Title Evaluation of the response capability of the United Arab Emirates (UAE) to the impact of natural hazards.

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EVALUATION OF THE RESPONSE CAPABILITY OF THE UNITED ARAB EMIRATES (UAE) TO THE IMPACT OF NATURAL HAZARDS

by

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A thesis submitted for the degree of Doctor of Philosophy of the University of Bedfordshire

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July 2010

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ABSTRACT

The UAE is an Islamic state which has undergone dramatic urbanization in the last 30 years. It is situated near the eastern margin of the Arabian tectonic plate, close to the seismically active collision zone between the Arabian and Eurasian Plates, marked by the Zagros Mountain belt of Iran. In the UAE the population of Dibba in Fujairah has felt tremors as recently as November 26 2009 and an earthquake with a magnitude (M) of 5 occurred in Masafi, Fujairah, in March 2002. The most recent earthquake was M 4.3, and awareness of seismic hazard is increasing. In addition to earthquakes, rapid heavy rainfall in the arid environment of the UAE typically results in high level of discharge and flooding. Tropical storms have also struck the Indian Ocean coast of the UAE and have caused damage in coastal areas. The impact of natural hazard events in Fujairah since 1995 and the responses of the authorities and affected communities illustrates the issues faced by the country and is discussed in the thesis.

The Federal Plan to face disasters in the UAE prepared by the Civil Defence sets out the role of the government structures in the UAE to manage disasters with particular reference to the Ministry of Interior, which is the responsible body. A survey of UAE ministries and the Civil Defence shows that in practice there is lack of clarity between the roles of government bodies and there are many areas of confusion regarding jurisdiction and responsibility between the federal and individual emirate institutions. It was a

concern that some supporting ministries were unaware of their role as set out in the overall plan. There is lack of evidence of an integrated approach and no testing of effectiveness of emergency procedures through simulation exercises.

It is recognized that, not only are school children particularly vulnerable to natural disasters but also that education is an important mitigation tool through raising awareness of hazard exposure amongst the population. A survey of schools in Fujairah showed that there was little preparation for natural disasters and no framework to address this issue or to ensure the structural integrity of school buildings. The survey revealed that there is a willingness to learn among the school children and this was followed up by a pilot scheme to raise awareness. This is important as the survey also revealed that traditional views about losses are still common amongst parents, particularly in rural areas.

The vulnerability of the communities to natural hazards is strongly influenced by cultural and social factors. A survey was undertaken of the population in the UAE to investigate their awareness of natural hazards, their perception of risk and how this might be mitigated. The survey revealed a low level awareness and what the role of government agencies would be in the event of a disaster. A majority considered that disasters were Acts of God, a punishment, and the most effective way to mitigate risk was through religious observance. It is clear that even in a developed Islamic country an effective response to mitigate risk needs to recognize and address the cultural and religious contexts.

Finally the thesis evaluates the response capability of the United Arab Emirates (UAE) to the impact of natural hazards. This analysis shows that though there is a Federal Plan for Disasters there is little specific focus on natural hazards. Ministries not directly involved with the Civil Defence were sometimes unclear regarding their roles. At an operational level there is lack of clarity regarding responsibilities and lines of authority between different bodies and between Federal and emirate structures. The Civil Defence was very much focused on response with little effort devoted to reducing vulnerability through

awareness-raising, hazard assessment and monitoring. These need to be addressed to minimize the risk from natural disasters.

ACKNOWLEDGEMENTS

I would like to thank all who supported me throughout my PhD thesis Degree classes; it is a pleasure to thank the many people who made this thesis possible.

Above all, I would like to express my deep and sincere gratitude to my two supervisors, Professor Angus Duncan and Doctor David Chester for their important support and guidance throughout this work. I am also grateful to my supervisor, Professor Tony Seaton for his support with his detailed and constructive comments.

I would like to thank Professor David Rawson and Professor Tiantian Zhang Dr Fataneh Ghafari, Sandra Mather for stimulating discussions and advice.

I also would like to thank Dr Barry Haggett, laboratory manager at LIRANS, for his assistance with all types of technical problems and for keeping me safe throughout my studies.

I would like to thank my family in the UAE, especially my parents and my wife who have been supportive and understanding and pushing me when I wanted to give up. I would like to thank you for your love and your support throughout the past twenty-nine years. I dedicate this work to them.

I would like to thank Dubai Police for everything so I dedicate this work to them.

Finally, I wish to extend my warmest thanks to all those who have helped me throughout this fantastic experience of my life.

DECLARATION

I declare that this thesis is my own unaided work. It is being submitted for the degree of Doctor of Philosophy at the University of Bedfordshire. It has not been submitted before to any degree or examination in any other University.

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List of Acronyms

ADB - Asian Development Bank

ADPC - Asian Disaster Preparedness Center

AGU- American Geophysical Union

AEG- Ajman Electronics Government

AUS -American University of Sharjah

CDC- California Department of Conservation

CREW- Cascadia Region Earthquake Workgroup

DCD- Dubai Civil Defence

ESCAP- Economic and Social Commission for Asia and the Pacific

ECSSR- Emirates Center for Strategic Studies and Research

EMU-Emergency Management Unit

FCD- Fujairah Civil Defence

FEZ- Fujairah Education Zone

FEMA- Federal Emergency Management Agency

FCD- Fujairah Civil Defence

GSHAP- Global Seismic Hazard Assessment Program

GMT- Greenwich Mean Time

ISC- International Seismological Centre

IDNDR- International Decade for Natural Disaster Reduction

ISDR- International Strategy for Disaster Reduction

IBP- International Best Practices

MOI- Ministry of Interior

MOPW- Ministry of Public Works

MOE- Ministry of Education

MOH- Ministry of Health

MOSA- Ministry of Social Affairs

MOD- Ministry of Defence

MOEWS- Ministry of Energy, Water Sector

MOEW- Ministry of Environment and Waters

M - Magnitude

NCEMA- National Crisis & Emergency Management Authority

NSC- National Security Council

NRP- National Response Plan

NSET- National Society for Earthquake Technology Nepal

NRP-T- National Response Plan

NGOs- Non-governmental organizations

NEIC- National Earthquake Information Center

OAS- Organization of American States

OCHA- United Nation Office for the Coordination of Humanitarian Affairs.

PAR- Pressure and Release Model

PGA- peak ground acceleration

QDMPG- Queensland Disaster Management Planning Guidelines

SEZ- Sharjah Education Zone

UAE- United Arab Emirates

UN- United Nations

UNESCO- United Nations Educational Scientific and Cultural Organization

UNFPA- United Nations Population Fund

UNPD- United Nations Procurement Divisions

USAID- United States Agency for International Development

USGS- United States Geologic Survey

UBC- Uniform Building Code

CHAPTER 1: INTRODUCTION

1.1 Introduction

Natural disaster is the consequence of the impact of a natural hazard on a socio-economic system with a given level of vulnerability (ISDR 2001). Natural disasters are extreme, sudden events that are triggered by natural factors (such as earthquakes, storms, floods, and landslides). Natural disasters can exert an enormous toll on society and on development. Over the past two decades, 3 million people have been killed and 1 billion affected by natural disasters (UNESCO 1993a) and 800 million injured or made homeless. In 1991 alone, the economic cost of disasters was estimated at 17 billion pounds (UNESCO 1993b).

A principal reason for the continuing increase in natural disasters is related to the growth of the population, particularly in developing countries, with the increase concentrated in urban growth, characterized by poor planning and limited infrastructure (Sqrensen et al 2006). The management of disasters is one of the most important challenges of the 21st century (Bieri 2009). As a result of the process of transition from a rural to a more urban society (UNFPA 2007), more than 3.3 billion people live in cities and by 2030 that number will have risen to almost 5 billion. The total world population is increasing by around 280,000 people per day, with 95 % of the annual population increase between 1994 and 2004 occurring in economically less developed regions (UNPD 2006). According to the State of World Population Report 2007, a current report from the United Nations Population Fund (UNFPA), in 2008 for the first time in human history more than half of the world's population will be living in urban areas. In recent years, there has been renewed interest in natural disasters and their management and consideration of appropriate responses and strategies to mitigate the impact of natural disasters (UNPD 2006).

Urban populations are growing rapidly, but their growth in the developing nations is most alarming since it is taking place in the absence of civic services, with unplanned growth

proliferation and non-engineered constructions making the disaster-prone areas more vulnerable (Wisner et al 1994). There has been increased awareness of natural disasters in recent years due both to improved media communication, and to increased incidence.

The Middle East has one of the longest records of historical seismicity in the world, extending back more than 2000 years (Degg and Homan 2005). However despite such advances in understanding the physical threat, the societies of the region remain vulnerable to earthquakes and other disasters. Recent earthquakes of M 7.4 on August 17 1999 Izmit in Turkey, the Bam earthquake of M 6.6 on December 26 2003 in Iran, the Asian earthquake and tsunami 2004 and the Kashmir earthquake of M 7.6 on October 2005 in Pakistan have brought to the fore natural disasters in Islamic countries.

This project evaluates the response capability of the UAE to the impact of natural hazards. The UAE is one of the Arab Islamic countries in the Middle East. The UAE is more exposed to natural hazards than has often been assumed as it is adjacent to the Iranian plateau and close to the Zagros Fault, which is characterized by high seismic activity. The UAE sits near the edge of the Arabian Plate close to major epicentres across the Arabian Gulf along the collision zone, and the M 5 earthquake of March 2002 in Masafi (Fujairah Emirate) has raised awareness of earthquakes in the region (Wyss and Al Homoud 2004). The rapid growth of the population and its increased concentration in urban areas with unplanned growth and buildings not engineered to any seismic code makes these areas more vulnerable. Furthermore, the shift from a dispersed, partly nomadic population, to rapid industrial and urban development on the coast has led to a significant change in risk.

1.2 Aims & Objectives

1.2.1 General aims

The first aim is to evaluate the current preparedness of the UAE to handle natural hazards, and to suggest ways of minimizing the impact and reduce the likelihood of

natural disasters. The second aim is to demonstrate that acts of faith and religious devotion are factors of the response to disasters which in countries like the UAE have to be taken into account in the planning process.

1.2.2 Objectives

1. Determine the structure, responsibilities and procedures for Civil Defence in the UAE.
2. Identify the natural hazards that affect the UAE and evaluate the impact of recent natural disasters.
3. Undertake assessment of vulnerability and awareness regarding natural disasters in the schools community.
4. To determine the perception and understanding of natural hazards in the UAE population.

1.3 Methodology and the approach of the Study

The first stage

The first stage is to carry out a comprehensive survey of all relevant ministries and public bodies at both national and regional levels in the UAE, through interviews with selected personnel and analysis of relevant official documents. This stage involved interviewing the senior officials in the Ministry of the Interior (MOI) and establishing the current protocols for dealing with the impact of natural hazards. Interviews were also conducted with relevant officials in the MOI in all emirates, to gain a fuller understanding of planning procedures. This included the Director General for Civil Defence. A particular issue is to establish the current position with regard to monitoring, particularly

concerning the establishment of a seismic network. Key officials in the Ministry of Environment (MOEW), Ministry of Health (MOH), Ministry of Energy, Electricity & Water Sector (MOEEWS), and Ministry of Public Works (MOPW) were interviewed to establish their current procedures for dealing with natural disasters and areas of concern that they might have regarding training, experience from previous incidents and issues of communication and lines of command.

The current position regarding planning for natural disasters (building standards, education, planning restrictions, reconstruction) and dealing with the consequences (after the event) is discussed with officials from the Ministries of Education, Public Works, Transportation and Finance. In addition officials from Non Governmental Agencies e.g. the Red Crescent were contacted. This included academics engaged in natural hazards research at the American University of Sharjah (AUS) and the Emirates University.

Investigation at a regional level focused on one Emirate carried out as a case study. Fujairah was selected for this research as it has a recent history of natural disasters, for example, Masafi earthquake 2002 and Dibba earthquakes 2004, 2005 and the Al Qurayah floods 1995. The Fujairah region is adjacent to the Iranian plateau characterized by high seismicity. The active Dibba Fault, which is connected to the Zagros Fault, runs through Fujairah (Rodgers and Nakanishi 2005). Moreover, Fujairah suffers from underdeveloped infrastructure, poor construction, low levels of education and vulnerability to disasters. A particular issue investigated is how the national and regional structures operates in a time of crisis in a less developed emirate that relies on federal support.

Stage two

This involved a comprehensive survey of the population, through questionnaire study of both men and women within the urban and rural populace in the UAE, in order to obtain information on their awareness of natural disasters. The purpose of this questionnaire survey is to gain information which will assist in the evaluation of the response capability

of the United Arab Emirates to the impact of natural hazards. This information is critical to investigating the current preparedness of the population in the face of natural hazards and to suggest ways of minimizing their impact. For non-literate participants the questionnaire was conducted orally. Prior to commencing the main survey a pilot survey was undertaken with a sample size of 100.

The questionnaire survey was followed up with interviews and the investigation of schools to evaluate whether the schools and their staff are equipped to face natural hazards, and also if teachers can counsel students before, during and after natural disasters. This is one of the first studies in an Islamic country of attitudes of children, their parents and teachers oncerning natural disasters and explore the influence of faith and culture. Ways are suggested to minimize the impact and reducing the likelihood of natural disasters by preparation scenarios, providing resources, booklets and lectures. Schools are a good place for initiating these studies as children are among the most vulnerable to disasters. This research investigates ways of improving understanding and awareness of natural disasters involving seven schools in Fujairah.

The Stage	The work
Stage one	
11/ 2006	Project started
3/ 2007 – 8/2007	Comprehensive survey of all relevant ministries and public bodies at both national and regional levels in the UAE, through interviews with selected personnel and analysis of relevant official documents.
9/ 2007 – 12/2007	Case study of natural disasters in Fujairah Emirate.
Stage two	
2/ 2008 – 3/2008	Pilot survey of population.
5/ 2008 – 10/2008	(1) Main population survey of all the Emirates in the UAE, through questionnaire study, in order to obtain information on their awareness of natural disasters. (2) Meeting with National Crisis Emergency Management Agency (NCEMA).
1/ 2009 – 5/2009	(1) Survey of Fujairah Education Zone. This involved a comprehensive survey by means of questionnaires, followed up with interviews with FEZ officials, school staff, pupils and parents. The purpose of the survey was to evaluate whether the schools and their staff are equipped to face natural hazards, and also if teachers can counsel students before, during and after disasters. This research investigates ways of improving understanding and awareness of disasters through working with schools. (2) Study of impact of Sharm flood.
2/2010	Follow up meeting with NCEMA.

Table 1: Schedule of research undertaken in the thesis.

1.4 Importance of study

Natural disasters in 2004 and 2005, including the Sumatra earthquake, Hurricane Katrina in the USA, and the Kashmir earthquake in Pakistan, provided dramatic evidence of the impact of natural hazards. Responsible for more than 350,000 deaths and combined economic losses in the order of US$300 billion, these powerful events ranked among the most costly disasters of the past 100 years (Pielke 2008). However, most natural hazards such as earthquakes and landslides occur without warning despite scientific understanding of their cause and behaviour (Arne and Kaja 2006). Societies which are prepared for such events minimize risk and toll.

In recent years, there has been renewed interest in natural disasters and their management and in considering appropriate responses and strategies to reduce the impact of natural disasters. Natural disaster management strategy depends crucially on carefully evaluating and planning responses in three stages: before, during and after the event (Vakis 2006). To be effective, such a strategy also needs to be well functioning and in place before the disaster occurs. The aim of this study is to evaluate the current preparedness of the UAE in the face of natural hazards, and to suggest ways of minimizing the impact so as to reduce the likelihood of natural disasters and give a better understanding of the perceptions of an Islamic community to natural disasters. This is particularly important in the Middle East where recent natural disasters in Turkey and Iran have illustrated the vulnerability of the population when facing natural disasters.

1.5 Context

The scale of the natural disasters that have occurred globally and recent trends lend weight to the fact that such incidents are increasing. There is evidence that natural disasters are taking an increasing toll of human life but great regional disparities exist in the type (Human casualties versus economic impact) and magnitude of losses experienced between the developed and developing world (Degg and Chester 2005). It is estimated that the financial burden of all global disasters in the 1980s was $120 billion

compared with $70 billion in the 1970s, and $40 billion in the 1960s. Before 1987 there was only one case where the insured loss from a disaster exceeded $1 billion; in 1995 alone there were 14 such instances, with the Kobe earthquake in Japan costing more than $100 billion (Degg and Chester 2005). Between 1980 and 2007, more than 8,300 disasters caused by natural hazards have taken the lives of over two million people and produced economic losses over of $ 1.5 million (UNISDRa 2009). Of this total, around 90 % of events, and over 70 % of casualties and 75 % of economic losses were caused by floods, tropical cyclones and storm surges and windstorms. In 2008 alone, around 236,000 people lost their lives in over 300 disasters in earthquakes, storms, flood, landslides and other destructive events; more than 190 million people were directly affected, and damages exceeded $180 billion (UNISDRa 2009).

It is clear that developing countries are particularly vulnerable to natural disasters: infrastructure is inadequate; productivity is low; the general standard of education is poor and they suffer from political and economic instability. In the 1986 San Salvador earthquake 53,500 families lost their homes and about 40,000 could not afford to reconstruct them (Alexander 1993). Urban vulnerability is a very severe problem in many developing countries with high demographic growth rates. Urbanisation is a major factor in the growth of vulnerability, particularly of low-income families. The urbanisation process results in land pressure as migrants from outside move into already overcrowded cities, so that new arrivals have little alternative other than to occupy unsafe land, construct unsafe habitations or work in unsafe environments. Furthermore, global environmental change and natural resource degradation pressures contribute to increasing the vulnerability (Blaikie et al 1994). In response to the increasing impact of natural disasters on December 11, 1987, the United Nations General Assembly adopted resolution 42/169 designating the 1990s the International Decade for Natural Disaster Reduction (IDNDR). The principal stated purpose of the Decade was to reduce natural disasters through concerted international actions. The IDNDR provided an opportunity to apply scientific and technological methods for the reduction of risks and also to develop regional strategies across the globe (Weisaeth et al 2002).

The International Strategy for Disaster Reduction (ISDR) agreed by the UN following the IDNDR aims at building disaster resilient communities by promoting increased awareness of the importance of disaster reduction as an integral component of sustainable development, with the goal of reducing human, economic and social and environmental losses due to natural hazards, and related technological and environmental disasters (ISDR 2001). The ISDR recognises that the period between 1960 and 2000 witnessed a significant increase in the occurrence, intensity and severity of natural disasters, particularly during the 1990s. So there has been increased awareness of natural disasters and their management and consideration of appropriate responses and strategies to mitigate their impact. The rapid increase of the population particularly in hazardous environments has escalated both the severity and frequency of natural disasters (Guha 2005).

In the Middle East despite recent advances in understanding, the region remains vulnerable to earthquakes. In 1992 at Dahshur south of Cairo a M 5.6 earthquake, that might generally be described as being of medium magnitude, yet because of the poor performance of many modern buildings near to the epicentre led to more than 500 people being killed, 1000 injured and 40, 000 being made homeless (Degg and Homan 2005).

Another recent example is the 1999 Izmit (north-western Turkey) earthquakes of M 7.4, which occurred in the southeast of Izmit, an industrial city approximately 90 km east of Istanbul. Unofficial estimates place the death toll at more than 40,000 (Wright et al 2001). The apparent lack of community and individual preparedness were key issues in this disaster because most of the deaths and injuries were caused by collapse of commercial and residential buildings (Wright et al 2001). This was one of the strongest earthquakes to hit Turkey in historic times. Yet if this earthquake had occurred in Japan, the impact would have been much less. This earthquake exacted a considerable human toll that was disproportionate given the magnitude of the physical event.

In the Izmit and Dahshur earthquakes, the people did not know how to prepare for the possibility of an earthquake, or what to do during and after the event. A large number of school children were admitted to hospital with crush injuries caused by reaction and

stampeding in the rush to exit school buildings. There was also an uninformed reconstruction after the disasters and a general lack public capacity to challenge inappropriate building construction and regulation practices in Egypt and Turkey (Amr and Sadek 1996).

Asia experiences some of the world's worst natural hazards - frequent earthquakes, storms and annual monsoons. Natural disasters are increasing in number and size every year due to a number of factors including rapid population growth, urbanisation and climate change. There is abundant evidence that natural disasters disproportionately affect developing countries. Between 1991 and 2005 more than 90% of natural disaster deaths and 98% of people affected by natural disasters were from developing countries (Simpson et al 2008).

Pakistan suffers from frequent earthquakes, their occurrence being associated with the Indian tectonic plate exerting continuous pressure on the Eurasian Plate. In Pakistan earthquakes normally occur along the Himalayas, Karakorums and part of the Hindu Kush ranges in the north, Koh-e-Sulaiman range in the west with the Chaman fault line near Quetta and the Mekran fault line along the sea coast (NSET 2009). Pakistan is known to be vulnerable to earthquakes, particularly after the Quetta earthquake on 31st May 1935 at 3.00 hours which killed more than 50, 000 people (OCHA 2006). But the October 2005 earthquake is the worst natural disaster that Pakistan has experienced in recent years (Arambepola 2005), though it may be surpassed by the floods of 2010.

The earthquake epicentre was 19 km northeast of Muzaffarabad close to the border area of Kashmir, devastating an area of nearly 30,000 km^2. This was the world's third-worst natural disaster of the past 25 years. The total devastation caused was much higher than has been recorded from earthquakes in the recent history of Pakistan (Richard et al 2006). The earthquake left widespread destruction, killed more than 70,000, and the total cost of the earthquake is estimated to be $5.2 billion (UN 2005). The disaster further caused enormous damage to infrastructure such as bridges and roads, cut off huge areas from main road access, and water and electricity supplies were severely affected. Many of the towns were completely flattened, such as Balakot. This made search, rescue and relief

challenging. More than one month after the disaster, relief operations continued (Strand and Borchgrevink 2006). Poverty is one of the serious problems facing Pakistan in terms of disaster preparedness. The links between vulnerability and poverty are complex.

Vulnerability is often discussed in terms of the interaction between physical and social variables, with poverty entering as one of the dominant social dimensions affecting overall vulnerability (Wisner et al 1994). Cultural constructs and human social systems are responsible for creating the reality of natural hazards. For example, urban housing is poorly constructed in a country such as Pakistan with creation of settlements on marginal land exposed to multiple hazards. Moreover, illegal settlements lack basic municipal services (Daanish 2005).

In Iran, one of the stronger historic earthquakes occurred on 26 December 2003 at 05:26 A.M. local time of Iran. This explains the extraordinarily high death toll for the event, because it occurred while most people were indoors and still sleeping. The earthquake devastated the city of Bam, located in the south-eastern part of Iran. More than 26,000 lives were lost in Bam and surrounding towns and villages in Southeast Iran. The reason for this tragedy was an unfortunate combination of geological, social and human circumstances and left the majority of the Bam population homeless.

Bam and Kerman Province had an estimated death toll of more than 40,000. Furthermore, over 25,000 people were injured and about 75,000 people became homeless by this event (Farrokh et al 2004). Between 30,000 and 50,000 people suffered injuries in the Bam region, requiring hospitalization, yet all the functioning hospitals in the area were severely damaged or demolished. Two hundred health professionals perished in Bam alone. More than 6,000 children became orphans, and approximately 500 people were permanently disabled (Manuel 2005). More than 80% of the buildings and houses were damaged beyond repair; the historical monument Arg-i-Bam was totally destroyed. It was one of the most disastrous earthquakes in the recorded history of Iran. The UAE is geographically, geologically and geophysically close to Iran to the south of one of the most seismically active zones in the world (Khalid and Malkawi 2004).

The Asian Tsunami December 26, 2004 at (00:58:53 GMT) will be remembered as one of the worst human tragedies in recent history. Disaster brought incalculable suffering and caused major loss of life and devastation to millions of people around the Indian Ocean. It was the worst natural disaster in recorded history caused by a submarine M 9.1 earthquake off Sumatra in the Indian Ocean (Gower 2007). The tsunami struck Indonesia, Sri Lanka, and India. Most of the loss of life occurred in Sumatra, Indonesia, where the tsunami destroyed virtually every village, road, and bridge; the waters reached up to 4 km inland and at least 200,000 people drowned. Thousands of people were missing and more than one million more lost their homes (Gail 2005). It is estimated that on average 50% of the people in the coastal region died. The tsunami devastated communities with its high toll of human lives, injuries, and adverse effect on family networks, livelihood and homes. Most families were affected by disability and death.

The 2004 Indian Ocean Tsunami highlighted inherent vulnerabilities of the world's coastlines and the people who live there. Coastal populations are on the increase in many parts of the world, mostly due to the exploitation of sea resources. In a single day the 2004 Indian Ocean tsunami killed over a quarter of a million people and blighted the lives and prospects of over two million more. So education is one of the easiest ways to reduce tsunami life loss. Such education needs to include knowledge of the cause of a tsunami to help individuals understand how their own observations can help them take appropriate action (ADB 2005).

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) established in 1947 with its headquarters in Bangkok, Thailand, emphasized that natural disasters have hit with particular force in the Pacific and Asia (ISDR 2009). Natural disasters across the region accounted for 37 per cent of the world's total, just in the first nine months of 2008. The deaths from disasters in 2008 were nearly four times the annual average for the previous decade. From January to September 2008, a total of 28 natural disasters affected more than 101 million people, killed more than 223,000 and caused more than 103 billion $ in economic damage. Among the most serious events were earthquakes, storms and floods. One of the worst events was the earthquake in the

Sichuan Province of China on 12 May which killed 87,000 people, which affected more than 45 million others and caused 20 billion $ in damage, which devastated basic social infrastructure (ISDR 2009). These events evidence the threat to societies posed by tropical storms, earthquakes, floods, droughts and other natural hazards.

According to UN sources, in 2008 and for the first time, more people will live in cities than in rural regions and there will be rapid development over a short period (ISDR 2009). So this is likely to increase population densities in hazardous environments. Inappropriate land-use and construction practices, along with population pressures, are also increasing vulnerability. This global trend toward urbanization concentrates millions into dense megacities, and will lead to increased vulnerability to natural disasters. These countries need to invest more in disaster risk reduction measures if they want to better protect development gains.

In the UAE the population of Dibba in Fujairah is feeling frequent tremors particularly in the last two years; the most recent of these tremors was 26/10/2009 M 4.3. This tremor indicates there is energy on the Dibba fault that needs to be released and that it may cause a major earthquake in the UAE in the near future. This emphasizes the need to make sure that disaster plans are ready and that the civil defence, police and hospitals are prepared. Furthermore, there are three major reasons to respond the threat of earthquakes in the UAE. Firstly, some international analysts and researchers have said the hazard in the UAE is about the same as that in Turkey and Iran and parts of California (Wyss and Al Homoud 2004).

The second reason is that in the UAE there are two main faults; one of them runs along the west coast through the major cities from Abu Dhabi to Ras Al Khaimah. The other is the Dibba Fault, which links with the Zagros belt. Thirdly an earthquake with a magnitude of 5.1 has already occurred in Masafi Fujairah, on March 2002. This situation necessarily implies that the UAE is ultimately vulnerable to a large earthquake because it is not too far a distance from the southern shores of Iran. During the last 5 years there has

been increased awareness of natural hazards in the UAE since the M 5.1 earthquake of March 2002 in Masafi (Wyss and Al Homoud 2004).

Furthermore, intense rainfall in the arid environment of the UAE typically results in high level discharge and flooding. A good example is the flooding that occurred in Al Qurayah, in December 1995. Landslides also are an important environmental hazard, especially in mountainous terrain. Rapid slope failure leads to loss of life, property damage, injury, disruption of communication, supplies and economic activities, and loss of productive soil and land (Alexander 1993). In the middle of March 2006, intense and prolonged rainfalls lasted from three to four days consecutively. A major landslide occurred on the New Al Tawaian-Dibba Road, the land sliding started about 9:00 am and rocks continued to fall for a number of hours. Storms and cyclones when they come onto land, the heavy rain, strong winds and large waves can damage buildings, trees, cars and disrupt cities. Tropical Gonu storm hit Fujairah and some parts of Sharjah in 2007. Large waves breached the Fujairah coast and flooded the streets, causing chaos and panic among tourists and residents.

Fujairah Emirate has been selected for a case study of the impact of natural hazard events (Chapter 6) as it has suffered more from natural disasters in the last 15 years than any of the other emirates. Fujairah is particularly at risk from natural hazards, and indeed most of the recent UAE natural hazards have occurred in Fujairah. For example the following natural disasters have occurred in Fujairah Al Qurayah flood 1995, Masafi earthquake 2002, Al Tawaian-Dibba Landslide 2006, Gonu Storm 2007 and the Sharm flood 2009. This has provided a valuable opportunity to evaluate the performance of the authorities, in particular the Civil Defence, in responding to these events and whether this has improved as a result of the adoption of the Federal Plan to Manage Disasters adopted in 2005 and the Federal Law (23) regarding the Civil Defence approved in 2006. Fujairah is one of the three emirates (also Ajmam and Um Quwain) with a larger proportion of its population living in a rural environment. This provides the opportunity to explore how more traditional values influence attitudes regarding natural hazards and their impact.

CHAPTER 2: NATURAL HAZARDS, DISASTERS AND ISLAMIC THEOLOGY

2.1 Introduction

In this thesis, the issue of natural hazards in the UAE is discussed through consideration of the response capability of the UAE to the impact of natural hazards. Also when the subject matter is related to natural hazards in an Islamic country it is important to investigate the influence of Islamic theology. In this chapter a brief description of the natural hazards, disasters and Islamic theology is presented. It has long been recognized that natural disasters occur as a result of natural hazards but the impact is often accentuated as a result of human activity and environmental degradation in hazard-prone areas (Burton et al 1993, Smith 2001). Vulnerable populations who are sensitive to impacts, and who have low adaptive capacity will be particularly affected by hazardous events (Wisner et al 2004). Empirical evidence suggests that exposure to natural hazards comprises only a small part of vulnerability and that cultural, social, and economic factors are important elements in increasing vulnerability to hazards (Pelling 1997, Adger and Brooks 2003, Few 2003, Emma 2005). Social networks and ties, the news media, culture, interpersonal networks, and trust in risk information all moderate the way in which disasters occur.

Each of these factors contributes to better or worse preparedness and they lead to more or less engagement by the public (Kasperson et al 1988, Pidgeon et al 2003). Habits, routines, beliefs and cultures affect behaviour (Tversky and Kahneman 1974). Theories of human behaviour for example the theory of Reasoned Action (Fishbein and Ajzen 1975) consider that people act according to their beliefs about the outcomes of their behaviour and how they value that outcome and this creates their attitude towards the action. Behaviour is modulated both by this attitude as well as by perceptions of what others think they should do and how they should behave, i.e. behavioural norms (Emma et al 2009).

The Muslim view of different natural hazards is relatively prominent in Arabic literature on earthquakes. The impacts of earthquakes in the Middle East in historic time have been researched by Tahir (1994), Ambraseys et al (2005), Akasoy 2007 and Ambraseys (2009). In spite of this work, there are still many studies and documents which have not been considered. This reflects how Muslims in the pre-modern age discussed issues connected with natural hazards. In the case of earthquakes, Greek sources and studies confirm the occurrence of earthquakes in Arabia before Islam (Ambraseys et al 1994, Ambraseys 2009). However, neither Arabic literature nor any other source contains references to beliefs of the inhabitants of pre-Islamic Arabia.

The knowledge of attitudes to natural disasters among Muslims is based on the two main sources of Islam, Koran and Hadeths, which carry reports of the sayings and deeds of the prophet (Ibn Hazm 6/810). These sources are interpretation that natural disasters are punishments and serve as a demonstration of God's omnipotence and his power to strike those who oppose his prophets. Many of the Holy Quran texts have it that the wicked and the sinners are punished by natural disasters.

2.2 Hazard, Vulnerability and Risk

In evaluating natural disaster risk, the social production of vulnerability needs to be considered with at least the same degree of importance that is devoted to understanding and addressing natural hazards. Risk can be considered as the probability of the interaction of a hazard with a community and the likely loss (casualties and damage) to be a consequence of vulnerability (Alexander 2000, Wisner et al 2004). This can be represented in a semi-quantitative way by (Wisner et al 2004):

Risk = Hazard $_{X}$ Vulnerability.

The natural disaster risk is directly affected by the hazard produced and the degree of hazard vulnerability experienced by exposed persons in a particular period of time and space. This pseudo-equation is not new and actually finds its origins in risk analysis and safety engineering studies of frequency and severity exposure to risks (Wisner et al

2004). Wisner et al (2004) built a conceptual framework of vulnerability analysis through the Disaster Pressure and Release Model.

2. 2.1 Hazard

2.2.1.1 General definition of hazard

Around half of all natural hazard and disaster research has been carried out during the past two decades (Hogan and Marandola 2007). This is due to the increasing global toll of natural disasters, the disproportionately high burden of losses in developing countries and the framework of specific research objectives which have been defined by the United Nations, who designated the 1990s the IDNDR (Chester 2002). Hazard in the general definition by ISDR in 2009 is a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, loss of livelihoods and services, property damage, environmental damage or social and economic disruption (ISDR 2009).

So called natural hazards have always been associated with disasters and are environmental. Often the natural hazards can be broadly described as the ecological implications of global environmental change, like climate change. Some socioeconomic characteristics such as poverty, gender, age or lifestyle, together with the mass violence or political creation of discrimination, amplify the risks from environmental hazards (Smith 2004). Natural hazards are indeed geophysical events; they have the characteristic of posing danger to the different social entities of earth (Ayala 2002).

2.2.1.2 Definition of natural hazard

Natural hazard has been defined by Alexander (1993, 4-5) in four ways:

- *An interaction of people and nature governed by the co-existent state of adjustment of the human use system and the state of nature in the natural hazard system.*
- *A naturally occurring or man-made geologic condition or phenomenon that presents a risk or is a potential danger to life or property.*

- *The probability of occurrence within a specified period of time and within a given area of a potentially damaging phenomenon.*
- *Those elements in the physical environment (which are) harmful to man and caused by forces extraneous to him.*

A natural hazard is a physical event which makes an impact on human beings and their environment.

2.2.1.3 Classification of Natural Hazards

1- Atmospheric *Single element* ❖ **Excess rainfall** ❖ **Freezing rain (glaze)** ❖ **High wind speeds** ❖ **Heavy snowfalls** ❖ **Hail** ❖ **Extreme temperatures** *Combined elements/events* ❖ **'Glaze' storms** ❖ **Thunderstorms** ❖ **Tornadoes** ❖ **Heat/cold stress** ❖ **Hurricanes** ❖ **Blizzards**	**2- Hydrologic** ❖ **Floods – river and coastal** ❖ **Rapid glacier advance** ❖ **Wave action** ❖ **Drought** **3- Geologic** ❖ **Mass-movement** ➢ Landslides ➢ Mudslides ➢ Avalanches ❖ **Earthquake** ❖ **Volcanic eruption** ❖ **Rapid sediment movement**

Table 2: Classification of Hazards (Based in part from Glade et al 2002).

The relative importance of each of these hazards varies from country to country and within countries because of geological, geographical and meteorological variations, also the different mitigation strategies that may be in place in each country (Table 2).

2.2.1.4 Natural Hazard Assessments

During the last ten years major lessons have been learnt about how studies of natural hazard reduction should be carried out, which have involved social scientists, earth scientists, and policy makers. Studies that assess natural hazards provide information on the probable location and severity of natural hazards and the likelihood of their occurring within a specific time period in a specific area (OAS 2010). These studies rely heavily on available scientific information, including geologic, geomorphic, historical information, specific maps, aerial photographs, climate and hydrological data; both written reports and oral accounts from long-term residents also helps characterize potential hazardous events. A natural hazard assessment promotes an awareness of the issue in a disaster-prone region, evaluates the threat of natural hazards, and finally, to suggesting ways of minimizing the impact and reduce the likelihood of natural disasters (OAS 2010).

For example, a study in 2003 on coastal erosion in the Philippines, examined factors influencing coastal erosion along a 60-kilometre coastline in La Union in the Philippines. Extensive data were collected on wave and wind action including storms, earthquakes and slope angles, associated subsidence, substrates, presence and absence of natural buffers such as mangroves and coral reefs, shifts in the position of a river mouth, coastal protection structures and mining and other land uses. As a result of the study's findings, the Philippines government decided to relocate settlements and schools, redesign seafront structures and rehabilitate mangroves (ProVention 2007).

2.2.2 Vulnerability

2.2.2.1 Vulnerability definition

Vulnerability is broadly defined as the susceptibility to loss, and it is an essential concept in hazard research and is central to the development of risk mitigation strategies (Aysan 1993).

Types of vulnerability are defined as follows:

- Lack of access to resources (materials/economic vulnerability).
- Disintegration of social patterns (social vulnerability).
- Limited access to political power and representation (political vulnerability).

- Certain beliefs and customs (cultural vulnerability).
- Weak buildings (physical vulnerability).
- Lack of strong national and local institutional structures (organizational vulnerability)
- Lack of access to information and knowledge (educational vulnerability)
- Lack of public awareness (attitudinal and motivational vulnerability).

The multiple definitions and divides of "vulnerability"

In some recent studies (Wisner et al 2004), more emphasis is placed on people's "capacity" to protect themselves rather than the vulnerability that limits them, through focusing most attention on the social, political and economic processes that make people "vulnerable". This approach can reduce people to being passive recipients, even victims. Because this analysis tends to emphasise people's weaknesses and limitations, and is in danger of showing people as passive and incapable of bringing about change. But actually people do possess significant capabilities as well. Almost everyone has some capacity for group action and self protection: the processes that generate "vulnerability" are countered by people's capacities to resist, adapt to those processes, avoid, and to use their abilities for creating security, either before, during, and after a disaster. With this have come debates about the correct balance between qualitative and quantitative data, and to question if is it possible to quantify vulnerability (Wisner et al 2004).

