table>
There are two clear outcomes from this focus on risk reduction. The first one is the inclusion of the public of Ghana. By introducing the public in the disaster management efforts there is a sense of ownership that intends to decrease some of the man-made effects within a crisis. The second one is the preemptive effects of reduced risks in the economic balance of a disaster. If risks are decreased by shrinking vulnerabilities and increasing capacities, the economic effects of a disaster are also lowered.

“Last year we organized a debate for the chiefs and we talked about disaster effects and showed them some clips with some of the things that happened... when you show them these pictures, they begin to understand how important it is to keep their own surroundings free from hazards” (David Mensah, Regional Coordinator for Central Region)

This reflects the first step of what Beck (1992) calls a reflexive modern society. By exposing individuals to the effects that disasters have on others, the individuals become self-conscious or reflective of their own potential experiences of similar disasters. This produces a shift from reacting to risks to trying to prevent them (Cottle, 1998).

The economic math is hard to deny, strong investment in prevention pays off during the relief stage. Nevertheless, the push for risk reduction requires a socio-economic context that sets the foundations for proper strategies to work (Wisner et al., 2005). If this is mostly an externally imposed shift from the HFA, as some of the respondents point out, then this would be a premature self-reflective step from a society that has other needs before tackling risk.

“If you look at the cost of managing disasters, loss of life and properties, relief of displaced citizens... when you put all these costs together you realize that is much more economical if you invest in disaster risk reduction” (Yao Doe-Tamakloe, Chief Disaster Control Officer)

“If you don’t reduce the risk, you spend much in helping, you spend much in relief, you spend much in bringing everyone to their normal functions. The Hyogo Framework has shifted our focus from management to risk reduction” (Anasthasia Bleboo-Boafo, Head of IT)

Regardless of its origins, it is clear that NADMO has put considerable efforts in reducing risks in a campaign called Risk Reduction through Education. This seems to have an important impact on all respondents, with a remarkable acceptance and success.
“Education is the first and most important step. If you fix the education of the population, then management becomes much easier” (Simon Miles Bakar, Regional Coordinator for Volta Region)

It is apparent to the respondents that the way of education is a fruitful one. All of them mention the progress of such strategy. It is also to be mentioned that many comment that there is still much work to be done. The fine line between education and awareness is a tough one to define in situations of development. How far into the educational system can NADMO go is something that cannot be assessed through interviews, but if the progress is strong and clear, it is clear that this is a successful approach that needs to be strengthen within the society.

6.1.2 Theme 2: Hierarchical channels

Hierarchies, while providing governmental structures a clear notion of authority, have a tendency to blur channels of communication. A layered vertical structure often can produce a feeling of detachment between levels, and the reality of the organization can differ depending of each level in the hierarchical tree.

The second theme identified (summarized in Table 4) is a reflection of the vertical disposition of crisis management in developing countries. The idea that international structures define policies that have to be carried out on a national level sets the stage for a great leap in the hierarchies. But the next levels within the national borders are equally vertical.

“In the structure of NADMO you’ll be looking at the President as the head of National Security, who is the head of NADMO. Then you have the National Coordinator, and then it comes down to the regions, and to the districts, and to the zones, and then to the communities. So we have a structure all the way to the community level” (Dr. Kingsford Asamoah, Head of Research)

There is nothing inherently wrong with following such a vertically oriented structure, but certain problems tend to arise. The hierarchies, in the example of Ghana, are topped by international actors, such as the UN, that with initiatives like the Hyogo Framework of Action, create policies that are applied to the signing countries. The national actors, mostly governments try to adapt the international policies into national vision of where crisis management agencies need to go (Palm & Ramsell, 2007). In this case, NADMO takes that vision and translates it into strategies that are forwarded to the regional offices. It is these regional committees that materialize strategies into actions, both in the cities and the villages. Each hierarchy level uses different channels to transfer information, especially formatted and adapted to the recipient in the next level. In the cities,
for example, mass media is used to reach out to the population. In the rural areas, chiefs are the main channel to disseminate information.

Table 4 - Theme 2: Hierarchical channels

<table>
<thead>
<tr>
<th>Name</th>
<th>NADMO’s Structure</th>
<th>Ghana’s Society</th>
<th>Hyogo Framework for Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>David Mensah</td>
<td>Every district has a disaster committee, then it's regional, and national. If national can't take it, the State of Emergency is declared.</td>
<td>Approaching everyone is very difficult, but we don't leave anyone behind. Families hold together.</td>
<td>We implemented our preventive action because the HFA states every signing country must have it.</td>
</tr>
<tr>
<td>Dr. Kingsford Asamoah</td>
<td>It goes from the President, to the over 2800 volunteer groups. We have a structure all the way to the community level.</td>
<td>It’s about knowing the vulnerabilities and capacities of each community, and knowing the focal people.</td>
<td>We comply internationally with our National Plan of Action, bringing all institutions of Ghana together in terms of risk reduction.</td>
</tr>
<tr>
<td>Helen Ntoso</td>
<td>We are a large organization. Manpower is not a problem but sometimes organize everyone is.</td>
<td>We create workshops to teach at district level, then we tackle local communities through their chiefs or the radio in urban areas.</td>
<td>The HFA set the foundations on how we operate nationally. I don’t think people think much about it though.</td>
</tr>
<tr>
<td>Anasthasia Bleboo-Boafo</td>
<td>We rely on technical committees to study situation, to come up with a report, then we deliver it to the public.</td>
<td>Communities act as a group, we do not need to target individuals one-by-one.</td>
<td>The HFA shifted our focus from management to risk reduction. We used to help the displaced, now we’re supposed prevent &amp; educate.</td>
</tr>
<tr>
<td>Yao Doe Tamakloe</td>
<td>We have several commissions, divisions, and committees. This way we have all fronts covered.</td>
<td>We’ve formed disaster volunteer clubs in various communities to be closer to those in higher risk.</td>
<td>We have been focusing on awareness, education, and training because the HFA stipulates so.</td>
</tr>
<tr>
<td>Vivien Akumia</td>
<td>It's a very vertical organization. The top is the president, all the way to the community.</td>
<td>People move to the cities because they can find better jobs there. It’s a very heterogeneous society.</td>
<td>We are not very concerned about the HFA. The National Committee gives us the guidance on what to do.</td>
</tr>
<tr>
<td>Aninkora Sie Kwaku</td>
<td>We try to channel into the public what is decided by the headquarters in Accra.</td>
<td>In Ghana, families are still the core. They take care of the elderly and disabled.</td>
<td>The HFA gives shape to our policies, but we shape them to our needs, too.</td>
</tr>
<tr>
<td>Simon Miles Bakar</td>
<td>We are linked to the National Committee so that we can plan our own measures. It is important to have constant dialogue.</td>
<td>In Volta we have a diverse setting of people. It is difficult to handle when there are internal social tensions.</td>
<td>I know that we get most of our tasks from the HFA, but I'm not yet familiar with it.</td>
</tr>
<tr>
<td>Alex Attakpah</td>
<td>We go back and forth the chain. I visit the HQ quite often, and we brief our zonal coordinators monthly.</td>
<td>Our communities are very independent. The national feeling is there but it’s mostly tied to sports.</td>
<td>At a municipal level, the HFA has very little effect. It’s the National Committee that decides for us.</td>
</tr>
</tbody>
</table>
Ultimately, the goals set by the international agencies end up being applied at a very local level, shaped by specific national needs and different levels of capacity (Schipper & Pelling, 2006).

This theme has the variables of NADMO’s structure, Ghana’s society, and the Hyogo Framework for Action (HFA), as they are the main actors within a much more complex structure.

All of the respondents are well aware of the strongly hierarchical nature of NADMO, and there are no explicit problems regarding this particular setting. Later on some of the effects of this will become apparent.

There are no referrals to a bloated system, there is no perception of an organization too big to function well, and that is remarkable.

A few comments are made on the difficulty of managing a large body of employees, especially the up to 2800 volunteer groups within the communities.

“We have a human resource problem. It’s not so much the numbers, but the quality. We have lots of unqualified people who are not properly trained, they don’t know what they are supposed to do” (Vivien Akumia, Metropolitan Coordinator for Kumasi)

This is precisely one of the problems of such a big organization, especially one that due to the socio-economic context lacks the resources for proper training or recruitment.

However, even the hierarchical course of action is widely accepted among the respondents.

“Every district has a disaster management committee, and a disaster management platform. The chief or chair of the committee in the district or zonal coordinators go first and pass the informational along. If the incident is too big, they contact the national office. If the national office can’t contain it, the state of emergency is declared” (David Mensah, Regional Coordinator for Central Region)

And while this compound of bodies and scalability of information is in place internally, externally, the social setting is no less complex. Depending on the region, rural or urban areas follow their own hierarchical structures. Too complex to describe, in fact, for the scope of this study.

However, it becomes clear that the way the public needs to be approached responds tightly to each community and its own characteristics. From remote
villages to urban clusters, each community is ruled by local assemblies that control information through proximity.

“Approaching the public depends on each community. In Kumasi we use the media, like radio. In the villages we assemble the community and talk to them. In more remote places we need to talk to the chief and he delivers our message” (Aninkora-Sie Kwako, Regional Coordinator for Ashanti Region)

Regarding the role of the Hyogo Framework for Action, the pattern here is more of dissent than one of general consensus. The narratives of the respondents clearly point to a dichotomy based on their closeness to the hierarchies of policy making. Those in the regional offices have a lower concern for the HFA than those working at NADMO’s headquarters. This was particularly interesting, because while policy making was introduced in the interviews, international policy, or the HFA was not mentioned in the interview framework, however, the respondents brought it up. At the regional level, the views on the HFA were of less importance, pin pointing the importance of the National Committee as main source of policy. At a national level, the general acknowledgement was of changes done due to international policy, in particular due to the HFA’s regulations.

“Before the Hyogo Framework, NADMO was helping internally displaced, now, internationally, we’re supposed to make sure that we prevent disasters and educate people” (Anasthasia Bleboo-Boafo, Head of IT)

“At a municipal level, we have very little contact with the HFA. We hear about it in meetings, and we are aware that we are a signing member, but here it is the National Committee the one that decides what is our course of action” (Alex Attakpah, Municipal Coordinator for Keta Municipality)

This difference in the perspective on how the policy process works seems rather obvious, as the scope for each level in the hierarchies receives orders from the level directly above, but it shows a disconnection between those who receive policy made with an international scope to those who have to enforce it in a local level.

6.1.3 Theme 3: Interaction & accessibility

The third theme is tightly related to the previous one. The way NADMO interacts with the public in general responds in an intricate way to those hierarchical channels embedded in the culture of the country. As shown in Table 5, the main
variables for this theme are: Informing the public, Physical Accessibility, and Intermediaries.

The first variable is one of the primary focuses of this study, as the flows of communication between the crisis management organization and the general public is essential to understanding the potential of mobile communications. It is clear by the responses that the disparity between urban and rural areas becomes a key factor to understand the methods to reach the public.

The channels used by NADMO's officials vary greatly according to who they want to reach. The pattern emerging from the narratives of the interviewees shows that in urban areas, the figure of the sole intermediary has shifted to either a mass media outlet, or to community groups. Radio seems to be the prevalent channel of communication, followed by TV programs, and flyers. Interviewees also mention workshops with groups of citizens that represent certain metropolitan areas, however, the importance seems to be related, more importantly, to the shift in trust and responsibility, than to an actual case of leadership obtained by these groups.

As Vihalemm, Kiisel and Harro-Loit (2012) discuss, areas that lack familiarity with the governmental agencies tend to react better to communication strategies if they are delivered by individuals that are not regarded as the media and that can act as trustworthy intermediaries. On the other hand, urban citizens lack this figure and their response to mass media communications by NADMO has uneven success.