Vulnerability	- Vulnerability is the potential for loss (Mitchell 1989). - By vulnerability we mean the characteristics of people in terms of their capacity to anticipate, resist and cope with, recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood are put risk by a discrete and identifiable event in society or in nature (Wisner et al 1994). - Vulnerability is defined as an aggregate measure of human welfare that integrates environmental social, political, and economic exposure to a range of potential harmful perturbations. Vulnerability, a multilayered and multidimensional social space defined by the determinate, political, economic institutional capabilities of people at specific times, and in specific places (Bohle et al 1994). - Vulnerability is the differential susceptibility of circumstances contributing to vulnerability. Demographic, economic, biophysical, social factors such as population ages, economic dependency, racism and age of infrastructure are some factors which have been examined in association with natural hazards, (Dow 1992). - In 2009 the ISDR defined vulnerability as characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. There are many aspects of vulnerability, arising from various physical, economic, social and environmental factors. vulnerability indicators might focus on the such as,

	lack of public information and limited official recognition of risks and preparedness measures, and lack of awareness and poor design and construction of buildings, and disregard for wise environmental management and inadequate protection of assets, which increase the susceptibility of a community to the impact of hazards and the susceptibility to damage (UNISDR 2009). Vulnerability reflects not only these elements, but physical well-being of the populace, education, income, mitigation measures and preparedness (Birkmann 2006).

Table 3: Definitions of vulnerability.

Vulnerability reflects not only these elements, but the physical well-being of the populace, education, mitigation measures and preparedness (Table 3).

2.2.2.2 The nature of vulnerability

Human vulnerability and natural vulnerability

Human vulnerability: is based on the social, political, economical, and cultural systems. Hence, vulnerability can be defined as the propensity of an endangered element due to any kind of natural hazard to suffer different amount of damage or degrees of loss depending on its particular social, cultural, economic and political weaknesses. The resulting loss from natural hazards depends on the population its resilience and the capacity of the population to support or resist the disaster. So disasters occur when hazards meet vulnerability (Eshghi and Richard 2008). Although humans can do little or nothing to change the intensity of most natural hazards, they have an important role to play in ensuring that natural hazards are not converted into disasters by their own actions.

So it is important to understand that human intervention can influence the severity of natural hazards.

Natural vulnerability: depends on the threatening natural hazard (related to geographical location), thus, for example there is landsliding vulnerability, tsunami vulnerability, volcanic vulnerability, flooding vulnerability, hurricane vulnerability (Ayala 2002).

2.2.2.3 Vulnerability analysis

2.2.2.3.1 Pressure and Release Model

In the Pressure and Release model (PAR model), the basis is that a disaster is the intersection of two opposing forces: those processes generating vulnerability on one side, and the natural hazard event on the other (Wisner et al 2004). It shows how natural disasters occur when natural hazards affect vulnerable people. The 'release' idea is incorporated to conceptualise the reduction of disaster: to relieve the pressure, vulnerability has to be reduced. The expanded analysis of the principal factors in the PAR model that relate to exposure to physical hazard and human vulnerability focuses on the process by which the natural event impacts upon people and their responses. The PAR model is based on the idea that an explanation of natural disasters requires us to trace the connections that link the impact of a hazard on people with a series of social factors and processes that generate vulnerability. The explanation of vulnerability has three sets of links that connect the disaster to processes that are located at decreasing levels of specificity from the people impacted upon by a disaster (Root causes, Dynamic and Unsafe conditions), See Figure 1.

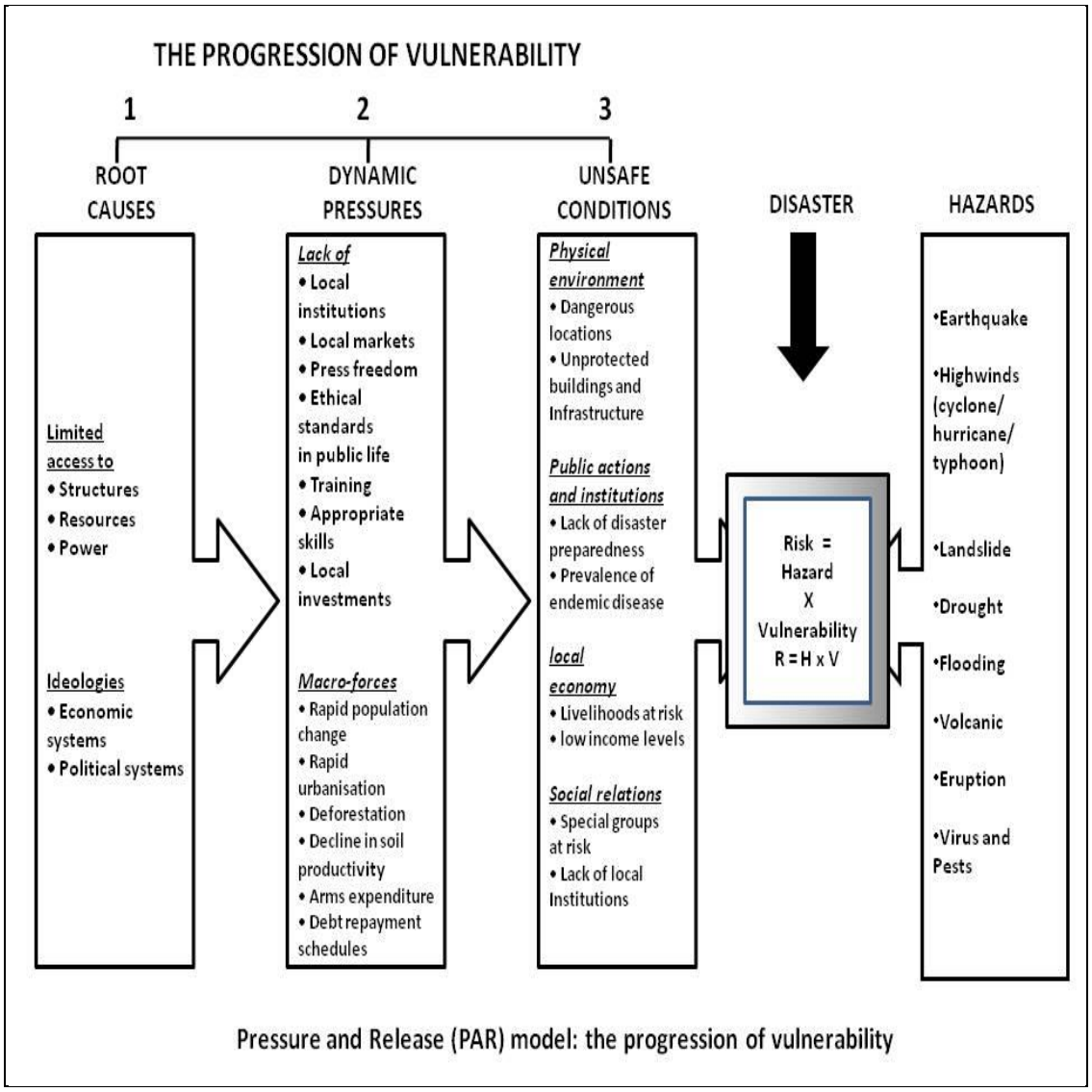

Figure 1: Pressure and Release Model: the progression of vulnerability (Wisner et al 2004).

2.2.3 Risk

2.2.3.1 Risk definition

The word "risk" is usually placed on the concept of chance or possibility, such as in "the risk of an accident"; in popular usage. Whereas in technical settings the emphasis is usually placed on the consequences, in terms of "potential losses" for some particular cause, place and period. So risk is the combination of the probability of an event and its negative consequences (ISDR 2009).

The difference between risk and hazard can be illustrated through two people in the sea, one in a large ship and the other in a rowing boat. The hazard (large waves and deep water) is the same in both cases but the risk (probability of drowning and capsize) is very much greater for the person in the rowing boat. Clearly, the relationships between hazard and risk are much altered by human conditions and actions (Okrent 1980). Natural hazards comprise phenomena such as earthquakes, volcanoes, tsunami, landslides, tropical cyclones and other severe storms; tornadoes and high winds; floods; wildfires (Appel 2001, Hossain 2002).

2.2.3.2 Risk Perception

Risk perception is different from risk assessment, because risk means different things to different people. Individual perceptions of risk are regarded as equally valid, because each individual chooses within the available limits their own response (Whyte and Burton 1982). Differences between risk assessment and risk perception are shown in Table 4

Phase of analysis	Risk assessment	Risk perception
Risk identification	Event monitoring Statistical Inference	Individual Intuition Personal Awareness
Risk estimation	Magnitude Frequency Economic costs	Personal Experience Intangible losses
Risk evaluation	Cost/benefit Analysis Community Policy	Personality Factors Individual action

Table 4: Major differences between risk assessment and risk perception.

Probabilistic perception is the most sophisticated type because it accepts that natural disasters will occur and that many events are random. For the purpose of this thesis risk is defined as the potential or possibility of losses as a consequence of a specified natural hazard, and its negative consequences.

2.2.3.3 Risk Management

The risk management task is typically performed by national/regional agencies that attempt to combine both risk assessment and risk perception. The fundamental risk management dilemma is "Where should we spend whose money to undertake what programmes to save which lives with what probability" (Zeckhauser and Shepard 1984). This dilemma is addressed through the following policy options (Somers 1995):

- Economic: Financial measures, such as subsidies, tax credits and fines, can be used by governments to encourage compliance with hazard reduction policies.

- Educational: Public information programmes that can be used to raise hazard awareness so that people can take voluntary action to reduce risk.

- Regulatory: The relevant authority enforces compliance with safety requirements through the force of law.

The Australian Standard/New Zealand Standard on Risk Management defines risk management as the culture, structures and processes that are directed towards realising potential opportunities whilst managing adverse effects (Somers 1995). In terms of disaster mitigation and management, risk management is a process of identifying risks and hazards to a community in the event of a natural disaster.
This process encompasses:

- An understanding of the community (that is, identifying the context).

- Identifying the “what, where, when, how, and why” (identifying the hazards).

- Identification of what is likely and probable to occur in that community and the consequences of these outcomes (analysing the risks, setting priorities for dealing with these risks evaluating risks).

- Determining options and strategies for dealing with these risks (treating risks).

Each stage of the risk management process involves extensive consultation and communication with the community and other key stakeholders, including ongoing monitoring and review. Figure (2) outlines the risk management process according to the Australian Standard (QDMPG 2005).

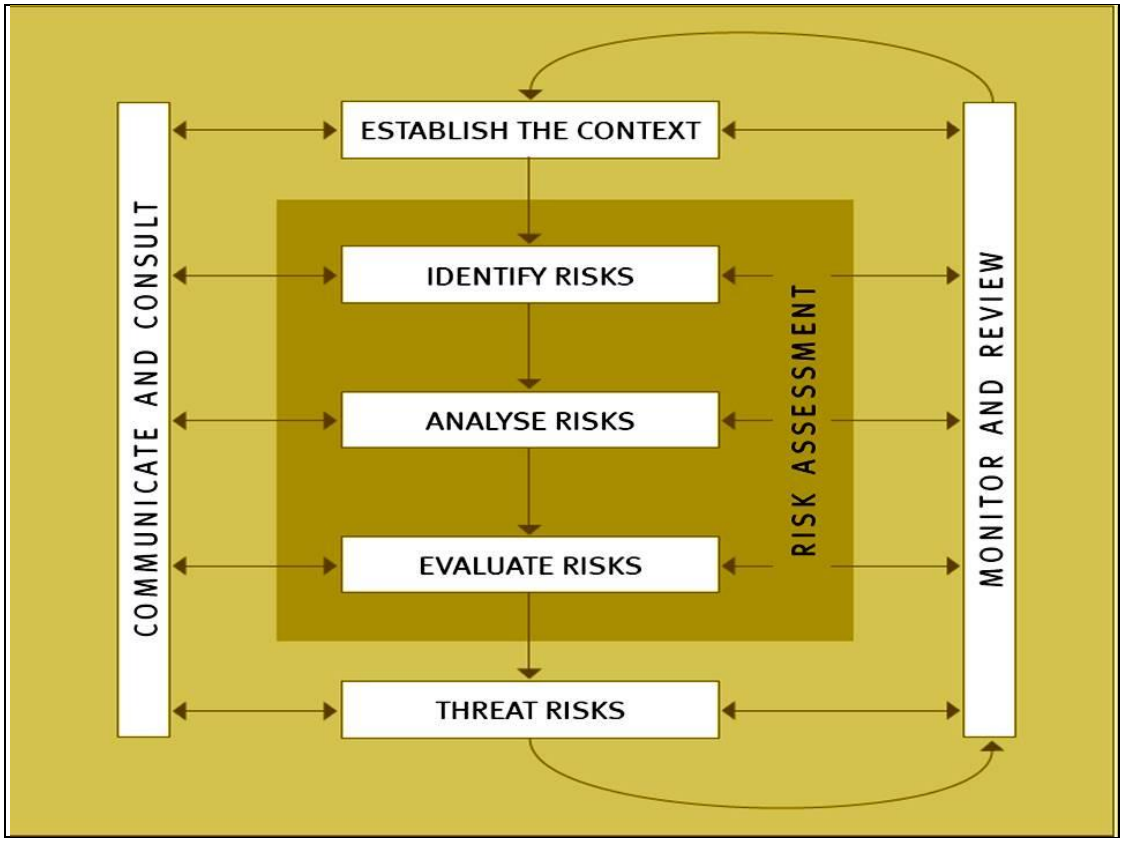

Figure 2: The risk management process according to the Australian Standard (QDMPG 2005).

As outlined in the diagram in Figure 3, the Risk Management Guidelines provide a contextually enhanced framework which parallels a general risk management approach (Salter 1999).

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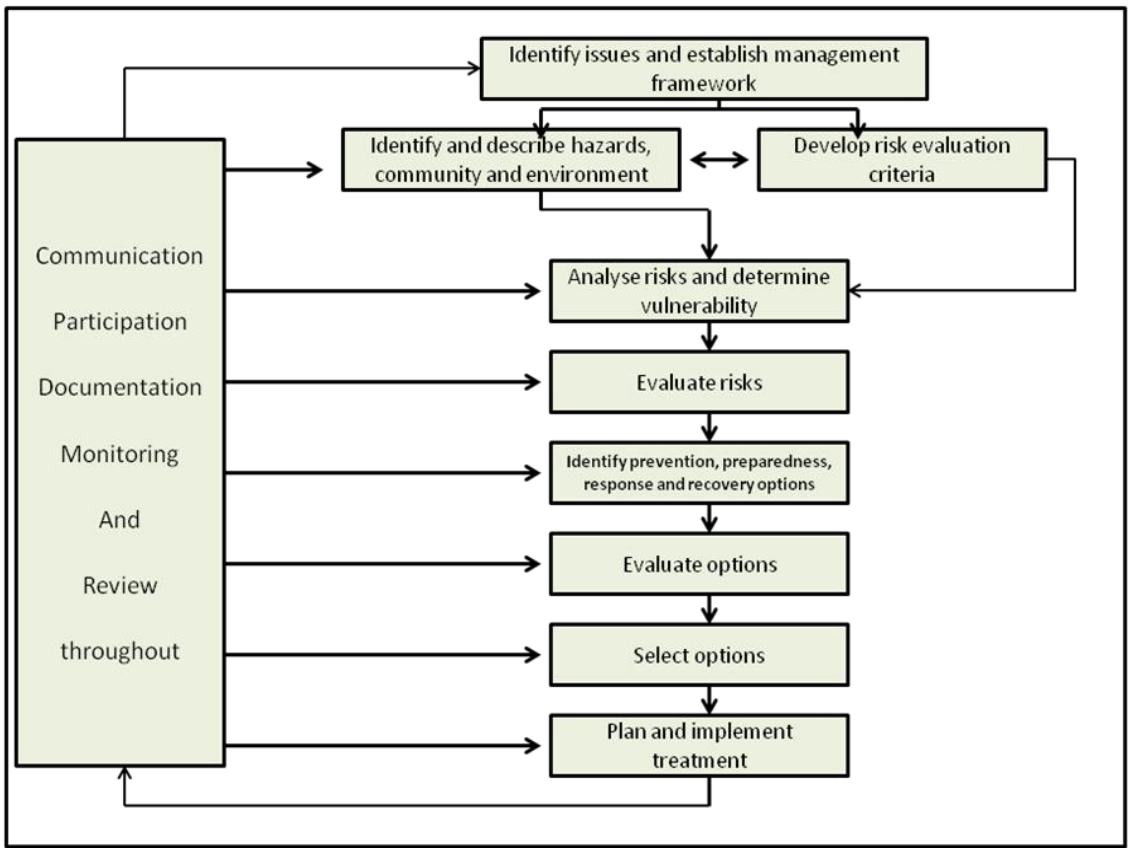

Figure 3: Main elements of the emergency risk management framework (Salter 1999).

2.2.3.4 Risk assessment

Risk cannot be eliminated but can be minimised, so it has to be assessed and managed in order to reduce the likelihood of disaster. A methodology needs to be put in place to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend (ISDR 2009). Risk assessment involves evaluating the significance of a risk, either qualitatively or quantitatively. Quantitative risk assessment has not been attempted for all environmental hazards and it is a process understood by a minority of the public and the complex

interactions can make it difficult to provide an effective quantitative assessment. Because in quantitative risk assessment, when risks have been quantified, uncertainties attach to the estimate. Also its interpretation when drawing up spending priorities for limited resources is difficult. Semi-quantitative risk assessment is expressed by Wisner et al (2004):

$$\text{Risk} = \frac{\text{Hazard (probability) x Loss (expected)}}{\text{Preparedness (loss mitigation)}}$$

So the Risk needs to be assessed in a way more accessible to lay people. Because every person and organisation has something to contribute to risk management and achieving optimum safety involves controversial value judgments. Qualitative risk assessments are used for screening risks to determine whether they merit further investigation, and can be useful in the preliminary risk management activities. Also this provides the needed information and analysis to answer specific risk management questions. A qualitative risk assessment provides the policy-maker with all the information and data they require. For example perhaps the information gathered from risk assessment that is readily understood by non-specialists. A qualitative risk assessment may also provide the necessary insights into a previously unidentified pathway (FAO 2002). There is often uncertainty about the best way to manage hazard and qualitative analysis is best viewed as a partial, rather than a complete function (Kates and Kasperson1983).

2.3 Disaster

The word disaster came into the English language in the sixteenth century through the Latin root meaning “bad star”. The words imply that when the stars are in a bad position, a disaster is about to occur (Eshghi and Larson 2008). There is no precise and clear definition for a disaster. In fact some experts believe that the definition of a disaster can be different based on the geography, political situation and economic state of the disaster-prone countries. However, there is general agreement that a disaster is relatively sudden,

highly disruptive and in most cases time limited although the effects may be longer lasting. So disaster is a natural or man-made event that negatively affects life, livelihood, property, or industry often resulting in permanent changes to human societies, ecosystems and environment.

2.3.1 Disaster definition

- *Disaster*- A serious disruption of the functioning of a society or a community involving widespread human, economic, material or environmental losses and impacts, which exceeds the ability of the affected society or community to cope using its own resources (USAID 2006).

- *Disaster risk*- the potential disaster losses, in lives, livelihoods, health status, assets and services, which could occur to a particular society or community over some specified future time period (ISDR 2009).

- *Disaster management*- is a complex series of activities that include risk assessment, preparedness to cope with future disasters and prevention measures, emergency response to a disaster, recovery and reconstruction. Community preparedness and good development can reduce the impact of a disaster especially for the most vulnerable people, such as those living in hazard-prone areas (Alexander 2000).

A disaster therefore, is a serious disruption of community involving widespread human, economic, material or environmental losses and impacts, which exceeds the ability of the affected community to cope using its own resources, and may need the intervention of foreign aid.

2.3.2 Human Reactions to Natural Disasters

Humans react in a variety of ways to natural disasters and these vary also at different stages in the natural disaster event. These reactions will also be influenced by culture. Characterization of behaviours, however, may lead to inaccurate descriptions of human reactions. There is a tendency to minimise natural hazards and deny their effects, with the aim of showing they are not as threatening as they seem. The result is a failure to recognise real problems and needs. There is also a tendency to over-dramatise natural hazards events and show that no one can do anything about them, and things will never be the same again. This approach is one which takes satisfaction in the natural disaster, and leads to failure to recognise the endurance and resilience of people and communities in the face of extreme situations. Table 5 from Montoya (2002) illustrates the positive and negative reactions of humans to natural disasters, with a focus on the time relative to event.

Stage	Time Relative to Event	Reaction	
		Positive	Negative
1	Before event	Understand warnings, preparedness	Panic, fear
2	During event	"What should we do?"	Fatalism, "Act of God"
3	1 min. to 1 day after event	Response by survivors, initial search and rescue	Looting, sight-seeing adding to traffic chaos
4	1 day to 1 week after event	Community effort, search and rescue by emergency services	Increase in price of basic food and commodities
5	1 week to 1 month after event	Provision of temporary camps, burial of dead, analysis of problems	Provision of wrong food and medicine, disposal of dead
6	1 month to 1 year after event	Clear up debris, commitment to major rehabilitation projects, international funds	Provision of unsuitable and unacceptable temporary accommodation, allocation of blame, corruption and misuse of emergency funds
7	1 to 5 years	Some mitigation work, some progress on rehabilitation	No visible evidence of damage, bureaucracy and aid fund accountability delays rehabilitation and reconstruction
8	5 to 30 years	Increased mitigation work, review preparedness and response programmes	Conflicting objectives lead to relaxation of building regulations to reduce cost of social housing, smaller event produces same effect on target city
9	Until next major event in 100, 200 or 500 years	Steady programme of mitigation work	"Not happened in my lifetime", no votes for mitigation, funding reallocated

Table 5: Human reactions to natural disasters (Montoya 2002, 2-4).

2.3.3 Natural disaster management cycle

A definition of natural disaster is to be understood as the consequences of the impact of a natural hazard on a socio-economic system with a given level of vulnerability which prevents the affected society from coping adequately with this impact (ISDR 2001). Effective disaster planning is not optional, it is critical for the success of countries. Various types of natural disaster have wreaked havoc on countries worldwide. Disaster management planning (preparedness, warning systems, resource identification, training, simulations) can improve the safety and effectiveness of a community's response in times of disaster (Jeanth 2003).

Natural disaster plans include such activities as formulating and practicing disaster plans; testing and providing training for disaster response; and communicating with the general public and others on disaster vulnerability and what to do to reduce it. In short, the disaster plan involves measures to increase response and recovery capabilities and to foresee problems and project possible solutions (David et al 2004). The Federal Emergency Management Agency (FEMA) has taken the leadership role in developing disaster management policy in the United States. In so doing, they developed a four-stage plan to disaster management (Skeet 1977, Rubin and Barbee 1985, Robert and Quarantelli 1985, Mushkatel and Weschler 1985, Zimmerman 1985, Petak 1985, Heide 1989, Burkhart 1991, Paton and Duncan 2002 Alexander 2003 and Marcia 2007). The four stages are response, mitigation, recovery and preparedness as shown in Figure (4).

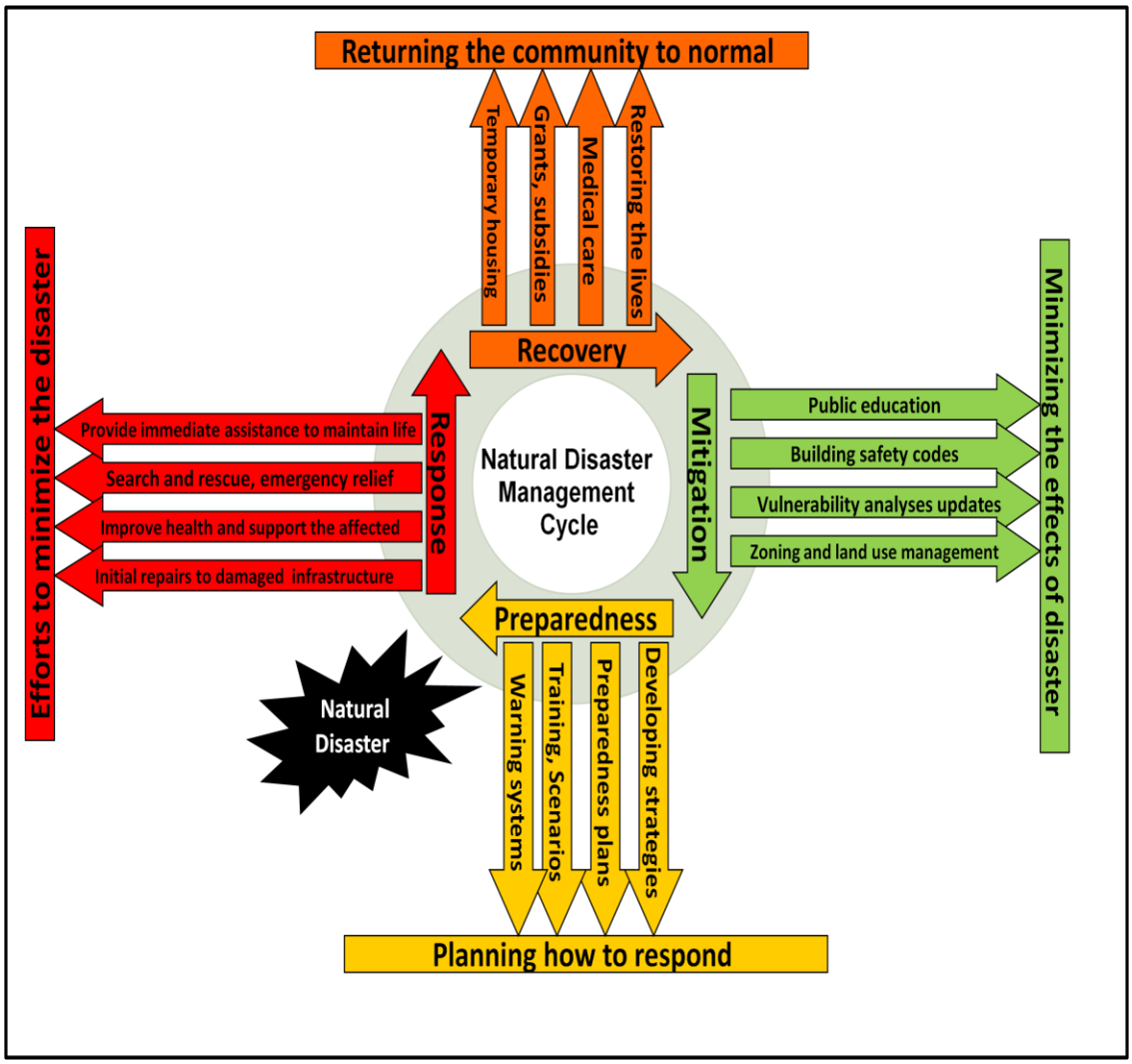

Figure 4: Natural disaster management cycle, the four stage FEMA approach to disaster management.

2.3.3.1 Response stage

During this stage a number of emergency activities are carried out, which aim to meet the immediate needs of casualties and victims and to minimize the impact. The focus in the response stage is on meeting the basic needs of the people by providing immediate assistance to maintain life, improve health and support the morale of the affected population. To implement search, rescue and emergency relief and assist refugees with transport, temporary shelter and food. It will also involve initial repairs to damaged infrastructure. Response is the provision of disaster relief and assistance when it is needed and the maintenance of safety and public order. Evacuation, the distribution of

primary necessities and the mobilization of emergency services come under this category, as shown in Figure 5.

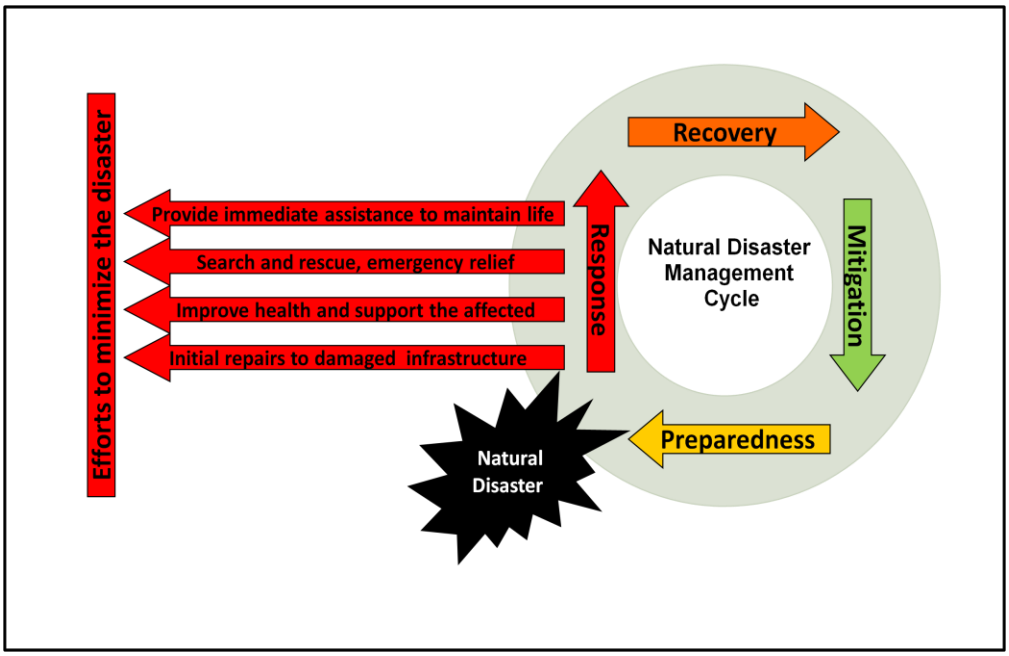

Figure 5: Natural disaster management cycle, response stage.

2.3.3.2 Recovery stage

This stage involves returning the community to normal, the activities aimed at restoring livelihoods and the infrastructure that supports them. This involves temporary housing, and provision of basic household amenities, grants and medical care. Recovery activities continue until all systems return to normal (Figure 6).

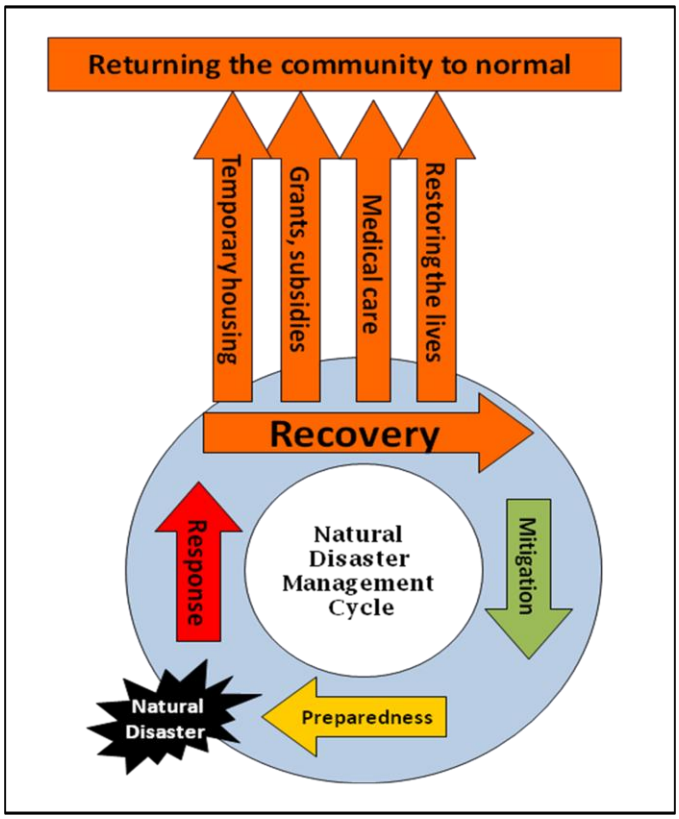

Figure 6: Natural disaster management cycle, recovery stage.

2.3.3.3 Mitigation stage

This is the planned reduction of risks to human health and safety. This may involve modifying the causes or consequences of the hazard (generally little scope with many natural hazards) and reducing the vulnerability of the population. This will include regular vulnerability analyses, building codes, building use regulations, safety codes, health infrastructure, education, hazard zonation and proper land use management. So the target of this stage is to minimize the effects of a disaster, (Figure 7).

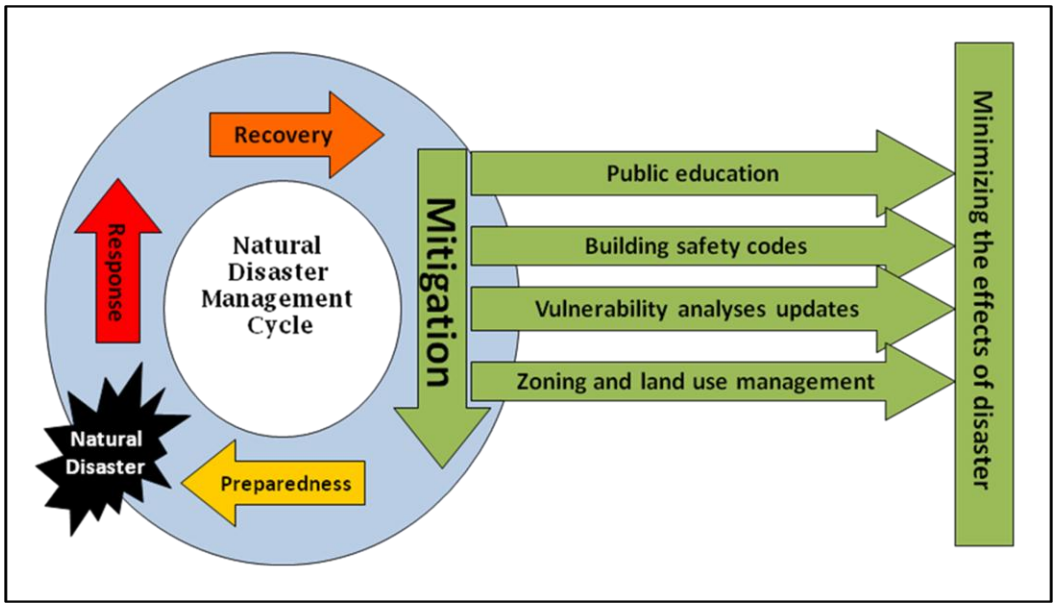

Figure 7: Natural disaster management cycle, mitigation stage.

2.3.3.4 Preparedness stage

This stage involves planning how to respond; this stage can be described as the logistical readiness to deal with disasters and can be enhanced by having effective response mechanisms and procedures. This includes rehearsals, developing long-term and short-term strategies, public education and building early warning systems, training programmes and public information services. Also ensuring strategic reserves of food, water, equipment, medicines and other essentials. Effective preparedness allows communities and institutions to provide a quick, organized response to disasters. Disaster scenarios also should be practiced regularly (Figure 8).

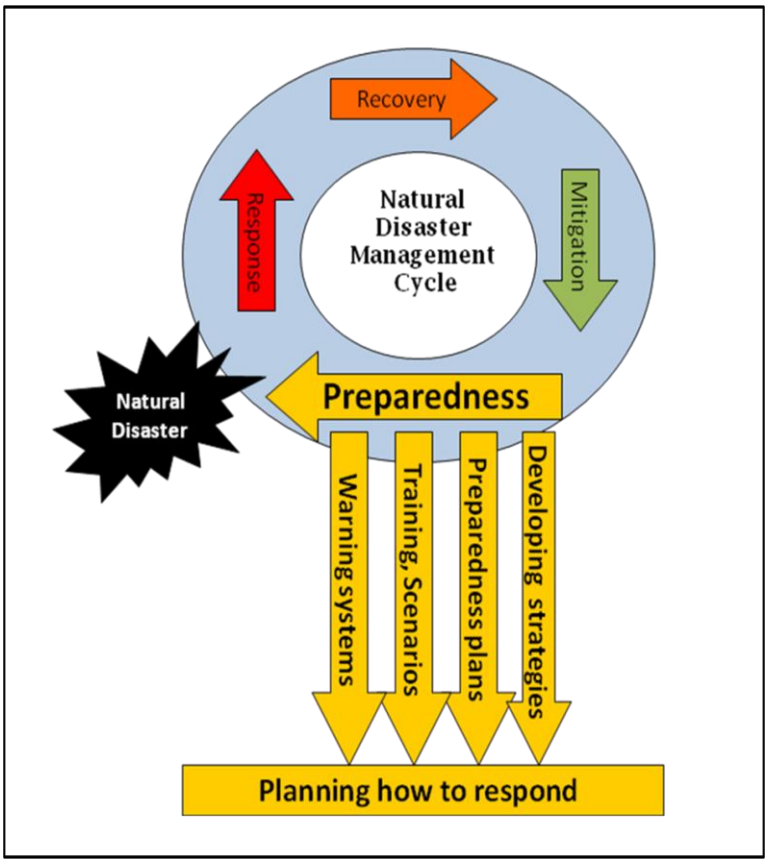

Figure 8: Natural disaster management cycle, preparedness stage.

2.4 The role of Islamic theology in understanding the natural hazards

2.4.1 Definition of Islam

Islam is an Arabic word derived from the root salama, which means to agree to something or to have peace. The verbal construct of Islam is aslama, which means to submit or surrender one's will and life to the will of God (Allah). The word Islam means submission to the will of God (Bowker 1970). The Holy Quran presents Islam not simply as a religion but as the framework within which Allah created the universe. It follows what modern science calls the laws of nature; but these laws, from an Islamic point of view, are not the laws of nature but the laws of Allah for nature. The angels are Muslim in a more active way, in that they are beings who serve Allah. They are His emissaries to

the rest of His creation (Ayoub 2001). Islam began with the beginning of the Prophet's mission, when Jibraa'eel (the Archangel Gabriel) brought down the Revelation from Allah in Makkah in the Arabian Peninsula. This occurred in the month of Ramadan, the beginning of the Prophetic mission happened around 608 or 609 CE (Hadith, by Muslim. Salmaan al Farsi). The Holy Quran is the principal source of religious thought in Islam, and its multi-dimensional meanings are the principal source of guidance on all aspects of life. It is fully and comprehensively adaptable to all matters and times (Ghafory 2009). Arabic is the language of Holy Quran, Sirah and Hadith, which formed the earliest literature of the Muslim community. The major beliefs in Islam (Pillars of Faith) are the oneness of God; He has no associate in his divinity, the Acts of God. Generally the term "Islam" in Holy Quran scholarship relates to all of the Abrahamic religions, due to their common belief in one God and the prophets.

Often communities of many religions consider that natural disasters such as earthquakes, tsunamis and storms are punishment and anger from God. This view is also prevalent in Muslim communities, because the Holy Quran said when God chooses to inflict a collective punishment on people; there is a definite purpose to be served by that punishment (Al Naggar 2006). However, some Muslim communities consider such disasters if they strike Islamic countries to be Acts of God, but if they strike non Islamic countries it is punishment. Many in Islamic countries continue to see natural disasters as random, freak events for which they are unable to plan, control or prepare. Many Islamic countries have a long history of natural disasters for example Egypt, Iran, Pakistan and Turkey.

2.4.2 Islamic theology in understanding natural hazards

It is well known when feeling ill that most of people appeal to God when coping with severe stress (Paragament and Hahn 1986; Paragament 1997). "Who say, when afflicted with disasters, To Allah we belong, and to Him is our return" (Holy Quran Baqarah 2:156). And this feeling and behaviour is also frequently observed amongst those who are faced with natural disasters. Theology and religious reactions to natural disasters are to be found within societies around the world and over the span of human history and in most

traditions of faith (Chester and Duncan 2009). For example at Pylos in ancient Greece there are indications that the god Poseidon, who was believed to be the cause of earthquakes, was worshiped as early as the Mycenaean era which lasted from ca.1,600 to ca.1,100 BCE. Also effigies found on the slopes of Popocatéptl volcano have been interpreted by Plunket and Ursula (1998) as evidence of the propitiation of divine wrath by the society which once inhabited this part of Mexico. Geomythology is defined as the study of ancient oral traditions that preserve the memories of prehistoric geological events (Harris 2000), but this requires caution because in some societies geomythology continues to co-exist alongside written records of natural disasters.

In past centuries humans were vulnerable to natural extremes and dominated by the need to survive amid the challenge of nature, which was the main goal of their entire lives. The priests told them that natural hazards were the will of the gods or by cohorts of evil spirits and they had no choice but to trust them. They were ready to appease the gods by payment of money and food if the priests assured them that such disasters will not be repeated and not happen again (Al Qamanny 1999). Most civilizations had gods that killed people who disobeyed them. Natural hazards were explained in terms of the anger of the gods. In fact, history is full of evidence that priests, religious leaders and priests took advantage of people's fears and consequently oppressed them in the name of a god (Al Shaherkane 2002).

Risk mitigation of natural hazard in developing countries in particular needs methodologies and scientific facts to be blended with religious beliefs, indigenous knowledge and historical traditions. The dissemination of this type of knowledge can clear misconceptions and increase people's understanding of and knowledge about disaster-related issues. This process is necessary for disaster impact reduction (Ghafory 2009). In analysis of natural disasters the conventional wisdom holds that disasters are features of either demoralised nature or vulnerability (Alexander 1993). The notion of the 'Act of God' has been almost completely changed. During the IDNDR, (1990-2000) a consensus emerged that, if responses to disaster are to be successfully managed, then an awareness of local culture is vitally important (Chester 2005).

As a result of superstition and misconceptions, much of the population in some countries still believes that little can be done to reduce the impact of natural hazards. So people have tended to consider natural events in terms of myth, religion and witchcraft and the work of the ghost or punishment from God. Even today in some developing countries, citizens, rulers and religious leaders try to take advantage of natural hazards in the name of religion. This unfortunate tendency is evident in some of Muslim countries such as, in Indonesia and Sri Lanka after the 2004 tsunami and in Iran and Pakistan after the earthquakes of 2003 and 2005. Many Muslim scholars and clerics said the 2004 tsunami was punishment and a warning from God regarding corruption, sin, immorality, adultery and disobedience of God (Al Naggar 2010). But such views speaking of the punishment of God neglect the scientific evidence and awareness which suggests that much of the vulnerability that led to the terrible losses of lives and property was in large part a consequence of political, social and cultural factors.

There is however, a lot of evidence in the main Islamic texts that provides more rational interpretations such as:

- In seeking guidance from the Holy Quran there are more references to God's kindness than to His wrath. Whereby all the (Sorah) and chapters in Holy Quran begin with a phrase (In the Name Of Allah the Beneficent the Merciful). It should be also noted that no statement by the (Hadith) ever mentioned that natural hazards are expressions of the wrath of God or the result of disobedience. This reflects the meaning in the context of the time of the prophets. Instead of referring to Acts of God, there are many statements in main sources of Islam referring to the need to prepare for disasters and prevent them from occurring.

- There are ninety nine names of Allah; they are mentioned in the Holy Quran. The ninety nine names of Allah known as in Arabic language (Asma Husna) such as, (Al Rahman: the merciful, Al Ahad: the one, Al Rahim: the compassionate, Al Salam: the flawless and the giver of peace, Al Barr: the source of all goodness, Al Ghaffar: the forgiver..etc), (Al Ghamdi 2005). All of these names reflect that

Allah does good, God is justice and the meaning of life and God is mercy, and God is love. So all the names of God in Holy Quran explain that he is not unjust or a killer (Ebn Al Qayyim 2005). This shows that reference to the punishment of God is not from the Holy Quran, but derives from the way that some Muslim people interpret it.

The lectures and statements (Hadith) of the Prophet Mohammad and his companions are a valuable source of information on Islamic teaching and are complementary to the Holy Quran. Some of these lectures and statements can be related to the need to do good deeds and also to issues related to preparedness for earthquakes, such as:

- God loves those who do a deed correctly, perfectly and completely (Narrated by Al Bayhaqi 4 / 334).
- People's actions that have good intentions and produce good results are a means of worshipping God. (Narrated by al Bokhary 1/1907).
- Those who cheat and violate the law and people's rights are not true Muslims. This statement should be a moral and religious incentive toward the implementation of a policy for any type of violation of codes and regulations (Narrated by Abu Naeem 4/188).

These multiple meanings of the Holy Quran and Hadith can be adapted to the principle of natural disaster impact reduction and that it can be used as a basis or incentive for enhancing risk reduction in Islamic countries. The main message of Islam to human beings is guidance, given in order for people to do good, show ability, wisdom with deeds based on knowledge and cognition.

2.4.2.1 Profile about natural disaster in Holy Quran

Holy Quran is a comprehensive and realistic school whose principal objective is to address or answer all questions regarding human needs, whether they are spiritual, sentimental, intellectual, individualistic or social and whether they pertain to this world or the future. Because it is based on a perfect conception of the universe (Al Najaar 2010).

2.4.2.1.1 Natural disasters in the story of God prophet:

2.4.2.1.1.1 Prophet Noah

The story of Prophet Noah, his experience with flood disaster is one of the best examples for teaching reported in any religion. He had forewarned his people that they would be destroyed because of their evil ways and their constant rejection of his claims. He forewarned them in the same breath that the means of their destruction would be flood, a deluge and flood whose like had never been seen before and that no one would be safe from it. This disaster is acknowledged by the world's three great religions, i.e. Judaism, Christianity and Islam (Tahir 1994). In this respect, the Qur'an says:

> "So We revealed to him, saying, Construct the Ark within Our sight and under Our guidance; then when comes Our command, and the fountains of the earth gush forth...; and address Me not in favor of the wrong-doers; for they shall be drowned" (Holy Quran Al Mumenoon 23:27).

God spoke to Noah, and commanded him to build a great ark (Ship), which would be a refuge for him, his family and many animals so that they could escape the flood. Then came the thunder lightning, and violent shaking of the earth. Heavy rains fell, causing a great flood. So everyone apart from Noah and his team died (Ebn Katheer 2008).
The lessons that should be learned from the story of Prophet Noah are:

- God instructed his prophet Noah to build the Ark in order to be safe in flood and storm. "And construct the ship under Our Eyes and with Our Inspiration and address Me not on behalf of those who did wrong; they are surely to be drowned" (Holy Quran Hud 11:37).
- Safety from natural hazards can only be achieved when one is prepared.
- God's protection of his prophets is also achieved through respecting the laws of nature, which are based on wisdom, knowledge and human ability.

2.4.2.1.1.2 Prophet Salih

Salih was sent unto the tribe of Thamud, He went to them on the back of a she-camel. The Thamud tribe began complaining that this huge she-camel drank most of the water and frightened their cattle. They laid a plot to kill the she-camel, Prophet Saleh said, this she-camel of Allah is a sign unto you so you leave her to graze in Allah's earth. But they killed the she-camel and insolently defied the commandment of their Lord. Then he warned them: Enjoy life for a few days then the punishment will descend upon you. Three days after Salih's warning, thunderbolts filled the sky, followed by severe earthquakes which destroyed the entire tribe and its homeland. The land was violently shaken (Al Qurashy 2002).

> "But they belied him and slaughtered it, so their Lord destroyed them for their sin" (Holy Quran Al Shams 91:14).

2.4.2.1.1.3 Prophet Hud

Hud was the Prophet sent to the tribe of Aad for their reformation. Aad were not ignorant of the existence of God, nor did they refuse to worship Him. What they did refuse was to worship one God alone. They worshipped other gods, including idols. God wanted to guide and discipline these people so he sent a prophet from among them. Hud hoped to instill faith in them, but they refused to accept his message. A drought spread throughout the Aad land, for the sky no longer sent its rain. The sun scorched the desert sands, looking like a disk of fire which settled on people's heads. Aad people hastened to him asking: "What is that drought Hud", Hud answered "God is angry with you. If you believe in Him, He will accept you and the rain will fall". The Aad mocked him and became more obstinate and sarcastic. The drought increased, the trees turned yellow, and plants died. The weather changed suddenly from burning dry and hot to stinging cold with wind that shook everything. It slashed the skins of the Aad. The storm raged for 8 days and 7 nights (Al Tastary 2004).

> "And as for Aad, they were destroyed by a screaming, violent wind, which Allah imposed upon them for seven nights and eight days in succession, so you would

see the people therein fallen as if they were hollow trunks of palm trees, then do you see of them any remains" (Holy Quran Al Haqqah 69:6, 7, 8).

"So the earthquake seized them, and they became within their home [corpses] fallen prone" (Holy Quran Al Araf 7:78).

2.4.2.1.1.4 Prophet Lot (Lut)

Prophet Lut sent to the city of Sodom (Sadum), which was on the western shore of the Dead Sea. This city was filled with evil, the people robbed and killed travellers. Also those men had sex with men instead of with women. God revealed to Prophet Lut that he should summon the people to give up their indecent behaviour, and they refused to listen, even when Lot warned them of Allah's punishment. The angels warned Prophet Lut to leave his house before sunrise, taking with him all his family except his wife. An earthquake rocked the Sadum. It was as if a mighty power had lifted the entire city and flung it down in one jolt (Ebn Katheer 2008).

"And we rained upon them a rain [of stones]. Then see how was the end of the criminals" (Holy Quran Al Araf 7:84).

The nature of the Sodum disaster raises considerable interest in the geological literature. The Biblical description refers to fire and sulphur raining down on Sodom and Gommorah, the city being overturned and the smoke of the land going up like smoke from furnace. This description clearly reflects a sudden event without warning. The Dead Sea Rift Valley is a seismically active region particularly along its Eastern Border Fault which runs along the east coast of the sea (Chester and Duncan 2009), and the description of the overturning of the city points to an earthquake.

2.4.2.1.1.5 Prophet Mosa

The pharaoh who ruled Egypt was a tyrant; for his faithlessness and his persecution of the children of Israel. God sent Moses and Aaron, peace be upon him, to Pharaoh and Moses spoke to him about God, His mercy and His Paradise and about the obligations of

monotheism and His worship. Pharaoh listened to Moses' speech with disdain. He thought that Moses was crazy. God punished the people of Pharaoh with years of drought, and shortness of fruits (crops, etc.). Pharaoh and his army had seen the miracle, how the sea had parted. A giant wave of water that engulfs the chariots and soldiers of Pharaoh army in the Red Sea. Holy Quran presents this natural disaster as a punishment for sinners and as a vindication for the surviving righteous minority (Decosse 2005).

> "Then we inspired to Moses, “Strike with your staff the sea, and it parted, and each portion was like a great towering mountain. And we advanced thereto the pursuers. And we saved Moses and those with him, all together. Then we drowned the others” (Holy Quran Ash Shuar 26:63, 64, 65, 66).

In short, the Holy Quran explanation of major disasters that these phenomena were either manifestations of divine power sent to punish humans or presaged the imminent end of the world.

2.4.2.1.2 The notion of the 'Act of God' and Punishment

Arabia is the great western peninsula of Asia. Its area is about three million square kilometers. The name derived from "Araba", a small district in the south east of the province of Tehama, to which Yarab, the son of Kahtan, the father of the ancient Arabs gave his name. The most famous tribes of the ancient Arabs were those of Aad and Thamoud (Al Kassab 2008). The destruction of the first two tribes by God for refusing to acknowledge the missions of his prophets to them or to obey them, is frequently referred to in the Koran as instances of God's judgment on obstinate unbelievers and a warning to the Quraishites, the tribe of Mohammad who were his most powerful and inveterate enemies. "But if they turn away, then say, "I have warned you of a thunderbolt like the thunderbolt [that struck] 'Aad and Thamud", Sorat Fussilat, 13 (Ebn Katheer 2008). The Arabs of today are descended from two tribes Adnan and Kahtan. The Arabians were for some centuries governed by descendants of Kahtan, Yarab one of his sons, founding the kingdoms of Yemen. Yarab continued to reign undisturbed over Yemen until the time of Alexander the Great (Kahalah 1968).

The first great natural disaster that befell the Arabian tribes, who settled there, was the flood of Maareb dam, which happened about 340 BC. According to the story of the flood referred to above, Abd Shams, one of the famous Kings of the tribe of Himyar having built the city of Saba and constructed a vast reservoir to store up the water of the mountain torrents for the use of the inhabitants in the years of drought. The water rose to a height of around twenty fathoms (40 m), and was kept in on every side by masonry so solid that many of the inhabitants of the region had their houses built on its walls. Each family had a certain portion of this water distributed by aqueducts. God being highly displeased at their great pride and insolence, and resolving to humble and disperse them, caused a mighty flood to break down by night and carry away the whole city (Ghalwash 2008).

The collapse of the Maareb dam in Yemen in the Peninsula's south-west corner. has been debated by scholars for years, some saying it was caused by exceptional rainfall, others believing it were caused by an earthquake and the traditional view of Arabic studies interpreting it as punishment from God. But whatever the cause, the collapse of the dam marked the end of an ancient civilization of South Arabia called Maareb (Talley 1978).

2.4.2.2 Concept of earthquakes events in Muslim communities

Earthquakes are separated from other hazards in meaning, significance, and risk perception throughout the Islamic World due to their specific focus in their own chapter or surah "al-Zalzala" (99th) in the Qur'an. Also indirectly in various verses, such as nos. 7:78, 7:91, 7:155, 7:171, 16:26, 17:37, 17:68, 29:37, 34:9, 67:16 and 69:5 As a warning of the looming Judgment Day or as divine punishment or retribution (Al Tabatabai 1985). So in the Holy Quran earthquake events are interpreted within two different yet related frameworks and are viewed either as signs of a punishment of a limited duration for a specific group of people or a future apocalypse. The concept that has been addressed in all religions and beliefs is the concept of sin. In the past in many traditional societies, natural disasters were viewed as the result of people's sins. Most Islamic scholars and clergy relate this chapter to the Day of Judgment, or the earthquake disaster that will mark the end of the world (Akasoy 2009). Examples of some notable earthquake and other disasters which affected Islamic countries follow.

2.4.2.2.1 Earthquake in the Holy Land 1546

Biblical narratives focus on the Holy Land, this region is notable for its history of natural disasters, which include droughts, floods and storms (Kempe 2003), as well as volcanic activity and earthquakes. Frequent and damaging earthquakes have occurred in the Holy Land (Chester and Duncan 2009). Most of Muslim people say that, the Holy Land and the Al Aqsa mosque is a place safe from earthquakes. But the historic great earthquake in Jerusalem (Holy land) which occurred about noon on 14 January 1546 is considered to be one of the largest shocks in the Middle East and was associated with surface faulting and great loss of life. As a result the vault of the Holy Tomb sank and the walls and tower of the Temple were damaged and parts of them collapsed (Ambraseys 2005).

2.4.2.2.2 Agadir earthquake (Morocco) 1960

Agadir, Morocco, was struck by an earthquake in 1960 leaving around 15,000 dead and 25,000 injured. After the earthquake in a survey by Thomas (2005) less-educated people in general tended to attribute the earthquake to divine action and punishment from God. All questions, however, concerning the possibility of earthquake recurrence frequency or magnitude caused an overwhelming refusal to answer, or with the reply of Allahu a'lam "Just God know" or "God is wisest"-implying or directly stating that any attempt at earthquake forecasting, earthquake-related construction, advanced architectural standards for seismic safety, and/or related education was 'haram' or prohibited by Islam (Thomas 2005). Further discussions with participants in the Agadir survey indicated that any analysis, awareness or prediction was in fact, fortune-telling and therefore an act forbidden by the Holy Quran and Hadith. The less educated were more likely to say that God protected those who were devout.

Ascribing natural disasters to 'the wrath of God' can dramatically affect how communities perceive, manage, and modify the much-needed involvement in the mitigation process or participation in decision making in disasters. In strict religious communities, culture's

role may be essential in steering responses at the individual or community level (Dake 1991).

2.4.2.2.3 Dahshour earthquake 1992 (Egypt)

Islam has experience stretching back more than a thousand years of accommodating to differing social conditions and political structure around the world and this is manifested in a great diversity of practice (Halliday 1994; Al Azmeh 1996). One example of theological accommodation may be seen following the 1992 earthquake in Dahshour (south of Cairo, Egypt). Most of the Nile Valley villagers following the 1992 earthquake explained the event with reference to Holy Quran texts. Most agreed that the earthquake was punishment for the depravity of some people in Dahshour, and after the earthquake most of people in this region tried to be more religious, and spread the veil between the young girls. Furthermore, Imam Qaradawi describes the earthquake as punishment for disobedient and corrupt behaviour, and a test from God (Farook and Mojahed 2005).

2.4.2.2.4 Bam earthquake 2003 (Iran)

The M 6.5 earthquake of 26 December 2003 in the south-eastern part of Iran devastated the city of Bam (Malkawi 2004). Losses in the Bam earthquake in Iran were widely interpreted in Islamic terms. Following the Bam earthquake, Ayatollah Ali Khamenei, the Supreme Leader of the Islamic Republic, emphasized that the disaster represented God testing the Iran population rather than punishment of individual sinners, and this changed the perceptions of many people who viewed the people killed by building collapse as victims of injustice rather than divine action and punishment from God (Farhang 2004).

2.4.2.2.5 Asia tsunami 2004

The Asian tsunami of December 26, 2004, struck several countries and over 150,000 people were killed, this has been one of the most catastrophic disasters (John 2005). The high numbers of injuries, deaths and high cost of damages, included a number of

Muslim communities. Post tsunami WebPages quickly filled with discussions of the fact that many mosques that remained intact, without damage after the tsunami and once again Muslim communities linked the earthquake to punishment see for example (http://mdarik.islamonline.net/, http://www.islammemo.cc/, http://www.daoo.org/). The Muslim community has not attributed the endurance of these mosques to local architectural styles, open designs which allow water to pass through without serious damage. It is same notion in Turkey following the earthquake in 2000, where the large Golcuk Mosque was left unscathed amidst extensive damage. The appearance of the relatively unaffected mosques across the affected region supported the notion that the site was indeed 'sacred' and the congregation "devout". On the other hand, all faiths and all authorities got involved in the relief efforts. Muslim and Catholic charities in India coordinated teams of Hindus and Catholics to search for bodies (Thomas 2005).

2.4.2.2.6 Pakistan earthquake in 2005

Recently the eminent Pakistan physicist Hoodbhoy, an academic in the USA, has discussed the earthquake that struck Pakistan in 2005 and which killed around 90,000 people. Some Mullahs encouraged their followers to sell their television sets which were thought to have provoked Allah's anger and many of the Hoodbhoy's students accepted an explanation based on divine wrath. In Pakistan itself no prominent scientist challenged the idea of divine punishment (Hoodbhoy 2007).

2.4.2.2.7 Sudan

In the Sudan and East Africa various indigenous groups continue to tell stories about the dead who reside in the underworld and are thought to be the cause of earthquakes events (Anon 2009).

2.4.2.2.8 Indonesia

In Java the residents have their own perceptions about the dangers of the volcano Mount Merapi. They believe in spirits and these provided the residents with a subjective sense of security and safety (Schlehe 1996, Dove 2008, Schlehe 2008). Until recently in Java, the population provided human sacrifice to appease Broma volcano, chickens are now substituted (Sigurdsson 1999).

2.5 Summary

Many historic natural disasters have been interpreted by their victims in this 'traditional' Islamic manner. For instance: the sixteenth century polymath, Imam and scientist Abu al-Fadl Abd al-Rahman ibn Jalal al-Din al-Suyuti, emphasized moral explanations of all manner of disasters including judgments for drinking wine, adultery and spread of immorality and sin. The 1576 Egypt earthquake was widely understood as a reproof for the popularity of coffee houses in Cairo (Akasoy 2007). The Krakatau eruption in 1883 was interpreted as punishment for sins including the acceptance of colonial rule imposed by the Dutch (Sugirtharajah 2006).

In Islamic theology, many historic natural disasters have been interpreted by their victims in the traditional Islamic manner. For example: the sixteenth century polymath, Imam Jalaluddin Al Suyuti, emphasized moral explanations of all manner of natural disasters including judgments for drinking wine and adultery (Akasoy 2007). Even today, regardless of background, people from all religious traditions fall back on trite explanations, preposterous views and preconceived schemes, in an effort to make sense out of what is simply tragic (Decosse 2005). Understanding the reasons why people suffer has exercised theologians and minds of philosophers for thousands of years, being notable features, not only of the Hebrew Bible, the Christian New Testament and Christian theology, but also the sacred texts and theologies of other major world religions. In Christianity and Judaism until recently Divine punishment is sometimes

stressed, as being the predominant feature of most disasters recorded in scripture and many that have taken place subsequently (Leibniz 1712, Chester and Duncan 2009).
For instance: in Iceland in the Middle Ages volcanic eruptions were thought to be screams of tormented souls in the fires of Hell below. Divine retribution is still an explanation used by some evangelical Christian groups, a small minority, following both the Asian tsunami disaster of 2004 and the British floods of 2007 (Chester and Duncan 2009) and the Haitian earthquake of 2010 (Mohler 2010). A reaction that was also evident following Colchester (England) in 1884 and Venice (Italy) in 1873 earthquakes. Interpretation involving divine retribution is also evident in the aftermath of the Lisbon earthquake of 1755 (Chester and Duncan 2010). The 1755 Lisbon earthquake was interpreted as a divine punishment for the sins of the Inquisition (Wesley 1755). In Jainism, Buddhism, Hinduism and Shinto there is a common belief that a person's behaviour leads irrevocably to an appropriate reward or punishment (Pilgrim 1999), and this has often encouraged fatalistic attitudes towards natural disasters. Sometimes responses to disasters are syncretic and simultaneously show elements reflecting the theologies of several world religions. Not only of Hinduism, Islam and Buddhism, but also spirit cults, spirit healing and shamanism, ancestor worship (Chester and Duncan 2008).

Academic scholarship has been highly critical of the influence of religion on the human understanding of natural disasters. Religious explanations for disasters events became less prominent and were progressively replaced by more scientific and social scientific explanations of disasters and their human impacts, particularly after the Eighteenth Century Enlightenment. The notion of the 'Act of God' was superseded by a perspective in natural disasters interpretation. This change first began in Europe and North America, later spread to other parts of the Christianized world and has more recently influenced disaster responses in parts where other religious traditions predominate (Dynes and Yutzy 1965, Steinberg 2000, Chester and Duncan 2009). The Lisbon earthquake of 1755 was the largest natural disaster to have affected Western Europe for many centuries and it is often claimed as a ‘turning point’ (Moltmann1983 p 565, Young 2000 p 687, Chester and

Duncan 2010 p 2) in the ways by which educated people viewed disasters, without ascribing the earthquake to divine retribution.

In this thesis, we discuss the issue of natural hazards in the UAE through the response capability of the UAE to the impact of natural hazards. In evaluating natural disaster risk, the social production of vulnerability needs to be considered with at least the same degree of importance that is devoted to understanding and addressing natural hazards. The natural disaster risk is directly affected by the hazard produced and the degree of vulnerability experienced by exposed persons in a particular period of time and space .During the last ten years major lessons have been learnt about how studies of natural hazard reduction should be carried out. Studies that assess natural hazards provide information on the probable location and severity of natural hazards and the likelihood of their occurring within a specific time period in a specific area. A natural hazard assessment promotes an awareness of the issue in a disaster-prone region, evaluates the threat of natural hazards, and finally, suggests ways of minimizing the impact and reducing the likelihood of natural disasters.

In the Pressure and Release model (PAR model), the basis is that a disaster is the intersection of two forces: those processes generating vulnerability on one side, and the natural hazard event on the other. It shows how natural disasters occur when natural hazards affect vulnerable people. The PAR model is based on the idea that an explanation of natural disasters requires us to trace the connections that link the impact of a hazard on people with a series of social factors and processes that generate vulnerability. Risk cannot be eliminated but can be minimised, so it has to be assessed and managed in order to reduce impact and reduce the likelihood of disaster. A methodology needs to be put in place to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend

Effective disaster planning is not optional, it is critical for the success of countries. Various types of natural disaster have wreaked havoc on countries worldwide. Disaster management planning can improve the safety and effectiveness of a community's response in times of disaster. Through focusing on the four-stage plan to disaster management, the stages are response, mitigation, recovery and preparedness.

The role of the influence of Arabic and Islamic culture on disaster preparedness in the UAE population is important. To know if the notion of the (Acts of God) and punishment, is dominant in the UAE needs to be investigated as vulnerability of communities to natural hazards is strongly influenced by cultural and societal factors. (Alexander 1993).

CHAPTER 3: THE UNITED ARAB EMIRATES AN OVERVIEW

3.1 Introduction

In this chapter, the response capability of the UAE to the impact of natural hazards is discussed. Understanding of the UAE governance structure is critical in this analysis: the seven emirates, political structure and strategy of the UAE. It is important also to consider the geography and geology of the UAE. In this chapter a brief description of the structure of the UAE, the seven emirates and political structure, with the structure of the emirates is provided.

3.2 The Seven Emirates and Political Structure

At the end of 1971, when the British announced their intention of withdrawing from the Arabian Gulf, Sheikh Zayed, governor of Abu Dhabi, and Sheikh Rashid, governor of Dubai, acted rapidly to initiate moves towards establishing closer ties between the emirates through a federation. However, initially agreement was reached between the rulers of six of the emirates without Ras al Khaimah.

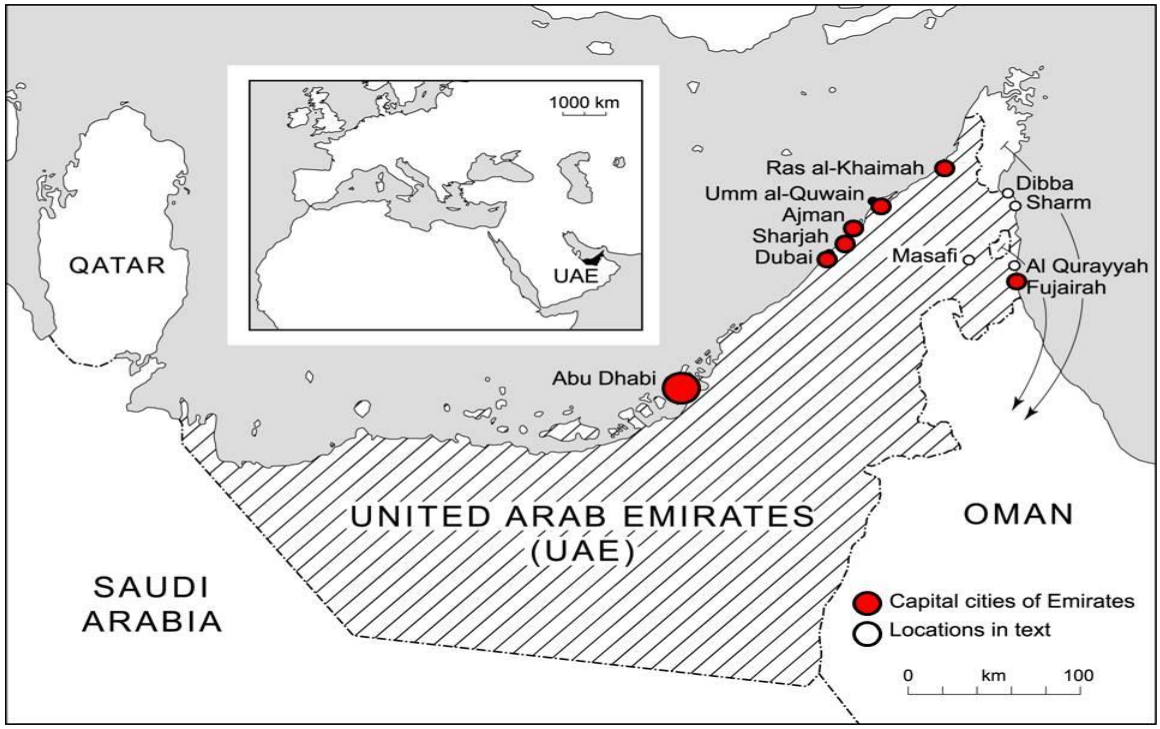

Figure 9: Location Map of the UAE.

The federation to be known as the UAE was formally established on 2 December 1971 with Sheikh Zayed as its President. The seventh emirate, Ras al Khaimah, formally acceded to the new federation on 10 February 1972. The UAE is a federation of seven emirates, Abu Dhabi, Ajman, Dubai, Fujairah, Umm al-Quwain, Ras al Khaimah, Sharjah (See Figure 9). The language is Arabic and the religion Islam. Comprising a total area of approximately 82,880 km^2 along the southeastern tip of the Arabian Peninsula, Saudi Arabia is to the south and west, Qatar lies to the west and Oman to the north and east. The total population of the UAE is 5.06 million and the majority live in three major cities: Abu Dhabi, Dubai, and Sharjah (Vine 2009), (See Table 6).

Population: 4.49 million (2007); 4.76 million (est. 2008); 5.06 million (est. 2009).
Nationals: 864,000 (est. 2007).
Non-nationals: 3.62 million (est. 2007).
Males: 3.08 million (est. 2007).
Females: 1.4 million (est. 2007).
Annual population growth rate: 6.31% (est. 2008–2009).
National population growth rate: 3.4% (est. 2008–2009).
Least populated emirate: Umm al-Quwain emirate with 52,000 inhabitants.
Most populated emirate: Abu Dhabi emirate with 1.493 million people.
Religion: Islam; practice of all religious beliefs is allowed.
Language: Arabic.
Percentage of women students at the UAE University: 75%.
Percentage of UAE women in labour force: approx. 30%.
School enrolment: 648,000 students in 1259 public and private schools. (2007/08), of which over half are female.
No. of government and private universities: approx. 60.
Illiteracy rate: 7%.

Table 6: Information on United Arab Emirates (Vine 2009).

3.2.1 The Seven Emirates

3.2.1.1 Emirate of Abu Dhabi

Abu Dhabi it is the largest emirate extending over approximately 65,000 km^2 and is the most populous (1.4 million in 2007). Abu Dhabi is bordered by Oman to the east, Saudi Arabia to the south and Dubai to the northeast. Abu Dhabi is the capital of the UAE and another major city is Al Ain in the eastern region of the emirate (Figure 10). This fertile area is rich in greenery with plenty of farms, public parks and important archaeological sites. Abu Dhabi comprises more than 80% of the area of the UAE and is dominated by desert covering as much as 70 % of its land area, including part of the Empty Quarter.

Figure 10: Emirate of Abu Dhabi, picture (a) Abu Dhabi corniche in the past and picture (b) Abu Dhabi cornish 2009 (Wedyan 2010).

The climate is hot and humid in the months of April to September, when the maximum temperatures average above 40°C. Unpredictable sandstorms occur in the emirate and sometimes visibility comes down to a few metres. Dense fog can also occur (Frederic et al 2009).

3.2.1.2 Emirate of Dubai

Dubai is the second largest emirate in the UAE after Abu Dhabi, with an area of around 3,900 km^2. It had a population of around 1.3 million in 2007. Located on the Arabian Gulf, in the northeast of the UAE, Dubai extends from the port of Jabal Ali in the west to the neighbouring emirate of Sharjah to the north-east. Dubai emirate has a multicultural society and it is a cosmopolitan city (Figure 11). It is an important tourist destination and its Jabal Ali seaport operates at the centre of the exporting trade in the Middle East. Dubai used a moderate amount of its oil reserves to generate the infrastructure for trade, tourism and manufacturing, in order to build up its economy.

The Dubai economy enjoys a competitive combination of cost, market and environmental advantages that create an ideal and attractive investment climate for local and foreign businesses. The major industries in Dubai include petroleum; manufactured goods such as liquefied gas, cement, aluminium ingots, electric cables; and traditional commodities such as dates, hides, frozen and dried fish, iron scrap and other metals. Tourism is the other sector which contributes significantly to the economy in Dubai (Dubai Statistics Center 2008). Today, Dubai is considered a regional and global centre in modern tourism. The construction industry in Dubai grew in the period 2000-2008, and during this period. Dubai was one of the fastest growing economies in the world (Balakrishnan 2008).

Figure 11: Emirate of Dubai, picture (a) Sheikh Zayed Road 1991
and picture (b) same road in 2010 (Maktoob 2010).

3.2.1.3 Emirate of Sharjah

The Emirate of Sharjah extends along approximately 16 km of the UAE's Gulf coastline and occupies more than 80 km^2 of the interior, with a population of around 0.8 million in 2007. Sharjah emirate lies directly to the east of Dubai along the Gulf coast. There are three enclaves belonging to Sharjah situated on the east coast, bordering the Gulf of Oman. These are Khor Fakkan, Kalba, and Dibba al-Husn making the total land area of the emirate around 2,600 km^2. This is equivalent to 3.3 % of the country's total area, excluding the islands. Sharjah is the third largest emirate in the United Arab Emirates and is ruled by Al Qasimi family.

The city is also notable for its numerous elegant mosques. Sharjah is also known to be the Cultural Capital of the UAE (Figure 12) and maintains the strictest decency laws. Important oases are in Sharjah, the most famous of which is Dhaid where a wide range of vegetables and fruits are cultivated on its rich and fertile soil. Sharjah city contains an impressive array of cultural and traditional projects, including several museums, reflecting Islamic design (Higgins and Rogers 1995).

Figure 12: Emirate of Sharjah, picture (a) Al Ethad Road 1985, picture (b) Same road in 2010 (Maktoob 2010)

3.2.1.4 Emirate of Ajman

Ajman emirate is situated between the Emirates of Sharjah and Umm Al-Quwain and is the smallest of the seven emirates. It is surrounded to its north, south, and east by Sharjah, and has a total area of 260 km^2, with a population of 0.2 million in 2007. Strategically located between the emirates of Sharjah and Umm al-Quwain, and close to the emirate of Dubai, Ajman has shown major industrial growth and commercial activity with a high rate of real estate investments in recent years, such as Ajman University (Figure 13). Most of the Ajman population resides in the city of Ajman. Ajman is ruled by the Al Nuaimi family (AEG2009).

Figure 13: Emirate of Ajman, Ajman University (AUST 2010)

3.2.1.5 Emirate of Umm Al Quwain

The Emirate of Umm Al Quwain is located on the Arabian Gulf coast of the UAE, between Sharjah to the southwest and Ras Al Khaimah to the northeast. It is located in the north of the UAE. The total area of the emirate is about 777 km^2, with a population of around 49,159 in 2007. This is equivalent to 1 per cent of the country's total area. Umm Al-Quwain (Figure 14) is ruled by the d Al Mualla family (Al Ogeely 2000).

Figure 14: Umm al Quwain Museum, (Maktoob 2010)

3.2.1.6 Emirate of Ras Al Khaimah

Ras Al Khaimah is on the southern part of the Arabian Gulf in the northern part of UAE bordering Oman. With a total area of 5,800 km^2 the population is around 0.2 million 2007 (Hellyer and Aspinall 2005). Ras Al Khaimah is developing its industrial sector (Figure 15). It opened the UAE's first cement company in the early 1970s and is now the federation's largest producer of cement. In the 1980s, the emirate formed Ceramics, which has become the largest ceramics producer, and Julphar, the Gulf region's first pharmaceuticals company. The first agricultural research centre in the UAE was also established here (Hurriez 2002).

Figure 15: Emirate of Ras Al Khaimah, the highest mountain peak in the Ras Al Khaimah, (Jess Mountain), in winter 2009 (Alrams 2010).

3.2.1.7 Emirate of Fujairah

The governor of Fujairah is His Highness Sheikh Hamad bin Mohammed Al Sharqi. The Emirate of Fujairah covers 1150 km^2, about 1.8% of the area of the UAE (Fujairah Yearly Statistics Book 2008) and the population is around 0.13 million in 2007. It is the only emirate that lies on the eastern side of the UAE, along the Gulf of Oman, while the other six emirates are situated along the Arabian Gulf (Figure 16).

Figure 16: Emirate of Fujairah, Bidiyah Mosque it was built at 1446, the oldest mosque in the UAE.

Life in this Emirate is quite traditional and the economy is supported by subsidies and Federal Government grants. Local industry consists of cement, stone crushing and mining. These industries have witnessed resurgence due to the increased construction activity taking place in other emirates (Personal interview Fujairah Municipality 2006).

3.2.2 The UAE Political Structure

3.2.2.1 Political Framework

The UAE enjoys a high degree of political stability and is the only state in the Arab world to have a working federal system that has stood the test of time. The President of the UAE is the ruler of Abu Dhabi and the Prime Minister and Vice President of the UAE is the ruler of Dubai. The relative political and financial influence of each emirate is reflected in the allocation of positions in the federal government. The system of governance in all the emirates is hereditary (Andrea 2007). The political influence and financial obligations of the Emirates are reflected by respective positions in the Federal government. Each Emirate still retains autonomy over its own territory. The federal system includes the executive branch, which consists of the President, Vice President, and the Federal Supreme Council, composed of the Emirates' seven rulers. After Sheikh Zayed bin Sultan Al Nahyan's death on November 2, 2004, the Federal Supreme Council elected his son, Khalifa bin Zayed Al Nahyan's, governor for Abu Dhabi and president of the UAE.