“There is not one way to reach them [the public]. You have to adapt to each segment of the population” (Helen Ntoso, Head of Operations)

“It depends, in the cities we normally use the radio, or the megaphone on a car, but in the villages we have to go personally” (Aninkora-Sie Kwako, Regional Coordinator for Ashanti Region)

In rural areas the channel of communication cannot be as straightforward and standardized as a radio communication. The social networks of the rural areas follow different hierarchies than in the city. The rootedness of its citizens allows for traditional settings to persevere, and in most cases, communities need to be approached by addressing their leader first. The chief of each village serves as a loudspeaker on which NADMO communicates in rural areas. The locality of trust, and the difficulty of accessing all the population, forces crisis managers to turn to chiefs in order to reach the communities. This is precisely the multidimensional level of trust that Barber (1983) identifies. Trust carries along a cooperation and familiarity that affects its nature.
### Table 5 - Theme 3: Interaction & accessibility

<table>
<thead>
<tr>
<th></th>
<th>Informing</th>
<th>Physical Accessibility</th>
<th>Intermediaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>David Mensah</td>
<td>Out to the public our PR officers go to the radios to announce the news, or we visit the communities.</td>
<td>In Ghana, most of the villages are not easy to reach, but people will not wait and they’ll inform us.</td>
<td>In a typical village, you talk to the chief, he’ll beat the gong-gong and he’ll summon the people.</td>
</tr>
<tr>
<td>Dr. Kingsford Asamoah</td>
<td>Since we have 900 zonal officers, it is easy to inform the people.</td>
<td>We can go everywhere. We might need to walk or take canoes, but we can reach everywhere.</td>
<td>Every community has a particular focal person to whom we talk in order to make sure the people are informed.</td>
</tr>
<tr>
<td>Helen Ntoso</td>
<td>We use the radio in metropolitan areas, but it is a one-way communication system.</td>
<td>We do not have to go absolutely everywhere. We need to talk to the key people and they deliver our message.</td>
<td>Chiefs, community assemblies, all are very important for us, because without them we wouldn’t have access to the public.</td>
</tr>
<tr>
<td>Anasthasia Bleboo-Boafo</td>
<td>We use the media. All sectors collaborate with weekly programs on TV and radio to tell people what NADMO is doing.</td>
<td>There are some places where we cannot call, so zonal officers need to walk to get there.</td>
<td>To the local level we need to use intermediaries who can talk with the communities.</td>
</tr>
<tr>
<td>Yao Doe Tamakloe</td>
<td>TV, radio, flyers, megaphones, every community need its own way for communication.</td>
<td>We can reach most places, but sometimes we need help from other institutions to reach some villages.</td>
<td>We use local chiefs beating gong-gongs or the Local Assembly Chief will use megaphones.</td>
</tr>
<tr>
<td>Vivien Akumia</td>
<td>The best system here in Kumasi is the radio. Everyone listens to the radio, so we get to all the citizens that way.</td>
<td>We don’t have that problem here, we can go anywhere in the city or its surroundings.</td>
<td>We reach our population through the media. In the city there are few intermediaries. That is sometimes troublesome, too.</td>
</tr>
<tr>
<td>Aninkora Sie Kwaku</td>
<td>It depends on the community. In Kumasi we use the radio, in the villages we need to go in person and talk with them.</td>
<td>There are places where we cannot access with people in large scale, but we get to send officers to inform.</td>
<td>In the villages they are our eyes. They know their grounds better than us and how to deal with their people.</td>
</tr>
<tr>
<td>Simon Miles Bakar</td>
<td>Normally our zonal coordinators summon and assemble the communities and we talk to them.</td>
<td>There are communities we cannot reach directly and not everyone has a radio, so we have to talk to their chief.</td>
<td>Communities rely on their chiefs for important decisions. If we talk to them it counts as if we’ve talked with all the community.</td>
</tr>
<tr>
<td>Alex Attakpah</td>
<td>We visit the community leaders and tell them what to do to reduce risks. Then they talk with their communities.</td>
<td>I’m lucky that in my municipality I can reach everywhere with my motorbike.</td>
<td>In the urban areas we have disaster assemblies that deal with the different communities.</td>
</tr>
</tbody>
</table>
“In a typical village, you beat the gong-gong and summon the chief. He will talk to the village. Sometimes you can use a loudspeaker, but we don’t have one here, so we just go there and talk to them” (David Mensah, Regional Coordinator for Central Region)

This narrative is confirmed by all nine respondents, giving the figure of the chief a particularly important role. The impossibility of NADMO to reach certain villages, either by means of trust or infrastructure makes it necessary to communicate to one (or a small group) of citizens and rely on them to pass along the information, precisely as Vihalemm, Kiisel and Harro-Loit (2012) suggest in their research.

In this way, the second variable of this theme becomes relevant. The physical accessibility of Ghana’s rural areas becomes an important factor to keep in mind when assessing crisis management. In the very same that Maslow’s (1943) Theory of human motivation defines five stages from human necessities on which, if one is not satisfied, the next stage cannot be achieved, physical accessibility becomes a central variable for this theme, leaving out of the picture web accessibility as is approached in the theoretical background. The real problem of physical accessibility is clearly perceived as essential in comparison to developing accessible systems for electronic mobile devices.

And it is understandable. In many cases, physical accessibility poses serious problems to NADMO when addressing the public, but also when relocating those displaced by a disaster, or aiding those suffering one.

“Most places we go by motorbikes, some places we have to take canoes, and sometimes we have to walk” (Simon Miles Bakar, Regional Coordinator for Volta Region)

This issue is more substantial in remote areas, farther away from the cities, however, the narratives of the interviews tended to hint that in the northern regions, the problem was more accentuated. It seems plausible that if some of the respondents came from the northern regions, this particular issue would have been shown in a deeper way.

“We are supposed to be equipped with an emergency unit in all regions, but we only have one here in Accra, So when we need to go to the northern regions, it can take 13 hours until we reach the disaster location” (Helen Ntoso, Head of Operations)

The final variable for this theme is also deeply connected to the first one, and partially to the second one. Due the societal structure of Ghana and it’s infrastructure surrounding rural areas, NADMO officials are obliged to resort to
intermediaries like the chiefs or the community leaders in order to access the villagers.

“To the local level, we use intermediaries, key people who can talk with the communities” (Anasthasia Bleboo-Boafo, Head of IT)

This particularity of Ghanaian society is not regarded as a problem, but a solution to several problems. While at first, having an extra layer between NADMO and the public could be seen as a hold up, from the local perspective, chiefs have a better access to the communities, and are regarded as most trustworthy because they are familiar and local. This is possible because the intermediaries embody the four dimensions of trust offered by Mishra (1996), competent, open, concerned and reliable. This helps solve the problem of reaching some of the communities, and decrease the level of non-compliance. Some of the narratives point out at the lack of proper intermediaries in the cities as the main reason for a high level of public non-compliance.

6.1.4 Theme 4: Interaction & trust

The fourth theme identified, shown in a condensed form in Table 6, is the natural evolution to the third theme, as once the public is accessed, the issue of trust arises.

Once the issue of accessing and informing the public has been dealt with, there is the question of how that information is transmitted and received, and how the interaction between public and governmental organization happens.

Trust and the effects of trust in the interaction are concepts that derived from the narratives in the interviews that were completely unexpected. However, the emerging patterns clearly show a concern from NADMO’s officials in the role of public trust within the organization’s goals and initiatives.

At this point it starts becoming apparent that communication, while it may be a problem, it is in fact one that can be solved with relative ease. This theme starts shaping the main change of focus of the study, taking an unexpected turn that will be discussed further in this study.

The variables for this theme are training, image, and compliance. As the core of a theme, these variables are largely related. Mishra’s (1996) dimensions of trust are the point of interjection for these variables. Training of volunteers is problematic and results in limited capacity. Along with the lack of resources, this leads to a damaged image of NADMO. The image of the organization relates to the competence of the organization perceived by the public. If this dimension is not fulfilled, it could lead to lack of trust and hence non-compliance.
<table>
<thead>
<tr>
<th><strong>Table 6 - Theme 4: Interaction &amp; trust</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Training</strong></td>
</tr>
<tr>
<td>David Mensah</td>
</tr>
<tr>
<td>Dr. Kingsford Asamoah</td>
</tr>
<tr>
<td>Helen Ntoso</td>
</tr>
<tr>
<td>Anastasia Bleboo-Boafo</td>
</tr>
<tr>
<td>Yao Doe Tamakloe</td>
</tr>
<tr>
<td>Vivien Akumia</td>
</tr>
<tr>
<td>Aninkora Sie Kwaku</td>
</tr>
<tr>
<td>Simon Miles Bakar</td>
</tr>
<tr>
<td>Alex Attakpah</td>
</tr>
</tbody>
</table>
As hinted previously, in the case of training, there is a common view on the importance of training of the human resources available to NADMO. All respondents acknowledge the need for training and the impact it has during a crisis.

“We do train our zonal coordinators and our volunteers. They are the ones that have direct contact with the public, which is the most important. They are what the public see first” (Alex Attakpah, Municipal Coordinator for Keta Municipality)

There is no such unanimity when discussing the current state of training of those human resources. There are respondents who consider that the level of training of the organization’s employees and volunteers is good.

“Every zonal officer is trained in community entry techniques, and they will use the focal people to inform the public” (Dr. Kingsford Asamoah, Head of Research)

There are respondents who consider the human resources, particularly and the local level of the organization as largely under trained.

“We are very lucky to have so many volunteers, and they are very well intended, but we can’t offer them all proper training. That puts a strain in their efficiency when a disaster strikes” (David Mensah, District Coordinator for Central Region)

In this case, the diverging views do not come from the urban/rural dichotomy, but from the regional/headquarters separation. The closer an officer is to the actual zonal officers, the more they see training as a problem.

The words of Mr. Attakpah lead to the second variable of this theme, image. While there is not a clear unanimous view on the current image of NADMO within the public, all respondents seem to hint that the organization’s image, in the past, was not particularly good.

Some respondents acknowledge that the efforts of the last years are starting to pay off with an enhanced appreciation in the eyes of the public and the importance that it has in NADMO’s daily tasks.

“We have been improving our response, we have been more efficient, and that has made people start realizing that we have an important role, here. They trust us more now” (Alex Attakpah, Municipal Coordinator for Keta Municipality)
“Conflict areas are difficult to handle. We try to be neutral there and show our value, so that people will trust us. It makes our work easier in the long run” (Simon Miles Bakar, Regional Coordinator for Volta Region)

Other respondents consider that the lack of training and the difficulty of Ghana’s infrastructure take a big toll on NADMO’s image, thus damaging their credibility.

“If we arrive very late to a location where there has been a disaster, when we arrive, we can only evaluate the damage and plan contingencies. That damages our credibility” (Yao Doe-Tamakloe, Chief Disaster Control Officer).

“Our servers are offline literally half the time. This not only renders our website unusable, but forces us to rely on generic email addresses. This lowers our credibility within Ghana, but also internationally” (Anastasia Bleboo-Boafo, Head of IT)

The final variable of this theme is the public’s compliance, or in this case, non-compliance. All respondents, in more or less direct fashion, point at the public’s major role in NADMO’s successes and failures.

“When a disaster happens or we think it will happen, we warn the public. We try to tell them where to go, where the safe grounds are, all the information they need, but they simply will not do it.” (Vivien Akumia, Metropolitan Coordinator for Kumasi)

In one particular case, a more holistic view is portrayed, mentioning the socio-economic characteristics of the country.

“I think it is a combination of trust and lack of alternatives. Sometimes it looks better to the citizen to hope for the best. Displacement locations are often perceived as a worse alternative than staying in the area where they belong” (Aninkora-Sie Kwaku, Regional Coordinator for Ashanti Region)

6.1.5 Theme 5: Information and communication technologies

Information and communication technologies (ICTs) are the fifth theme emerging from the interviews. This was a central part of the interview framework, so it did not become a theme spontaneously.

The respondents were asked about the use of ICTs in NADMO, both internally and externally, specifically about mobile phones and the internet. These two
communication systems became variables of the theme. Another variable is the GoTa System, an ICT that was not in the planning stages, but that is used within the organization with quite an optimistic success. Table 7 offers a condensed review of the content offered by the interviewees.

There is consensus in the fact that mobile phones being the predominant ICT used in crisis management in Ghana. Granted, mobiles phones, according to the respondents, do not work to approach the general public, nor work evenly in Ghana, however, they are the undisputed fastest way to receive and disseminate information to individuals once a disaster strikes.