The foreign policy of the UAE is based upon a set of guiding principles which are based upon a belief in the need for justice in international dealings between states, and the necessity of adhering to the principle of non-interference in the internal affairs of others and the pursuit of peaceful resolutions of disputes, together with a support for international institutions, such as the United Nations (ECSSR 2005).

In Foreign aid, the UAE has provided around US$70 billion in grants and loans and assistance for development projects in some 100 countries (Vine 2009). The UAE has also been a major contributor of emergency relief to regions affected by natural disasters both at a governmental level and through non-governmental organizations such as the UAE Red Crescent Society.

3.2.2.2 Strategy

The most important recent development in the UAE was the formal launching in early 2007 of a UAE Government Strategy. Covering 21 individual topics, in the six sectors of social development, economic development, government sector development, justice and safety, infrastructure and rural areas development. The strategy was established in December 2007 and mirrors the aim outlined within the National Program, to maintain high standards of living, and achieve sustainable development. This Strategy is a living document, so it is flexible and adjustable if need be. This strategy covers the six major areas as follows:

3.2.2.2.1 General principles

3.2.2.2.1.1 Social Development

The major direction for public policy within this area is to improve student and school performance levels in accordance with international standards, enhance the managerial independence of schools, and increase the performance quality of public and private schools, as well as promoting student centered education processes; and also to upgrade the sector health services capabilities, and formulate a public policy that sets the priorities for health services development. In addition, quality control systems would be implemented within public hospitals, together with the developing of primary health welfare units and the training of medical professionals.

The strategy aims at developing stable policies for the optimal organization of the workforce. This should also include determining minimum standards for the work environment and accommodation, and furthermore strengthening the national identity and establishing it as one of the main components and focusing on upholding allegiance to the country and its culture. This also includes a comprehensive population policy, focusing on Emiratisation. In addition the role of the country's youth population in community development is encouraged.

3.2.2.2.1.2 Economic Development

The major direction for public policy within this area is to upgrade regulations and legislation to match current and expected economic growth and stimulate economic growth, and strengthen the competitiveness of the national economy.

3.2.2.2.1.3 Government Sector Development

The major direction for public policy within this area is focused on strategic planning activities. It also includes upgrading the civil service system, and design of an integrated performance tracking system, concentration on emphasizing the principles of competence as the main criteria for recruiting, and qualifying leadership, promotion and retention.

3.2.2.2.1.4 Justice and Safety

- Judicial System

The major direction for public policy in this sector will focus on training, increasing the rate of citizens in judicial staff, raising the standards of judicial staff, as well as implementing International Best Practices based on local conditions.

- National Emergency System

The major direction for public policy within this sector is to formulate a National Emergency System, identifying operations, roles, and responsibilities to ensure prompt response, and boost the readiness of the emergency system's supporting sectors. This will lead to developing the institutional framework; and enhance co-ordination between Federal and local respondents.

Sample of Selected Initiatives

- Establish a National Emergency System
- Identify specialities lacking in the national workforce with regards to the emergency services, and co-ordinate between institutions to train qualified nationals for this area of expertise
- Introduce the concept of volunteering to the academic curricula and prepare a database of volunteers to be called upon in case of national emergency

- Devise a comprehensive Federal Emergency Management Regulation System
- Increase co-ordination with the private sector in developing and implementing the National Emergency Systems in specific sectors as needed

The UAE has previously not had a strategy for natural disaster management. This reflects the increased level of awareness with respect to natural disasters and changing needs of a developing nation, especially the emirate of Dubai.

His Highness Sheikh Mohammed Bin Rashid Al Maktoom Deputy President of the State, Prime Minister and Governor of Dubai, recognises the need for preparing for disasters, because the welfare of its people is an important responsibility for governments in sustaining what has been achieved in construction and development. The real measure of success is not in putting in place plans and documents, but in ensuring their effective implementation. This needs to be delivered through a comprehensive emergency plan which articulates the operations, roles and responsibilities of relevant bodies in the emergency sector. This requires testing (and subsequent modification through simulated exercises supported by specific training and adequate resources).

3.2.2.2.1.5 Infrastructure

The major direction for public policy within this area is to enhance cooperation between the federal and local housing programnes and to increase the number of beneficiaries of public housing. Co-ordination of the road classification/grading criteria is required to improve safety measures. Also the National Environment Strategy will deliver coherent application of the Federal Environmental Legislation nationwide. This will lead to the development of a legal framework, boost transparency as well as building partnerships with the private sector and spread awareness.

Sample of Selected Initiatives

- Strengthen environmental monitoring systems and revise fines imposed on environmental violations.
- Promote national campaigns to advocate the conservation of natural resources and boost environmental awareness.

- Apply the necessary regulations concerning the import-export of animals, foodstuffs, plants, agricultural and veterinary quarantine, and boost co-operation with relevant local bodies.
- Create an integrated environmental database.
- Provide appropriate incentives for the private sector to encourage its contribution in the development of the country's infrastructure.

Adopting an integral water management approach, supporting the contribution of the private sector and the adoption of renewable energy initiatives will increase the efficiency of water and electricity consumption.

3.2.2.2.1.6 Rural Areas Development

A major direction for public policy within this area includes investment in human resources, providing quality basic services throughout the country, and improving living conditions in those areas.

Sample of Selected Initiatives

- Formulate respective ad hoc local committees to identify rural areas needs and facilitate implementation
- Formulate a ministerial council tasked with rural areas development, and the planning, implementation and supervision of developmental projects
- Provide funding and training programs related to the management of small and medium sized enterprises and home-based businesses for rural area inhabitants.
- Launch media campaigns and conduct workshops and awareness seminars to increase the awareness of rural areas inhabitants about the importance of self-development (UAE Strategy 2007).

3.3 The Physical Geography and Geology of the UAE

3.3.1 Physical Geography of the UAE

Geographically, the UAE is located in the Middle East region of Asia at the tip of the Arabian Peninsula. The UAE can be divided into 3 major ecological areas: coastal areas, mountainous areas, and desert areas. The climate of the UAE generally is hot and dry (Al Gaydee 2000) and the terrain consists mostly of desert, stretching from the Arabian Gulf coast south to the uninhabited sands of the Empty Quarter, and east to the gravel plains bordering the Hajar Mountains. To the east the UAE is bordered by the Gulf of Oman, an area known as the Al Batinah coast. The Al Hajar al Gharbi (Western Al Hajar) Mountains, rising in places to 2,500 meters, separate the Al Batinah coast from the rest of the UAE. From the UAE-Oman border on the Arabian Gulf coast of the Musandam Peninsula (Ras Musandam), the Al Hajar al Gharbi Mountains extend southeastward for about 150 km^2 to the southernmost UAE-Oman frontier on the Gulf of Oman. The range continues as the Al Hajar ash Sharqi (Eastern Al Hajar) Mountains for more than 500 km^2 into Oman. The country's exact size is unknown because of disputed claims to several islands in the Arabian Gulf, because of the lack of precise information on the size of many of these islands, and because most of its land boundaries especially with Saudi Arabia remain undemarcated. Along the Arabian Gulf coast there are numerous offshore islands, salt marshes, and coral reefs.

Along the Gulf of Oman, there are plains where appreciable rainfall and good groundwater resources have made agriculture possible. Interior regions of the country are characterized by vast stretches of desert interrupted by scattered oases, gravel plains, and the Hajar Mountain range. The hottest months are July and August, when average maximum temperatures reach above 48° C on the coastal plain. In the Al Hajar al Gharbi Mountains, temperatures are considerably cooler, a result of increased altitude. Average minimum temperatures in January and February are between 10° C and 14° C. The average annual rainfall in the coastal area is fewer than 120 mm, but in some mountainous areas annual rainfall often reaches 350 mm. Rain in the coastal region falls in short, torrential bursts during the summer months, sometimes resulting in floods. The

region is prone to occasional, violent dust storms, which can severely reduce visibility (Hellyer 2005).

3.3.2 Geology of the UAE

The geological structure of the UAE follows that of the Arabian Platform, a body of continental crust that has remained relatively stable since the Cambrian Period. After the end of the Cambrian Period there was the closure of the Tethys Ocean to the east. This resulted in the emplacement of an immense ophiolite complex, consisting of sea-floor rocks, which now form the Hajar Mountains, thrust on to the margin of the Arabian platform. The current height and rugged topography of the Hajar Mountains are the result of uplift that began in the Oligocene and continues to this day. The platform is dominated by siltstones, sandstones, salt basin and carbonates that characterize the region. The rocks in the Arabian Platform accumulated on a stable marine-to-fluviatile shelf. The Arabian Platform encompasses not only present day Arabia but also the shallow Arabian Gulf and the rocks of the coastal Zagros Mountains of Iran (Bou Rabee 2001). For most of its history, the Arabian Platform has been part of the larger Afro-Arabian continent, and the two have behaved as a unit in response to plate tectonic movements. The UAE has remained in tropical or subtropical latitudes. So the geologic history of the UAE has therefore been primarily a history of the advance and retreat of the sea (Abdalla 2003).

The Desert

Most of the surface of the present day UAE is a sand desert, stretching from the Arabian Gulf coast south to the unbroken and uninhabited sands of the Empty Quarter, and east to the gravel plains bordering the Hajar Mountains. Sabkha is the Arabic term for low-lying saline flats subject to periodic marine inundation. Three types are recognized, based on their environment of formation. All are found in the UAE; Coastal sabkha, Fluvio-lacustrine sabkha and Inland or interdune sabkha. All sabkhas share certain characteristics - although they are restricted to hot, arid regions, the sabkha surface is always very close to the local water table, usually within about a metre (Edgell 2006).

The Hajar Mountains

The Hajar Mountains are located along the north-eastern margin of the Arabian plate, in northern Oman (Kusky 2005). The Hajar Mountain range is a key factor in inducing a significant amount of rainfall during summer in Fujairah (Camerapix 2002). These mountains have peaks of approximately 3, 000 meters, and run parallel to the coast of Gulf of Oman. The Hajar Mountains in Fujairah consist of a distinctive complex of igneous rocks, an ophiolite suite that represents the upper mantle and oceanic crust of an ocean that once lay to the north-east. These rocks are now thrust on top of contemporaneous shallow water sedimentary rocks of the Arabian Platform (Lippard et al 1986). The Hajar mountain range that divides the UAE in two, from Ras Al Khaimah to Al Ain has kept Fujairah separated from the rest of the country. The variability of the east coast climate is partly due to the presence of the Hajar mountain range. The Hajar Mountains parallel the east coast of the UAE and continue south-eastward into Oman, along the Fujairah border. In the north, the mountainous Musandam Peninsula, most of which lies within the Musandam province of the Sultanate of Oman, is traditionally called the (Ru'us al-Jibal), (Hellyer and Aspinall 2005). It is bordered by Oman from the Western side, the Emirates of Ras Al khaimah and Emirates of Sharjah from the southern side.

The Hajar Mountains parallel the east coast of the UAE. At their highest point in the north, in the Musandam Peninsula, the Musandam Mountains form a link, both in time and space, between the late Tertiary continental collision tectonics of the Zagros Fold belt of Iran and late Cretaceous ophiolite obduction tectonics of the Oman Mountains (Searle 1988). They reach a height of 2000 meters. The mountain slopes drop directly into the sea. This area is known locally as the Ru'us Al-Jibal, literally the 'heads of the mountains.' The Ru'us Al-Jibal exposes the thick sequence of Mesozoic carbonates of the Arabian Platform which correlate with the principal oil bearing strata that lie deeply buried to the west. South of the Ru'us Al-Jibel the Hajar Mountains consist of a complex of igneous and sedimentary rocks which represent the upper mantle, oceanic crust and deep ocean sediments of the ocean that once lay to the north-east. The igneous rocks of the mantle and oceanic crust are collectively called ophiolites. The ophiolite complex of

the UAE now lies above the rocks of the Arabian Platform. The Hajar Mountains constitute one of the world's most extensive surface exposures of ophiolites (Rodgers et al 2006).

3.4 Tectonics and Seismic Monitoring

3.4.1 The Tectonics of the UAE

Tectonically, the UAE is situated in the Arabian tectonic plate, specifically in the eastern part of the plate. To the southwest and south the Arabian Plate is bounded by seafloor spreading along the Red Sea, the Arabian Sea and Gulf of Aden (Johnson 1998, Vita-Finzi 2001). The eastern part of the Arabian Plate was affected by intraplate tectonics throughout Mesozoic and Cenozoic time. The Arabian Plate is bounded along the northwestern side by the major left lateral strike-slip motion on the Dead Sea Fault (Brew et al 2001 and Al Marzooqi et al 2008), (Figure 17). Along the north-eastern margin of the Arabian plate, the plate subducts beneath the Eurasian plate, it is defined by the Makran subduction zone (Farhoudi and Karig 1977, Bayer et al. 2006). The Makran region, bounding south eastern Iran and southern Pakistan (Byrne and Sykes 1992).

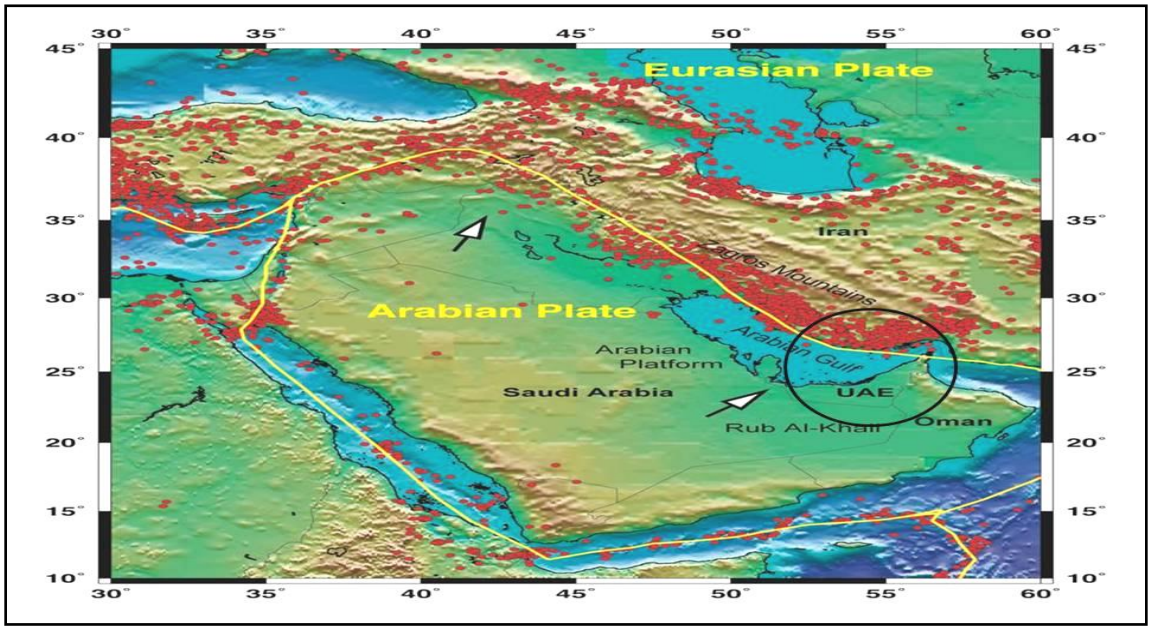

Figure 17: Earthquakes epicenters (red circles) in and around the Arabian plate, shows the seismic activity along the Zagros belt (Rodgers and Nakanishi 2005).

The interior of the Arabian plate is not known to have experienced any significant earthquakes over the past 2000 years (Reches and Schubert 1987, Vita-Finzi 2001). Earthquakes occur along the collision zone of the Arabian and Eurasian Plates that forms Zagros Mountains of Iran, one of the most seismically active regions in the world. The Zagros fold belt is a major source of earthquakes in the eastern border of the Arabian plate (McKenzie 1976). Large, greater than M 5.0, earthquakes in the Zagros are common and larger events, M 6.5, can be expected (Abdalla and Al Homoud 2004a). Figure 18 shows the Seismotectonics of UAE and its vicinity.

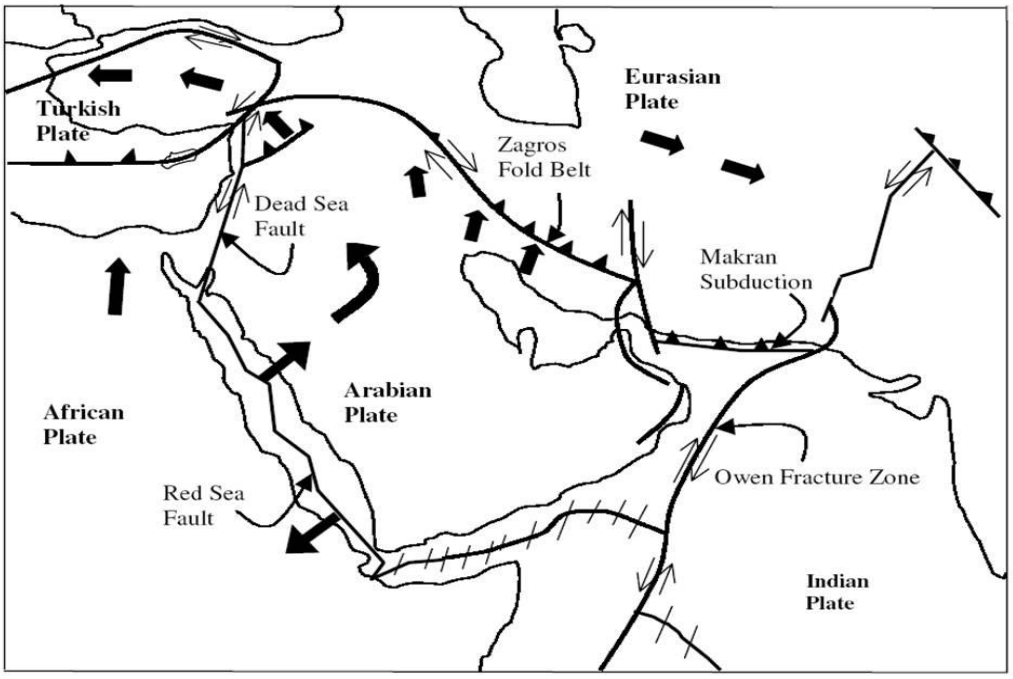

Figure 18: Tectonics of UAE and its vicinity (Abdalla and Al Homoud 2004b).

To assess earthquake hazard in the UAE it is important to first define where the UAE is located relative to tectonic plate boundaries and how these plate boundaries influence seismicity within the UAE. Clearly, these earthquakes can occur within 100 km of the UAE and pose a potential hazard to lives and property. Earthquakes do not only occur along plate boundaries, but on faults occurring within individual plates, where they are termed as intra-plate earthquakes. In the UAE there are two main faults, one of them runs along the west coast through the major cities from Abu Dhabi through Dubai and

Sharjah to Ras Al Khaimah and here there is no record of felt seismic activity in historic times. In the absence of data and information on micro earthquakes, we have to assume that these faults might be likely locations for future earthquakes. The other fault is the Dibba Fault, which links with the Zagros belt and in the last 5 years this fault has been active. Figure 19 shows the UAE faults (Johnson 1998). Most seismic activity in this belt takes place in the coastal part of the Arabian Plate that underlies the Zagros belt. This highly active seismic region forms the boundary between the Arabian tectonic plate and Eurasian tectonic plate. The Zagros belt extends for a distance of over 1500 km in the NW-SE direction along the western part of Iran passing from Turkey in the north along the northeastern part of Iraq to Iran in the south (Barazangi 1983). The UAE experienced damaging earthquakes near Masafi in early 2002. The largest event in this series was M 5.1 that occurred on March 11, 2002 and was detected and located by global seismic networks, such as the USGS, National Earthquake Information Center (NEIC) and the International Seismological Centre (ISC).

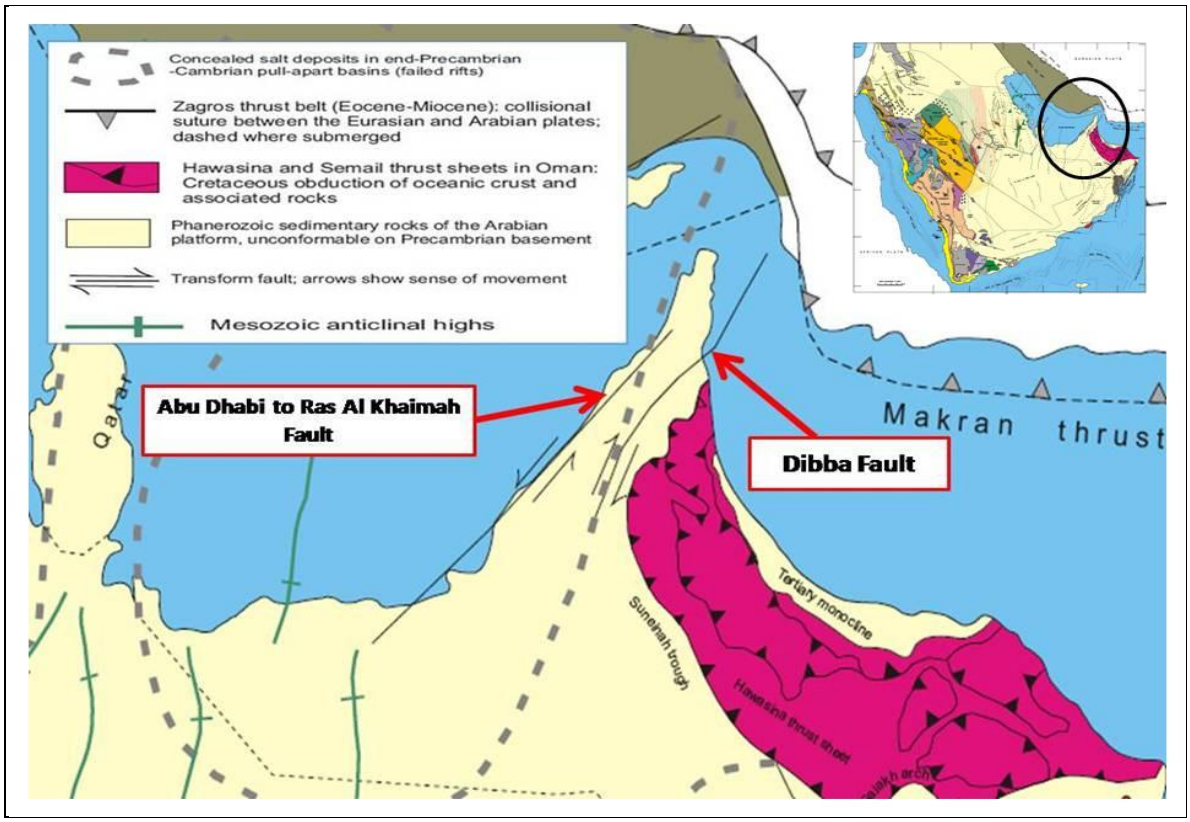

Figure 19: Tectonic map of the UAE and adjacent areas (Johnson 1998).

Date	Location of epicentre	Magnitude
25 December 1975	Fujairah Emirate	5.2
20 April 1977	Fujairah Emirate	5.1
6 February 1980	Fujairah Emirate	5.0
25 March 1986	Fujairah Emirate	5.4
6 August 1994	Fujairah Emirate	5.3
14 October 1995	Fujairah Emirate	4.8
15 January 1998	Fujairah Emirate	4.6
12 December 2000	Fujairah Emirate	4.7
11 March 2002 (Masafi)	Masafi, (Fujairah)	5.1
1 January 2003 (Masafi)	Masafi, Dibba (Fujairah)	4.6
5 October 2004 (Fujairah)	Masafi, Dibba (Fujairah)	4.8
13 September 2007 (Masafi)	Fujairah City, Masafi and Dibba, (Fujairah)	4.3
31 March 2009 (Fujairah)	Masafi (Fujairah)	4.8
7 May 2009 (Fujairah)	Masafi, Dibba (Fujairah)	4.5
10 May 2009 (Fujairah)	Masafi, Dibba (Fujairah)	4.8

Table 7: Magnitude of earthquakes in the UAE

1975 – 2009

Most recent earthquakes have occurred in the Emirate of Fujairah and have been large enough to be felt by the population (Table 7).

An analysis of seismic zoning of the UAE was undertaken by Abdalla and Al Homoud (2004a). This zonation is based on likely impact using the Uniform Building Code UBC97 (UBC97) code (Abdalla and Al Homoud 2004a). The zones range from zone 0 where no seismic design is required up to zone 3 in this region. The map used from UBC97 defines the value of Z for USA through zonation maps and for locations outside the USA values are listed for cities throughout the world. The zonation map in Figure 20 shows that the seismic hazard along the southern edge of the Arabian Gulf is generally low. It is also noteworthy that the capital of Oman (Mascat) is classified as Zone 2A in UBC97, suggesting slightly higher hazard. The higher hazard classification in Oman may reflect the influence of large but relatively distant earthquakes in the Makran zone in southern Iran rather than significant local earthquake activity. The UAE is close to Oman and Iran so it is in a seismic threat area. In the analysis performed Abdalla and Al Homoud (2004a) the Northern Emirates are in Zone 2A, the middle part is in Zone 1 and southern part of UAE is Zone O, as (Seen in Figure 20).

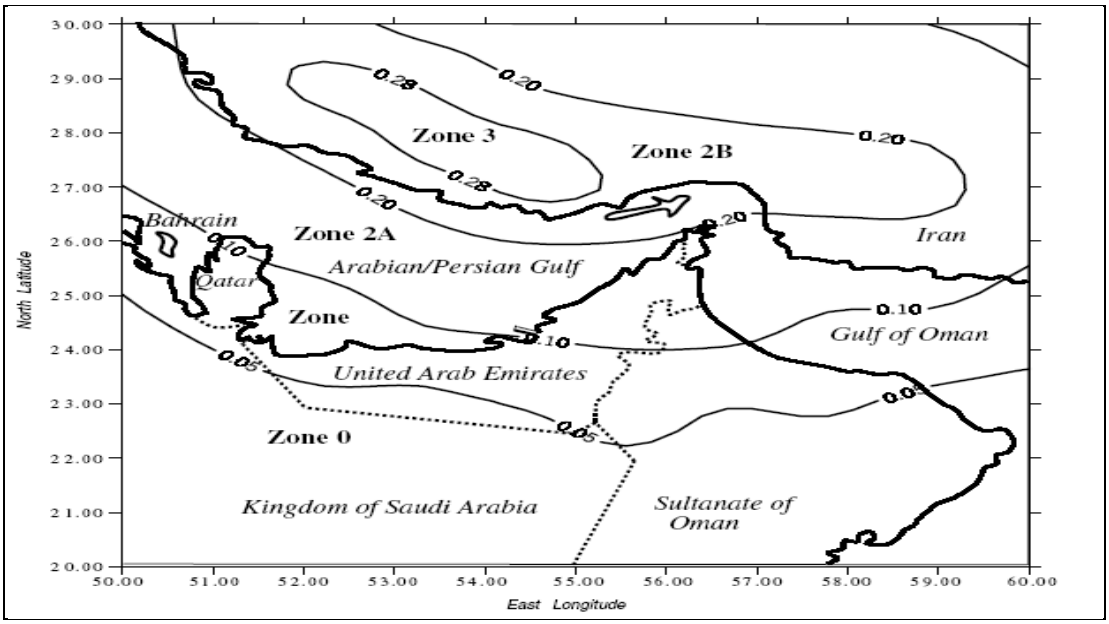

Figure 20: Seismic zoning map of UAE and its vicinity for 475 years return period Showing - zones 0, 1, 2A, 2B and 3(from Abdalla and Al Homoud 2004a).

Although the results of the seismic hazard assessment indicate that the most of the UAE has low seismic hazard levels, higher seismic activity is identified in the north part of

UAE particularly in Fujairah. So the northern Emirates are the most seismically active part of UAE. This level of seismic hazard can cause structural damage to key structures and lifeline systems. Therefore, it is advisable that earthquake effects should be taken into consideration when designing major structures in these regions. Also, there is no earthquake resistant design code developed or adopted for the UAE (Abdalla and Al Homoud 2004a).

Another study (Wyss and Al Homoud 2004), was based on estimating the probable consequences of larger earthquakes in the UAE, so that preparations can be made for a possible large earthquake. The approach is to estimate the number of injuries and deaths. The size and location of scenario earthquakes is highly uncertain in the UAE because very little information is available due to the lack of a local seismograph network. So the method for that study is to select several likely positions for epicentres, near and far from major cities, and to calculate the effects for a range of plausible magnitudes. This gives a picture of the range of scenarios for possible earthquakes. In estimating parameters for scenario earthquakes in southern Iran, they follow Tavakoli et al (1999). Their source zones 1, 11, 12 and 13 are closest to the region of the UAE. In that study they accepted their estimate for the maximum magnitudes of earthquake hazard to be expected and assumed an epicenter located on mapped faults within these source zones and positioned closest to the UAE. The epicenter and magnitudes they used are listed in Table 8.

Source Zone	Latitude	Longitude	Magnitude
1	25.7	58.0	8.1
11	27.7	56.4	7.6
12	27.0	56.0	7.2
13	26.6	55.5	7.0

Table 8: Parameters of scenario earthquakes in Southern Iran

(Tavakoli et al 999)

In all cases, the hypocentral depth is selected by Wyss and Al Homoud (2004) to be 20 km. Because of the considerable distance, changing the depths does not greatly influence the effects in the UAE. The time factor is important in disasters, so the occurrence time of earthquakes is an important factor to estimate the death toll. Therefore, the occurrence time contributes to the uncertainty of the toll results. In that study, the effects in scenarios are calculated for a time of 3 AM, because this is the worst case, and because most people are indoors. At the most favourable time, when many people are out of doors, the number of injuries is estimated to be lower by 20%. To focus on the area of active fault, that scenario assumes that the Dibba fault may be active. If an epicentral earthquake is assumed 40-50 km from the city of Dibba, the results would be approximately those already given in Table 8. Because the Dibba fault runs through the Dibba city, any distance to the city is possible.

For an example of an earthquake close to a major city in western UAE and in Oman, Wyss and Al Homoud (2004) selected arbitrarily an epicentral distance of 10 km to Dibba. At this proximity, more than 200 casualties would be expected, with more than half the buildings damaged slightly, and with an economic loss of 5% of the building value, even for an earthquake with the moderate M 5.5. With increasing magnitude the disaster is estimated to be stronger, reaching proportions that would be very serious for Dibba city at earthquake M 6. The result of this study confirmed that the UAE are not as safe from earthquake disasters as often assumed, by demonstrating that sizable earthquakes can occur in the UAE. This leads to the conclusion that M 6.5 earthquake cannot be excluded for the UAE, although the probability of such an event is low. The seismic risk in the UAE should not be ignored (See Table 9).

Forecast:					
Magnitude	Deaths	Injuries	Damaged bldgs %(Dibba)	Damaged bldgs (0-5) (Dibba)	Economic loss % (Dibba)
5.5	17-50	60-300	48	0.7	5
6.0	280-700	680-2500	86	1.9	23
6.2	770-1790	1620-5040	94	2.4	37
6.5	2510-5280	5380-11140	99	3.4	62

Table 9: Expected losses from the seismic scenario at Dibba (Wyss and Al Homoud 2004).

For M 6 earthquake, at 10 km epicentral distance, the approximate 23% economic loss to building value would amount to around $100 million. The number of deaths would be very large and the number of injured could probably not be handled by the hospitals in the UAE, if the magnitude exceeded M 6, because it is will exceed the capacity of hospitals. The same fate could be expected with equal probability for the city of Fujairah. For a Fujairah city scenario with epicentral distance and magnitude similar to those in the Dibba scenario then the losses would be larger by the ratio of numbers of buildings and inhabitants and more than 1000 deaths must be expected in Fujairah city (Wyss and Al Homoud 2004).

No studies are currently being undertaken regarding other natural hazards in the UAE (floods, landslide, and storms). Furthermore there is no evaluation study of the UAE government bodies which is relevant. Evaluation of the federal and local bodies in the UAE with regard to the preparation for the impact of natural hazards is very important. An important objective is to assess where government programmes to respond to natural hazards are strong, and where they are weak, so that changes can be made in the next planning stage to achieve better results. Also it is an important factor in ensuring continuous improvement. Effective evaluation outputs are helpful in identifying areas of strength and deficit, and actions can be taken to strengthen weakness, particularly for the Civil Defence because it has the lead role in natural disaster management.

3.4.2 The Seismic Monitoring in the UAE

The seismic activity in the UAE is recorded from global seismic networks because there is no established local seismic network. The global networks do not have the sensitivity to record smaller seismic events and the necessary accuracy to precisely locate the events. A seismic monitoring centre is important for the UAE because this Observatory can provide the government with the necessary information for monitoring earthquakes and providing technical input on seismic hazards. Furthermore, such an observatory can provide the government and public with earthquake alerts and educational materials to promote earthquake awareness. The locations of smaller earthquakes which can only be detected instrumentally indicate which faults are active. In order to obtain an accurate and comprehensive evaluation of seismic activity in the UAE, a network of seismic stations is needed. Several smaller events were felt during the years before and after the main Masafi event in March 2002 (Arthur et al 2006).

In October 2004, another earthquake struck near Dibba. Only relatively large earthquakes can be located and detected by seismic stations at distances greater than several hundred kilometres from the event, because seismic energy rapidly weakens with distance from the focus (Rodgers and Nakanishi 2005). So at the present time the assessment of seismic hazard in the UAE is based on the Global Seismic Hazard Assessment Program (GSHAP) which is endorsed as a demonstration program within the framework of the UNISDR. Given the limited knowledge of earthquakes in the UAE, it is necessary to build a national seismic network and lay the foundation for earthquake research and monitoring in the country. A seismic network is essential to locate earthquakes, determine event magnitudes, identify active faults and measure ground motions from earthquakes. Such a network can provide the data necessary for a reliable seismic hazard assessment in the UAE. In January 2001, the first earthquake monitoring centres in the UAE, the first phase of a network of seven earthquake monitoring stations, was set up at the American University of Sharjah (AUS) (Othman et al 2002).

The AUS Earthquake Observatory uses state-of-the art equipment and software to record and analyze the earthquake activity in the region. Dynamic axial loading as well as lateral

confining pressure can be applied simultaneously or in combination, based on the test requirements, with fully control/monitor overload, confining pressure, pore pressure, back pressure, volume change and more. In addition, this lab is equipped with various types of subsurface exploration equipment and a drilling machine. Major Equipments and Instruments, Earthquake Accelerometers, Seismic Sensor and Strong Motion Recorder (Figure 21 a) , Earthscope (Figure 21 b), GSR-24 Seismic Recorder / GSD-24 Seismic Digitiser (Figure 21 c) Broadband Seismometer and picture (Figure 21 d) Sub-surface Exploration Equipment (Figure 21 e) and Total Earth Load Cells (Figure 21 f). Unfortunately these monitoring stations are just for educational purposes in the civil engineering department and not for seismic research and monitoring, so it is not connected with global seismic centres.

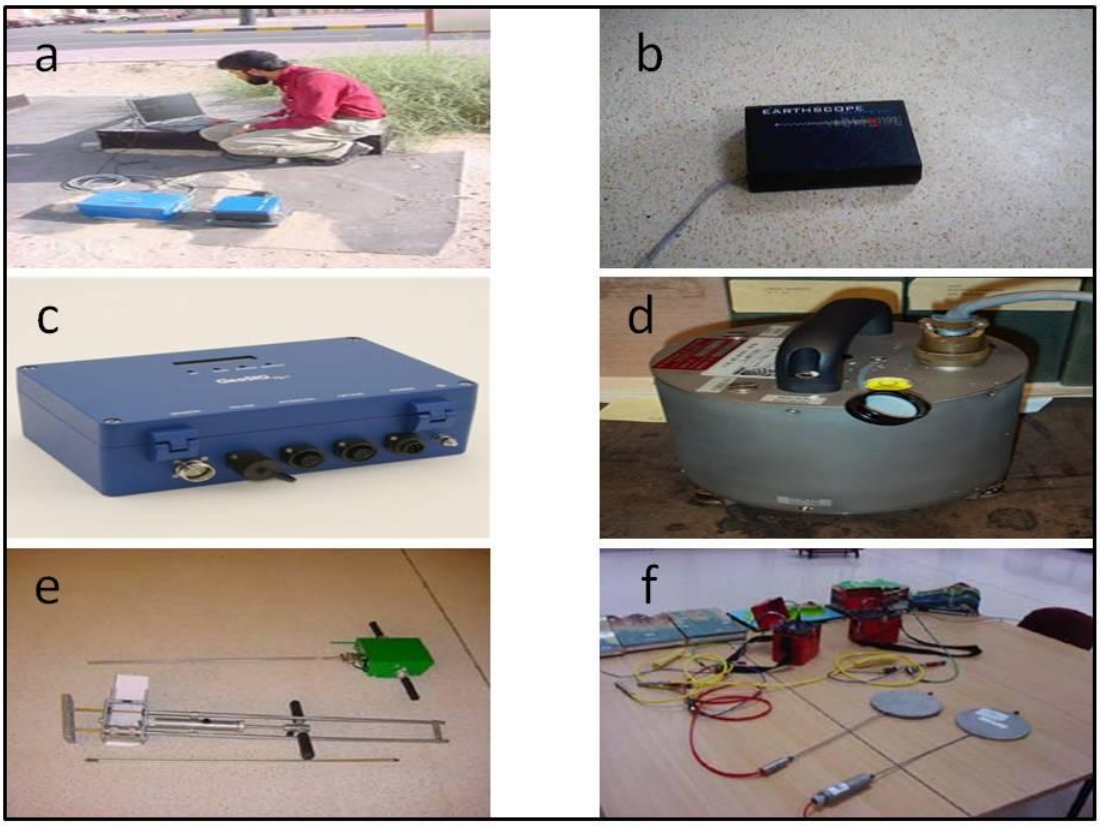

Figure 21: Monitoring of earthquake record in the UAS (AUS 2008).

There is a scientific partnership between the geology department of UAE University in Al Ain, the US Department of Energy, and the University of California (Lawrence

Livermore National Laboratory). This partnership set up monitoring equeipment in May 2003 to record seismic ground motion. They installed seismic monitoring stations near Al Ain and Al Hail in a cooperative project with Emirates University. This equipment records minor ground motions, including small earthquakes and explosions in the UAE and large, distant earthquakes but it has not been continued. The only way to have reliable knowledge of all seismic activity in the UAE is to deploy a permanent network of seismic stations that can continuously measure ground motions, including motions from very small earthquakes. Monitoring small earthquakes is essential in order to obtain an accurate and comprehensive evaluation of seismic activity in the UAE.

Dubai Municipality has set up the first Earthquake Warning System in the UAE. The system has been developed in line with the recent techniques being adopted to monitor seismic activity. The tremor warning system consists of four large-scale field monitoring stations. Each station contains apparatus for recording vibrations and movements of earth. The municipality had set up these tremor monitoring stations in Hatta, Nazwa, Al Faqa and Al Ashosh in Dubai (Dubai Municipality personal interview 2008). Dubai Municipality and Oman seismic centre local seismic networks are exchanging real-time data which improves the detections and accuracy of earthquake locations in the UAE. The observed seismic activity by these two networks from June 2006 to February, 2008 indicates a clustering of seismic activity in the northern part of UAE between Dibba and Masafi.

The National Centre for Seismic Monitoring and Meteorology, a Federal body has been created and equipped and will integrate with the other seismic and metrological stations across the country providing for their management, maintenance and development. It will create an integrated system for seismic monitoring. The national centre will be the authority to represent the country on seismic information on the regional and world levels. The new centre is affiliated to the Ministry of Presidential Affairs and it is established in coordination with the concerned authorities. It is networked with similar centres in the region for sharing of information and intervention at times of need.

It also provides meteorologied monitoring with advice and warning on storms. For example when the cyclone Phet hit Fujairah on June 4 2010, caused floods, losses and landslides in parts of Khalba. The National Centre for Seismic Monitoring and Meteorology reported that Tropical Cyclone Phet had maximum sustained winds of 105 knots (195 kilometers per hour) and gusts up to 130 knots (240 kilometers per hour). The storm was located roughly 220 nautical miles (410 kilometers) south-southeast of Masqat (Muscat), Oman and Fujairah in the UAE and some parts in Sharjah (NCSMM 2010).

3.5 Summary

The geological structure of the UAE follows that of the Arabian Platform. The Arabian Platform encompasses not only present day Arabia but also the shallow Arabian Gulf and the rocks of the coastal Zagros Mountains of Iran. Tectonically, the UAE is situated in the Arabian tectonic plate, specifically in the eastern part of the plate where earthquakes occur along the collision zone of the Arabian and Eurasian Plates. The Zagros Mountains of Iran are one of the most seismically active regions in the world. The Dibba Fault in Fujairah, which links with the Zagros belt and in the last 5 years this fault has been active. The UAE experienced the damaging Masafi earthquake in early 2002. The largest event in this series was M 5.1 that occurred on March 11, 2002 and was detected and located by global seismic networks. The Civil Defence is the most important body in managing the impact of natural hazards, and it is the lead body in disaster management in the UAE in accordance with the Federal Plan to face disasters.

The plan has been prepared by the Civil Defence, so it is important to understand its role in the government structure in the UAE. The Civil Defence is part of the Ministry of Interior, a brief description of the UAE government structure, the Federal plan to face disasters and the organization of the Civil Defence is provided in the next chapter. This sets out the structure, responsibilities and procedures for Civil Defence in the UAE.

CHAPTER 4: GOVERNMENT STRUCTURE IN UAE AND ORGANISATION OF CIVIL DEFENCE

4.1 Introduction

The Civil Defence is the most important body in managing the impact of natural hazards, so understanding its role in the government structure in the UAE is important. The Civil Defence is part of the Ministry of Interior (MOI), but it is necessary to understand its relationship with other government and non government bodies. In this chapter a brief description of the UAE government structure, the Federal Plan to face disasters and the organization of the Civil Defence is provided. This sets out the structure, responsibilities and procedures for Civil Defence in the UAE and the relationships with the individual emirates. This is followed by a survey of how the Civil Defence is operationalised and the extent to which it meets the requirements as set out in the Federal Plan. An evaluation of the current preparedness of the Civil Defence to fulfill its role in responding to natural disasters is provided. This is based on a survey which was carried out through interviews with selected officials in the Ministry of Interior, the Civil Defence, the directors of Civil Defence in the seven emirates, and relevant departmental managers. The chapter ends with a discussion of the findings of the survey highlighting areas in need of attention.

This survey regarding natural disasters preparedness is the first survey conducted in the UAE Civil Defence. Therefore the results of this survey are valuable for natural disaster preparations and disaster management in the UAE.

4.2 Government Structure in the UAE

The federal system of the UAE includes the executive branch, which consists of the President, Vice President, and the Federal Supreme Council, composed of the Emirates' seven rulers. The system of governance in all the emirates is hereditary (Andrea 2007). The political influences and financial obligations of the emirates are reflected by their respective representation in positions of the Federal government. A basic concept in the UAE development as a federal system is that a significant percentage of each emirate's revenues proportionate to its wealth is devoted to the UAE central budget.

Abu Dhabi and Dubai as the most prosperous emirates are the largest contributors to the budget of the Federal Government. Each emirate in the UAE retains autonomy over its own territory exercised by a governor. The prosperity of each emirate plays a significant role in the development and progress of the emirate and the ability to support, its local institutions from its own budget. Prosperous emirates are less reliant on Federal support, whereas emirates such as Fujairah are heavily dependent on federal assistance. It is important, therefore, to have a clear understanding of the relationship between regional (emirate) and government structures in the UAE.

The Federal Supreme Council is the highest constitutional authority and consists of governors of the seven emirates constituting the federation, and it is the highest legislative and executive authority. It is also the council that draws up the general policies and approves the various federal legislations; each Emirate has one single vote in the council resolutions and deliberations.

Responsibilities of Federal Supreme Council

The Federal Supreme Council performs the responsibilities outlined below:

1. Formulating the general policy on all matters invested in the federation under the constitution.
2. Endorsing the various federal laws prior to their issuance including laws of the annual general budget of the federation.
3. Sanctioning the decrees on matters that by virtue of the provisions of the constitution are subject to the ratification and approval of the Federal Supreme Council.
4. Ratification of treaties and international agreements. Such ratification is accomplished by decree.

5. Approving the appointment of the prime minister of the federation, accepting his resignation, and requesting him to resign upon the suggestion of the President of the Federation.
6. Approving the appointment of the president and the judges of the Supreme Federal Court, accepting their resignations, and dismissing them in the cases specified by the constitution.
7. Supreme control over the affairs of the federation in general.
8. Any other relevant responsibilities stipulated in the constitution or in the federal laws.

4.2.1 Federal Government

The Federal Government is the executive authority for the federation. Under the supreme control of the president of country and supreme council, it manages all internal and foreign affairs of the federation under its constitution and federal laws through the ministries (See Figure 22).

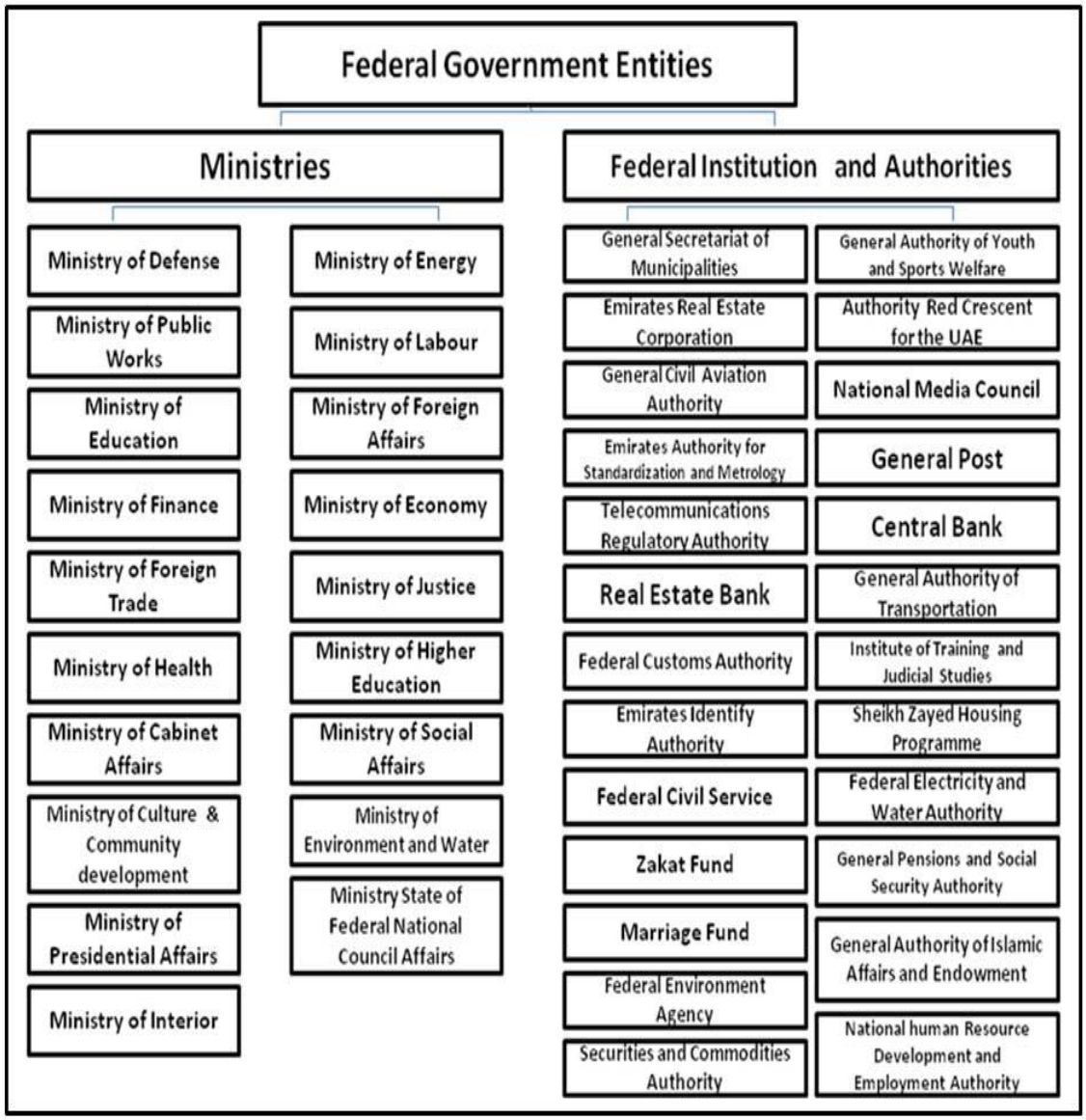

Figure 22: The Federal Government

4.2.2 Relationships with Emirate administrations

The UAE's political system, a unique combination of the traditional and the modern, has underpinned political stability, enabling the country to develop a modern administrative structure while, at the same time, ensuring that the best of the traditions of the past are maintained. Traditional and modern forms of government coexist in the UAE, both at the federal and emirate level. The political system in the United Arab Emirates is often described as direct democracy without suffrage. The rulers derive their power and

legitimacy from their dynasties and their positions in their respective tribes. But, in accordance with tradition, in order to maintain their authority, they need to retain the loyalty and support of their people. This was done by a strong adherence to the principle that the people should have free access to their ruler and that he should hold frequent and open Majlis (Court), or informal assembly, in which his fellow tribesmen could voice their opinions. This tradition continues today. Particularly in smaller emirates citizens and tribesmen prefer to wait for their ruler to hold an open Majlis to discuss their grievances. At a federal level, all ministries have a centre (department) in each emirate. The selection of the director of each department is based on the consent of the emirate's ruler. Each Emirate also has the right to build a department that is similar to that of the department of federal ministry. For example, the Fujairah Nature Authority undertakes work that is similar to that of the Centre of the Ministry of Environment of Fujairah. Each emirate retains autonomy over their own territory exercised by a governor.

A key focus of the strategy of the UAE 2007 is the maintaining of continuous cooperation between federal and local authorities, through, creating synergy between the federal and local governments. Enhancing the spirit of teamwork among government departments is critical in improving government performance and improving the quality of services delivered to residents of the emirate. According to the Constitution, emirates have full authority over their territories, i.e. maintaining law and order, provision of public services, development of social and economic standards within the emirate, enforcement of local ordinances.

4.3 Ministry of Interior and the Civil Defence

4.3.1 Ministry of Interior

In the UAE, responsibility for the security of the population rests with the Ministry of Interior as defined by the Council of the Ministers (No, 3 1991), with the aim to create a more secure society, and reduce vulnerability through establishing effective systems and procedures. The Ministry of Interior has developed an infrastructure across the country. It has identified the principles of safety and security for the population of the UAE with the

support and leadership of His Highness General Sheikh Saif Bin Zayed Al Nahyan, the Vice-President of Council of Ministers and Minister of Interior. The Ministry of Interior oversees, the General Headquarters of Police and Headquarters of Civil Defence in each of the seven emirates. The Ministry plays the main role in the field of readiness for confronting crises and disasters.

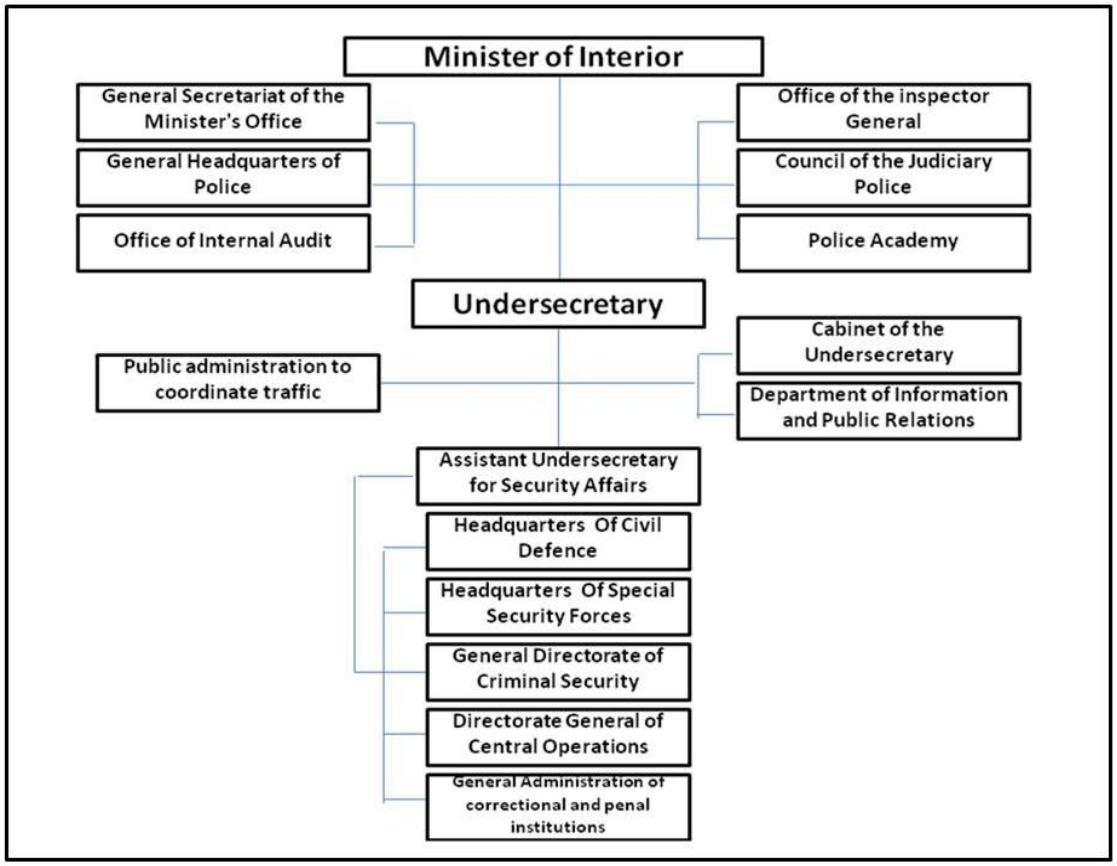

Figure 23: Organisational Structure of the Ministry of Interior

The Ministry of the Interior is responsible for disaster management in the country through the Civil Defence as stated in the Federal Plan for Disaster, the Civil Defence is an integral part of the Ministry of the Interior, and is under the responsibility of the ministry (See Figure 23, 24).

4.3.2 Federal Plan to face disasters

The UAE faces natural hazards such as landslides, earthquakes, tropical storms while not all natural hazards can be predicted and prevented, a state of preparedness and ability to

respond quickly to a natural disaster can considerably mitigate human casualties and damage to property and infrastructure. So it is important to have a plan of action for dealing with contingencies that arise in the wake of natural disasters and ensure this is periodically updated. So the Civil Defence in the UAE formulated the Federal Plan to face disasters.

The general policy to handle natural disasters in the UAE is manifested in the Civil Defence strategy through, bolstering cooperation and coordination efforts between the Civil Defence Department and the various competent government and non-government ministries, organs and authorities, and defines the duties that must be carried out by each body with respect to preventing and handling public disasters. The Federal Plan to face disasters is a direct application of this requirement, because it sets out the joint "coordination and cooperation mechanisms" between the competent bodies to control the exacerbating events and organize how they can be dealt with and minimize consequences.

Definition of Public Disasters

Federal Law No (3) of 1979 and the amendments thereof concerning Civil Defence defined the phrase "Public Disasters" as "any fire, flood, collapse, earthquake, storm, force majeure, or any sudden occurrence that may threaten lives, public or private properties."

Scope of Application

The scope of plan application includes "the occurrence or potential occurrence of a public disaster." This also includes the state of emergency that exists before the occurrence of a potential disaster that can be predicted to enable the official bodies to take the measures to raise the proper state of readiness to encounter such disaster in light of the available information.

Potential natural disasters

Fires, Floods, Earthquakes, Storms (tropical storms and cyclones) and Landslides.

Purpose of the plan

To coordinate efforts between competent bodies nationwide and organize their instant interventions to respond to a natural disaster that has actually happened or may potentially occur.

This objective shall be achieved by:

- Organising the relations between the competent authorities and Civil Defence, and to define their roles and duties in accordance with various legislations, and in compliance with the nature of their activities.
- Defining the executive measures and set the priorities in relation to face the natural disasters, eliminating their consequences and ensure the return of normality to the affected area with the knowledge of the competent bodies and relevant organisations in coordination with Civil Defence.

Mission

The Civil Defence shall take the necessary measures to protect people, as well as public and private properties, maintain the safety of transportation and communication, undertake regular work to ensure sustainability of public facilities during an emergency, protect public and private buildings, installations, organizations as well as national wealth resources, and take preventive measures and necessary actions to counter risks and contain them or alleviate and ultimately eliminate their effects. Full text of the Federal Plan is provided in Appendix A.

4.3.3 The Civil Defence Organisation

The concept of civil defence was in response to the need to protect communities exposed to the impact of total war that emerged during the Second World War. From that time on civil defence bodies were established to meet the needs of the communities in the face of disasters of all kinds. The importance of the civil defence lies in its purpose to maintain the safety of the population and protecting people and public and private properties. The onset of bombing of cities in the major conflicts of the 20th century led to the introduction of more formalised civil defence bodies (fire fighting and ambulances) involving both retained and volunteer staff (FEMA 2008). International agreements,

which aimed at protecting civilians, emerged from the beginning of the 20th century such as the Hague Fourth Agreement in 1907 as part of the Hague Conference of 1907. It involved established Laws and Customs of War on Land. The purpose was to preserve peace and prevent armed conflicts between nations, the wording of which has been inspired by the desire to diminish the evils of war.

The Geneva Agreement was signed in 1949 and its appendixes, for the Relief of the Wounded and Sick in Armies in the Field of 27 July 1929. In addition to the provisions which shall be implemented in peacetime, the Geneva Convention shall apply to all cases of declared war or of any other armed conflict. The Convention shall also apply to all cases of partial or total occupation of the territory, even if the said occupation meets with no armed resistance. The International Organization for Civil Protection in 1966 which works to reinforce protection and safety to people through exchanging experiences and information, supporting technical co-operative relationships among state members (DCD 2009).

4.3.3.1 Role, objectives, vision and duties of civil defence

The Role

The Civil Defence is responsible for protecting people and public and private property and maintaining transport and services infrastructure and proper access to food, water and medical support.

The UAE Civil Defence was established by decision number (4) of 1976, to protect citizens defence, public and private properties, rescue victims, secure transportation and protect national wealth during war and emergency. Fire brigades were merged under command of the General Directorate of the Civil Defence as one of main organs of the Ministry of Interior. The Ministry of Interior was assigned to take all necessary actions to the enable Directorate General of Civil Defence and associated departments to perform their duties article, (Civil defence -federal law no 23 2006).

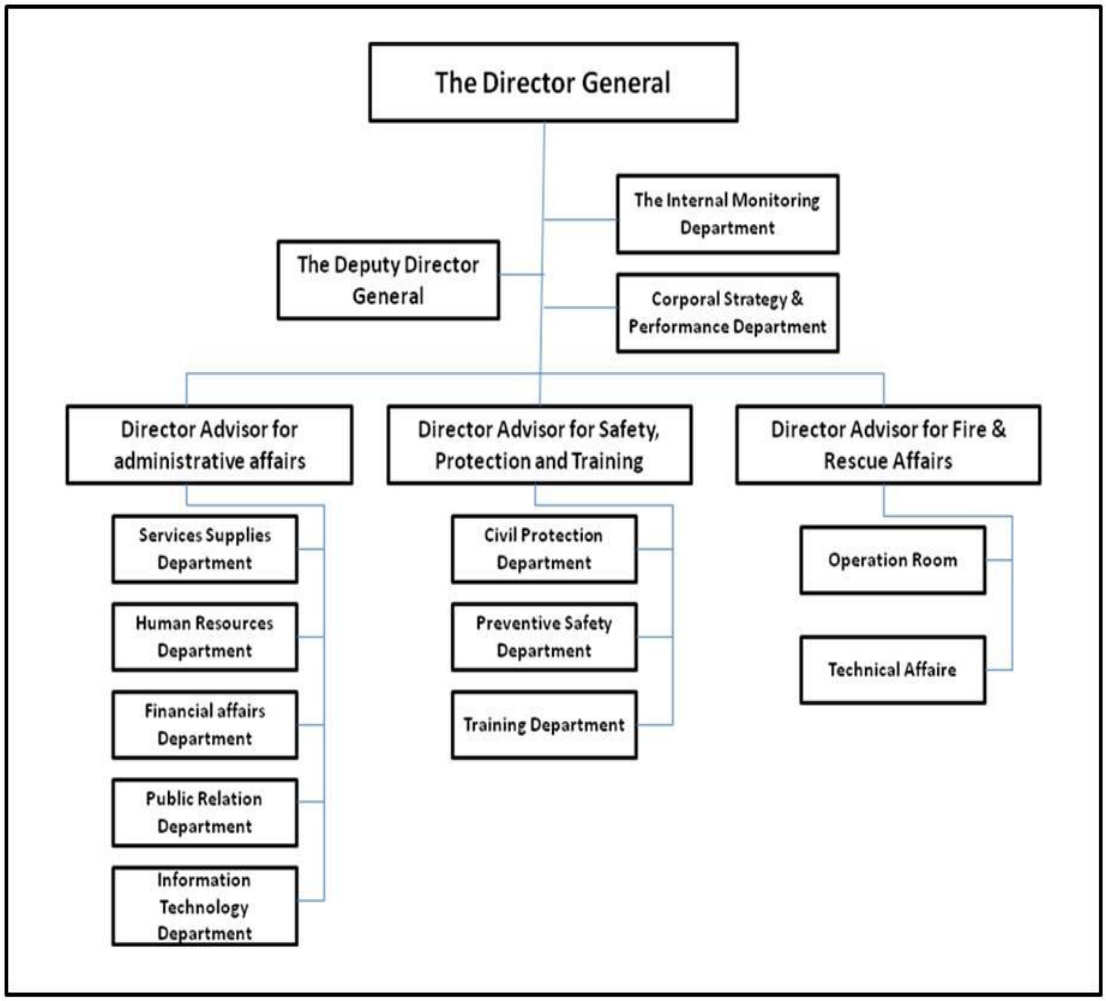

Figure 24: Organisational Structure of Civil Defence in the UAE.

The structure of the organization of the Civil Defence is illustrated in (Figure 24). Civil Defence in the UAE focuses on promoting awareness among members of the public. The UAE has set central plans pertaining to safety against dangers, it also coordinated media work to boost awareness and spread the culture of prevention. Civil defence teams conducted detailed field studies that considered safety aspects in different sites including the difference in the nature of work being performed at those sites and degrees of risk involved in equipment being used and the nature of people performing those jobs and their health conditions. The work started through a central awareness plan that targeted educational, health and transportation institutions, tourist and industrial sites, oil

establishments, residential units, clubs and associations. Unfortunately most of the activities of Civil Defence focused on testing fire-fighting and the experiences of evacuation.

The Civil Defence was set up under the following criteria:

The Objectives

- Protecting lives, private and public properties.
- Ensure environment safety, transportation and communication safety.
- Ensure discipline and order in public utilities. Duties are protecting private and public facilities, establishments and projects and national wealth during state war, emergency and public disasters.

The vision

Protecting lives, property and environment, to provide a fast professional service, efficient investment of human and material resources to give best results.

The duties

- To rescue victims, restore life in disaster return to normal life.
- To monitor the implementation of industrial / commercial security with regards to public utilities, and safety precautionary measures.
- To make the population aware of preventive measures.
- To set up volunteer teams and emergency units to support civil defence forces.

Functions of civil defence

- To rescue and save causalities searching for victims and provide help.
- Participating in rehabilitation of afflicted areas and re-establishing public utilities services.
- Supervising implementation of industrial safety in industrial and commercial establishments and ensuring fire preventive measures in private and public utilities.
- Setting up civil defence operation rooms.

- Educate general public on how to implement preventive measures during war and disasters.
- Organizing volunteer teams and technically train them to enhance civil defence forces whenever required.
- Bomb detection and informing on nuclear biological and chemical weapons hazards.
- Establish rapid emergency units to enhance civil defence forces in facing disaster situations.
- Storing firefighting equipment and appliances.

4.3.3.2 The Federal Law No. (23) For 2006 - Civil Defence:

General Provisions

- The country: United Arab Emirates.
- The Emirate: any Emirate in the UAE.
- The Minister: Minister of Interior.
- Undersecretary: Undersecretary of Interior.
- Apparatus: Public Management of Civil Defence.
- The Council: The Civil Defence Council (See Figure 25).
- The President: President of the Council.
- The Intended: any governmental organization or non-governmental organizations have a role to play in providing support for the Civil Defence in the disaster response.
- The public Management: Public Management of Civil Defence.
- Director: Director General of Civil Defence.
- Sub departments: departments of Civil Defence in 7 emirates.
- Volunteers: each person makes their own choice to participate in the work of civil defence.

Civil defence: body under Ministry of the Interior, to take all actions and work directly for the protection of life and property and sources of national wealth against risk and disasters.

The apparatus of the Civil Defence

1. The Civil Defence Council
2. Public Management and Sub department in 7 emirates (See Figure 26).
3. Local committees for Civil Defence.
4. Volunteers.

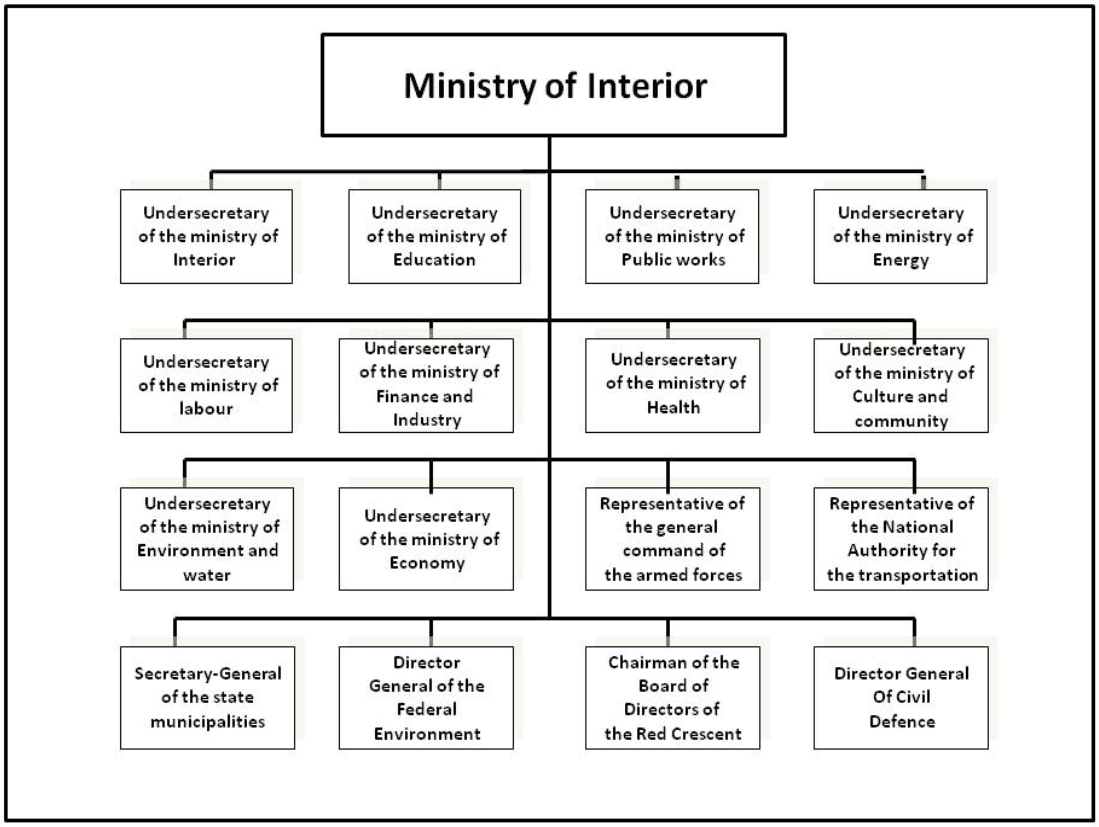

Figure 25: The Council of Civil Defence

The Works of Council

- Policy proposal of the Civil Defence.
- Preparation plans and follows.
- Conditions the shelters-public and private.
- Any of the terms of reference assigned to the Council for Civil Defence

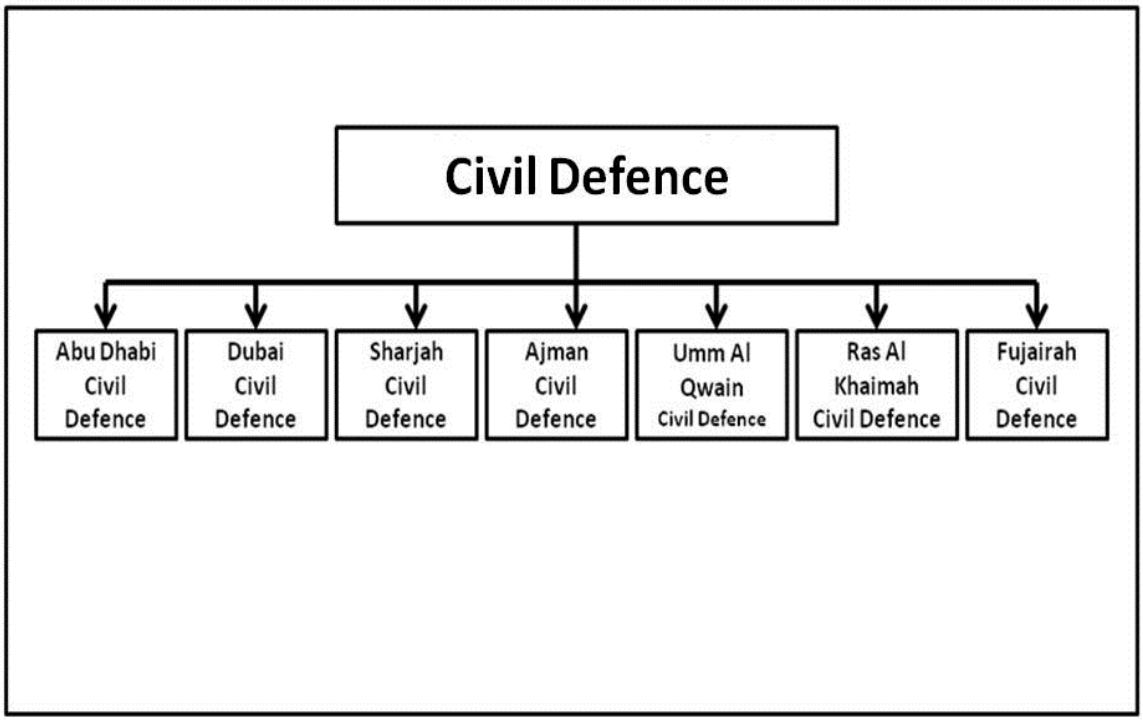

Figure 26: Organisational structure of Civil Defence in the UAE

Local committees for Civil Defence

A local committee to coordinate civil defence in each emirate has been established. The roles and responsibilities are set in Table 10.

The Members of local committees	The Works of the Local committees, Cooperation and coordination.
- Representative of the Governor: president. - Director General of police, member. - Director of the civil defence Department, member. - Director General of the municipality, member. - Director General of the educational, member. - Director General of the medical, member. - Director of the Office of Labour, member. - Director of the Electricity and Water, member. - Director General of the specific region in the energy sector and the Ministry of Energy, member. - Director General of the Agriculture in the Ministry of Environment and Waters, member. - Director of the Office of the Ministry of Public Works, member. - Representative of the companies and institutions in relevant communications, member. - Representative of the general command of the armed forces, member.	- Implementation of plans and projects of civil defence. - To examine the potential risks and prepare proposals to manage then send the results for Council. - To take all measures and actions to achieve the objectives of the civil defence. - To educate the people and encourage them to volunteer for the work of civil defence. - Management of operations centre and follow-up of events and supervising the proceedings during disasters. **Cooperation and coordination** - The coordination between civil defence and armed forces by decision issued by Minister in agreement with the Minister of Defence. - The Public Administration and Management Subcommittee responsible for the preparation and coordination with other bodies with respect to medical services, social, engineering, administrative, educational, police services, armed forces,

- Director Office of the Ministry of Economy, member. - Manager of the branch of the Red Crescent, member. - Manager of the branch of the Emirates Telecommunication, member. The Director-General of Police of emirate replace Chairman of the Committee in his absence.	and others. - The Public Administration and Management Subcommittee They the preparation and coordination with other bodies with respect to those who have the internal organs of security and safety, particularly oil companies, airports and other so as to provide support when the civil defence need. - The President of the Council has the right in emergencies and disasters make decisions to seize the real estate and movables and the means of transport for the implementation of procedures and the work of Civil Defence, but temporarily and with remuneration.

Table 10: Local committees for Civil Defence with Roles and Responsibilities

4.3.4 Evaluation of Civil Defence Operational Structures

This involved a survey of the organisational Civil Defence in the UAE as part of an evaluation of the UAE Policy on natural disasters. The following section explains the methodology used, and then summarizes major findings.

4.3.4.1 Survey Objective

To carry out a comprehensive survey of the Civil Defence, through interviews with selected personnel (Table 11). The purpose of the interviews was to gain general feedback about natural disaster management in the UAE and the disaster management activities in the Civil Defence, and in particular to investigate the extent of the implementation of the Federal Plan to face disaster.

The Government bodies	**Position of body**	**Type of persons involved**	**Number of persons involved**	**Amount of time per person**
Ministry of Interior **(Police)**	Federal body	General Director, Senior staff, staff	1 - 6 – 10 Total 17	40 to 60 - minutes for each person.
Ministry of Interior **(Civil Defence)**	Federal body	General Director, Senior staff, staff	1 - 6 – 30 Total 37	40 to 60 minutes for each person.
The Ministry of Public Works	Federal body	Senior staff	4 Total 4	40 to 60 minutes for each person.
The Ministry of Education	Federal body	General Director, Senior staff	1 - 5 Total 6	40 to 60 minutes for each person.
The Ministry of Health	Federal body	General Director, Senior staff	1 - 4 Total 5	40 to 60 minutes for each person.
The Ministry of Social Affairs	Federal body	General Director, Senior staff	1 – 2 Total 3	40 to 60 minutes for each person.
The Ministry Of Energy	Federal body	General Director, Senior staff	1 - 2 Total 3	40 to 60 minutes for each person.
The Ministry of Environment and Water	Federal body	General Director, Senior staff	1 - 3 Total 4	40 to 60 minutes for each person.
NCEMA	Federal body	Senior staff	1 Total 1	40 to 60 minutes for each person.
The UAE Red Crescent	Federal body	General Director, Senior staff	1 - 1 Total 2	40 to 60 minutes for each person.
The Emirates Volunteers	Regional body	Senior staff, staff	1 - 3 Total 4	40 to 60 minutes for each person.

Table 11: Schedule of interviews carried out during the project.

4.3.4.2 Methodology of Ministry of Interior (MOI) and Civil Defence survey

The methodology used in this survey broadly involved a case study approach (Robson 1995). The general interview guide approach was used, the guide approach is intended to ensure that the same general areas of information are collected from each interviewee; this provides more focus than the conversational approach, but still allows a degree of freedom and adaptability in getting the information from the interviewee (McNamara 1999). This survey by interview method investigates the constituent parts of natural disaster preparedness and in so doing provides a realistic explanation of their genesis and character. This leads to a critique of existing methods of disaster and risk mitigation. Interviews allow follow-up, to further investigate the responses, this is particularly useful for getting the story behind a participant's experiences in particular issues and the interviewer can pursue in-depth information around the topic. Robson (1995) argues that to carry out a case study effectively it is necessary to have:

- A set of research questions
- A sampling strategy
- And, to decide upon methods and instruments for data collection.

This stage involved interviewing the Director General of Civil Defence in the UAE, Director General of Police in the UAE and Directors of some police stations, most of Directors of Civil Defence in the UAE. Interviews were also conducted with relevant officials in the MOI, such as Director General of Emergency Management and Public Safety, Director of Crisis Management and Disaster, and Director of Rescue, and Head of Operations to gain a full understanding of the procedures. Individuals were selected, based on their situation and their position in government jobs and responsibility, including preparedness for natural disasters, as stated in the Federal Plan.