“Mobile phones work particularly well when there is an emergency and we need to deliver information quickly. It has the additional benefit that it works both ways, and since almost everyone has a phone or knows someone who does, we can call them, but they can call us, too” (Helen Ntoso, Head of Operations)

The flow of information is bidirectional and synchronous, and helps coordinate all the stakeholders and set them in action in extremely short lapses of time. Even though phones are not a mass medium, such as the radio or the television, their value for immediate and two-way communication is unparalleled.

“Mobile telephones are very good for us, but the networks are very fragmented in Ghana. That’s why the GoTa is better. We can call everywhere, to any carrier, and we can access the internet through the terminal. Besides, it is not charged per call, so calls are free” (Dr. Kingsford Asamoah, Head of Research)

Only with the exception of Dr. Asamoah and Mrs. Bleebo-Boafo, all respondents graded the mobile phone as the most important ICT in their work duties. The Head of Research and the Head of IT are the only one to consider the GoTa system more important.

Hence, the GoTa System is the second variable for this theme. The GoTa system, as seen in Chapter 3.3 Crisis communication: strategies and informing the public has been adopted by the Ghanaian government as a major system for internal communication. In the context of NADMO, the GoTa system offers another look into the hierarchical disconnection of the organizational levels.

“The GoTa system is country-wide and it can always connect to the internet. It is much better than commercial services, because it reaches almost every community in Ghana, and since it is from the government, we don’t need to pay for the phone calls.” (Dr. Kingsford Asamoah, Head of Research)
Table 7 - Theme 5: Information & communication technologies

<table>
<thead>
<tr>
<th>Name</th>
<th>Mobile Phone</th>
<th>GoTa System</th>
<th>Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td>David Mensah</td>
<td>Every district coordinator has a mobile phone. We made a deal with Vodafone so internal calls are free.</td>
<td>The GoTa is not so spread here, so we end up using multiple phones.</td>
<td>Not all regions have a modem, so we only use the Internet with the national headquarters.</td>
</tr>
<tr>
<td>Dr. Kingsford Asamoah</td>
<td>Mobile phones are useful, but networks are fragmented, that's why the GoTa is better, plus it's free for calling.</td>
<td>The GoTa is a country wide system and it can even connect to the internet, and can call regular mobile phones, too.</td>
<td>Sadly, the internet hasn't caught up yet, but I'm rooting for a WebEOC with maps, protocols, live video coverage, etc.</td>
</tr>
<tr>
<td>Helen Ntoso</td>
<td>Mobile phones work particularly well to deliver fast information, and work both ways. We can call, but they can call us too.</td>
<td>Almost all our district officers have a GoTa terminal, but there are some areas where the network is still not working.</td>
<td>The problem with the internet is the power outages. If we don’t have electricity, then we would be completely stopped.</td>
</tr>
<tr>
<td>Anasthasia Bleboo-Boaf</td>
<td>They are the starter. When something happens, a quick phone call starts the process of crisis management.</td>
<td>It is the most useful system. It is used by National Security officers, not only NADMO.</td>
<td>It fails to give instant information about what is happening. We put the incident in the website after the incidents.</td>
</tr>
<tr>
<td>Yao Doe Tamakloe</td>
<td>On emergency cases, it is the phone that we use. People call us, to our Hotlines, and we call our people, too.</td>
<td>Every regional operations officer has a GoTa. The ones who don’t use it are because of the antennas’ signals.</td>
<td>Our internet facilities are not available at every place. It is still a very unreliable system for us.</td>
</tr>
<tr>
<td>Vivien Akumia</td>
<td>We get calls from the public or our submetro coordinators or our volunteers. We use mobile phones a lot.</td>
<td>We used to have the GoTa system, but for now I think it’s only regional coordinators who are using the GoTa.</td>
<td>I have internet, but I can’t use it with the submetro coordinators because they don’t have it.</td>
</tr>
<tr>
<td>Aninkora Sie Kwaku</td>
<td>We use it a lot internally very much. It is the fastest way to get by, even if we need multiple phones to reach everyone.</td>
<td>I use the GoTa system quite a bit because I can reach most of my people with it. We need to have zonal officers with a terminal each.</td>
<td>It has a lot of potential, but to be honest, our public can’t use it, and we can’t use it at a larger scale.</td>
</tr>
<tr>
<td>Simon Miles Bakar</td>
<td>For some places where the GoTa doesn’t arrive, we have to rely on private providers. We use up to 4 carriers here.</td>
<td>The GoTa is very good internally. All the district coordinators have one, and it is always one, without outages.</td>
<td>There’s not much use for the internet here, because almost no one has access to it.</td>
</tr>
<tr>
<td>Alex Attakpah</td>
<td>We use it to call the disaster assembly, so that they can gather whatever they need. Then we go to the location.</td>
<td>It is very useful, but there are some places where you can’t reach your zonal coordinators, so we use our personal phones.</td>
<td>The internet is…nononono. If I need to send lots of info to the HQ, I go there myself. It is not reliable with the internet.</td>
</tr>
</tbody>
</table>
However, at regional and local levels the use of the GoTa system is questioned. Admittedly, the quality of the GoTa system is not discussed, but it is its outreach and the limited supply of terminals that cause dissent instead.

“The GoTa system is not so spread here, not everyone has it and sometimes it doesn’t work, so we made a deal with Vodafone and now every district coordinator has a mobile phone. That’s what we use here.”

(David Mensah, Regional Coordinator for Central Region)

There are different models of GoTa terminals with different levels of access. However, it is clear that this promising system is not completely integrated within NADMO’s structure from top to bottom, and there seems to be lack of information on how or who gets a GoTa. The reasons are unclear, but they could be due to either high cost of terminals, or signal connectivity.

Regardless of the multiple uses of the GoTa system and its spread within the organization, it remains an internal ICT, one that the general public has no access to, and hence cannot use it.

The Internet, on the other hand, is one of the ICT that has the potential for public use. In wealthier countries, the Internet has become a ubiquitous system of communication, from entertainment to governance, to almost any aspect of everyday life (Pieterse, 2010). It is precisely in the adoption of the internet, the third variable of this theme, that the digital divide can be seen.

Rogers’ (2003) diffusion of innovations identifies the social system as one of the main factors for the spread of a new technology. The necessities and skills of Ghana’s public are not the same as those of the wealthier countries, thus making the time frame much longer. But as Hoffman (2011) discusses, there are shortcomings to applying diffusion of innovation in a developing setting. The inequalities between societies, especially in terms of infrastructure, are so significant that the level of diffusion is not only related to the four elements discussed by Rogers.

All of the respondents unanimously agree that the internet has not been able to spread, and thus it is not particularly useful for NADMO, both externally and internally.

“The internet is a great tool, but there isn’t much use for it here because almost no one has access to it, so we can’t really use it” (Simon Miles Bakar, Regional Coordinator for Volta Region)
There is an acknowledgement of the qualities and potential of the internet, but at this point, it hints that Ghana’s infrastructure and socio-economic status may not be ready for massive internet communication.

“The internet is…nononono. If I need to send lots of information to the headquarters, then I go there myself and deliver it. If it’s little information, then I use the telephone. But it is not reliable with the internet. (Alex Attakpah, Municipal Coordinator for Keta Municipality)

6.1.6 Theme 6: Challenges

The last theme emerging from the interviews relates in an indirect level with all other themes. It is a theme resulting from the particularities and idiosyncrasies of developing regions.

As seen in the reflection on Beck’s (2006) theory of global risk, these local characteristics are bound to shape the way that crisis management is being done, the governmental and organizational structures, the social response to it, and the tools used to address the problems. The challenges, the sixth and final theme, are the main restraining factor to deploy substantial crisis management initiatives. It is an aspect that is often overlooked by international stakeholders, practitioners, and scholars.

This theme has three main variables: outages, infrastructure, and real needs. The last variable requires additional motivation. During the interview, when asked about the biggest challenges for NADMO, all interviewees, without hesitation shifted their narratives from ICTs to what mostly was referred as “the real needs”. Table 8 shows a matrix with the condensed content of this theme.

Outages, the first variable of this theme, come in various forms in Ghana. The first and most noticeable one is blackouts and power outages. This particular type of outage has immediate effects on other outages, such as network coverage, internet access, and website uptime.

The inequalities in the socio-economic and infrastructure context of a developing country have an important role on the ability of a government to properly deploy the necessary initiatives to conform to the HFA (Hoffman, 2011). Furthermore, the requirements of the international policy makers and the needs of the local communities do not match (Strobl, 2007). This matches the case of NADMO in Ghana.

All interviewees, except for Mrs. Akumia, experience serious outage problems or limited mobile phone network coverage.
“It doesn’t happen often here. We have a generator, so it doesn’t affect us that much.” (Vivien Akumia, Metropolitan Coordinator for Kumasi)

<table>
<thead>
<tr>
<th>Table 8 - Theme 6: Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>David Mensah</td>
</tr>
<tr>
<td>Dr. Kingsford Asamoah</td>
</tr>
<tr>
<td>Helen Ntoso</td>
</tr>
<tr>
<td>Anasthasia Bleboo-Boafo</td>
</tr>
<tr>
<td>Yao Doe Tamakloe</td>
</tr>
<tr>
<td>Vivien Akumia</td>
</tr>
<tr>
<td>Aninkora Sie Kwaku</td>
</tr>
<tr>
<td>Simon Miles Bakar</td>
</tr>
<tr>
<td>Alex Attakpah</td>
</tr>
</tbody>
</table>

Regardless of the experience of regular outages, most of respondents approached the issue with particular composure and optimistic resignation.
The general feeling derived from the narratives is that these are structural recurrent problems that everyone is aware of, that cannot be dealt with at the moment, and thus, needs to be accepted as a daily nuance.

The nonchalant stance offered by the respondents is a humbling experience to anyone that might consider half an hour of internet outage an outrage.

“Blackouts happen more often than what we would like, but often enough that we learn how to live with them. You just have to be patient.”
(Aninkora-Sie Kwaku, Regional Coordinator for Ashanti Region)

The problem of infrastructure proved to be a more alarming one. The effects of limited infrastructure in the country seem to have a serious impact on crisis management. According to the respondents, having difficulty to reach communities and evacuating citizens from disaster areas is a major problem difficult to deal with. Its effects are obvious in terms of management, but as it has been pointed out, it also damages the organization’s image, and thus their capacity to influence on the general public.

“With the problems of infrastructure that we have, we need to preposition relief material in at least three big storage facilities around the country, so that we can arrive everywhere more quickly, but we don’t have the resources for that” (Yao Doe-Tamakloe, Chief Disaster Control Officer).

The final variable of this theme is called real needs because it intends to reflect some of the main structural problems affecting crisis management in Ghana. These real needs have nothing to do with communication, nor ICTs, and were unanimously portrayed by all interviewees.

“We really need more emergency vehicles, equipment, and resources. Training our human resources would come next.” (Dr. Kingsford Asamoah, Head of Research)

All interviewees directed their focus to resources, vehicles, and logistics. As it has been pointed out, ICT’s, communication, and human resources are areas with room for improvement, but the flows of information successfully convey the message, and NADMO’s officers mobilize.

The real problem, the real needs for all interviewees is the impossibility for NADMO to do outstanding crisis management, and to fulfill international policy, due to their lack of resources, rescue units, relief materials, etc.
“Our biggest challenge right now is human transportation Resources, trucks, getting to the people is very difficult, and at times, relocating people is almost an impossible task.” (Simon Miles Bakar, Regional Coordinator for Volta Region)

This general response, in addition to the structural socio-economic situation of Ghana posed a major shift of direction of this study, providing an eye-opening experience in the way ICTs are applied and introduced in developing countries. It is particularly disheartening to focus on how ICTs can be improved when so many other, more pressing, issues need to be solved.

6.1.7 A final note on ICTs

It is worth mentioning that as the narratives of the interviewees steered away from ICT’s, mobiles phones, and communication, the final questions in all cases tried to end with a note regarding to the study in hand. For that reason, the final question was always related to any ICT improvement or change within their working field. This particular question, while being present in all cases, did not create a particular theme, as it does not reflect actual needs or current state of NADMO, but a response based on a hypothetical situation, in case they could change certain available technologies. Furthermore, the short replies allow for little or no variables on which to deconstruct the content of the replies.