The survey covered the federal and regional bodies in the seven emirates, related to the issue of natural disasters and preparedness level. The Federal Plan to face disasters was the basis for investigation with the bodies that are responsible for disaster management. The purpose of the interviews was to offer a general feedback mechanism about natural

disaster management in the UAE and the disaster management activities in these bodies. Official records were also studied. Interviews were based on tasks undertaken by participants in natural disasters management for each body in the UAE. Reiteration of certain themes in the results throughout the survey is evident. The recurrence of themes is intentional: the repetition of certain themes accurately reflects the answers of interview respondents about disaster management in the Civil Defence of the UAE.

Secondary Data

Secondary sources of data and information were collected, the sources of information included:

- Newspapers - local newspapers with reports on periods of natural disasters in the UAE and the also the English-language press to compare with answers.
- Government reports and transcripts - concerning civil defence issues, in each emirate.
- Research reports and published work - in UAE Universities.

4.3.4.3 The interview questions

The interviews were semi-structured with open questions. Because the interviews were being carried out by the researcher, some questions were improvised by the researcher, in light of the discussion which took place between the researcher and officials following up issues raised. The questions covered 10 main areas:

(l) Leadership (2) preparedness of human resources (3) Management of information (4) training courses (5) Importance of detailed population information (6) documentation (7) the cooperation (8) the evacuation places (9) the learning from previous disasters (10) coordination meetings to consider natural disaster.

4.3.4.4 The result of Interviews

The UAE Civil Defence focuses on the emergency evacuation plans and how the bodies implement it. The aim and strategy of the Civil Defence is the purpose of this research.

The investigation involved personal interviews with the managers of the Civil Defence and analysis of relevant official documents and the Federal Disasters Plan 2005. The federal and regional bodies, rely on each other in disaster situations. The policies and practices that guide response to disaster vary widely across federal, state, and other entities. The Al Qurayah flood in 1995 and its aftermath, along with other recent disaster events in the UAE, revealed much about institutional responses, collective behaviour and interorganisational coordination in response to the natural disaster.

The issues that this raises are explored in reviewing the results of interviews. Interviews were conducted in Arabic and responses quoted are translations by the author. Senior staff because of their role could not be anonymised and this was made clear to them. Other staff were selected to reflect different roles and levels in the organisation and were anonymised.

The views of senior officials in the MOI regarding natural disaster management

> "The ministry is not unaware of this issue and there are great efforts being made by the MOI to develop a disaster plan and this is almost ready" (Director General of Police in the UAE).

> "There is some confusion and duplication in the roles among the work of the Civil Defence and police; this is borne out by the past events. But now the coordination is much better than before" (Director of Emergency Management and Public Safety, in Central Operations).

> "The processes of disaster management system are complex and require a lot of coordination between many parties, training and scenarios. There is benefit from the experiences of other countries and people with a high degree of education in this field, and then I can say the MOI is ready to face natural disaster" (Director of Crisis Management and Disaster in Dubai Police), General Headquarters of Police.

> "Equipment and support are available, but we are looking for coordination, clarification roles, and training on natural disasters through scenarios" (Director of Rescue Department in Dubai Police), General Headquarters of Police.

Leadership

In response to the question about the leadership role of the civil defence during natural disasters some who were interviewed were concerned that in practice there were issues.

> "The role of civil defence as a leader during a disaster management is almost missing, because other bodies are not recognizing the role of the Civil Defence during natural disasters with the interference of police system in several specializations, which should be the core work of the Civil Defence. The attempt to take the leadership role from the civil defence in confronting natural disasters, so it is causing confusion and duplication in the roles among the work of the Civil Defence and police" (Director General of Civil Defence in the UAE).

> "The Civil Defence is not the leader in the disasters response in the UAE" (Directors of Civil Defence A and B in smaller emirates).

This view may have been coloured by the experience of the past disasters.

> "The role of civil defence as a leader during a disaster management is not very clear, because of lack of recognisation of the role of the Civil Defence during natural disasters with the interference of Army and police in several specializations, which should be the core work of the Civil Defence" (2 from 3 Directors of Civil Defence in bigger emirates).

> "Confirmed that, interference of some high rank officers (police or army) who reached the damaged area in issuing orders, and in leading the Civil Defence

team, even though they did not have the experience in managing natural disasters" (Directors of Civil Defence C and D in smaller emirates).

The responses of the interviews with leaders of Civil Defence in the UAE reflect contradiction about the stated plan of the purpose of the federal plan. To coordinate efforts between competent bodies nationwide and organize their instant interventions to face a natural disaster requires clear lines of authority. In the Federal Plan this objective shall be achieved by: establishing the relationship between the competent authorities and Civil Defence, and to define their roles and duties in accordance with legislation, and in compliance with the nature of their activities. So it is clearly set out in the document but is not implemented in reality. The Civil Defence faces a lack of clarity in the actual delineation of leadership and operating responsibilities. So there is currently difficulty in managing natural disasters in the UAE, because of the intervention of different bodies in a haphazard way through issuing orders and decisions in the field.

The interviews with civil defence staff in smaller emirates, who had experienced natural disasters events raised the following issues:

> "They are no references to life losses in past disasters" (Civil Protection Department E and F in smaller emirate).

It was noted that there was no record of fatalities in the records of the UAE disasters. The participants noted success of the evacuation and this may be the result of a constructive and efficient interaction between the people and the authorities. Interview with (G) in Civil Protection Department in a smaller emirate raised an important point.

> "Some people tend to panic, that making it difficult to control them during evacuation and others disseminated rumours and crowd in front of the disaster site, thereby hindering the work of the Civil Defence".

It is a natural belief that some of people, in proximity to a highly hazardous environment, will tend to panic, and disseminate rumours. In this case it may be due to the lack of awareness of hazard that confronted them and the appropriate response. When people realise the danger they are in they will generally behave rationally.

The human resources

In response to the question about the preparedness of human resources in civil defence to natural disasters, some who were interviewed were pessimistic and stated that in practice there were issues.

> "The specialised human resources are not sufficient in the disaster response in the UAE Civil Defence" (Director General of Civil Defence in the UAE).

> "The shortage of specialised human resources in this field in the Civil Defence creates a formidable obstacle. The Civil Defence staff who will help activate this role need knowledge and experience in getting ready for confronting natural disasters" (Directors of Civil Defence 3 from 4 in smaller emirates and (B) from larger emirates).

The Interviews highlighted that most of officers and civil defence personnel in smaller emirates, have no background about the nature of the land they live on, or the possibility of natural hazards in their area. The specialized human resources in this field needs improvement.

The management of information

In response to the question about the availability of information and management in facing natural disasters. Some who were interviewed were concerned that in practice there were issues.

> "The lack of information detailed study about the natural hazards in Civil Defence particularly in the UAE" (Director General of Civil Defence in the UAE).

> "The scarcity of information, accurate maps, and lack of detailed study about the natural hazards in the UAE is an issue. This causes great difficulty in the process of disaster response, especially in natural disasters. Knowledge and understanding is needed to facilitate decision making when disasters strike, because the information is needed at all disaster administration levels" (Director of Civil Defence 2 from 3 in bigger emirates. All of Directors of Civil Defence in smaller emirates agreed on this point).

> "Focused heavily to find a general solution to the consistency of terminologies that are used during disasters in the exchange of messages between all departments of civil defence, police and other authorities. Furthermore, message formats should be simple and should guide the reporter through the sequence of stating the event, identifying current response status and decision-making and prioritizing needs. That information must be presented in a way that is helpful to those who have to act upon it and make the necessary response" (Interviews with C, D and E in smaller emirates).

It is clear that Civil Defence staff consider that there is a lack of knowledge about the natural hazards and the most effective responses that should be brought to bear. The systems for communication of information between departments during a crisis need to be more informative and systematic.

The training courses

In response to the question about the staff training courses to enhance preparednesss for natural hazards, some who were interviewed were hesitant and somewhat reluctant to admit that in practice there were issues.

> "Regarding the natural disasters training courses I think it is available, with training courses both internal and external" (Director General of Civil Defence in the UAE).

> "Lack of training courses on how to respond to natural hazards in Civil Defence" (Directors of Civil Defence 3 from 4) in smaller emirates.

This view may have been more apparent in civil defence in smaller emirates rather than bigger emirates, because in bigger emirates only 1 from 3 raised this point.

Interviews with participants (D), (E), and (C) Civil Protection Department in the smaller emirates revealed the lack of awareness of dangers of natural disasters and the need to educate the people how the protect themselves. There is a shortage of programmes of awareness issued by the Civil Defence making people aware of the need to be ready for natural disasters (such as earthquakes, floods and hurricanes).

> "Most of individuals in civil defence departments of smaller emirates are unanimous regarding the role of the Civil Defence, in training the personnel of its department to confront natural disasters. This is currently directed at officers, particularly regarding external training courses" (Interview H, I, and J and K) in smaller emirates.

The Civil Defence has a leadership role during the natural disasters but the qualifications and experiences that help take up this role are lacking. This leads to the police and other bodies taking this role from the Civil Defence. Development of human resource and its importance for the readiness for confronting natural disaster is nearly absent in smaller emirates, in contrast with Civil Defence Departments in some of the bigger emirates. The readiness for confronting natural disasters in some emirates is clearly limited, programmes for raising awareness do not exist and there is no strategy for directors of Civil Defence to follow.

Importance of Detailed Population Information

In response to the question about the preparedness of civil defence to respond to natural disasters and vulnerability of relevant population data. Some who were interviewed were hesitant to answer that in practice there were issues.

> "Regarding the population data, I think it is available" (Director General of Civil Defence in the UAE).

> "Population data is not renewed and mostly incorrect" (Directors of Civil Defence 3 from 4 in smaller emirates).

This view may have been more in civil defence in smaller emirates rather than bigger emirates, because in bigger emirates only 1 from 3 raised this point.

> "Population information is very important, this information is fundamental for the Civil Defence to be able to inform the population in appropriate time at the different steps of the disasters. Unfortunately this information is missing, and where available is not accurate and not updated so is not useful at the current time" (Interview A, B and C in smaller emirates).

> "Data are often available in the Civil Defence but not collected, analysed and integrated, additionally the information is variable in quality and sometimes contradictory making it difficult to interpret and therefore those in authority cannot make informed decisions. One of the major difficulties that faces the Civil Defence is integrating the information generated by the different federal and regional bodies. It necessitates the need for a common agreed protocol for information exchange between the data bases of the different federal and regional bodies" (Interviews with D, E and G in bigger emirates).

Regarding the population data, the director general of Civil Defence said it is available, on the other hand, most of directors of Civil Defence in smaller emirates said that population data is not renewed and mostly incorrect and it is not collated, analysed and

integrated, sometimes contradictory making it difficult to interpret. So its is not useful at the current time. It is a clear that there is a difference in view between the federal and regional officers.

The documentation

In response to the question about the documentation of previous natural disasters some who were interviewed were hesitant to answer.

> "There are no documents relating the previous natural disasters, and there is no detailed documentation for these events in civil defence" (Director General of Civil Defence in the UAE).

> "Documentation for past disasters in the Civil Defence is completely absent. Sorry to say that there are not any documents to confirm what disasters had happened previously" (Directors of Civil Defence 3 from 4) in smaller emirates.

Also only 1 from 3 agrees with this opinion in the bigger emirates.

The cooperation

In response to the question about the cooperation between the civil defence in the seven emirates regarding natural disasters preparedness again some who were interviewed were hesitant to answer. Not surprisingly they may have been reluctant to be critical of colleagues in other departments.

> "The cooperation between the UAE civil defence, to the natural hazards preparedness, is available and effective" (Director General of Civil Defence in the UAE).

However the view from the smaller emirates indicated:

"Relationship, communication and transparency at work, are nearly nullified among the Civil Defence regarding natural disasters and the readiness for them, all units working alone. This is no collaboration or transparency or exchange of expertise or experiences between the Civil Defence in the UAE. As you cannot compare the civil defence in the smaller emirates with other civil defence in bigger emirates, where there is strong local support, equipment and devices, advanced technology" (Director of Civil Defence 2 from 4 in smaller emirates).

"If they asked for something for Civil Defence we need months or years, to get approval. Furthermore, devices equipment and logistic support, to facing natural disasters, are distributed among departments of the emirates in an inefficient way and not based on correct study of need" (Participants A, B and C in smaller emirates).

The evacuation places

In response to the question about the space for evacuation in the UAE. Some who were interviewed were concerned and identified issues.

"The responsible authorities in the emirates delayed much in deciding the places for evacuation which is made more difficult in this huge development of construction in the UAE, where providing a space for evacuation is difficult, but not impossible" (Director General of Civil Defence in the UAE and corroborated by Directors of Civil Defence 3 from 4 in smaller emirates).

The learning from previous disasters

In response to the question about the learning from previous disasters. Some who were interviewed seemed not to want to address this point. Issues were identified.

"I think we learned some things from previous disasters in the UAE" (Director General of Civil Defence in the UAE).

> "Despite repeated natural disasters every year, there has been no change in the civil defence and no learning from previous disasters" (Directors of Civil Defence 3 from 4 in smaller emirates, also only 1 from 3 in bigger emirates agrees this opinion).

Also one of the most significant findings from interviews was that, the natural disasters in general are an almost annual problem in some smaller emirates, although the type and magnitude of event varies. So despite repeated natural disasters every year, there has been no change in the civil defence process of confrontation, because it is still not ready (Participants A, B, and C and D) in smaller emirates.

Coordination meetings to consider natural disaster

In response to the question about the meetings by the Civil Defence in preparation for natural disasters. Some who were interviewed seemed to have concerns and in practice there were issues.

> "I think there are some meetings, also it's associated with the occurrence of disaster events" (Director General of Civil Defence in the UAE).

> "Most of meetings are not completed, the projects and preparation for confronting natural disasters and formation of committees are not asked about, problems are not considered and these committees being satisfied with one meeting or two, then no meeting for years without clarifying the reason. So this explains the weak readiness for confronting disasters" (Directors of Civil Defence 2 from 4 in smaller emirates).

> "There are plenty of discontinuous meetings, which are held only after an incident or disaster, held for readiness for confronting disaster, but soon forget its importance once its effects are removed and when public opinion forgets it" (Director of Civil Defence in bigger emirates).

There appears to be a significant issue with regard to the holding of coordination meetings. There does not appear to be a proper agenda or process of effective evaluation. Meetings appear to be held on an ad hoc basis in response to events.

4.4 Summary

The structure of the UAE Civil Defence as it is currently set out makes it difficult for it to cope with the impact and aftermath of natural disasters. In general the survey highlighted the current reactive policy for facing the natural disasters, neglecting the awareness and preparation stages which are important in mitigating risk.

The aim of the Federal Plan is to provide a framework to coordinate efforts between competent bodies nationwide and organize their instant interventions to face natural disasters in the UAE. In the Federal Plan this objective shall be achieved by the Civil Defence in organising the relationships between the competent authorities and Civil Defence, and to define their roles and duties in accordance with legislation in compliance with the nature of their activities. But this is not reflected in the implementation and reality. The Civil Defence faces a lack of clarity in the actual application of responsibilities and accountabilities. There is some confusion and duplication in the roles among the work of the Civil Defence and the police in responding to natural disasters. Lack of recognition of the role of the Civil Defence during natural disasters has resulted from interference by the Army and police in several specializations, taking over the core work of the Civil Defence.

The shortage of specialised human resources in the field of natural disaster management in the Civil Defence creates a formidable obstacle especially in small emirates. Furthermore, there is a lack of information and detailed study about the natural hazards in the Civil Defence. The readiness for confronting natural disasters is very limited in some emirates and programmes of awareness-raising do not exist. There has been major use of scenarios to test procedures and coordination between relevant authorities. There is limited collaboration between emirates with limited exchange of expertise or experiences.

The capability of the civil defence in the smaller emirates does not compare with that of the bigger emirates, where there is strong local support, equipment and advanced technology. Equipment and logistic support, to face natural disasters, is distributed among departments of the emirates in an inefficient way and is not based on proper evaluation of need.

Public management capability is tested during disasters in particular the relationships between the federal and local bodies, who necessarily rely on each other in disaster location. This study demonstrates that the actual policies and practices that guide response to disaster varies widely in the UAE across federal, emirate and other entities and in the current position does not meet the requirements of the Federal Plan.

Principal findings are:

- Confusion and duplication of roles, in particular between the police and the Civil Defence, in the response to natural disasters.
- Lack of training and simulation exercises.
- Distribution of resources is not aligned against strategy or need.

CHAPTER 5: THE SUPPORT MINISTRIES AND NATIONAL INSTITUTIONS

5.1 Introduction

In this chapter a brief introduction to the UAE Ministries and Institutions is provided. The purpose of this chapter is to investigate the vulnerable points in natural disaster management in the support bodies in the UAE ministries and institutions. The effectiveness of these bodies is explored, through determining their responsibilities by mean of interviews with selected officials in Ministries and Departments. The methodology used in this survey is the same as that used in the evaluation of Civil Defence. But in this chapter the investigations will focus on the preparation and obstacles in these bodies. This survey by interview method attempts to investigate the constituent parts of a natural disaster preparedness and in so doing provide a realistic explanation of their character and genesis. A critique of existing methods of disaster and risk mitigation is presented. This survey regarding natural disaster preparedness is the first survey conducted in the UAE support bodies. Therefore the results of this survey are a contribution for natural disaster preparations and disaster management in the UAE.

5.2 The Support Ministries

The role of support ministries and other bodies is very important during disaster management as they are in support of civil defence and complementary to the response to natural disasters. Their involvement is critical to ensure flexible actions towards effective assistance to help the victims of a disaster and affected people. During disaster response operations, collaborative critical decisions are often made by decision-makers from a diversity of professional fields and many different organizations. This may hamper the effective coordination of a disaster response, particularly when a multiplicity of federal, state, local, institutions and volunteer organizations take part in the effort. So the evaluation of ministries and institutions and their preparedness for natural disasters is an important element of this research. To establish the role of these bodies, their organization and relationship to other bodies is very important.

5.2.1 The Ministry of Public Works (MOPW)

The UAE has witnessed huge commercial development to become one of the pioneering commercial centres in the Middle East. The federal legislation and laws of the UAE entrusted the tasks of execution of Federal building projects of all ministries to the MOPW according to the Law No. (1) 1972. The Ministry of Housing and City Planning was entrusted to oversee city planning, design and execution of federal housing projects. In 1977, a federal decree was issued to merge the MOPW with the Ministry of Housing and City Planning. In accordance with that, the work of the Ministry was rearranged and specializations were distributed to achieve the goals of the Ministry and to exercise responsibilities and duties entrusted to it.

The UAE is undergoing rapid development with one of the highest construction rates in the world. During recent years, specifically the period from 2000 to 2004, the construction sector in the UAE increased around 160%, with an annual growth rate of 27.7%. Although there is inevitably considerable uncertainty associated with the assessment of seismic hazard in the UAE, a number of studies of the seismic hazard have been published in the last eight years. There are diverse interpretations of the earthquake threat in the UAE, creating confusion regarding an appropriate seismic code (Aldama et al 2009). The available information and data on this issue is contradictory. For example for buildings of 6 storeys or more in height, the Dubai Municipality requires design to the specified seismic loads but this is not required in Sharjah which is immediately adjacent. There are at least seven studies, which have presented seismic hazard estimates for the UAE. The seven studies have drawn very different conclusions regarding the level of seismic hazard in the UAE, with estimates of the 475-year peak ground acceleration (PGA) (Aldama et al 2009).

<u>The Strategy and Specializations</u>

The MOPW is doing its best for the construction and the housing sector in the UAE, through it's performance in constructing buildings and federal general facilities, and providing houses for citizens on behalf of the Government of the UAE. Developing,

organizing and controlling the construction sector and the housing sector involves participation and cooperation with the related authorities. The specializations of the Ministry are clarified through the decision of the ministers' council No. (22)1999 concerning the organizational structure of the MOPW. The Ministry specialises in the following:

1. Building, maintenance and improving federal roads.
2. Constructing of buildings and public facilities and supervising their maintenance.
3. Study and preparing the conditions and specifications of projects of housing and city planning.
4. Design of construction projects for federal public buildings.
5. Setting procedures for maintenance for federal public buildings.
6. Planning, design and preparing terms and specifications for federal housing projects and undertaking tenders, contracting with consultancy establishments and supervising the execution of contracts.
7. Planning, design and execution of projects of federal buildings including kindergartens, schools, dispensaries, mosques, markets, social centres, government offices, and other public buildings.
8. Distribution of houses, built by the Government, to the deserved citizens through cooperation with local departments in concerned emirates.
9. Giving technical advice and helping local departments in the emirates in the field of planning and execution of their own housing projects.
10. Any other specializations entrusted to the Ministry in accordance with laws and legal regulations.

The MOPW established a national housing plan, which will be the key focus area for implementation in 2008 - 2010. The national housing plan includes the construction of new cities on par with international standards in order to provide a higher standard of living for the citizens, so the plan will be covering housing requirements for the next 20 years, with focus on developing remote areas through an infrastructure database, with a specific objective to meet the needs of the people in those areas. Furthermore, the

ministry will identify the required standards for school buildings and ensure a maintenance mechanism for all schools. The MOPW is also responsible for roads and safety across the country. The ministry's plan included a close scrutiny of the local and federal road networks to ensure compliance with safety standards and federal regulations. The plan also includes promoting the use of renewable energy through liaising with local entities to include this feature in building specifications.

5.2.1.1 Result of interviews

The preparedness and obstacles

In response to the question about the preparedness of MOPW to respond to natural hazards and obstacles facing the ministry it was clear that many managers were reluctant to answer the question at first as they did not realize that this work falls within the specialisation of the ministry.

> "Role of the ministry comes immediately after a natural disaster by limiting the physical damage to infrastructure, also the main obstacle that the specialized human resources in this field are lacking in the ministry" (Project Manager in the MOPW).

> "There is a lack of a seismic code for the building in most of the UAE building, particularly in the old buildings that were built 30 years ago or more. But there were suggestions submitted by the ministry to the concerned authorities regarding designs resistant to earthquake (seismic code) but this subject was suspended either for its high cost or the non importance in the view of the authorities. Also there is no law or legislation to require owners, contractors and engineers of the building to build according to specifications for earthquake hazard. Furthermore, the ministry cannot impose on the population the construction of homes in a manner resistant to earthquakes or other natural hazards. Furthermore, the MOPW did not follow up this suggestion with the responsible authorities, to inquire about late reasons of this suggestion" (Engineer A in the MOPW in bigger emirates).

The fact that the MOPW is not following up these issues indicates that it is not a priority, for the ministry.

> "There are very few studies, in the field of Seismic Code in the UAE, there is one regional study established by Dubai Municipality in 2006, regarding seismic code. The study was launched to find out if buildings will have to adapt to a higher classification than the current Zone A of the Uniform Building Code (UBC), under which a structure can resist earthquakes measuring M 5.5. It was recommended that the developers may have to adopt new building codes to further resist the impact of an earthquake also to upgrade the current code. The Dubai Municipality specifies that for buildings of 6 storeys the Zone 2A design criteria in the UBC 1997 should be employed. In contrast, UBC 1997 currently classifies Dubai, Abu Dhabi, to be in Zone 0. However, the Swiss Re world map of seismicity and volcanism (Swiss Re 1991) shows that Dubai emirate is located between the moderate and heavy exposure. The Munich Re World Map of Natural Hazards (Munich Re 2004) locates the site in zone 0, which means there is no seismic risk. A tentative estimate of the hazard has been derived (Grunthal et al 1999) by simulating the "attenuation" of the seismic hazard from southern Iran across the Arabian Gulf. Another study by Al-Haddad et al carried out a probabilistic seismic hazard assessment for Saudi Arabia. This study did not include any source zones in eastern Arabia. Also the study carried out a probabilistic seismic hazard assessment for the UAE, and estimated the 475-year bedrock PGA in the greater Dubai area to be of the order of 0.15g, corresponding to Zone 2A in the UBC 1997. This approach means that large earthquakes close to emirate of Dubai are included in the seismic hazard computations with a relatively high frequency of recurrence. Due to the definition of a source zone, spanning from the northern part of the UAE and Oman across to southern Iran" (Engineer B in the MOPW in bigger emirates).

> "When we are talking about buildings in UAE and their readiness to confront natural disasters we can say the dominant type of buildings in UAE is reinforced concrete single family residential houses (villas) that were designed and detailed

for gravity load only. The old houses are usually one story reinforced concrete or masonry structures but even if all new buildings are built well, older buildings remain hazardous in some of the cities of UAE, especially in the Northern Emirates, which are within zones of moderate seismic activities The UAE building are not founded as resistant to earthquakes except some of the modern towers which are analyzed based on linear static gravity loads only and usually designed based on British Standards (BS8110 1997) or American Concrete Institute (ACI-318 2002). So there are many old buildings which were not constructed with the specifications as resistant to earthquakes, so these buildings will remain as sources of fear and anxiety for the inhabitants, the growth of urban infrastructure in the UAE has brought about an escalation of risk to the urban community from earthquake hazards. This risk can be minimised to ensure sustainable development and community safety by ensuring that all buildings and structures are designed to resist earthquakes, using suitable building codes. Through these points above mentioned we can observe the lack of readiness processes against natural hazard in the MOPW" (Engineer D in the MOPW in the bigger emirates).

It is not earthquakes that are killing people but the buildings are the real killer of people (Abdalla 2004).

Emirate	Commercial Buildings	Houses	Public Buildings
Abu Dhabi	117469	278189	50425
Dubai	79214	237728	73294
Sharjah	57153	201033	36584
Ajman	17898	50237	11472
Umm Al Quwain	8714	10988	2238
Ras Al Khaimah	40143	50321	1216
Fujairah	16197	26364	6236
Total	36815	863860	129247

Table 12: Statistics of Commercial Buildings, Houses and Public Buildings -2005 (Teadad 2006).

The researcher concluded from interviews that there is a lack of awareness of ministry officials and staff on the issue of protection and readiness regarding natural disasters and how to protect the population. There is evidence in one quote of a possible lack of willingness by authorities to address the issues. Also there is a lack of specialists and experts in the field of natural hazards. The ministry follows the reaction policy, regarding the natural disasters and lack of awareness in this scope by the ministry official, for example, the attendance of some official at some lectures and discontinued workshops held at the time of the disasters and incidents that arouse the public opinion. These workshops had become neglected by representatives of the ministry.

5.2.2 The Ministry of Education (MOE)

This Ministry is responsible for the educational process, in the UAE and in its development to lead the universal progress. It is looking to an educational system that harmonizes with the best universal educational standards and develops the student ability for continuous learning and to contribute to achieving enduring development for the community. The MOE is responsible for planning and executing a successful educational system including students, parents and schools in a harmonized system that achieves the highest levels in educational performance, in its role in serving their community (MOE 2009).

5.2.2.1 History of Education in the UAE

There was little education in the UAE prior to the discovery of oil, because the people's attention at that time was to provide fundamentals such as clothing and food, so there was no money for education and schools. The economy in those days was a simple one, based on fishing, pearl diving, coastal trade and the most rudimentary agriculture. In that preliminary period education was largely gained through experience, and sitting with elders. Latterly education developed in the UAE away from a traditional simple style to systematic education based on lessons and curricula (See Figure 27), (MOE 2009).

Figure 27: History of education in the UAE, "Mutawwa" with students, educating the students the Holy Quran Hadeeth, and knowledge in Islam in Fujairah (SEZ 2009).

Historical Development of Education in UAE

Education went through four types of system as it evolved in the history of the UAE.

- First Type: Mutawwa:

This type of education was practised by many males and females old teachers who were named "Mutawwa". These teachers depended on memorizing the Holy Quran and Hadeeth, and knowledge in Islam. It continued until the beginning of oil discovery then started to lose its role.

- Second Type: Scientific Circle Education:

This type of education was practiced by scholars and a few scientists (Sheikhs), and intellectuals who had much knowledge in religious education, grammar and history. It was held in mosque's corners or in a private place in the house of the scholar himself. The most famous circle was the one that included some scientists who lived in emirate of Ras Al Khaimah during the last British Expedition in 1819. They graduated from such scientific circles then they started to develop schools with lessons and curricula.

- Third type: Developed education or semi-systematic:

In the period between 1907 to 1953, developed education began when pearl merchants were influenced by the other Arab countries. Schools were opened in some cities and teachers and scientists brought in to manage and supervise lessons and the process of education in schools. The most popular schools in Sharjah were the Taimia Mahmoudia in 1907; in Dubai it was Al Ahmadia, established in 1912, Salmia 1923 and Al Falah 1926. Since 1936, the evolutionary education in Dubai witnessed a noticeable development.

- Fourth Type: Modern Systematic Education:

The UAE has witnessed recently a big leap in the field of organized education. This type of education started with Al Qassemia School in Sharjah -1953/1954. This education was organized and provided by schools, with classes and curricula along with tests and certificates given to students at the end of every school year.

Today and after the Union there are over 290,000 children at government schools, both boys and girls. Furthermore, each city and village has schools for all levels. The UAE offers free education to every male and female national from kindergarten to university. There is also an extensive private education sector, while several thousand students, of both sexes, pursue courses of higher education abroad (Al Taboor 1992).

<u>The objectives of MOE</u>

1. An active educational system with national experts and capabilities, that depends on decentralized policies and practices.
2. To provide an infrastructure that relies on modern techniques through all educational levels and to employ it in the educational process to allow schools to utilize it in management.
3. To provide modern curricula accompanied with evaluation tools and procedures that rely on universal academic standards and contributes to creating an educational environment which makes the student the pivot of the educational process.

4. To develop and improve School buildings and utilities, provide them with equipment and tools that harmonize with modern educational standards and in a way that enables schools to lay out and execute developed curricula and activities.
5. Promoting policies and regulations for human resources to contribute to improving and developing the quality of performance for the working educational committees in the educational system.
6. Develop systems that enable parents to contribute to following their children's academic performance and provide the concerned people in the community with full information about the educational progress and performance.
7. Promote professional development programs and systems for all of educational staff.

5.2.2.2 Results of interviews

The preparedness and obstacles

In response to the question about the preparedness of MOE to raise awareness of natural hazards and obstacles facing the ministry several issues were identified.

> "There are some scientific subjects, natural hazard like a volcano and earthquake, hurricane and others, but not related to awareness. But there may be some personal efforts by some of the education Zones, in smaller emirates including on this field" (Director of Educational Research and Institutional Education).

It is clear from this response that this is not part of the formal curriculum and that this is not a priority of the ministry.

> "Nothing included in the ministry strategy related to natural disasters or standards for the security of the student from natural disasters. Our proof of this is that no material in the curriculum of school syllabuses relates to natural hazard culture or methods of protection during natural disasters in all study levels. The level of awareness with students and teachers is weak. And there is a lack of communication between the civil defence and the education zone in the natural

disasters preparedness issue. Moreover, the meetings of committees are discontinuous and irregular between the ministry and the concerned authorities in readiness for natural hazards and they meet only on the happening of a disaster to calm down public opinion. The role of the Civil Protection administration in the Civil Defence is to hold lectures and seminars that might contribute to spread the culture of disasters among teachers and students; but this role is not properly implemented" (Director of Education Zone in smaller emirate).

"About the safety of school buildings and their ability to cope with earthquakes, there was poor maintenance of some schools especially in the countryside and distant territories which are greatly subject to earthquakes, such as in the emirates of Ras Al Khaimah and Fujairah. Also there were several complaints of school headmasters and Education departments all over the country declaring that some schools are not structurally safe and represent a real danger to the students. Furthermore, the design of schools is an essential factor. Poorly designed schools will endanger the students whether by the construction or the internal design of the school or the doors limitation and evacuation areas" (Director A in the MOE).

"Most of the ministry officials are not aware of the simplest procedures to mitigate disasters risk. There are weaknesses in lectures about natural disasters because most Education Zones in the country did not include any lecture concerned with natural disasters such as earthquakes, cyclones, and floods. Furthermore, the MOE do not have procedures about management during the natural hazards. Also no committee or team was formed in the MOE concerned to follow up the natural hazard culture or set up a training programme to enable the ministry personnel and staff of education zones to manage responses to incidents in case of natural disasters. Natural disasters in the UAE may be small, but should not be ignored" (Director B in education zone in smaller emirate).

5.2.3 The Ministry of Health (MOH)

In many countries and especially in developing countries, national health budgets and systems are already unable to meet basic public health needs. As a result, even relatively small natural disasters, economic weakness and lack of resources can overwhelm the coping capacity of the health system. Strong health services and good health are critical in reducing the impact of disasters. Effective health systems provide essential protection from disaster and recovery from it. In the last decade, the MOH developed its strategy for the years 2008 - 2010 with a new vision that states, "Healthy individuals living in a supporting and sustaining health conscious and caring society" (MOH 2009).

In most natural disasters events it is not the hazard itself that necessarily leads to a disaster, but the inability of the population to anticipate, cope with, respond and recover from the effects of the hazard. Disasters disrupt people's livelihoods, affect people's capacity to maintain their living conditions and can reduce access to health care. Disaster events impose a substantial health burden: either directly on populations, in terms of increased morbidity and mortality, or indirectly through disruption to the health system, and losses to infrastructure and supplies. The health sector should play a leading role in natural disaster risk reduction. A fully functioning health system positively impacts on the capacity of a country to protect itself, and recover from, natural disasters (Merlin 2009).

Objectives of ministry

The paramount objective of the UAE MOH is to provide and maintain the highest quality healthcare services that benefit residents. The commitment to high ethical standards is consistent with the values of Islam and with Islamic and traditions.

1. To promote the legislative role of MOH in coordination with other related sectors.
2. To build and develop the managerial and technical capacities of the Ministry of Health.
3. Implement the best international practices in the field of health care.

4. Promote the role of MOH in the field of preventive medicine.
5. To raise the level of health awareness in the community and to decrease morbidity rate of diseases.
6. To ensure accessibility of comprehensive health services to all.
7. To develop the managerial, technical and financial health system.

Role of ministry in disasters

It is the offer of health care for everyone living in the UAE and its indispensable role during natural disasters which can be represented in the following tasks:

1. Preparation & equipping of hospitals and relief centres to receive casualties during disasters.
2. Preparation of blood banks and encouragement of citizens for blood donation.
3. Supervision of collecting bodies ensuring identification and safe burial operations.
4. Health supervision over the shelter of refugees.
5. Train volunteers on aid works to act as support teams in all health fields.
6. Develop an appropriate mechanism to raise the efficiency and readiness of hospitals and increase its capacity when needed, and develop programmes to train medical staff.

Furthermore, the supportive services with those who are affected by a disaster are used to help diminish long term psycho-social effects, through promotion of individual, family and community resilience in addition to the response activities with disaster survivors (EMU 2009).

5.2.3.1 Results of interviews

The preparedness and obstacles

In response to the question about the preparedness of MOH to respond to natural hazards and obstacles facing the ministry some who were interviewed seemed to have been reticent and reluctant to speak, but issues were identified.

"There is some current preparedness for road accidents and currently the MOH is establishing a plan for disaster management in general with all health zones, in the UAE" (Deputy Minister of the MOH).

"There is a lack of local doctors and nurses in most of emirates hospitals, which is considered as an immense obstacle to the readiness to confront disasters, Functions of Nursing and medicine are almost marginalized despite its importance compared to other jobs in the UAE. The government has relied on their services without providing them any incentives or good salary. Most hospitals are suffering from severe shortages in medical staff in the normal situation let alone for a disaster time" (Directors A and B in smaller emirates hospitals).

"Regarding the preparedness for natural disasters, the past strategy of the UAE did not concentrate on the necessity of preparation for natural hazards. That reflected a weakness in MOH in the disasters field and in addition to neglect and indifference by the MOH to activate this Issue in the past. Furthermore, the civil defence focuses on evacuation and fire, ignoring that the preparation and coordination with regard to natural disasters with MOH. In the same time evacuation sites were not assigned by the concerned authorities because locating these sites enables the MOH to perform inspection over the evacuation places and assure their validity and to provide a safe environment which prevents the spread of diseases. Also most of the specialists in MOH did not know anything about the Federal Plan to Face Disaster" (Director C in smaller emirates hospitals).

"The lack of coordination among bodies related to disaster management, and no clear-cut job description of those bodies, in the case of overcoming these obstacles the MOH is ready to face natural disasters" (Head of Emergency in the smaller emirate hospital).

It is clear from these responses there is much to do in preparing the MOH to manage the impact of a natural disasters.

5.2.4 The Ministry of Social Affairs (MOSA)

The MOSA Strategy 2008-2010 follows the UAE Government Strategy's recommendations, and reflects its key objective of establishing a high standard of living and sustainable development in the country through coordination between the federal government and local governments in all areas related to social welfare. Other objectives include sustaining strengthening social bonds, and protecting family values, and tackling social challenges and encouraging voluntary social work (MOSA 2008).
The natural disasters preparedness obligation in the ministry is based on the role of the ministry in providing social welfare in of case natural disaster, and for securing the functions vital to society. Also it directs, supervises and coordinates social preparedness in cooperation with the relevant federal and regional bodies. Furthermore, the Ministry is responsible for ensuring necessary services for the continuity of the life cycle after the end of the disaster.

The non-governmental organizations (NGOs)
There are many NGOs working in UAE. All the NGOs are supposed to work under the supervision of the MOSA which is entrusted with the implementation of the by-laws that govern the work of NGOs.

5.2.4.1 Results of interviews

The preparedness and obstacles
In response to the question about the preparedness of MOSA to respond to natural hazards and obstacles facing the ministry with regard to this some who were interviewed seemed confident, but in practice there were issues.

> "Our efforts in natural disasters field and subsidiary aid committees to ministry in case of natural disasters, subsidiary aid committees were formed with the missions as follows :
>
> 1. To inspect and make initial estimations of damages.

2. To suggest the necessary arrangements.
3. To raise recommendations to the Supreme Aid Committee in the ministry, by (388 on 12.2.2007 the decision of the MOSA).

Furthermore, there is a decision of the Minister's Cabinet to organize the aid process in natural disasters: the value of the aid, the quality of allocation, the compensation, the duration of the aid and everything that relates to the aid (according to the Ministers Cabinet decision 11/ 2002). But the MOSA did not participate in any scenarios relating to the preparation for confronting natural disasters. So the ministry includes in its new strategy many goals for the procedures of preparation for confronting disasters and spread of the training programs among the individuals of the community" (Deputy Minister of the MOSA).

"The Federal Plan to Face Disasters does not clearly define the role of the MOSA. This is clear in the duplication of tasks and duplication between the ministry and the aid associations such as the Red Crescent. As well as coordination between the MOSA and the Ministry of Finance it is an obstacle facing the MOSA, on the other hand, it is very necessary to facilitate and expedite the process of handing out compensation during disasters" (Directors A and B in the MOSA in the smaller emirates).

In the light of the above mentioned, we can say that the MOSA is ready to perform its duties during disasters, but issues of duplication of role and coordination with other ministries have been identified.

5.2.5 The Ministry Of Energy, Electricity & Water Sector (MOEWS)

5.2.5.1 Electricity & Water Sector

The Sectors of Electricity and Water have an important role during natural disasters; its role is concentrated on cutting off water and electricity to the damaged areas. Then it

has the important role in re-establishing electricity and water to the regions afflicted by disaster and also to provide temporary shelters with electricity and lighting, as well as providing them with clean water. It is important to ensure the provision of water pipes and electrical cables in the areas of evacuation places. To prepare for natural disaster a disaster strategy must be developed based on geographical location and situation. Having contaminated water and no electric power or both could be a real problem if you do not have a disaster recovery plan. The role of the Electricity and Water Sector in the Federal Disaster Plan: Supply of temporary power lines and clean drinking water in the evacuation camps with coordination with other relevant sectors, and also prepare the appropriate technical personnel to ensure the repair of electricity supply.

5.2.5.2 Results of interviews

The preparedness and obstacles

In response to the question about the preparedness of MOEWS to natural hazards and obstacles facing the ministry some who were interviewed seemed reluctant to address the question.

> "We are ready and prepared to face natural hazards" (Executive Director in the Electricity &Water Sector in MOEWS).

> "The Federal Plan for Disasters does not clearly define the role of the MOEWS, So how can we prepare for natural disasters without knowing our role? The shortage of natural disasters scenarios which were set by the MOEWS and Civil Defence, with co ordination with other authorities in the field of training were few and typically not in the field of earthquakes, floods and storms which represent the natural hazards threatening the country. There were no scenarios or training in the sector regarding this issue. Furthermore, there have not yet been the locating of the shelters and sites of evacuation and these are not assigned in most of the states to provide the sites with the necessities and connect the assigned area with electrical cables" (Director A in the Electricity & Water Sector in a smaller emirate).

> "There is neglect in the sector in field of preparedness for natural disasters, because the sector did not request the Civil Defence or the Ministry of Interior to send an expert person to discuss the topic of natural disasters as a part of training of officials and technicians. It is regrettable that some of the managers in the sector of Electricity & Water in smaller emirates do not know the contents the Federal plan for confronting disasters and they did not read it" (Director B in Electricity & Water Sector in a bigger emirate).

From the responses it can be seen that there is a degree of weakness in the readiness procedures of the Sector of Electricity and Water in confronting natural disasters. It is clear that there is a lack of understanding of roles and responsibilities as set out in the Federal Plan.

5.2.6 The Ministry of Environment and Water (MOEW)

The past name of this ministry was Ministry of Agriculture & Fisheries; the past roles for this ministry did not include natural hazards. So it did not address the issue of disasters and natural hazards. In the past the ministry's focus was on crop development, livestock development, fruit trees and marketing, farm visits, training for farmers and Agro processing, and providing the country and people with the best management of its aquatic and fisheries resources. The vision of the ministry in 2007 is conserving the environment and the natural resources for sustainable development through integrated management of balanced ecosystems and sustainability of water resources and animal, agricultural and fish wealth in cooperation with partners and within the international accepted criteria (MOEW 2009).

Ministry's Aims

1. Adapt the concept of the integrated management to rationalize consuming of the underground water due to overuse side by side with development of alternative resources in coordination.

2. Enhance the environmental security within the programs of the Federal Environment Agency in order to control air and water pollution within defined limits and control desertification and biological diversity.

3. Deepening the research and studies to ensure realizing the best standards of sustainable development for the natural wealth. Elaborate on, raise and stabilize environmental awareness.

4. Increase the average of the biological security to ensure the safety of the country against the biological risks resulting from epidemics and diseases that may affect birds and animals.

5. Achieve food security in the UAE through adapting the principles of balanced economic performance in demand and the necessary plant and animal products for local consumption.

6. Regulate fishing activities and develop living aquatic resources.

7. Empower, rehabilitate and motivate human resources in the ministry in accordance with the latest practices and standards.

8. Develop and fulfill the legal, administrative and technical structure of the ministry including the systems of inspection and control.

Though not specified in the aims with regard to water supply and other environmental issues this ministry will have responsibilities regarding natural disasters for example water supply to the distribution system.

5.2.6.1 Results of Interviews

The preparedness and obstacles

In response to the question about the preparedness of MOEW to face natural hazards and obstacles facing the ministry in this issue. Some who were interviewed seemed to at first try and hide the facts and avoid the question, especially by the Minister of MOEW, in practice there were issues.

> "We are ready for all natural hazards, and we have prepared strategies to manage and control these risks" (Executive Director of Technical Affairs in the MOEW).

However, this answer was not supported by any documentation. However, the real measure of success is not in developing plans and documents, but in the implementation of them.

> "Experts and qualified human resources in this specialization may be the largest obstacle in this field" (Director A and B in smaller emirates).

> "The lack of coordination among bodies related to disaster management, and there is no clear-cut job description of the MOEW" (Director C in the MOEW)

5.3 The National Institutions

5.3.1 The National Crisis & Emergency Management Authority (NCEMA)

Disaster management in the UAE at the beginning of the 1990s, was limited and without scientific planning, because there was no formal emergency plan at the time. Formulation of the plan took nearly 15 years until it was sent to the managers in the Ministry of the Interior for comment and response to the comprehensiveness of this plan in 4/6/2005 (Decree 5/7/3901/2005). Even though the process of creating this plan dates back to the beginning of the 1990s, it has not yet entered into force. The Tropical Gonu Storm event in 2007 presented an opportunity for the UAE government to learn lessons and enhance the strategy for managing disasters and for better coordination of operations within federal and regional and other organisations in the UAE. Natural disasters were not formally identified in the brief for NCEMA (Table 11). The government saw the outcome of Gonu storm as an opportunity to redefine disaster management in the UAE.

The new strategy of the UAE government involved the National Emergency System. The major direction for public policy within this sector is to formulate a National Emergency System, identifying operations, roles, and responsibilities to ensure prompt response, and boost the readiness of the emergency system's supporting sectors. This will lead to

developing the institutional framework; and enhance co-ordination between federal, regional and local respondents and increase co-ordination with the private sector in developing and implementing the National Emergency Systems. The UAE has previously not had a strategy for disaster management. This reflects the increased level of awareness with respect to natural disasters and the changing needs of the UAE. After the issuance of the new strategy for the UAE, this included a focus on disasters and crises because the disasters are a major threat to sustainable development and therefore there needs to be an agency coordinating disaster management. These considerations led the UAE government to launch in 2007 the NCEMA. As an organization working for disaster management at national level, the NCEMA came into existence from the Federal No. (2) 2007 by a Government of UAE order upgrading the NCEMA, which was located at Abu Dhabi. (See Figures 28, 29).

5.3.1.1 General Description and Mission

The NCEMA falls under the authority of the National Security Council (NSC). It is the federal organization responsible for developing national policies and procedures for training and auditing of all crisis and emergency management related activities on a national level. Also it is the leading national organization responsible for managing and coordinating all efforts related to crisis and emergency. NCEMA's mission is to coordinate all national efforts to save lives, coordinate the national recovery efforts and preserve national properties and assets by limiting the effect of emergencies and crises.

5.3.1.2 Terms of reference

This Terms of Reference are aligned with arrangements described in the NCEMA:

1. Building strategic plans for the management of emergencies and crises. Take all necessary measures to be applied in cooperation with the organs.

2. Development of disasters awareness strategy.

3. Fostering of research and system development in disaster management.

4. Coordination and command arrangements in each hazard.

5. Coordination of bodies' role and disaster management in the facing plans with both government and non-government bodies.

6. Planning and procurement of resources.

7. The authority will ensure that appropriate plans, systems, policies and processes are in place to meet national legislation and requirements for emergency planning, response and recovery.

8. The authority will define each body's responsibilities and ensure that emergency preparedness, training, exercises, job descriptions, policies and procedures are in place.

9. Development of bodies' performance, conducting of emergency management system and response exercises.

10. The authority will define; oversee any related sub committees that are established from time to time.

11. The authority will advise and recommend emergency planning policies and practices in response to national developments.

12. Any other task assigned by the government.

5.3.1.3 Goals and Objectives

1. Compose a unified federal emergency law that consequently develops a National Response Plan (NRP) and governs the management of national emergencies.

2. Establish a national crisis and emergency command and control to be the executing arm for the NCEMA responsible for managing national capabilities and resources and coordinating between all parties participating in disasters and crisis response. Ensure preparedness of all organizations involved in the management of emergency and crisis within the UAE by conducting periodic training and exercises.

3. Establish a national emergency command center to be responsible for coordinating and managing all capabilities and resources on a national level.

4. Organize an annual international crisis and emergency management conference aiming to improve performance, raise awareness and effectiveness of emergency response efforts and capabilities for the UAE.

5. Establish a national crisis and emergency college to be responsible for establishing unified national definitions and standards of all crisis and emergency related concepts to ensure integration and collaboration and proper coordination between all related parties and organizations within the UAE. As well as train, conduct research, and raise public awareness for matters related to crisis and emergency management and develop improved communication and other related mechanisms.

5.3.1.4 Organization Structure of NCEMA

A review of other national planning documents indicates a trend to holistic, all-hazards response planning and preparedness. This holistic approach facilitates coordinated, effective, and efficient response. The Board Director of NCEMA consists of the Chairman of the board/National Security Adviser, Deputy Chairman of the board/Chief of Staff of Armed Forces and Members of the board See Figure 28. The assignment of authority for response and incident command and the organization structure agreed for NCEMA structure are presented in Figures 28 and 29.

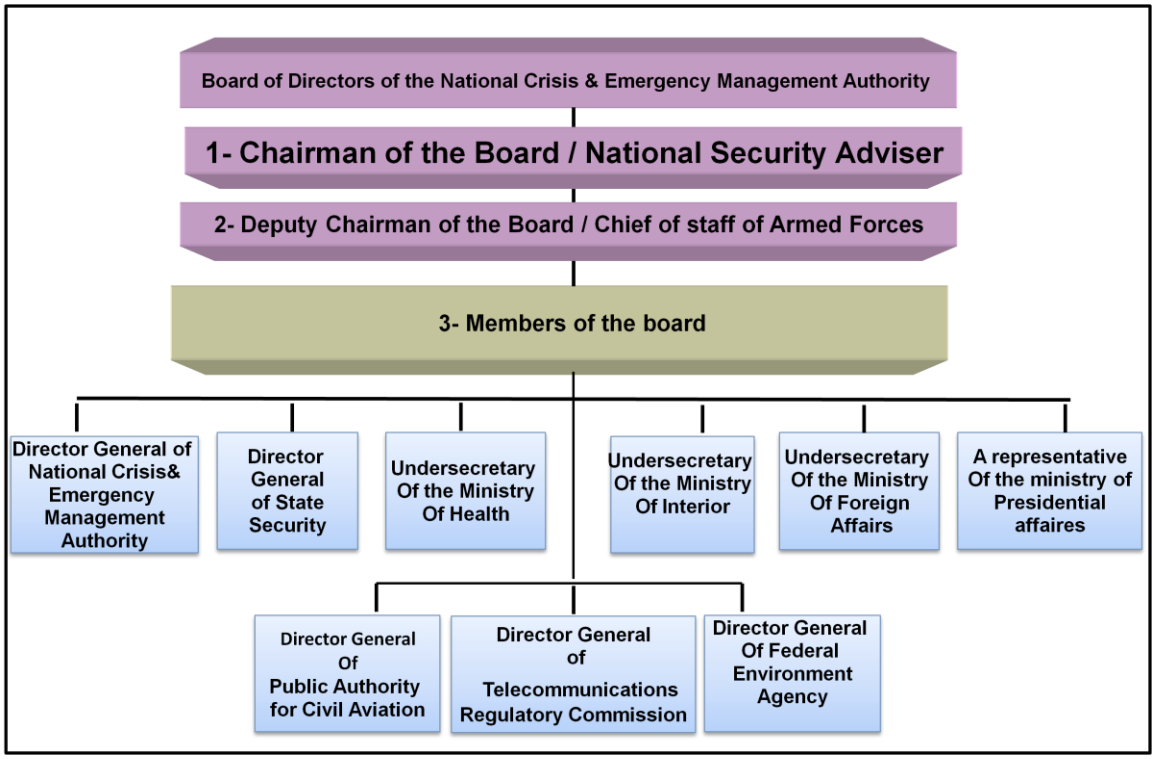

Figure 28: Organizational Structure of board directors of the NCEMA(NCEMA 2007).

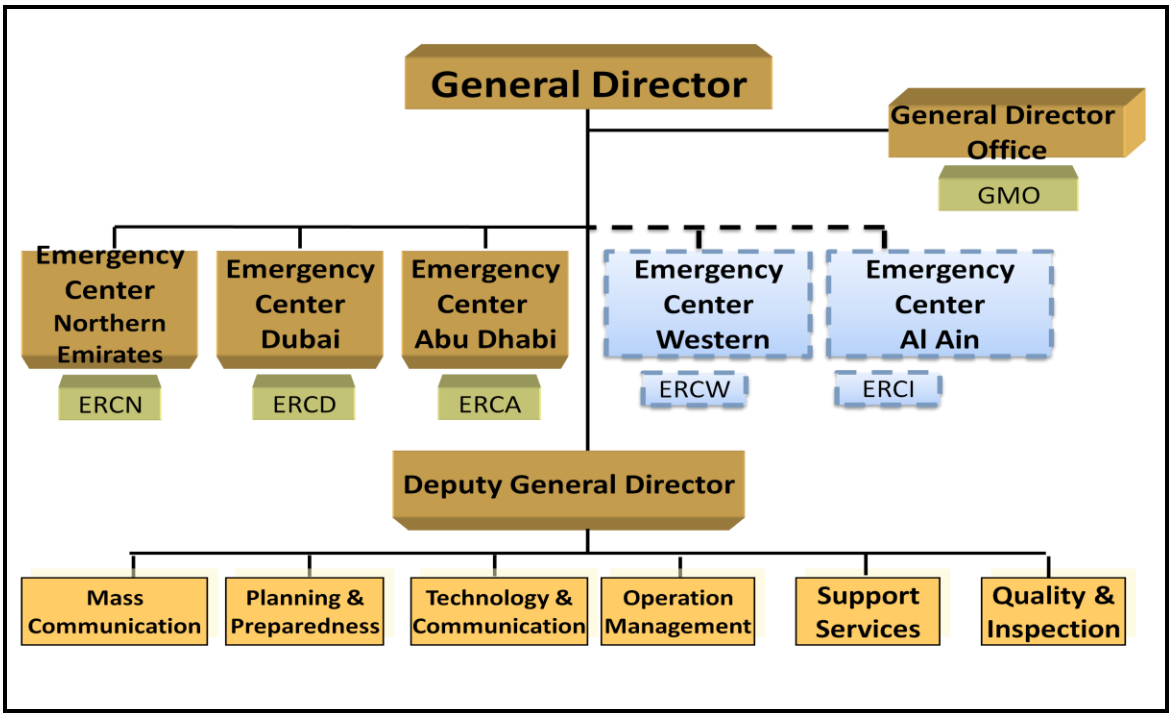

Figure 29: Organization Structure of NCEMA (NCEMA 2007).

5.3.1.5 National Response Plan Template

The Ministries and Key Stakeholders	Emergency Support Function (ESF)	Support Annexes & Incident Annexes
- President of the country. - Supreme Council. - Federal National Council. - Prime Minister. - Deputy Prime Minister. - Ministry of Defence. - Ministry of Finance and Industry. - Ministry of Interior. - Ministry of Governmental Sector Development. - Ministry of State for Cabinet Affairs. - Ministry of State for Foreign Affairs. - Ministry of Social Affairs. - Ministry of Education. - Ministry of State for FNC Affairs. - Ministry of Health. - Ministry of Foreign Affairs. - Ministry of Presidential Affairs. - Ministry of Higher Education and Scientific Research. - Ministry of Public Works. - Ministry of Justice. - Ministry for Financial and Industrial Affairs. - Ministry of Energy. - Ministry of Labour. - Ministry of Environment and Water. - Ministry of Culture, Youth and Community Development. - Ministry of Economy. - NCEMA	- Public Safety and Security. - Resource Support. - Urban Search and Rescue. - Communications. - Public Health and Medical Services. - Public Works and Engineering. - Energy. - Fire fighting - External Affairs. - Emergency Management. - Mass Care, Housing, and Human Services. - Transportation. - Total Quality Management. - National Strategic Planning and Preparedness. - Public Information. - Long-Term Community Recovery and Mitigation.	- Financial Management. - Science and Technology. - Special Populations. - Volunteer and Donations Management. - International Coordination. - Logistics Management and Support. - Private-Sector Coordination. - Public Affairs. - Worker Safety and Health. **Incident Annexes** - Biological Incident. - Oil and Hazardous Materials Incident. - Terrorism Incident Law Enforcement and Investigation. - Catastrophic Incident. - Cyber Incident. - Food and Agriculture Incident. - Nuclear/Radiological Incident.

Table 13: National Response for disaster Plan Template (NCEMA 2007).

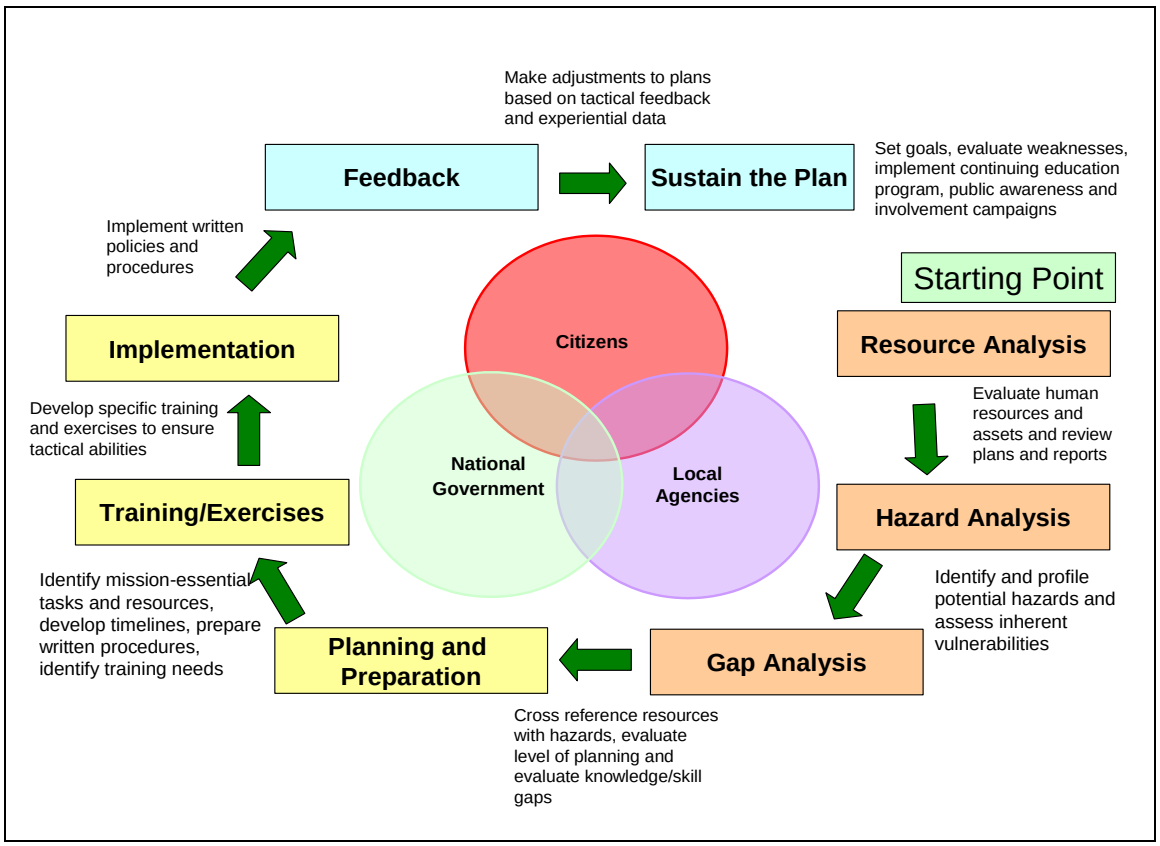

Figure 30: Preparedness cycle of disasters (NCEMA 2007).

Preparedness activities and measures taken in advance to ensure effective response to the impact of hazards, the preparedness cycle of disasters in NCEMA (See Figure 30) plan included:

1. Resource Analysis: evaluate human resources and assets, review plans and reports. The resource analysis must not only give attention to economic costs but also has to determine if it is feasible to obtain the needed physical material and manpower in the required time period.

2. Hazard Analysis: identify and profile potential hazards. Through identification, studies and monitoring of any hazard to determine its potential, origin, characteristics and behaviour (ISDR 2009).

3. Gap Analysis: Cross reference resources with hazards, evaluate level of planning and evaluate knowledge/skill gaps. Gap analysis is a very useful tool for helping to answes two questions - where are we now? and where do we want to be? The difference between the two is the GAP. The next step is to close the gap, by using tactical approaches.

4. Planning and preparation: Activities and measures taken in advance to ensure effective response to the impact of hazards, including the identification of mission-essential tasks and resources, develop timelines, prepare written procedures, identify training needs, issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.

5. Training/exercises: Develop specific training and exercises to ensure tactical abilities.

6. Implementation: Implement written policies and procedures, this stage can help to identify possible gaps and useful next steps to take.

7. Feedback: Make adjustments to plans based on tactical feedback and experiential data.

8. Sustain the Plan: Set goals, evaluate weaknesses, implement continuing education program, public awareness and involvement campaigns. Disaster risk management at all levels with focus on district and community level activities, based on which the Government of the UAE would replicate the approach and process in the remaining hazard-prone districts in the country.

5.3.1.5.1 Purpose

The UAE National Response Plan (NRP-T) has been developed to:

- Provide a national framework for cooperation in response to or prevention of incidents or threats.
- Provide a comprehensive, all-hazards approach to incident management.
- Provide a systematic process for planning, preparedness, response and recovery.
- Align control, communication, resources and similar terminology at all levels of government including local and national (See Table 11).

5.3.1.5.2 Concept of Operations

The NCEMA, in conjunction with the lead agencies for disaster and consequence management response, and local authorities where appropriate, will notify, activate, deploy and employ federal resources in response to a threat or act of disaster. Operations will be conducted in accordance with statutory authorities and applicable plans and procedures, as established by the policy guidelines established in NCEMA. The concept of operations include functions of resilience, emergency management cycle using functions of resilience, and coordination of national resilience functions and organizational structure.

a. Functions of Resilience

Resilience in a time of crisis is built upon the capacity of the government to maintain core governmental functions. The capacity to provide these core governmental functions relates directly to the public's confidence in its government.

1. Financial Resilience

The financial resilience of a country is critical to both short-term and long-term needs of the government following a emergency. Sustaining core governmental functions is dependent on the availability of secured funds to support each of these functions. Consumer confidence is tied to the government's ability to maintain services, subsidies and other financial services.

2. Environmental Resilience

Environmental stewardship is critical to the resilience of government and its people. In times of emergency, a government must protect its natural and agricultural resources. Large scale hazardous events may potentially have a long term impact upon a country's natural resources. The potential loss of these core functions not only impacts the economy of the country, but may have significant impacts on the global economy.

3. Infrastructure Resilience

In the aftermath of a crisis event, residents must have the ability to communicate, have access to basic utilities, and have access to varying modes of transportation. Just as important to the president's ability to access these basic infrastructure needs, government is dependent on these same needs to support response to an event. The failure of government to adequately provide these core functions will have a negative impact on consumer confidence.

4. Social Resilience

The success of a society to maintain human services is critical to its ability to manage a crisis event. Core human services include providing food and shelter, health and medical services, and education. The ability of government to provide these needs has a significant impact on the confidence of citizens in their government.

5. Governmental Resilience

Each category of resilience serves as a function of government. However many of these functions can be subsidized and supported through local, national, and international non-government associations, such as the Red Crescent. The governmental functions identified as core to the resilience of the government are those functions directly available through the national or local government.

b. Emergency Management Cycle using Functions of Resilience

The diagram shown below indicates the functions of resilience and how they are connected in fostering comprehensive preparedness (Figure 31).

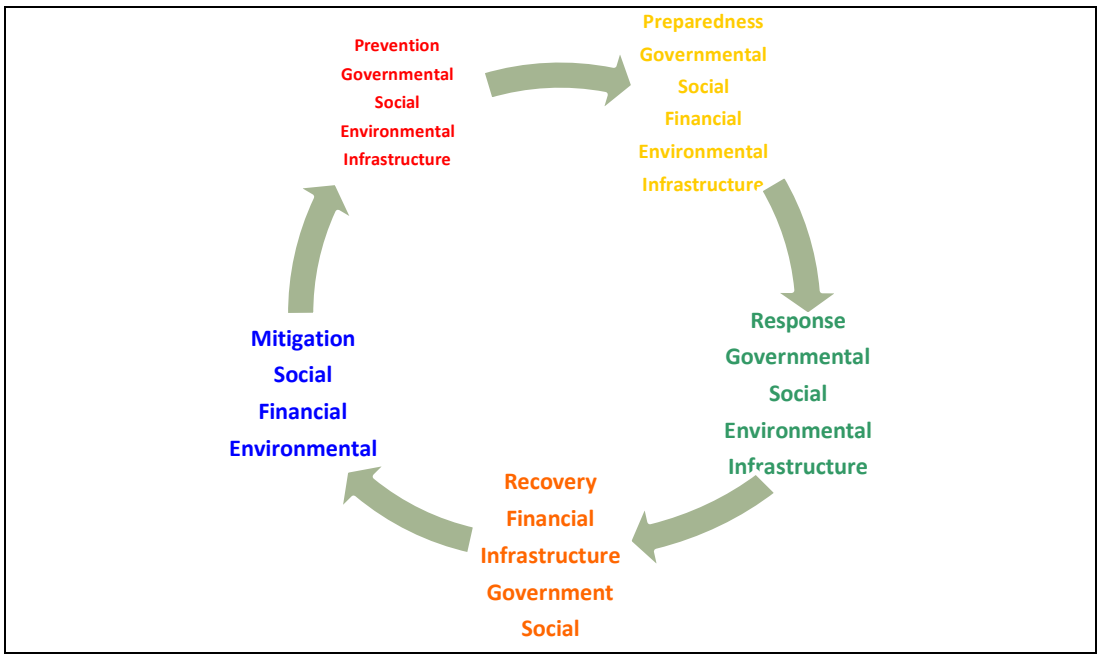

Figure 31: Emergency Management Cycle using Functions of resilience (NCEMA 2007).

c. Coordination of National Resilience Functions

The efficiency of emergency management is based on development of a coordinated management structure. This is complicated as there is no clear methodology to determine the value of any one function of resilience as compared to another's value. The analogy of an orchestra best demonstrates the need for proper coordination of resources supporting each of these functions of resilience. In the time of a catastrophic event, government must ensure that it is capable of coordinating these various functions.

d. Organizational Structure

Effective coordination of national resilience functions is built upon a defined organizational structure within the government. Similar to the orchestra analogy, the

government's response must have organizational structure. Organization begins with the assignment of responsibility. Ministries within the Federal government have either a primary or supporting role to the effectiveness of the government's response to a catastrophic event.

5.3.1.6 Results of Interviews

The preparedness and obstacles

In response to the question about the preparedness of NCEMA to respond to natural hazards and obstacles facing the authority there was a clear sense of enthusiasm by the Office of the Director-General of the NCEMA.

> "There are no obstacles facing the NCEMA. We are continuing to draw the plans and amend them and consult with all members and visit the developed countries, which preceded us in this issue. In developing the Authority our staff visited 30 bodies, such as ministries, institutions, and the departments of the State, local and federal bodies and the Ministry of the Interior and its related entities. Furthermore, they visited several countries that have emergency management systems, to find out the latest of developments in this field (organizational structures, laws and regulations, equipment, buildings and their design, training institutes, programs and courses). Also visited the emergency center in the United States; the United Kingdom who exercise the same functions of the Board COBRA as well as the Ministry of Defence, Ministry of Foreign Affairs; Hashemite Kingdom of Jordan Emergency Management Agency and security structure in Greece" (Director of the Office of the Director-General of the NCEMA).

From the interview the Director of the Office of the Director-General of the NCEMA and study of documents of NCEMA there is no specific reference to natural disasters. The NCEMA plan needs to make specific reference to natural disasters. NECMA needs to implement procedures for monitoring and surveillance of natural hazards if it is to address mitigation of risk. Furthermore, there needs to be an initial process of consultation and analysis. Awareness of the needs of the local communities (economic

and social) will be critical in ensuring policies are appropriate and realistic. In short the lesson is not in the preparation of plans and formulation but in the process of implementation.

5.3.2 The UAE Red Crescent

The International Federation of Red Cross and Red Crescent was founded in 1919 in Paris in the aftermath of World War 1. The war had shown a need for close cooperation between Red Cross Societies, which, through their humanitarian activities on behalf of combatants and prisoners of war, had attracted millions of volunteers. The society is the world's largest and most famous humanitarian organization, providing assistance without race, discrimination as to nationality, religious beliefs, political opinions or class. There were five founding member Societies: Britain, Italy, France, Japan and the United States. Now the International Federation comprises 186 member Red Cross and Red Crescent societies. The Red Crescent is used in place of the Red Cross in many Islamic countries. The mission of the International Federation is to improve the lives of vulnerable people those who are at greatest risk from situations that threaten their survival, or their capacity to live with an acceptable level of social and human dignity and economic security. Often, these are victims of natural disasters and poverty (IFRC 2008). The Red Crescent Authority of the State of UAE was founded on 31/1/1983 and received international recognition as a member of No. 139 of the International Federation of Red Cross and Red Crescent Societies on 27/8/1986. In 2001 the UAE Red Crescent humanitarian body was recognized as the second-best in the continent of Asia (IFRC 2008).

It is considered a fully financial and managerial independent agency, it is the only national agency that performs activities inside and outside the country as a volunteer aid society. It assists people during war and peace time, natural disasters and supports the state in its efforts in the field of the humanitarian acts per the legislation effective and Geneva Conventions in 1949 or any convention that is part of it. The agency aims to achieve a humanitarian mission to maintain people in life and assure humanity, relief

from suffering through co ordination and co-operation with the concerned authorities inside and outside the country.

5.3.2.1 Results of Interviews

The preparedness and obstacles

In response to the question about the preparedness of Emirates Red Crescent with regard to natural hazards the answers were enthusiastic.

> "The Emirates Red Crescent carries out relief operations to assist victims of natural disasters, at the national level and international level. Our role in the national level, support and assist poor families with low-income within the state and extending a helping hand to needy people in normal circumstances. In disasters the Red Crescent carries out relief operations to assist victims, at the national level and international level. Furthermore, it is focused on promoting humanitarian values, disaster preparedness, disaster response, health and community care.
>
> The Red Crescent is ready for confronting natural disasters. So we are looking to a process of co-ordination between the participating departments to recognize the leadership team, whether it is the police, the Civil Defence or the armed forces; the solution of this problem depends on the clear definition of roles during the disaster, because the leadership is unknown when confrontating the natural disasters. It is confusing the operation of aid delivery of assistance to those affected by disasters" (Director of Emirates Red Crescent in smaller emirates).

5.3.3 The Emirates Volunteers

To enable rapid early relief activities in the event of a disaster, local disaster prevention efforts must be effective in normal times. Local residents as well as government bodies also need to cooperate and participate in devising ways to protect communities so that residents' efforts can be reflected in disaster management plans. In the UAE the number

of people volunteering to participate in relief activities has increased in the event of natural disasters in recent years. Today, there are several nationwide institutions established in the UAE by volunteer groups for relief activities in disasters. It is therefore important to study the problems being encountered by them and to understand the role that they play in natural disaster management in terms of facilitating communities' preparedness for disasters. The foundation of the voluntary work in UAE are set out in Federal Law No (6) in 1974 and its amendments. This law identifies the procedures organizing the voluntary work of these societies through the MOSA (Federal law 9 in 2002).

5.3.3.1 Results of interviews

The preparedness and obstacles

In response to the question about the preparedness of Emirates Volunteers to natural hazards the views were supportive.

> "It is the first time that someone cares about our opinion and ask us about our opinion this field. In natural disasters case, quick measures should be taken focused on immediate needs while no explicit specifications are available in Federal Plan to Face Disasters. Such as the distributing relief goods at a specific Shelter or providing relief services to specific elderly or physically impaired people. So actions are required to modify available principles described in manuals when they are found to be inappropriate in past disasters. The most common activities carried out by volunteers in the aftermath of Gonu storm were disaster debris removal, mud removal and assistance to evacuees. With respect to the affected during Gonu storm 2007 opinions about volunteers, 80% of the affected strongly agree, and grateful to the volunteers, assistance provided by volunteers contributed to the recovery of the affected areas. So these high percentages of respondents who felt grateful to the volunteers and these results indicate that the people in the affected areas have positive opinions of volunteers" (Director of Emirates Volunteers in bigger emirate).

"Volunteers are expected to prove their potential in situations not assumed in scenarios or disaster manuals if they are not excessively organized but are allowed to work freely. Excessive organization of volunteers is likely to hamper volunteer's actions" (Volunteer A in smaller emirate).

"The disaster plan must be a flexible and balanced in determining the work of volunteers. At the time of the Gonu storm, cooperation between volunteers and the federal and regional authorities posed a number of problems and some confusion arose, the major factor was the lack of know-how regarding cooperation between volunteers and federal and regional agencies. Because the use of volunteers in times of disaster was a novel step, each action was a new experience. Also, volunteers stay for long periods without activities and without training scenarios, so they often remain idle for a long time" (Volunteer B in smaller emirates).

The role of volunteers is limited in the UAE because of:

- Lack of encouragement by the concerned authorities towards the importance of the volunteer role.
- The volunteers are not summoned to face disasters, so their presence is uncoordinated with the support departments.
- The volunteers are not actually trained properly whether by the civil defence or the Red Crescent.
- "Need to engage media in the role of these voluntary societies" (Volunteer D in bigger emirates).

The volunteers of the Red Crescent are clearly highly motivated and provide a valuable contribution. There needs to be better coordination by government bodies.

5.4 Summary

The survey of UAE Support Ministries, National Institutions and Volunteers in their response to natural hazards gives a basic understanding of current provision and lessons are identified that should be taken into consideration by officials and government authorities. The interviews highlighted that no analysis about previous natural disasters has occurred in the UAE. Furthermore, there is no clear policy or guidelines available with regard to natural hazards. The NCEMA plan needs to make specific reference to the Civil Defence; it is the lead body during disaster response as set out in the UAE Federal Plan.

Furthermore, the NCEMA plan needs to make specific reference to natural disasters. The NECMA needs to implement procedures for monitoring and surveillance of natural hazards if it is to address mitigation of risk. Moreover, awareness of the needs of the local communities (economic and social) will be critical in ensuring policies are appropriate and realistic. In recent years in the UAE , there has been renewed interest in natural disasters and their management and in considering appropriate responses and strategies to reduce the impact of natural disasters. Having completed the analysis of government management of responses to the threat and impact of natural disasters in the UAE a timeline is presented in Table 14 showing the development of a natural disaster response capability since 1976.

Year and Event
1976 The UAE Civil Defence was established by the Federal Government to: protect citizens as well as public and private property: to rescue victims; secure transportation and protect national wealth during war and emergency. **1979** The definition of Public Disasters is contained in the UAE, Federal Law No (3) 1979 and its subsequent amendments. Civil Defence this defined "any fire, flood, collapse, earthquake, storm, *force majeure*, or any sudden occurrence that may threaten lives, public or private properties". **1990** Concern regarding disaster management was raised in the UAE following the first Gulf War in 1990. At that time there was no formal emergency plan. Formulation of the plan took nearly 15 years until it was presented as the *Federal Plan for Disasters* (2005 -see below). **2001** In January 2001, the first earthquake monitoring centre in the UAE was established. This consisted of a network of seven seismic stations in Fujairah set up by the American University of Sharjah. This network was, however, for educational and not monitoring purposes. **2002** The formalisation of the role of voluntary work in UAE was established by Federal Law. This concerned the operation of bodies such as the Emirates Volunteer Sociaety and the Red Crescent. **2003** In May following the Masafi earthquake, a scientific partnership between the geology department of UAE University in Al Ain, the US Department of Energy and the University of California (Lawrence Livermore National Laboratory) set up a seismic monitoring network. This partnership was short-term and has not been continued. The Federal Plan for Disasters was drawn up by the Civil Defence authorities. The plan was approved in 2005. The plan set out the structures for the operation of Civil Defence and the relevant government and non-government bodies and organisations. The plan defines the duties that must be carried out by each body with respect to preventing and dealing with disasters affecting the public. **2005** Following approval of the *Federal Plan for Disasters*, a Federal Law was passed codifying the responsibilities of the Civil Defence authority, its relationship with other government organizations and non-government organizations and the role these bodies have in providing support. **2006** The first study of seismic vulnerability of buildings in the UAE was carried out by Dubai Municipality. The study was launched to find out if buildings will have to adapt to a higher classification than the current Zone A of the Uniform Building Code (UBC), under which a

structure can resist an earthquakes measuring M 5.5. It was recommended that developers should adopt building codes to further resist the impact of an earthquake. The Dubai Municipality specifies that for buildings of 6 storeys or more the Zone 2A design criteria in the UBC 1997 should be followed.

2006
An important development was the formal launch in early 2007 of a UAE Government Strategy. The aim, outlined within the National Program, is to maintain high standards of living, and achieve sustainable development. This strategy also covers justice and safety. The UAE has previously not had a strategy for natural disasters management and this initiative reflects the increased level of awareness with respect to natural disasters in the UAE. The new strategy for the UAE, includes a focus on disasters as these are a major threat to sustainable development and there needs, therefore, to be an agency coordinating disaster management. These considerations led to the UAE government in 2007 to launch the *National Crisis and Emergency Management Authority* (NCEMA). The NCEMA was established and was located in Abu Dhabi.