The responses leaned towards a better improvement of the internet with five answers focusing only on the internet as a tool, followed by two requesting an improvement of the GoTa system and its use of the internet, and two more for regular mobile phones.

Interestingly enough, two answers suggested the use of cheap smartphones that could use the internet in order to quickly spread information by just pressing buttons on an app’s interface.

“I would like to see an improvement of phones with internet access, so that when there are power outages, the internet would still work, and if it reached all the regions, then you could immediately contact everyone regardless of the blackouts.” (Helen Ntoso, Head of Operations)

“Having a simple phone that can easily send information very fast, like a smartphone, with icons that represent each disaster.” (David Mensah, Regional Coordinator for Central Region)
6.2 Responses to the short interviews

As it has already been discussed, a set of short interviews were conducted in order to get a quick image of the use of mobile phones in Ghana. *Appendix 2 – Short interviews responses* offers a table with the complete set of responses obtained via the short interviews. *Table 9* offers a condensed overview of those responses.

**Table 9 – Responses to the short interviews (summary)**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Private/Work</th>
<th>Call/Text</th>
<th>Mobile Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver</td>
<td>6 Private</td>
<td>10 Call</td>
<td>7 Yes 3</td>
</tr>
<tr>
<td>Waiter</td>
<td>9 Work</td>
<td>0 Text</td>
<td>14 No 19</td>
</tr>
<tr>
<td>Guide</td>
<td>2 Both</td>
<td>12 Both</td>
<td>1</td>
</tr>
<tr>
<td>Hotel Clerk</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
</tbody>
</table>

The responses to the short interviews offer a few interesting points. In the first place, all respondents use their mobile phones as a private device, and almost half of them also use them for work. There are no respondents that solely use their devices for working purposes.

Most of the respondents claim that they use the mobile telephones mostly for sending text messages instead of for calling. Only one respondent considers an equal use between SMS and calls.

When it comes to internet use, the respondents interviewed tend not to use internet on mobile phones, with three respondents that browse the internet and nineteen that do not.

Additionally, it is important to point out that nine of those who do not use the internet think that they need a contract with a service provider in order to be able to use the internet. This particularity proved to be not true, as providers offer pre-paid plans to connect to the internet, and therefore, these respondents were misinformed. Four of the respondents do not use the internet because they do not know how to connect or use the internet; three consider that the connection is too slow and thus they do not use the internet; and another four consider that the internet is not that useful and therefore they do not use it. This relates back to Rogers’ (2003) diffusion of innovations. In this case the innovation is in place but the channels of the communication as well as the societal system require more time and capacities to spread the use of mobile internet.
Those three respondents that use their mobile phones to browse the internet use it mostly to check the e-mail and to read news.

It is worth mentioning that the presentation of these results does not aim to offer a representative image of the population of Ghana as a whole, but rather a quick overview of the use of internet in mobile phones by a group of workers of the service industry in Ghana.

6.3 Results on the mobile internet speed tests

Assessing the suitability for mobile internet as a mean of mass communication in crisis situations requires more than suited protocols and citizens that are prepared to use the technology. It also requires an extended infrastructure that can reach most citizens of a national territory.

This study covered the availability of mobile internet and its speed in several locations along five regions of the southern parts of Ghana. Appendix 3 – Mobile internet speed tests offers the complete set of results from the 103 tests conducted. Table 10 offers a condensed summary of the results from the mobile internet speed tests. The first column shows each network connection, and the number of times it was obtained. The following columns provide the average speed, the fastest value, and the slowest value of the Ping, Downloading rates, and Uploading rates obtained in the tests.

Table 10 – Results from the mobile internet speed tests (summary)

<table>
<thead>
<tr>
<th>Network</th>
<th>Ping</th>
<th>D/L</th>
<th>U/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Mean</td>
<td>169 ms</td>
<td>100,2 Kb/s</td>
</tr>
<tr>
<td>3G</td>
<td>Fastest</td>
<td>77 ms</td>
<td>182,3 Kb/s</td>
</tr>
<tr>
<td>E</td>
<td>Slowest</td>
<td>433 ms</td>
<td>1,3 Kb/s</td>
</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>103</td>
<td></td>
</tr>
</tbody>
</table>

It is worth pointing out that while the General Packet Radio Service (G) was achieved sixteen times, only two of those resulted in actual transfer of data packets. The other fourteen tests resulted in failed tests.

At first glance, there is a higher rate of connectivity success, and the average pings are moderately low. The average Download and Upload rates are not particularly slow either and would easily allow for online messaging at a fully
responsive speed. These results could be equated to those of a low-range ADSL service offered in wealthier countries

However, from the condensed results it does not transcend the locations of the test. As it was expected, the best results were obtained within the boundaries of the urban areas. Rural areas, even within the main routes connecting larger urban clusters had serious connectivity issues or not connectivity at all. Therefore, it is important to point out that while the results are not particularly negative and offer some lines for optimism, the current state of mobile internet connectivity in remote areas encourages for alternative methods to communicate with secluded communities that are far away from the commercial networks’ reach. The digital divide in this case follows the dichotomy rural/urban, rather than developed/developing but it is aggravated by commercial inefficiency (cf. Pieterse, 2010).

These results could allow, though, for limited pilot testing for mobile internet solutions within urban limits in order to study the suitability for such an approach in crisis management communication.

6.4 NADMO’s website accessibility analysis

The intention behind an accessibility test is to assess the conformance of a website with the established standards, best practices, and in governmental digital publications, with the legal framework (Adams et al., 2007).

In the case of NADMO’s website (http://www.nadmo.gov.gh), there are no clear legal requirements. For this reason the test analyses HTML & CSS validation, WCAG 1.0, WCAG 2.0, and Section 508 conformance. Additionally, a look on the speed and server uptime is made, as these are important factors to make a website available to mobile phones in developing countries.

6.4.1 Website time frame

Prior to April 2013, NADMO’s official website offered a relatively deficient user experience. Server up-time was only 52%, with fairly outdated content and limited information. The website failed severely all the accessibility tests described in Chapter 5.4 NADMO’s website analysis, including HTML & CSS validation.

It seems irrelevant to produce the results of the early tests, as NADMO has completely revamped its website with a new CMS (Joomla) and a fresher look. Regardless of design perspectives, the new website is the current digital outlet for NADMO, and as such, a new analysis was due. The new tests were
conducted during the month of September 2013. The results presented in the following lines are extracted from those tests.

6.4.2 HTML & CSS validation

HTML and CSS are two of the most important standards for a website. In the wake of the semantic web, it is these languages (HTML & CSS) the ones that support the way screen readers and automatic content analysis tools access content.

A quick HTML validation test on W3C website (http://validator.w3.org/) offers the results shown on figure 5.

It is worth pointing out that the language used is HTML 5, which allows for a more flexible syntax of code. Regardless of this, the results show twelve errors in the home page alone, and nine warnings. The W3C Validator Suite, in an automatic test up to a level of 11 pages finds 341 errors, stating a website health of 11%.

Most of the errors are related to the use of presentational code within the structure of the document, which should be approached through the CSS code instead of the HTML document.

![W3C Validation Results](image)

**Fig. 5** W3C HTML validation results

The CSS code used for NADMO’s website is the third version, which is the most current version of CSS.

The validation for CSS code offers a different picture. In this case, as figure 6 shows, there is only one error, but it is an important one. A complete style sheet file fails to load as the URL calling the file is unavailable.
For the automatic test of actual accessibility guidelines, the software Total Validator Tool, which can be used as a standalone installed application, or as an add-on to either Firefox or Chrome web browsers is useful. For this particular study, the Chrome extension was used.

Figure 7 shows the interface of Total Validator Tool, which offers accessibility validation for the WCAG 1.0 and 2.0 in all three of the levels of accessibility as well as the US Section 508.

Fig. 6  W3C CSS validation results

6.4.3 WCAG 1.0, WCAG 2.0, & Section 508

The results for the WCAG 1.0 show that level A and AA are not supported by the website of NADMO. This means that the outmost important levels of
accessibility are not supported by the website. There are seven errors at level A (the most important level) and eighteen errors at level AA.

**Fig. 8  Total Validator WCAG 1.0 results summary**

Appendix 4 – Total Validator Tool results output provides the complete list of errors that fail to comply with the WCAG 1.0. Figure 8 shows a summarized view provided by Total Validator Tool.

A similar scenario is presented in the validation of the WCAG 2.0. NADMO’s website fails to comply with the WCAG 2.0, with seventeen errors on level A, and one error on level AA. On Appendix 4 there are the full results, and figure 9 provides a summarized picture of the results offered by Total Validator.

**Fig. 9  Total Validator WCAG 2.0 results summary**

Finally, the third and final test performed with Total Validator is the analysis against the accessibility validation in regards of Section 508’s set of standards.

As figure 10 shows, there are ten errors that fail to comply with Section 508, thus failing this validation, too. Appendix 4 offers a list of all the errors.
6.4.4 Loading times, uptime, and access

The final section of NADMO’s website analysis looks at the access performance of actual users.

The first characteristic is to study the loading times of the website. For this particular analysis, the tool Yslow is used, as an add-on to the Chrome web browser.

The performance of NADMO’s website is not particularly good, grading a D on the measurements of the tool. Figure 11 shows a summary of the results. The grading follows the American grading system, where performance is graded from most optimal with an A and least optimal with an F.

There are several characteristics that make the site slow down. Particularly important are the HTTP requests, which make the server load to overload and slow down the loading rates. There are 12 external JavaScript files, 29 CSS stylesheet files, and 23 external background images.

Other sections of the website perform particularly well, and that leads to a relatively easy fix to reach a better grade.

One important detail, though, is the actual page load in terms of kilobytes. As seen in figure 12, the home page makes a total of 86 HTTP requests for a total weight of 1959.7 Kb.
This is particularly important, as it means downloading almost 2 Mb just in order to load the homepage of NADMO’s website. If the deficiencies of the server are considered, as well as the limited network speeds, and the fact that most mobile users have to pay per megabyte consumed, this is a highly inefficient website for the contextual characteristics of a developing country.

There are, however, some positive aspects. One of the characteristics of the website that has improved dramatically is the server uptime and response. The server monitor UptimeRobot was set up to both Ping and try to access the server for nadmo.gov.gh. In June 2012 NADMO’s website had an uptime of only 52%. During the summer of 2013, the uptime had risen to 73%. As of September 2013, the server has managed a remarkable 99.55% uptime for the 30 days of the month. This figure is par to modern western servers.
In terms of actual access, through Google Analytics (embedded in the website in June 2012) has received 900 visitors of which 764 are unique visitors since April 1st. This averages in 128 users per month, a more than modest figure.

In terms of mobile devices, 193 visits were made through mobile phones, and 35 via tablets. This represents a 25% of visits done via mobile phones, which is an astounding increment compared to 2012, when only 11.6% of users visited the website via mobile devices.

About a 60% of the visits are done within Ghana, of which 81% are accessed from an IP located in Accra.

As a final note on NADMO’s official website, it is worth mentioning a rather inconsistent behavior when accessed through mobile platforms. In first place, when accessed via tablets (tests were carried out with iPad, iPad mini, and Samsung Galaxy Tab 10.1), the desktop website is presented. On mobile phones (tested were carried out with iPhone 4S, and Samsung Galaxy S4) the response was rather surprising. On the iPhone and Android browsers (Chrome) based on the WebKit layout engine present a standalone website offering a link to the “Desktop Version”. On the Android browsers based on the Gecko layout engine (Firefox, Dolphin) what is presented is the old version of NADMO prior to April 2013. This is a particular bizarre development, and it is obviously a result of a misconfiguration of Joomla’s mobile agent handler. Thus, no NADMO website is prepared for mobile devices, not as a standalone, nor as responsive design.
7 Discussion and conclusions

This chapter starts by offering a set of brief observations of the data that has been collected and analyzed through the course of this study. Such discussion stems from empirical data, but it is influenced by the theoretical framework presented in Chapter 3 Theoretical discussion: Risk, communication, and accessibility and the personal views and experiences of the researcher. It continues by trying to answer to the research questions that motivated the study. These answers are supposed to derive naturally from the overall discussion offered in this chapter. The chapter concludes with a personal view regards the theoretical and practical contributions of the study, as well as introducing ideas that could spark interest in future research.

7.1 Conclusions from the analysis

There are several conclusions to be made on the analysis of the empirical data that this study produced. For the sake of clarity, such observations are made following the order in which the analysis is made, starting by the first theme of the interviews until the final analysis of NADMO’s website.

The main conclusion about the first theme, Disaster management context, is the fact that coordination of stakeholders is the basic approach taken by NADMO. There are parallel narratives that provide other areas of focus, but the general notion is that NADMO cannot (nor it is supposed to) tackle crisis management single handedly and relies on a wide variety of actors to approach disasters. The other observation about this theme is the strength that risk reduction and education play in the long run. The shift of strategy done in 2009 provided results that were acknowledged by all those interviewed. The literature seems to be on the same line with these observations. Rosenthal, Boin and Comfort (2001) point to the idea of dynamic processes on which communities and organizational structures face crises together. Similarly, ‘t Hart et al (2001) introduce the notion of continuous crisis management on which education plays an important role in the first stages of a crisis life-cycle.

The second theme, Hierarchical channels, presents one of the main characteristics of crisis management organizations as governmental agencies. A strongly hierarchical structure can generate disruptions in the channels of communication, as the organization’s verticality adds various levels in the chain of command. Surprisingly, even though hierarchies are widely discussed in the narratives of the interviewees, there is not a general feeling that this is a negative trait for NADMO. There seems to be a sense of pride in the President of the government
being also the head of NADMO, and that the organization is tightly connected to the high ranks of each ministry. In terms of Ghana’s society, it is clear that there is a dichotomy between rural and urban areas. While rural areas keep a strong hierarchical structure, usually topped by the chief of the community, the urban areas are deprived of such vertical approach, which some see as a problem, since there are no proper intermediaries to address the urban citizens. Finally, the Hyogo Framework of Action, central for the plans and policy making of NADMO is only identified as relevant to their daily work by those who work in the organization’s headquarters. The officers who work in regional offices see the HFA as something distant that has little to do with those involved in regional crisis management. This relates directly to the theory of Global Risk (2006) developed by Beck, as the incorporation of new risks from external actors are mirrored in local society, but since those risks are not experience in the same way, they are not assimilated reciprocally. The flows of institutionalized cooperation at a global scale, and their interactions at a national and local levels defined by Pellig & Uitto (2001) are also present in this theme. The international hierarchies, spurred by supply chains and economic activity become diffuse as policies are enforced in the national and local levels.

The third theme, Interaction and accessibility is tightly linked to the direct contact between NADMO and the general public. In this case the duality between urban and rural areas is also omnipresent. The ways in which the citizens are approached is clearly related to where those citizens live. The physical accessibility and the access to mass media, (both geographically dependent characteristics) are particularly important. In those places where citizens are accessible (usually within the confines of a city), mass media such as radio and TV are the main channels to distribute information. In those places where accessibility is difficult and gathering the public is a challenge, the usual approach is to talk to an intermediary, usually the chief, who will beat the gong-gong and summon the community. Only then can the message of NADMO be delivered. There seems to be a third way that has the potential to work in settings that are neither too remote nor too massive, and is the community assemblies. These tend to be groups of community representatives that have the role of mediators between the government and the community, either by a one-way communication, or by instructional workshops that aim for education, at the top levels of the social hierarchies.

Interaction and trust is the fourth theme emerging from the interviews and introduces some of the real problems that crisis managers in Ghana face. First and foremost, the large quantity of voluntaries and groups run by NADMO is regarded, almost unanimously as a problem. Training such a large group of
people (mostly without higher education) requires time and resources, which are scarce in developing settings. This brings forth the problem of the image. The volunteers, often the first contact of the organization with the public, provide limited performance due to their low training. This, connected to other problems related to resources and logistics, is viewed as damaging the image of the organization. There is a strong effort on improving the image of NADMO in the face of the public. This leads to yet another front of preoccupation which is the low level of compliance shown by the public. The general consensus seems to agree on the lack of trust, just as Luhmann (1979) and Moornman et al. (1992) describe. It is worth to mention an interesting point of view by Aninkora Sie Kwaku, one of the respondents, who suggests a combination of lack of trust and lack of alternatives, as the option of non-compliance is often perceived as more appealing than following NADMO’s recommendations (see Table 6 - Theme 4: Interaction & Trust).

The fifth theme is Information and communication technologies. This theme is centered on the role of ICTs in crisis management. There is an agreement on the extended adoption of mobile phones as the main system of communication both internally within the ranks of NADMO, but also externally with the public, even if only at an individual level. Admittedly, the mobile phone has certain limitations such as coverage network fragmentation and limited usability when approaching large groups or communities. In those cases it is radio, TV, and even mouth-to-mouth communication are regarded as more effective. In addition to the mobile phone, a trunking system such as the GoTa system is also highly praised by NADMO’s officers. However, it is clear that the image of the GoTa system is much more positive in the headquarters of the organization than in the regional offices. There seems to be a disconnection between the main offices of NADMO and the lower ranks in terms of the usefulness or how spread the GoTa system is.

Especially notorious is the case of the internet. This is the uncontested and ubiquitous communication system that has revolutionized communications between individuals and organizations in wealthier countries. However it is a common narrative in the interviews that the internet is neither suitable nor reliable for the contextual situation of Ghana. As Yap (2011), Pieterse (2010), and Swarts (2008) point out, the digital divide and the context of development offer a completely different situation for technological advancement in poorer countries.

The final and sixth theme derived from the interviews is Challenges in reference to the outages, shortfalls of Ghana’s infrastructures and the real needs as experienced by NADMO’s officers. This theme is particularly important, as it sets the slightly pessimistic tone of this study. Without an intentional aim at
diminishing ICTs and the role of communication in crisis management in developing countries, it became quickly apparent, that this was a solvable issue, only secondary to the real problems in the crisis management discipline in Ghana. All the interviewees without exception identified the lack of resources as the biggest problem and challenge to their daily work. Outages, lack of vehicles, equipment, and resources outshined by far the role of mobile phones and communication as the general problems for all the respondents.

On the other hand, the scope of the study is centered in ICTs, for that reason the last question of the interviews tried to remain within that focus. There was a division of opinions as to what would be the desired improvement or change within the ICT innovations in crisis management. A proper implementation of the internet was the most common request, followed by a stricter adoption of the GoTa system and a country wide mobile phone network.

Further in the study, a look into the use of mobile phones by the general public offers a general view of the potential uses of mobile internet to distribute content by NADMO. The results derived from the short interviews indicate the low uptake of the internet via mobile telephones by service sector workers in Ghana. Even though most of those interviewed used their telephones for personal reasons, very few used them to access the internet. The main reasons for that stem from slow connectivity to lack of interest or minimal perceived usefulness of the internet. Another important note to be made is the alarming misconception of some users on either how to access the internet, or their service providers’ prerequisites to access the internet. In many occasions the idea that the internet is not accessible for those with pre-paid plans was the main reason not to use the internet. This preconception turned out not to be true.

Studying the human component of mobile phone use helped to build an idea of some of the main problems of ICT adoption in a developing setting, however, the contextual environment is equally important. For that reason, the infrastructure and technical component complement the picture. It is almost impossible to detach the users from the technical aspect of ICTs, but if the users wanted to access the internet with their mobile phones, would they be able to do it? ICTs without the skilled individuals to use them lose their potential benefits (Van Dijk & Hacker, 2003)

The series of speed tests conducted in the southern regions of Ghana shed some light into this question. The fragmented network coverage offered by commercial mobile providers offers a more than reasonable mobile internet access in the urban areas. It is clear that any Ghanaian with an internet-ready mobile phone could access services that rely on data connectivity. However, it is also clear that
any Ghanaian that is on rural areas has limited or non-existent mobile internet coverage and in some remote areas, not even regular mobile network is available.

This offers a particularly new look at the premise of accessibility taken by the study. While the preliminary notion of accessibility was taken from the disability point of view, the main question of accessibility in Ghana is geographic and socio-economic, as ICTs are widely inaccessible to those in the rural areas. Once again, the scope of the study suffers a step back in terms of priorities as personal pre-conceptions proved to be misguided. Nevertheless, mobile accessibility remains an unsolved question for NADMO, but it is not perceived as a problem yet, as too few people fall in this category, while a large group of population fall in the category of geographical accessibility.

Finally, to regain the focus of ICT (and most importantly internet) accessibility, the analysis of NADMO's official website covers the possible scenario that users and infrastructure were ready to use the internet.

The analysis offers an optimistic progress documented by two analyses conducted with the difference of one year. The website is still not complying with the industry standards for accessibility, but it has improved in design, and most importantly in uptime. The framework for an accessible digital mean of communication is one step closer to proper normalization. Not so much is the access of the website through a mobile device. It is expected to experience differences according to each device, but the current state of NADMO's website is highly ineffective and can lead to serious problems of communication, as some devices will access the old website that was available prior to April 2013. Furthermore, the lack of a streamlined version for mobile phones makes an almost 2 Mb download page load, which on a mobile phone within Ghana’s infrastructure, can prove to be particularly difficult.

### 7.2 Answers to the research questions

According to the data gathered, the analysis made, and the conclusions discussed in this study, it is time to look back at the questions that motivated this study and answer them.

#### 7.2.1 RQ1: What are the challenges, if any, for NADMO in terms of communication? How can those challenges be overcome?

There are several challenges for NADMO in terms of communication. Each source of data studied in this thesis points to different ones.
Through the interviews, it can be deduced that intermediaries, non-compliance, infrastructure, trust, and outages are serious challenges to tackle. The short interviews point to a lack of usability of the internet, but also a lack of knowledge from the users’ perspective. The speed tests show a clear infrastructure gap between urban and rural areas. And finally the web analysis, while showing an important increase in the access of NADMO’s website through mobile devices, still shows a very low usage of internet services, tied to a limited capacity in offering mobile-centered solutions to the users.

The technical trends and the crisis managers offer a quite optimistic view on the field of communication. Progress has been made, education is leaving its mark in the process and eventually these challenges will be overcome. However, it is impossible not to mention that while these challenges are important, the challenges that Ghana faces have little to do with communication. A serious dichotomy by contextual national needs and those imposed by the international community put a strain in an already debilitated economy with little room for optimism.

7.2.2 RQ2: What is the role of mobile technologies (and mobile telephony especially) in the process of managing crises at NADMO, both internally and externally?

Replying to this question requires an ample vision of what crisis management is. In the new adoption of long-term and continuous crisis management described by ‘t Hart et al (2001) mobile phones are of utmost importance.

The narratives derived from the interviews are very clear on this. Mobile phones are the most used ICT to communicate. Internally, mobile phones connect the lower ranks of the organizations, from regional to zonal and district officers. Higher ranks or those in the headquarters used the GoTa system, another type of mobile technology that offers a wide range of functionalities to the users. Externally, mobile phones allow connecting NADMO with other crisis management stakeholders such as the police or firefighters. Additionally, mobile phones allow to reach areas that do not have landline access, or to allow the public reach NADMO at a very high speed when a disaster occurs.

As it has been shown by the data, mobile technologies face various challenges, from the users’ perspective, the technical perspective and the infrastructure perspective. There are no proper channels to reach wider pockets of society and there are still too many communities living in areas without connectivity. However, the role of mobile technologies in the process of managing crises at NADMO has become extremely important as the main system of communication, both internally and externally.
7.2.3 **RQ3:** Which technological advances must be implemented in mobile technology in order to increase accessibility in a crisis environment?

In the vein of the previous question, when thinking about implementations, there are several other priorities that need to be addressed before reaching an optimal state of mobile technology in which the majority of Ghanaians have access to information through their mobile devices.

NADMO’s crisis managers make a good point when they say that, while sometimes difficult, communication is still achieved between them and the public. Information reaches its destination, and then it is the citizens’ turn to put it in practice, which often does not happen. For that reason, when trying to address this particular question, they usually shifted their narratives towards resources, vehicles, and logistics.

Dr. Kingsford Asamoah, particularly enthusiastic of the GoTa system, mentioned that adding more antennas in order to increase the area supporting the networks would allow for an easier communication within the organization, but also in order to use mobile internet. He has high hopes for a WebEOC (web emergency operations center), but acknowledged the need for terminals, education, and infrastructure for it to work. Indeed, a long distance goal.

Anasthasia Bleboo-Boafo also is quite keen on pointing out the needs for reliable power supply that would lead to minimal outages. In absence of this, smartphones with internet access could help overcome the blackouts, as they could work with the internet without having power.

It seems that most of the challenges to be overcome require several approaches from varied fields to happen all at once. Research Question 3 will remain as a partly unanswered question, veiled by the complexity of the contextual background of Ghana as a country.

7.2.4 **RQ4:** Could mobile telephony, taking into consideration its accessibility challenges, still be the most accessible ICT for the Ghanaiian population?

Finding a proper answer to this question needs to be compartmentalized into a diverging notion of whether certain technologies are considered ICTs or not.

If the traditional broadcasting technologies as older type of ICTs are taken into consideration, then the answer is probably not. Radio is still the most used communication system used by NADMO in order to reach most of the Ghanaian population. The current situation of infrastructure does not call for a foreseeable
imminent change. TV is probably more popular in the urban areas, but air time is more expansive, so crisis managers turn to radio, as it is cheaper and reaches a larger amount of the population.

If radio and TV are not considered ICTs, then the reply is yes, and it probably already is the most accessible ICT. The accessibility challenges will eventually be bridged, as mobile telephony offers an extremely advantage against most of other ICTs, which is a relatively cheap infrastructure combined with an already popular device that is powered by batteries.

Contextualizing the accessibility challenges could be an important factor as well, since the problem of accessibility for crisis management in Ghana is different than the digital accessibility challenges experienced in wealthier countries. Geographical and socio-economic problems are to be bridged first before the need for a fully “digitally” accessible device becomes a priority.

7.2.5 RQ5: Is the current context of Ghana ready for a nation-scale implementation of a mobile Internet-oriented crisis management system?

This particular question benefits from the multiple method approach taken in this study.

The content derived from the interviews already hints to a limited use for internet based solutions. However, it is the analysis from the data collected through the short interviews and the internet speed tests that gives the answer to this question.

With the current context of Ghana there are no possible scenarios for the implementation of a mobile internet-oriented crisis management system. The idea of a WebEOC is still a distant goal.

7.2.6 RQ6: Which technological advances can lead to a more efficient information system that meets the needs of NADMO and the accessibility standards?

There are two major technological advances that could lead to a more efficient information system, helping NADMO but also meeting the accessibility standards.

In the first place a unified commercial mobile phone network that can be accessed in all the territories by all the service providers at the same time. This would allow easy communication to all the areas of the country providing access to even remote communities.
Secondly a wide spread use of broadband that could be accessed through mobile handsets. This would allow for a reliable system that could connect NADMO with the public, and that would be less sensitive to power outages.

A spread use of mobile internet would require proper accessible digital platforms for NADMO to communicate with the public, making it a priority to have an accessible website that conforms with the international standards. Furthermore a useful set of e-government strategies could increase the internet use by the general public if they perceived the internet as a useful tool.

It is worth mentioning that this approach is an oversimplification of deeper socio-economic structural problems that require a much broader approach, such as education, infrastructure, and organizational modernization.

### 7.3 Concluding remarks

The following lines provide a brief summary of the findings of this study.

Communication, while difficult, is not a problem. Funding and resources are the unanimously acknowledged problem by the respondents. The lack of resources affects the image of NADMO, damaging its credibility and debilitating the public’s trust. Public non-compliance is a recurrent issue, especially in the urban areas, where there are no intermediaries. A strongly hierarchical social structure requires intermediaries to reach pockets of the population.

Mobiles phones are widely spread across population. On occasions, there is a need for multiple devices to reach various networks due to commercial service fragmentation. However, there seems to be a misconception that users need a monthly contract in order to access the internet through their phones. Further, this study indicates that mobile users may not perceive the value of the internet.

Over a hundred speed tests performed in this study show that using mobile internet to reach the population is, as of now, unthinkable. About 80% of the tests outside of main cities did not work. Speeds vary greatly and unevenly.

NADMO’s website averages 128 visits per month. Only 60% of the visits are from Ghana, and of those 80% are from Accra. There has been a strong increase of mobile platform users, doubling the figures in one year. From 12% in June 2012 to 25% in September 2013. The uptime has also improved dramatically, averaging 52% of uptime in until April 2013 to 99,55% in September 2013.

While accessibility is taking the right steps forwards, it needs to take a much more wider approach before fitting the patterns of western accessibility standards.
The notion that communication was a minor problem and that the real needs were rooted in much deeper structural problems that are carried by local, national, and international interactions was completely unexpected. At international levels, developing countries struggle to comply with risk policy that does not reflect the current national and local needs. There is a disconnection between policy making processes at multiple levels: international, national, and local. The interconnectedness of it all was overpowering to the point of discouragement.

It is probably worth pointing out that not all research needs to focus on the biggest problems affecting societies, but the overall experience during the fieldwork is that identified by Rogers (2011), where one of the reasons of why most ICT4D projects fail is that the solutions are not looking at the whole of the problem, and are built on condescending assumptions.

Another interesting result is that of the intermediaries and the problems of non-compliance. The conflicts of communication between the hierarchical channels derives in a need of intermediaries to bridge the lack of trust. The thought of having to approach a community through a single intermediary that would then spread the message had not been expected and adds a layer of complexity to the process of crisis management.

The conclusions that can be drawn from this study are many. The importance of the contextual situation of Ghana, as a developing country, is of outmost importance for any ICT4D and M4D initiative if it is to succeed. Mobile telephony is the most advanced and adopted ICT by the general public, but the commercial idiosyncrasies call for a more unified system, and hence the adoption of a trunking system such as the GoTa system. Communication is a problem that can be solved with patience, even though it is difficult to imagine patient citizens during the conditions of a natural disaster. However, fulfilling the role of crisis manager without vehicles, equipment and resources is an almost impossible task that damages the image of the crisis manager and feeds the lack of trust in the public generating non-compliance. Meanwhile, the internet is a long way to the optimal conditions for web-based systems that are inclusive all the Ghanaian citizens.

7.4 Academic contribution

This study reflects upon various noteworthy theories from various disciplines with the intention of creating a background that allows comprehending each step of this study.
There is an intended emphasis on the necessity to do extensive preliminary study of the context surrounding that problem before designing the research project. The early stages of this study failed that premised and rushed to design a solution for a problem that was not fully understood. The fieldwork in Ghana changed the approach majorly, but prevented me of writing a completely misguided thesis.

Hopefully this can be a good reminder for researchers who are interested in development but who have not been exposed to the physical context of their research. Without that context it is virtually impossible to understand the nature of the themes to be studied.

Methodologically, this study provides a triangulation of methods that can be valuable in similar studies, where communication via mobile technologies and the assessment of website accessibility is required.

7.5 Practical contribution

This study takes a mildly skeptical approach to international crisis management policy making, as well as the current state of ICT4D and M4D. The interest shown by richer countries is usually motivated by economic reasons which in a way demystify the values of development work.

Practitioners within crisis management or organizations seeking to start an ICT4D initiative could benefit from this study by seeing some of the multiple interacting sectors that give shape socio-economic contexts being extremely relevant in order to properly plan and execute development initiatives.

7.6 Future research

During the process of this study, several questions and riddles appeared that escaped the scope of the domain of this research. Taking that into consideration, two new lines of future research are encouraged.

The first one proposes a pilot study that uses an internet-based application for urban elites in Ghana, as this pocket of society is predominantly educated and already owns a smartphone. An early stage system could help perfect a system that could lead to the WebEOC once the conditions for a full-scale internet-oriented system are in place.

The second encourages studying the effects of religion in crisis management and the possible explanation of the public non-compliance through their religious beliefs. One of the main differences between contexts in the western countries
and Ghana is a steady secularization of the population, and subsequently of the government of the former, and deeply rooted Catholicism of the latter. If disasters can be explained by divine intervention, may be the responses to them are also affected by that characteristic.
References


UNFCCC (2007). Climate change: Impacts, vulnerabilities and adaptation in developing 
[Accessed 01-05-2012]

communities to disasters. Retrieved from: 
http://www.unisdr.org/2005/wcdr/intergov/official-doc/L-docs/Hyogo- 

Geneva, Switzerland. ISBN: 9789211320282

United States Access Board (2010). Section 508 Homepage: Electronic and Information 
2012]


industry practice and perceptions. Human factors and ergonomics society annual 
meeting proceedings, Proceedings 6 - Consumer Products, pp. 19-22.


W3C (1999). Web Content Accessibility Guidelines (WCAG) 1.0. Retrieved from: 
http://www.w3.org/TR/WCAG10/ [Accessed 14-05-2012]


http://www.w3.org/TR/WCAG20/ [Accessed 14-05-2012]

http://www.w3.org/TR/2008/NOTE-UNDERSTANDING-WCAG20-20081211/ 
[Accessed 14-05-2012]

W3C (2009). How WCAG 2.0 Differs from WCAG 1.0. Retrieved from: 


### Appendix 1 – Interview Framework

<table>
<thead>
<tr>
<th>Overarching themes</th>
<th>Questions</th>
<th>Possible Probes (follow up questions)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Role of the interviewee at NADMO</strong></td>
<td>How long have you been working at NADMO and what is your position in the organization?</td>
<td>Are there other employees with a similar position?</td>
</tr>
<tr>
<td></td>
<td>What are your responsibilities?</td>
<td>Do you supervise other workers? How many?</td>
</tr>
<tr>
<td><strong>Role of NADMO</strong></td>
<td>Which are the main functions of NADMO?</td>
<td>How are these functions defined? Are there different divisions for each function?</td>
</tr>
<tr>
<td></td>
<td>Which are the main goals of NADMO?</td>
<td>Which is the most important goal? How is the level of success assessed?</td>
</tr>
<tr>
<td><strong>NADMO’s Preventive Action</strong></td>
<td>In August 2009 NADMO declared a shift of focus from Disaster Management to Disaster Risk Reduction. Why?</td>
<td>Do you think it has been successful?</td>
</tr>
<tr>
<td></td>
<td>Prevention through education was deemed the core work. How do you approach Ghana’s citizen to prevent disasters?</td>
<td>Which are the best channels to approach the population?</td>
</tr>
<tr>
<td><strong>NADMO’s Disaster Management Workflow</strong></td>
<td>Which type of information is most important for NADMO?</td>
<td>How is the flow of information handled? How do you receive information and how do you spread it?</td>
</tr>
<tr>
<td></td>
<td>Which channels are used to receive or communicate information?</td>
<td>Do you use NADMO’s infrastructure? Do you use third party systems or channels? Which is the best method to reach the general public in Ghana?</td>
</tr>
<tr>
<td></td>
<td>Do you think mobile telephony could have a positive use in transmitting information to the public?</td>
<td>Why not? Why yes?</td>
</tr>
<tr>
<td><strong>Accessibility Efforts</strong></td>
<td>Outside of the main cities, how does NADMO inform people in less populated villages?</td>
<td>Are there any specific places where NADMO has no access?</td>
</tr>
<tr>
<td></td>
<td>What about people who have normally less access, like the elderly, disabled people, the poor?</td>
<td>Are there specific accessibility efforts to approach this demographic? Which ones? Why not?</td>
</tr>
<tr>
<td></td>
<td>In your opinion, which method would be most successful to reach to all demographics in Ghana?</td>
<td>What makes you say that?</td>
</tr>
<tr>
<td><strong>The role of ICT at NADMO</strong></td>
<td>Which is most useful technological advance used to handle information for you at NADMO?</td>
<td>Would you say it’s the same for most of your colleagues? Which are essential for your work?</td>
</tr>
<tr>
<td></td>
<td>Which are the biggest challenges that NADMO’s officials have to overcome to fulfill their responsibilities?</td>
<td>How do you overcome them?</td>
</tr>
<tr>
<td></td>
<td>Do you experience any outages of Internet, Mobile Telephony coverage, electricity from your providers?</td>
<td>How does that affect your work? How often does it happen?</td>
</tr>
<tr>
<td></td>
<td>If you could improve or change any type of technology, which one would be?</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix 2 – Short interviews responses

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Occupation</th>
<th>Private/Work</th>
<th>Call/Text</th>
<th>Mobile Internet</th>
<th>Reasoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-06-07</td>
<td>Cape Coast</td>
<td>Taxi Driver</td>
<td>Both</td>
<td>Call</td>
<td>No</td>
<td>Needs a contract</td>
</tr>
<tr>
<td>2012-06-07</td>
<td>Elmina</td>
<td>Waiter</td>
<td>Private</td>
<td>Text</td>
<td>No</td>
<td>Needs a contract</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Cape Coast U.</td>
<td>Waiter</td>
<td>Private</td>
<td>Text</td>
<td>No</td>
<td>Is not that useful</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Elmina Castle</td>
<td>Guide</td>
<td>Both</td>
<td>Text</td>
<td>Yes</td>
<td>Mostly e-mail</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Twifo</td>
<td>Waiter</td>
<td>Both</td>
<td>Text</td>
<td>No</td>
<td>Needs a contract</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Kakum</td>
<td>Guide</td>
<td>Both</td>
<td>Call</td>
<td>No</td>
<td>Connection is too slow</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Elmina</td>
<td>Hostel Clerk</td>
<td>Both</td>
<td>Call</td>
<td>No</td>
<td>Needs a contract</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>Accra</td>
<td>Bus Driver</td>
<td>Private</td>
<td>Text</td>
<td>No</td>
<td>Is not that useful</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>Accra</td>
<td>Hostel Clerk</td>
<td>Private</td>
<td>Text</td>
<td>Yes</td>
<td>Email, sports news</td>
</tr>
<tr>
<td>2012-06-11</td>
<td>Accra</td>
<td>Taxi Driver</td>
<td>Both</td>
<td>Call</td>
<td>No</td>
<td>Needs a contract</td>
</tr>
<tr>
<td>2012-06-11</td>
<td>Accra</td>
<td>Waiter</td>
<td>Private</td>
<td>Text</td>
<td>No</td>
<td>Doesn’t know how to</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Kumasi</td>
<td>Hostel Clerk</td>
<td>Both</td>
<td>Text</td>
<td>No</td>
<td>Needs a contract</td>
</tr>
<tr>
<td>2012-06-13</td>
<td>Kuntanase</td>
<td>Waiter</td>
<td>Private</td>
<td>Text</td>
<td>No</td>
<td>Connection is too slow</td>
</tr>
<tr>
<td>2012-06-13</td>
<td>Lake Bosomtwe</td>
<td>Hostel Clerk</td>
<td>Both</td>
<td>Text</td>
<td>No</td>
<td>Needs a contract</td>
</tr>
<tr>
<td>2012-06-14</td>
<td>Lake Bosomtwe</td>
<td>Taxi Driver</td>
<td>Both</td>
<td>Call</td>
<td>No</td>
<td>Doesn’t know how to</td>
</tr>
<tr>
<td>2012-06-14</td>
<td>Lake Bosomtwe</td>
<td>Waiter</td>
<td>Private</td>
<td>Text</td>
<td>No</td>
<td>Needs a contract</td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Koforidua</td>
<td>Waiter</td>
<td>Private</td>
<td>Both</td>
<td>No</td>
<td>Connection is too slow</td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Akasombo</td>
<td>Taxi Driver</td>
<td>Both</td>
<td>Call</td>
<td>No</td>
<td>Is not that useful</td>
</tr>
<tr>
<td>2012-06-16</td>
<td>Keta</td>
<td>Waiter</td>
<td>Private</td>
<td>Text</td>
<td>No</td>
<td>Doesn’t know how to</td>
</tr>
<tr>
<td>2012-06-17</td>
<td>Accra</td>
<td>Hostel Clerk</td>
<td>Both</td>
<td>Text</td>
<td>Yes</td>
<td>Email, news</td>
</tr>
<tr>
<td>2012-06-17</td>
<td>Accra</td>
<td>Taxi Driver</td>
<td>Both</td>
<td>Call</td>
<td>No</td>
<td>Needs a contract</td>
</tr>
<tr>
<td>2012-06-18</td>
<td>Accra</td>
<td>Waiter</td>
<td>Private</td>
<td>Text</td>
<td>No</td>
<td>Is not that useful</td>
</tr>
</tbody>
</table>
## Appendix 3 – Mobile internet speed tests

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Network</th>
<th>Ping</th>
<th>Download</th>
<th>Upload</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012-06-06</td>
<td>Tesano, Accra</td>
<td>H</td>
<td>120 ms</td>
<td>91 Kb/s</td>
<td>12 Kb/s</td>
</tr>
<tr>
<td>2012-06-07</td>
<td>Osu, Accra</td>
<td>H</td>
<td>79 ms</td>
<td>180,1 Kb/s</td>
<td>58,3 Kb/s</td>
</tr>
<tr>
<td>2012-06-07</td>
<td>Kaneshie, Accra</td>
<td>H</td>
<td>117 ms</td>
<td>119,4 Kb/s</td>
<td>13 Kb/s</td>
</tr>
<tr>
<td>2012-06-07</td>
<td>Road to Cape Coast</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-07</td>
<td>Kasoa, road to Cape Coast</td>
<td>E</td>
<td>412 ms</td>
<td>2 Kb/s</td>
<td>3,2 Kb/s</td>
</tr>
<tr>
<td>2012-06-07</td>
<td>Road to Cape Coast</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-07</td>
<td>Mankessim, road to CC</td>
<td>E</td>
<td>390 ms</td>
<td>4,6 Kb/s</td>
<td>2,9 Kb/s</td>
</tr>
<tr>
<td>2012-06-07</td>
<td>Cape Coast</td>
<td>H</td>
<td>98 ms</td>
<td>102 Kb/s</td>
<td>21,1 Kb/s</td>
</tr>
<tr>
<td>2012-06-07</td>
<td>Elmina</td>
<td>G</td>
<td>206 ms</td>
<td>99,9 Kb/s</td>
<td>21,9 Kb/s</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Stumble Inn, Elmina</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Sekondi road</td>
<td>E</td>
<td>383 ms</td>
<td>6,3 Kb/s</td>
<td>12 Kb/s</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Cape Coast University</td>
<td>H</td>
<td>108 ms</td>
<td>132,2 Kb/s</td>
<td>34,3 Kb/s</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Development Office, CC</td>
<td>H</td>
<td>156 ms</td>
<td>106,3 Kb/s</td>
<td>19,2 Kb/s</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Saint Agustin’s College, CC</td>
<td>3G</td>
<td>192 ms</td>
<td>86 Kb/s</td>
<td>17,8 Kb/s</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Prospect Hill, Cape Coast</td>
<td>3G</td>
<td>218 ms</td>
<td>72,2 Kb/s</td>
<td>17,2 Kb/s</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Ankaful Forest Reserve</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Elmina Castle</td>
<td>3G</td>
<td>183 ms</td>
<td>77,5 Kb/s</td>
<td>23,6 Kb/s</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Elmina</td>
<td>3G</td>
<td>190 ms</td>
<td>102 Kb/s</td>
<td>22,1 Kb/s</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Elmina Beach</td>
<td>3G</td>
<td>203 ms</td>
<td>99,9 Kb/s</td>
<td>21,9 Kb/s</td>
</tr>
<tr>
<td>2012-06-08</td>
<td>Stumble Inn, Elmina</td>
<td>G</td>
<td>430 ms</td>
<td>1,7 Kb/s</td>
<td>2 Kb/s</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Beulah road, CC</td>
<td>3G</td>
<td>214 ms</td>
<td>79 Kb/s</td>
<td>18,6 Kb/s</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>NADMO, Cape Coast</td>
<td>H</td>
<td>92 ms</td>
<td>164,3 Kb/s</td>
<td>42,5 Kb/s</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Jukwa road, CC</td>
<td>H</td>
<td>134 ms</td>
<td>111,9 Kb/s</td>
<td>14,1 Kb/s</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Road to Twifo</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Akroform</td>
<td>E</td>
<td>370 ms</td>
<td>3,7 Kb/s</td>
<td>2,8 Kb/s</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Kakum National Park</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Twifo Praso</td>
<td>3G</td>
<td>151 ms</td>
<td>43,5 Kb/s</td>
<td>17,7 Kb/s</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Road to Cape Coast</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Amamoma, Cape Coast</td>
<td>3G</td>
<td>203 ms</td>
<td>99,9 Kb/s</td>
<td>21,9 Kb/s</td>
</tr>
<tr>
<td>2012-06-09</td>
<td>Eli’s Restaurant, Elmina</td>
<td>E</td>
<td>396 ms</td>
<td>3,4 Kb/s</td>
<td>1,2 Kb/s</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>Fort St. Jago, Elmina</td>
<td>3G</td>
<td>172 ms</td>
<td>92 Kb/s</td>
<td>18,7 Kb/s</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>McCarthy Hill, CC</td>
<td>H</td>
<td>87 ms</td>
<td>153,3 Kb/s</td>
<td>41,4 Kb/s</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>Road to Accra</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>Biriwa, road to Accra</td>
<td>E</td>
<td>391 ms</td>
<td>4,4 Kb/s</td>
<td>2,9 Kb/s</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>Road to Accra</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>Janman, Accra</td>
<td>H</td>
<td>104 ms</td>
<td>67,3 Kb/s</td>
<td>15,8 Kb/s</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>Catters Hostel, Accra</td>
<td>H</td>
<td>83 ms</td>
<td>149,5 Kb/s</td>
<td>38,7 Kb/s</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>Labone, Accra</td>
<td>H</td>
<td>92 ms</td>
<td>156 Kb/s</td>
<td>36,3 Kb/s</td>
</tr>
<tr>
<td>2012-06-10</td>
<td>Labadi, Accra</td>
<td>H</td>
<td>90 ms</td>
<td>150,4 Kb/s</td>
<td>34,1 Kb/s</td>
</tr>
<tr>
<td>2012-06-11</td>
<td>Shashie, Accra</td>
<td>H</td>
<td>92 ms</td>
<td>156 Kb/s</td>
<td>36,3 Kb/s</td>
</tr>
<tr>
<td>2012-06-11</td>
<td>NADMO HQ, Accra</td>
<td>H</td>
<td>78 ms</td>
<td>176,1 Kb/s</td>
<td>41,4 Kb/s</td>
</tr>
<tr>
<td>2012-06-11</td>
<td>NADMO HQ, Accra</td>
<td>H</td>
<td>80 ms</td>
<td>179,8 Kb/s</td>
<td>40,1 Kb/s</td>
</tr>
<tr>
<td>2012-06-11</td>
<td>Cantonments, Accra</td>
<td>H</td>
<td>86 ms</td>
<td>162,3 Kb/s</td>
<td>39,8 Kb/s</td>
</tr>
<tr>
<td>2012-06-11</td>
<td>James Town, Accra</td>
<td>H</td>
<td>82 ms</td>
<td>158,3 Kb/s</td>
<td>40,2 Kb/s</td>
</tr>
<tr>
<td>2012-06-11</td>
<td>CC Uni. Guest House, Accra</td>
<td>H</td>
<td>96 ms</td>
<td>131,7 Kb/s</td>
<td>32,6 Kb/s</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Tesano, Accra</td>
<td>H</td>
<td>121 ms</td>
<td>94,2 Kb/s</td>
<td>22,7 Kb/s</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Kojo bus station, Accra</td>
<td>H</td>
<td>130 ms</td>
<td>81 Kb/s</td>
<td>24,5 Kb/s</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Road to Kumasi</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Dunkwa, Road to Kumasi</td>
<td>E</td>
<td>340 ms</td>
<td>4,6 Kb/s</td>
<td>2,6 Kb/s</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Kwaala, Road to Kumasi</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Foso, Road to Kumasi</td>
<td>3G</td>
<td>159 ms</td>
<td>81,5 Kb/s</td>
<td>22,2 Kb/s</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Road to Kumasi</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Date</td>
<td>Location</td>
<td>Type</td>
<td>Time</td>
<td>Uplink</td>
<td>Downlink</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------</td>
<td>------</td>
<td>-------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Dompoase, Road to Kumasi</td>
<td>E</td>
<td>397 ms</td>
<td>4,1 Kb/s</td>
<td>2,1 Kb/s</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Kumasi</td>
<td>3G</td>
<td>138 ms</td>
<td>63,9 Kb/s</td>
<td>28,7 Kb/s</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>NADMO, Kumasi</td>
<td>H</td>
<td>107 ms</td>
<td>123,5 Kb/s</td>
<td>35,8 Kb/s</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Abusuaa, Kumasi</td>
<td>3G</td>
<td>136 ms</td>
<td>84,7 Kb/s</td>
<td>25,4 Kb/s</td>
</tr>
<tr>
<td>2012-06-12</td>
<td>Guest House, Kumasi</td>
<td>3G</td>
<td>153 ms</td>
<td>73,2 Kb/s</td>
<td>22,2 Kb/s</td>
</tr>
<tr>
<td>2012-06-13</td>
<td>Patasi, Kumasi</td>
<td>H</td>
<td>133 ms</td>
<td>119,1 Kb/s</td>
<td>34,5 Kb/s</td>
</tr>
<tr>
<td>2012-06-13</td>
<td>NADMO, Kumasi</td>
<td>H</td>
<td>98 ms</td>
<td>133,4 Kb/s</td>
<td>36,3 Kb/s</td>
</tr>
<tr>
<td>2012-06-13</td>
<td>Kejetia, Kumasi</td>
<td>3G</td>
<td>147 ms</td>
<td>76 Kb/s</td>
<td>23,9 Kb/s</td>
</tr>
<tr>
<td>2012-06-13</td>
<td>Centre for National Culture</td>
<td>H</td>
<td>94 ms</td>
<td>155,8 Kb/s</td>
<td>36,3 Kb/s</td>
</tr>
<tr>
<td>2012-06-13</td>
<td>Road to Kuntanase</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-13</td>
<td>Road to Kuntanase</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-13</td>
<td>Lake Bosomtwe</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-13</td>
<td>Lake Bosomtwe</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-14</td>
<td>Lake Bosomtwe</td>
<td>G</td>
<td>433 ms</td>
<td>1,3 Kb/s</td>
<td>1,7 Kb/s</td>
</tr>
<tr>
<td>2012-06-14</td>
<td>Edwinese, Lake Bosomtwe</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-14</td>
<td>Lake Bosomtwe</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-14</td>
<td>Lake Bosomtwe</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-14</td>
<td>Lake Point, Lake Bosomtwe</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Lake Bosomtwe</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Road to Kuntanase</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Kuntanase</td>
<td>3G</td>
<td>141 ms</td>
<td>69,4 Kb/s</td>
<td>18,3 Kb/s</td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Road to Kumasi</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-15</td>
<td>STC bus station, Kumasi</td>
<td>H</td>
<td>137 ms</td>
<td>105,7 Kb/s</td>
<td>28,5 Kb/s</td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Road to Koforidua</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Nkawkaw</td>
<td>E</td>
<td>331 ms</td>
<td>4,1 Kb/s</td>
<td>3,6 Kb/s</td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Koforidua</td>
<td>3G</td>
<td>152 ms</td>
<td>72,7 Kb/s</td>
<td>20,6 Kb/s</td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Road to Akasombo Dam</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Akasombo Dam</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Kpong, Road to Accra</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Road to Accra</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Madina, Accra</td>
<td>H</td>
<td>99 ms</td>
<td>162,5 Kb/s</td>
<td>42,8 Kb/s</td>
</tr>
<tr>
<td>2012-06-15</td>
<td>Catters Hostel, Accra</td>
<td>H</td>
<td>83 ms</td>
<td>149,5 Kb/s</td>
<td>38,7 Kb/s</td>
</tr>
<tr>
<td>2012-06-16</td>
<td>Aywaso, Accra</td>
<td>3G</td>
<td>144 ms</td>
<td>73,4 Kb/s</td>
<td>25,4 Kb/s</td>
</tr>
<tr>
<td>2012-06-16</td>
<td>Tema</td>
<td>3G</td>
<td>122 ms</td>
<td>86,1 Kb/s</td>
<td>29,2 Kb/s</td>
</tr>
<tr>
<td>2012-06-16</td>
<td>Road To Keta</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-16</td>
<td>Anloga, Keta</td>
<td>G</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2012-06-16</td>
<td>Keta</td>
<td>E</td>
<td>279 ms</td>
<td>7,9 Kb/s</td>
<td>5,3 Kb/s</td>
</tr>
<tr>
<td>2012-06-16</td>
<td>Road to Accra</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 4 – Total Validator Tool results output

**WCAG 1.0**

**Link Errors**

E404 - 1 instance(s): Not Found: The remote server could not find a document at the URL provided. The link may refer to a document that no longer exists, or is pointing to the wrong place.

E508 - 32 instance(s): Check your web server logs to determine the cause.

**HTML Errors**

E620 - 4 instance(s): The most common reason for this error is the use of a browser-specific attribute (such as 'leftmargin' in the <body> tag), which is not part of the official HTML specification being tested against. If the attribute is for purely for layout then consider using CSS instead.

E622 - 2 instance(s): The HTML specification being validated against defines certain valid values for each attribute. Usually a list of valid values will be displayed when you see this message. Note that many values must be in lower case in XHTML, including the ‘x’ in numeric hex entity references. Note also that what values are allowed varies from standard to standard.

**WCAG 1.0 A Errors**

E800 - 2 instance(s): When using <img>, specify a short text equivalent with the ‘alt’ attribute.

E809 - 2 instance(s): No <th> tags where found in a table or they contain no text, suggesting that you have not clearly identified any row and column headers. Or this is a [WCAG 1.0 5.4 (AA)] error as there is a <caption> or ‘summary’ present.

**WCAG 1.0 AA Errors**

E822 - 1 instance(s): Using relative units helps the page to be rendered correctly at different resolutions and people with sight difficulties often ‘zoom in’ to pages to read them.

E831 - 3 instance(s): Associate labels explicitly with their controls.

E833 - 3 instance(s): Use text or an image to identify the target of links.

E835 - 6 instance(s): This error appears when you have not used the 'title' attribute and have different links with the same link text.
WCAG 1.0 A Probable Errors

P800 - 3 instance(s): This problem appears if you have defined a <script> and there is no <noscript> alternative following it. You should ensure that pages are usable when scripts are turned off or not supported. Using <noscript> is a common way of doing this, but if you have used an alternative mechanism you can ignore this problem.

WCAG 1.0 AA Probable Errors

P823 - 5 instance(s): Heading elements must be ordered properly. For example, in HTML H2 elements should follow H1 elements, H3 elements should follow H2 elements, etc. Developers should not skip levels (e.g., H1 directly to H3). Do not use headings to create font effects.

Parsing Warnings

W001 - 2 instance(s): There should not be any white space at the start or end of an attribute's value. This is a minor issue and can probably be ignored.

HTML Warnings

W613 - 8 instance(s): Authors should not specify a 'border' attribute on an <img> element. CSS should be used instead.

WCAG 1.0 A Warnings

W802 - 3 instance(s): When using <img>, it is valid to have an empty 'alt' attribute for images that have no content; such as spacers and parts of larger images that have been broken up or used for other layout purposes. You may wish to check that in this case the alt-text has not simply been forgotten, in which case it would be a [WCAG 1.0 1.1 (A), US-508-a] error.

WCAG 2.0

The WCAG 2.0 test provided the following results:

Link Errors

E404 - 1 instance(s): Not Found: The remote server could not find a document at the URL provided. The link may refer to a document that no longer exists, or is pointing to the wrong place.

E508 - 32 instance(s): Check your web server logs to determine the cause.

HTML Errors

E620 - 4 instance(s): The most common reason for this error is the use of a browser-specific attribute (such as 'leftmargin' in the <body> tag), which is not part of the official HTML specification being tested against. If the attribute is for purely for layout then consider using CSS instead.
E622 - 2 instance(s): The HTML specification being validated against defines certain valid values for each attribute. Usually a list of valid values will be displayed when you see this message. Note that many values must be in lower case in XHTML, including the 'x' in numeric hex entity references. Note also that what values are allowed varies from standard to standard.

**WCAG 2.0 A Errors**

E831 - 1 instance(s): Associate labels properly with their controls.

E860 - 2 instance(s): If there is no 'alt' attribute, then assistive technologies are not able to identify the image or to convey its purpose to the user.

E866 - 3 instance(s): Use the 'title' attribute to label form controls when the visual design cannot accommodate the label (for example, if there is no text on the screen that can be identified as a label) or where it might be confusing to display a label. User agents, including assisting technology, can speak the 'title' attribute.

E872 - 1 instance(s): You must provide a mechanism that allows users to explicitly request changes of context. The intended use of a submit button is to generate an HTTP request that submits data entered in a form, so it is an appropriate control to use for causing a change of context.

E879 - 2 instance(s): Provide either a <caption>, 'title' or 'summary' attributes to describe the table. This must be a proper description and not a terse one. Or this is an accessibility error as there is structural markup present.

P871 - 3 instance(s): Describe the purpose of a link by providing descriptive text as the content of the <a> element. The description lets a user distinguish this link from other links in the Web page and helps the user determine whether to follow the link. The URI of the destination is generally not sufficiently descriptive.

P883 - 5 instance(s): Heading elements must be ordered properly. For example, H2 elements should follow H1 elements, H3 elements should follow H2 elements, etc. Developers should not skip levels or use headings for presentation effects.

**WCAG 2.0 AA Errors**

E910 - 1 instance(s): Using relative units helps the page to be rendered correctly at different resolutions and allows people with sight difficulties to 'zoom in' to pages to read them.

**Parsing Warnings**

W001 - 2 instance(s): There should not be any white space at the start or end of an attribute's value. This is a minor issue and can probably be ignored.
**HTML Warnings**

W613 - 8 instance(s): Authors should not specify a 'border' attribute on an `<img>` element. CSS should be used instead.

**WCAG 2.0 A Warnings**

W860 - 3 instance(s): When using `<img>`, it is valid to have an empty 'alt' attribute for images that have no content; such as spacers and parts of larger images that have been broken up or used for other layout purposes. You may wish to check that in this case the alt text has not simply been forgotten.

W868 - 6 instance(s): If you have different links with the same link text it can be confusing to the user. So you should either change the link text or add a unique 'title' attribute to each link.

**Section 508**

**Link Errors**

E404 - 1 instance(s): Not Found: The remote server could not find a document at the URL provided. The link may refer to a document that no longer exists, or is pointing to the wrong place.

E508 - 48 instance(s): Check your web server logs to determine the cause.

**HTML Errors**

E620 - 4 instance(s): The most common reason for this error is the use of a browser-specific attribute (such as 'leftmargin' in the `<body>` tag), which is not part of the official HTML specification being tested against. If the attribute is for purely for layout then consider using CSS instead.

E622 - 2 instance(s): The HTML specification being validated against defines certain valid values for each attribute. Usually a list of valid values will be displayed when you see this message. Note that many values must be in lower case in XHTML, including the 'x' in numeric hex entity references. Note also that what values are allowed varies from standard to standard.

**Section 508 Errors**

E800 - 2 instance(s): When using `<img>`, specify a short text equivalent with the 'alt' attribute.

E809 - 2 instance(s): No `<th>` tags where found in a table or they contain no text, suggesting that you have not clearly identified any row and column headers. Or this is a [WCAG 1.0 5.4 (AA)] error as there is a `<caption>` or 'summary' present.

E831 - 3 instance(s): Associate labels explicitly with their controls.
Section 508 Probable Errors

P800 - 3 instance(s): This problem appears if you have defined a `<script>` and there is no `<noscript>` alternative following it. You should ensure that pages are usable when scripts are turned off or not supported. Using `<noscript>` is a common way of doing this, but if you have used an alternative mechanism you can ignore this problem.

Parsing Warnings

W001 - 2 instance(s): There should not be any white space at the start or end of an attribute’s value. This is a minor issue and can probably be ignored.

HTML Warnings

W613 - 8 instance(s): Authors should not specify a 'border' attribute on an `<img>` element. CSS should be used instead.

Section 508 Warnings

W802 - 3 instance(s): When using `<img>`, it is valid to have an empty 'alt' attribute for images that have no content; such as spacers and parts of larger images that have been broken up or used for other layout purposes. You may wish to check that in this case the alt-text has not simply been forgotten, in which case it would be a [WCAG 1.0 1.1 (A), US-508-a] error.