2008
The National Centre for Seismic Monitoring and Meteorology, a Federal body, was created and will integrate with other facilities providing for their management, maintenance and development. This will create an integrated system for seismic monitoring. The national centre will be the authority to represent the country on seismic information on the regional and world levels. It also provides meteorological monitoring with advice and warning on storms. This new centre being developmented stage

2008
In the Dubai Municipality set up the first permanent seismic monitoring system in the UAE. The seismic network consists of four large-scale field monitoring stations in Hatta, Nazwa, Al Faqa and Al Ashosh in Dubai. This system is currently not linked to the National Centre for Seismic Monitoring and Meteorology.

2010
The NCEMA remains at a developmental stage.

Table 14: Timeline for the development of a natural disaster response capability in the UAE.

Principal issues that emerged from this survey of support ministries and national institutions are:

- Lack of regulation requiring adherence to a seismic code for buildings.
- Lack of a policy in the Ministry of Education regarding raising awareness regarding natural disasters nor the safety of buildings and people.
- Shortage of appropriate medical resources.

- Senior officials in some ministries clearly unaware of their responsibilities as set out in the Federal Plan.
- Lack of urgency in the implementation of NCEMA.

An important point raised during the interviews, all those who were interviewed focused on natural disaster events in the emirate of Fujairah, because most of the UAE natural hazards have occured there (Masafi earthquake 2002, Al Qurayah flood 1995, Al Tawaian landslide 2005 and Tropical Gonu storm 2007 and Sharm flood 2009). In short the social and environmental vulnerability to natural hazards in Fujairah can be explained by several factors. The increase in vulnerability to natural hazards is related to: population growth and density, rapid urbanization and unplanned human settlements, poor engineering of construction, lack of adequate infrastructure, social vulnerability, and inadequate environmental practices. All of these factors make Fujairah a good example to be the Emirate case study in this thesis.

CHAPTER 6: FUJAIRAH EMIRATE: CASE STUDY OF NATURAL HAZARDS

6.1 Introduction

The Fujairah Emirate is located on the east coast of the UAE and is the only Emirate that is almost totally mountainous. Fujairah is particularly at risk from natural hazards, for example the Al Qurayah flood 1995, Masafi earthquake 2002, Al Tawaian-Dibba Landslide 2006, Gonu storm 2007 and Sharm flood 2009, so it is important to investigate this emirate. This is the first documentation of natural disasters to be conducted in the UAE except for the Masafi earthquake 2002.

Figure 32: Fujairah City showing recent development in this Emirate, (a) showing Fujairah City in 2009, (b) showing Fujairah City in 1991 (Al Rams 2009).

6.2 Geography of Fujairah

The governor of Fujairah is His Highness Sheikh Hamad bin Mohammed Al Sharqi, who succeeded his father in 1974 (FEG 2009). Fujairah emirate is situated on the eastern side of the UAE, along the Gulf of Oman. Fujairah was known as the land of the sea giants and its people regarded as tough and courageous. It is has a long history following the arrival of envoys from the Prophet Mohammed in 630 AD which heralded the conversion of the region to Islam. The Emirate derives its name from a spring of water located beneath one of the mountains. It is historically very old and people lived here before Christ. The Sharqeyeen were known to be tough and courageous and their roots are related to Faham Bin Malik (FEG 2009). The life in this Emirate is quite simple; the Fujairah economy is based around subsidies and federal government grants, distributed by the government. Local industry consists of cement, stone crushing and mining. These industries have witnessed resurgence due to the increased construction activity taking place in other emirates (See Figure 32), (Fujairah Municipality Personal interview 2009).

Population Estimates By Sex - Emirate of Fujairah
2004 - 2006

Year	Female	Male	Total
2004	44,581	69,392	**113,973**
2005	45,169	74,008	**119,177**
2006	47,427	77,708	**125,135**

Table 15: Population Estimates by Sex - Emirate of Fujairah
(Fujairah Statistic book 2007).

The length of Fujairah coast on the Gulf of Oman is about 70km. The Oman Mountains, also known as the Hajar Mountains, reach up to 3,000m in height and exhibit many features consistent with active tectonics (see Figure 33).

Figure 33: Satellite image of the UAE, showing the distribution of Geography environments.

The months of December to February are the coolest, the temperatures averaging around 30 Celsius but during the summer months it can reach 50 Celsius. This period also coincides with the rainy season; rainfall is higher than the rest of the UAE partly because of the effect of the mountains that encircle the Emirate. The Indian Ocean affects the climatic conditions of Fujairah as it lies on the Arabian Sea. The main cities and villages of Fujairah are Fujairah City, Dibba, Marbah, Siji, Bedyah, Masafi, Tawaian. It is linked by modern highways to all major cities in the United Arab Emirates. Fujairah is 90 minutes drive time from Sharjah and Dubai, and just three hours from Abu Dhabi.

Rainfall in Millimetres at Emirate of Fujairah

2004 - 2006

	Total for Month			Heaviest Fall in one Day		
Month, Year	**2006**	**2005**	**2004**	**2006**	**2005**	**2004**
January	0.0	15.5	6.6	0.0	11.6	4.3
February	17.7	19.4	0.0	12.9	15.6	0.0
March	4.6	11.1	0.0	3.0	10.7	0.0
April	-	-	-	-	-	-
May	0.0	0.3	0.0	0.0	0.2	0.0
June	0.0	0.0	0.0	0.0	0.0	0.0
July	0.0	0.0	-	0.0	0.0	-
August	0.0	-	1.9	0.0	-	1.0
September	0.0	0.0	0.0	0.0	0.0	0.0
October	1.0	0.0	14.0	1.0	0.0	14.0
November	3.2	4.1	1.0	3.2	3.7	0.8
December	59.3	12.5	35.4	44.2	11.7	22.7

Table 16: Rainfall in Millimetres at Emirate of Fujairah
(Fujairah Statistic book 2007).

6.3 Geology and structure of Fujairah

Most of the UAE is covered with sediments of the Arabian Platform (Rodgers et al 2006). Pre-Lower Cretaceous data on the geology of Fujairah are limited due to the absence of drill wells that reached the Jurassic-Paleozoic formations. Consequently the following description considers only formations for which data are available (Robertson et al 1990).

Lower Cretaceous

The Lower Cretaceous rocks in Fujairah are composed of cyclic carbonate deposits reflecting low-and high energy conditions which resulted from marine transgression and regression. The high-energy carbonates are characterized by high porosity and consequently act as reservoir units and are sealed by the low energy open marine carbonates, this group is known as Thamama Group. At the end of the Lower Cretaceous and during the deposition of the Shuaiba Formation, the broad Arabian shelf area developed a shallow basin.

Middle Cretaceous

The Middle Cretaceous rocks in Fujairah are called the Wasia Group which includes the following formations:

Natih Formation

The Natih Formation is a shelf carbonate sequence that is laterally equivalent to the Mishrif, Mauddud and Shilaif formations.

Nahr Umr Formation

The Nahr Umr Formation is represented by deep marine shales as a result of marine transgression, which started in the Middle Cretaceous. The thickness of the formation is controlled by the form of the underlying Shuaiba Formation. It has a thickness of about 150- 300 ft in Fujairah.

Upper Cretaceous

The upper Cretaceous rocks in Fujairah are also known as Aruma Group, this group is represented by a thick sequence of deep-water shales resulted from down warping (Searle et al 1983). The Late Triassic to Upper Cretaceous sedimentary rocks are folded and thrusted. They are dominated by a sequence of fine- to coarse-grained turbiditic limestones and deeper water mudstones and cherts, with minor volcanic rocks and mélange/olistostrome deposits (Lippard et al 1982). At the end of the Upper Cretaceous, uplift led to the deposition of Maastrichtian limestones.

The Dibba zone

The Dibba zone is a pile of thrust sheets of mainly Mesozoic oceanic rocks formed in that part of Tethys that lay between the stable passive continental margin of Arabia to the SW and the Semail ophiolite complex to the E and NE. The Semail Ophiolite shows a complete 12km thickness of oceanic crust and mantle of Cenomanian - Turonian age that was thrust west or southwestwards on top of the previously described thrust sheets during the late Cretaceous (Allemann and Peters 1972).

The sedimentary and volcanic rocks of the Dibba Zone are divided into four main units, namely the Shamal Chert Formation, Dibba Volcanic Formation, Hamrat Duru Group and Aruma Group (Phillips et al 2006). In the Fujairah region the ophiolite may be 'rooted' in the Gulf of Oman and is continuous with old (Cretaceous) oceanic crust being subducted along the Gulf of Oman and under thrusting NE below the Makran accretionary prism (Lanphere 1981) (Figure 34).

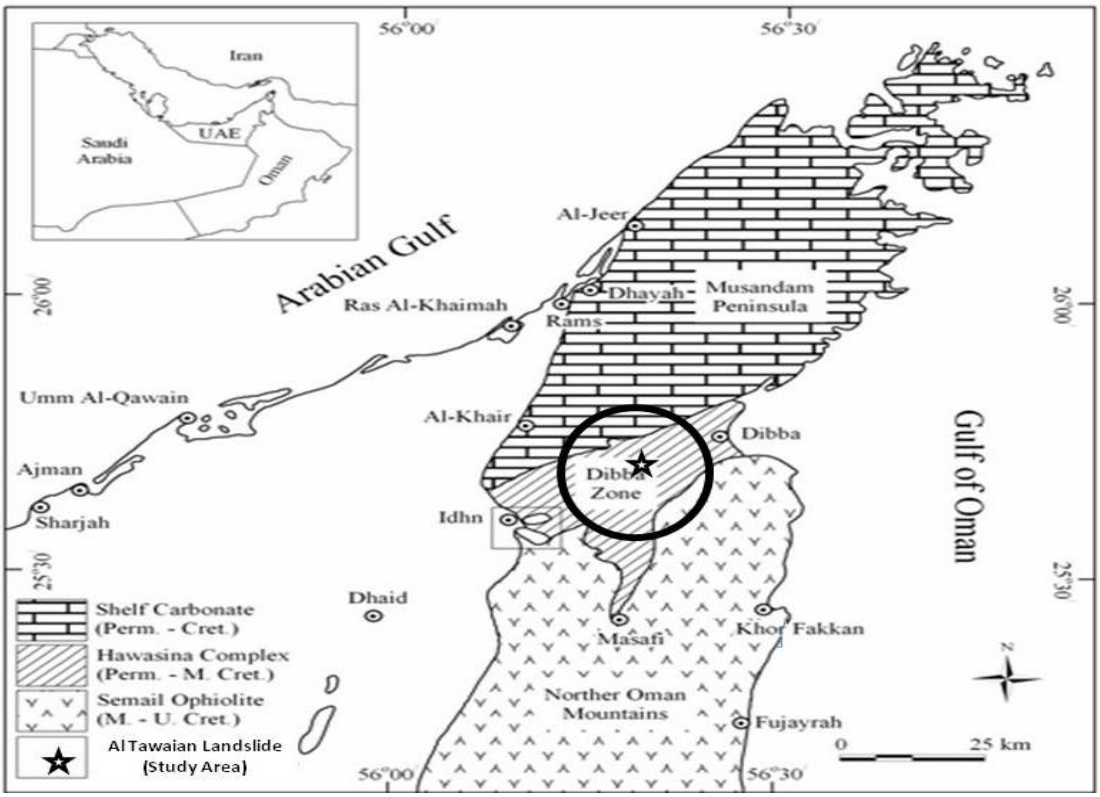

Figure 34: Simplified geological map of Fujairah and vicinity (Phillips et al 2006).

The Dibba Zone is bound by a number of northeast to southwest-trending high-angle brittle faults which separate the deeper water sediments from the shelf limestones of the carbonate Musandam platform to the north (Glennie et al 1974). The late stage culmination of the whole Musandam shelf carbonate sequence is now a completely exposed section from stable Arabian foreland in the Gulf region across the continental margin and shelf edge (Musandam Mountains), across the adjacent Tethyan oceanic basin

Dibba zone to the obducted Semail ophiolite complex which comprises a 12 km thick Cenomanian- Turonian oceanic crust and mantle sequence (Searle 1988).

6.4 Description of Fujairah natural disasters

Most of the UAE natural hazards have occurred in Fujairah, such as Al Qurayah flood 1995, Masafi earthquake 2002, Al Tawaian landslide 2005 and Tropical Gonu storm 2007 and Sharm flood 2009. This section looks at the impact of recent natural hazard events in Fujairah.

6.4.1 Al Qurayah Flood 1995

Introduction

This flood was caused by a dam failure and is different from natural floods for several reasons. Fast and violent flooding of the banks is significant, inundation of dry land where it is difficult to calibrate dissipative effects and very high peak discharge values occur in a very short time interval. This type of flood is typically many times larger than a precipitation runoff flood; and often they occur without early warning (Almeida and Franco 1993). Heavy rainfall in the arid environment of the UAE typically results in high level discharge and flooding. A good example is the flooding that occurred in Al Qurayah in December 1995. Three days of heavy rain and storms led to high water discharge water and this resulted in the failure of an old dam and extensive flood damage.

Location of Al Qurayah town

Al Qurayah town is located on the Indian Ocean coast (25° 14' 22N - 56°2138E), north of Fujairah City (Figure 35). It lies at the foot of the Hajar Mountains and is situated at the mouth of the Safad valley. The population is around 5026 and the total number of buildings and houses is around 414.

Figure 35: The map shows Al Qurayah location.

Description of the disaster and losses

On Friday, December 11 1995 at midnight following three days of heavy rain and storms high water discharge caused the failure of an old dam leading to extensive flood damage (Dubai Police 1995). The floods of December 1995 were the worst in the history of the Al Fujairah emirate and almost 90 percent of the Al Qurayah area was affected. The dam collapse resulted in considerable damage to roads, farms, buildings and all the houses and property. The collapse of the Al Qurayah dam on the hillside above the town sent a high surge of water rushing down the valley into the town. Many houses were destroyed and the waters damaged several others. Al Qurayah town became victim to widespread flooding that affected the food and livelihood security for hundreds of families in town, and large numbers of people were forced to flee and congregate on the higher elevations and mountains.

Figure 36: The impact of flooding on Al Qurayah, picture (a) Mosque (b) houses collapsed due to flood, (c) Debris and residual effects of the flood, (d) Guidance Plate describes the road to Al Qurayah.

Mud and debris were deposited in streets and all people were evacuated from their houses. Most of the houses were damaged; households lost their poultry, livestock, and other durable assets. In addition a surge from the sea damaged many houses along the waterfront. The Al Qurayah dam is fed from the Safad valley, the major valley in Fujairah emirate, the second valley. Thayb lies to the NW of al-Quanah. The Dam was at least 50 years old and poorly maintained, and this together with the extent of heavy rainfall coming after a long dry summer led to the failure.

Figure 37: Rescue team helping one of victims in Al Qurayah town during the flood 1995 (Dubai Police 199)

Floods left most of buildings and schools under high level of waters, and power lines were destroyed and trees uprooted. Most houses in Al Qurayah were damaged by the flood (Figure 36).

Response stage:

The Government of Fujairah, through the Rescue Team of Dubai Police, launched a response operation (Figure 37). At that time there was no national disaster management authority. The main purpose of the Dubai Police in the rescue stage in Al Qurayah was to avert loss of life, to reduce the property damage and then to establish public safety and to relieve public anxiety. At that time there was no plan to face natural disasters and organization and distribution of roles was through the personal efforts of the Dubai Police Officers. The relief and rescue operations were undertaken in Al Qurayah by the Dubai police and with some help from Fujairah Civil Defence (FCD). All the houses were damaged in Al Qurayah, no loss of life was reported in the affected population in the village and all of people were evacuated. The Dubai Police team had the disaster under control within 12 to 15 hours. The response operation was hindered by the lack of coordination between the responding bodies in the disaster location. Interference of some

high ranking officers (police or army) who reached the damaged area and issued orders to the Civil Defence team, even though they did not have experience in managing natural disasters, was an issue. There was duplication and repetition of the roles, and many decisions by staff with limited experience.

Furthermore, at the time the lack of a federal plan meant unclear definition of roles and responsibilities and lack of coordination between police and civil defence. This increased the size of losses at the time of the disaster which occurred after midnight, cutting off electricity with no warning. High waves from the sea coming to the town by strong winds caused damage along the sea front. The events revealed the shortage of individuals, equipment, devices and logistic support to face natural disasters. The manager of Fujairah Red Crescent, reported:

> "The Red Crescent response was mainly aimed at providing temporary shelter, clean drinking water, and prevention of disease outbreaks. They helped the most-needy in the affected families".

However there were issues with the Red Crescent operations, because many families complained of poor distribution of aid and support.

The Fujairah Civil Defence failed to respond to the disaster effectively and did not achieve its full potential as a coordinating body and suffered from lack of equipment, rescue boats and rescue teams. However, around the world most disaster response problems are not failures of individuals but are due to systemic problems. That is the usual organizational systems (procedures, designation of responsibilities and management structures) established by various organizations to cope with disasters do not function well (Litman 2006). Accordingly, this emphasizes not so much what one body can do to influence disaster response, but what can be done at an organizational and inter-organizational level.

Figure 38: Disaster response operations in the Al Qurayah flood (Dubai Police 1995). Picture (a) Rescue team of Dubai Police, they helping an elderly man in the affected area, Picture (b) During landing the rescue boats, Picture (c) rescue cars of Dubai Police and Army Helicopter, Picture (d) Image shows people gathered near the police and the army in disaster place.

After Al Qurayah 1995 the UAE government provided a budget of $4 million to rebuild the dam and three breakwaters are being built in the Safad and Thayb valleys above Al Qurayah town. Specialized companies were contracted for maintenance of dams in the country. The project is expected to help collect more rainwater, irrigate more farms and support underground water storage in the region. The dam is very important to the area with regard to floods. The dam will provide farmers in the area with a continuous source of water to irrigate their farms during summer. The breakwaters will also protect houses in Al Qurayah village from being swept away by torrents. New houses for the Al Qurayah population were built and compensation paid to those affected (Figure 39).

Figure 39: New houses for those people who affected by flood 1995

Lessons learned

The Al Qurayah region is prone to various types of natural disaster due to its geography because it is near the sea and it is between the mountains and valley mouths, on the narrow coastal plain. Moreover, the weak structure of the dam, the weather and lack of preparation, all these factors contributed to the natural disaster. Nobody can avoid floods but by implementing effective flood prevention schemes, damage can be minimized and if sufficient warning is provided efficient evacuation can be implemented. These are useful measures towards disaster preparedness and planning. Much of the growth in disasters due to natural hazards is attributable to an increase in vulnerability; reasons behind these changes are complex. The inadequate enforcement of planning, design and building standards is the first factor. In improving disaster planning evaluation of the required logistical support needs to be undertaken because during the Al Qurayah disaster

the civil defence discovered that they did not have the necessary heavy equipment to respond to the disaster nor the means to get them to the disaster location because the floods had cut the roads. So lack of adequate natural hazard assessment is an issue. The geographical and geological context together with analysis of past disasters is necessary to inform planning.

6.4.2 Masafi earthquake 2002

Introduction

During the last few years there has been increased awareness of seismic hazard in the UAE since the M 5.1. Masafi earthquake that occurred on the Dibba fault in 2002 (Al Houmod 2003, Kazmi 2005). The focal depth was just 10 km. The earthquake occurred on the Dibba fault in Fujairah with the epicentre of the earthquake at 20 km NW of Fujairah (Arthur et al 2006).

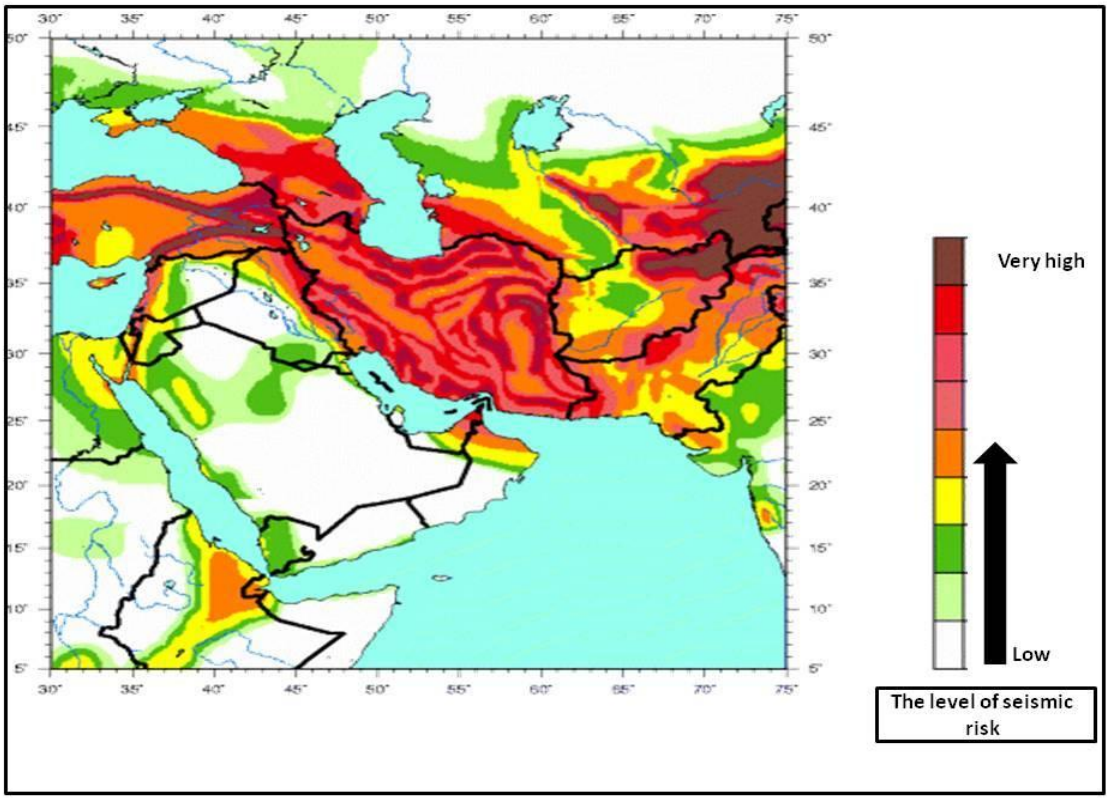

Figure 40: Middle East, Seismic Hazard Map (USGS 2008).

Location of Masafi

Masafi is a village located on the edge of the Hajar Mountains in the UAE (Figure 42). It is developed along the road which runs from Fujairah to Sharjah. Masafi is divided into two parts; one part belongs to the emirate of Ras Al Khaimah while the smaller belongs to the emirate of Fujairah. It is the highest village in the UAE also famous for its citrus and mango trees. It is located 25° 18 48 N, 56° 9 46 E (Figure 41) with a population of around 4000, most of them dependent on agriculture and sheep trade (Fujairah Municipality Personal interview 2009).

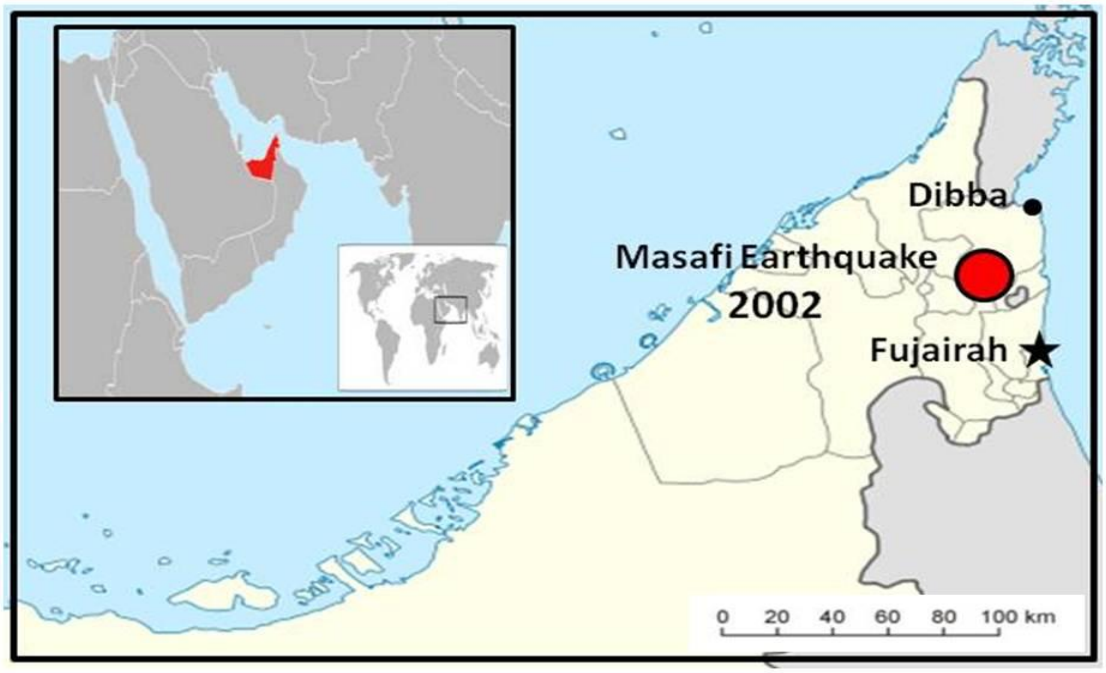

Figure 41: Map of Masafi location

Figure 42: Part from Masafi region.

Geological and active tectonic of Masafi area

The earthquake area is located in the northern part of the Oman Mountains, associated with the Dibba active fault. Most of the study area is underlain by the Semail ophiolite and metamorphic sole rocks. The remainder of the country is topographically high and is dominated by the Semail ophiolite (Zain Eldeen and Fowler 2006).

The Dibba fault, which is connected to the Zagros faultsystem, is about 100 km long. The earthquake occurred to the north of Masafi and estimated from regional waveform modeling, it is suggested that the event occurred by normal faulting probably along the north-striking Dibba Fault, as a result of normal fault reactivation (Rodgers et al 2003). Across the Arabian gulf the Iranian plateau frequently suffers destructive and catastrophic earthquakes that cause heavy loss of human life and widespread damage to buildings and infrastructure (Dehqan 2009).

Earthquake Details

The Masafi earthquake occurred on March 11, 2002, and the region was shaken by an earthquake M 5.1 at 01:00 A.M, local time (Figure 43). It occurred while most people were indoors, and this explains the strong awareness from the people for the earthquake.

> "The night before the main earthquake the local population felt at least four to six tremors, partly accompanied by rumbling noises. Because Masafi is a rural area, and most of residents are farmers they have heard the noise of poultry and sheep in an unusual way, the bird calls were also coming from the mountains and from farms loud animal calls around 3 to 4 hours before main earthquake. After the earthquake cracks and fissures were visible in mountains and Masafi road" (interviews with residents of Masafi, **according to residents of the region).**

The earthquake occurred on the Dibba fault in the UAE with the epicenter 20 km NW of Fujairah city. The focal depth was shallow at just 10 km. The United States Geological Survey (USGS) determined the epicenter location coordinates to be 25.236 -56.145. This location most probably indicates that the seismic energy released is attributed to the re-activation of the Dibba fault. The main shock located by global catalogs from teleseismic data (Al Homoud 2003) see (Table 17).

The earthquake was felt in most parts of Fujairah; the main shock was followed over the next weeks by more than twenty aftershocks with local magnitude ranging from Magnitude 4 to M 4.8. The location of those earthquakes was along the Zagros fault system on the Iranian side, opposite to the shores of the UAE. Most of these earthquakes were shallow and were felt by people in Fujairah. This is the biggest recorded earthquake in the UAE history and left widespread damage in houses, buildings and infrastructure in Masafi (Othman et al 2003).

Catalog	Latitude	Longitude	Depth	Time	Magnitude
USGS-PDE	25.236	56145	10	20:06:37.2	5.1 (m_b)
IDC-REB	252663	56.1009	0[a]	20:06:37.5	4.9 (m_b)
KISR	25.23	56.13	10	20:06:37	4.6 (M_s)
CMT	24.82	55.77	15	20:06:34.5	5.0 (M_w)

Table 17: Locations and origin times for the March 11, 2002 Masafi Earthquake (IDC-REB procedures often fix depths at 0), (Rodgers et al 2006).

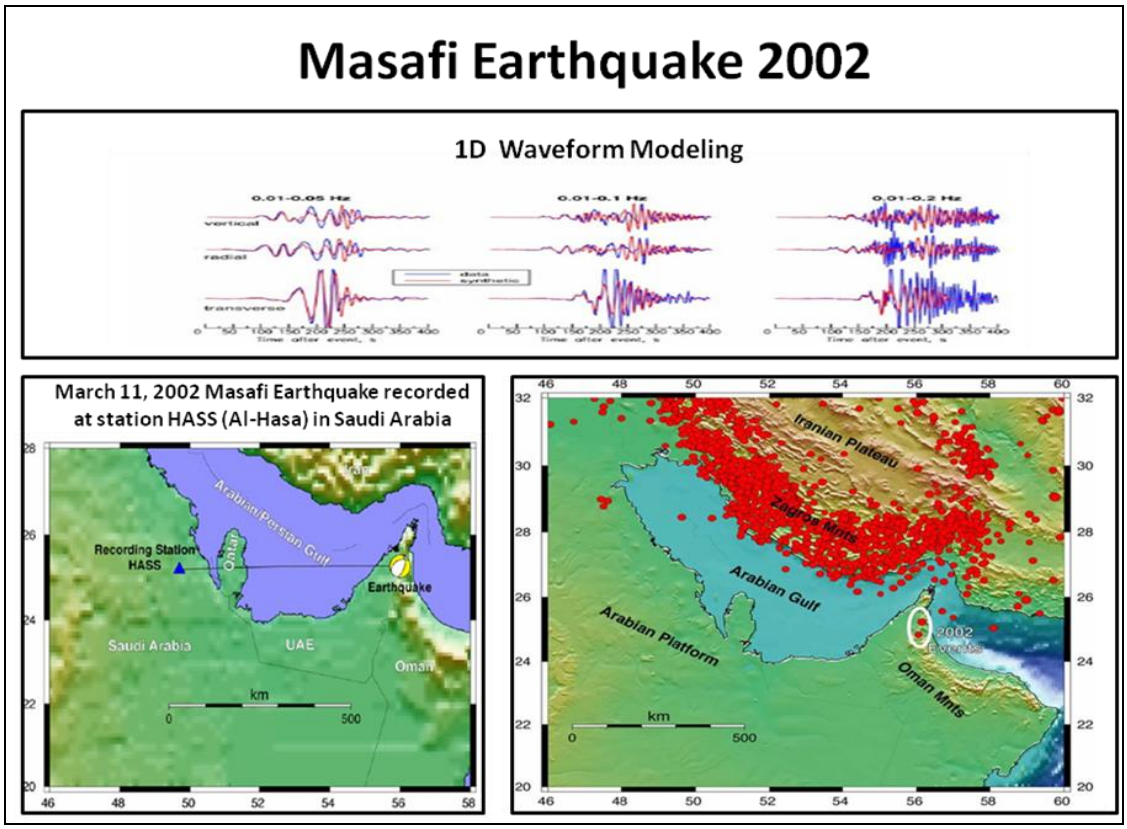

Figure 43: Details of Masafi earthquake 2002 (Rodgers 2005).

The response and losses

Even though there were no casualties in the March 11th event, there was major concern as a result of the loud sound of rock rupture heard in the mountains close to Masafi and

cracks occurred in a number of Masafi buildings and major damage occurred in the old schools buildings and Civil Defence in Masafi, the closest town to the epicenter of the earthquake (Figure 44). According to the experts, in the UAE, many buildings are constructed on layers of unconsolidated sand over more consolidated bedrock. This is precisely the condition that can give rise to amplification of shaking. The existing buildings were not designed to modern code provisions and had limited seismic resistance (Othman et al 2002).

> "Around 230 houses were affected, along with some schools and mosques. The first response from the Civil Defence, they evacuated all residents of Masafi, but there was no evacuation plan from the Civil Defence for the regions in Fujairah, but fear made the people leave their houses. Residents in Masafi spent around 3 nights outside their houses in tents. However, the week after disaster a federal committee visited the area The committee consisted of representatives from the Ministry of Labour and Social Affairs, the Ministry of Housing and Public Works, the Ministry of Interior (Civil Defence) and the Ministry of Agriculture and Fisheries. To evaluate the damage caused to houses, mosques and schools and buildings, to determine how many have been affected and suggest compensatory amounts to be given" (Senior official in the Emirate of Fujairah).

> "We and our neighbours had communicated with the Red Crescent to obtain from them tents, because they have waited many hours outdoors with their families without refuge, they said, and that the Red Crescent had not received any formal request for assistance from any department" (Citizens Ali, Abdulla and Ahmed from Masafi).

> "There have been rumours that these earthquakes were precursors for a bigger earthquake. Also he pointed out that the medical care provided was insufficient" (Rashed a citizen from Masafi)

Figure 44: The impact of earthquake Masafi 2002 on the buildings of Masafi, Picture (a) and (b) shows the effects of the earthquake on the walls of Masafi schools, picture (c) shows a crack the top board in a classroom, picture (d) shows the big crack in Masafi house. (AUS 2008).

In recent years, there has been a noticeable increase in the magnitude and frequency of seismic events in the emirate of Fujairah (see chapter 3). Most buildings, houses and structures in Fujairah have been designed and constructed with little or no compliance, with earthquake resistant design provisions. In the design of the majority of buildings in UAE, earthquake effects have been mostly ignored due to the absence of an earthquake resistant design provisions and the rule of law for enforcing them (see chapter five). The Masafi earthquake 2002 caused considerable alarm in the UAE and highlights the fact that damaging earthquakes can occur. The Ministry of Public Works, in 2009 completed construction of 85 houses in the Emirate of Fujairah, for the citizens affected by the Masafi earthquake 2002, and which occurred during the last period. Unfortunately, the

new houses were built in the same area, and without the seismic code for resistance future earthquakes (Figure 45).

Figure 45: New houses for those people who affected by Earthquake 2002

Lessons learned

The UAE is vulnerable to major earthquake motions originating from not too far a distance on the southern shores of Iran. The Dibba fault links with Zagros belt and that is enough to be a major hazard in the future (Malkawi 2004). The major concern in the UAE comes from the seismic activity in the Zagros fault in western Iran and it is one of the most active fault zones in the world (Barazangi 1983).

6.4.3 Al Tawaian-Dibba Road Landslide 2006

Introduction

Landslide is a general term for a wide variety of down-slope movements of earth materials that result in the perceptible downward and outward movement of rock, soil, and vegetation under the influence of gravity. The materials may move by falling, sliding, toppling, spreading or flowing. Some landslides are rapid, occurring in seconds, whereas others may take a long time hours, weeks, or even longer to develop. The landslide is an important environmental hazard, especially in mountainous terrain. Rapid movement causes most loss of life, property damage, injury, disruption of communication, supplies and economic activities, and loss of productive soil and land (Alexander 1993).

The actual type of landslide movement depends largely on the nature of the geologic environment, including material strength, slope configuration and pore-water pressure. Landslides are movement of rock and soil along slip surfaces. They are associated with a disturbance of the equilibrium that normally exists between strength and stress in material resting on slopes (Alexander 1993, Smith 2004) . The relationship between stress and strength is determined by factors such as the density and steepness of the slope and the height, and the strength, cohesion and friction of the materials on the slope. Yearly in many parts of the world, landslides cause disasters resulting in fatalities, injuries, destruction to infrastructure, property and houses, as well as loss of productive land (Alexander 1993, Smith 2004). Destructive landslides are triggered by heavy rainfall and also by other natural hazards such as earthquakes, volcanic eruption, and floods. Increasing the potential impact and likelihood of landslides can be caused be de-forestation and by the spreading of urban settlements into landslide-prone hilly areas. Construction and other human activities such as quarries may also be a factor (Javier 2003).

Description of Al Tawaian-Dibba Landslide 2006

On 19 March 2006, following intense rainfall which lasted three to four days, a major rockfall occurred on the newly opened Tawaian-Dibba highway, closing the road for over

6 months. The rock fall started about 9:00 am and rocks continued to fall for a number of hours. Halcrow was appointed to undertake an independent investigation into the causes of the landslide and the study involved detailed site reconnaissance including geological mapping and a review of the original design, the results of the investigation were presented in a report identifying the causes of the landslide (MOPW Personal interview 2008), (Figure 46).

Figure 46: Locution of Al Tawaian-Dibba Landslide 2006

Location and description of Road Project

The location of the landslide in the emirate of Fujairah (Figure 47), on the Al Tawaian-Dibba New Road, which links Fujairah Emirate with the other emirates is WGS84 grid reference, 416133E, 2825636N. Around 20,000 people use this road per day from the commuter people in Dibba. The 29.5 km new route was a major modern commercial highway of 22 metres width and designed to save around 80 km compared to the original route. However, the area was remote, with elevated terrain, exposure to wind, very rugged and dry with temperatures approaching 50°C. Major features were the numerous gullies formed by heavy rainfall events, which cut across the landscape, creating many

steep sided valleys. As a result, extensive construction was required to achieve the required grades, with considerable amounts of infill and retaining walls. The Al Tawaian-Dibba Road has been planned for construction since 1998, and construction was started in the late summer of 2001, with a projected finish of November 2003. The cost of this road $ 45 million, was funded by the Ministry of Public Works. Consultant engineers for the project were Jacobson Gibb (formerly Gibb Ltd) and the contractor Cyprus-based National Wheel J&P (MOPW Personal interview 2008).

Figure 47: Location of Al Tawaian landslide 2006

Geology of event area

The geological map of the Al Tawaian area indicates that the landslide has occurred within a region known as the "Dibba Zone". This area comprises Jurassic to Mid Cretaceous sediments (200 to 100 million years before present) of the Hawasina complex, typically fine-to coarse-grained turbiditic limestones and deeper water mudstones. The whole region was subject to extreme tectonic forces in the Upper Cretaceous period (65 Ma), that resulted in the sedimentary rock, together with associated

deep oceanic rock, being thrust up onto the adjacent continental block. The rocks have therefore suffered extensive tectonic deformation that has resulted in large scale and small scale folding and faulting (Figures 48 and 49), (GIBB LTD 2006).

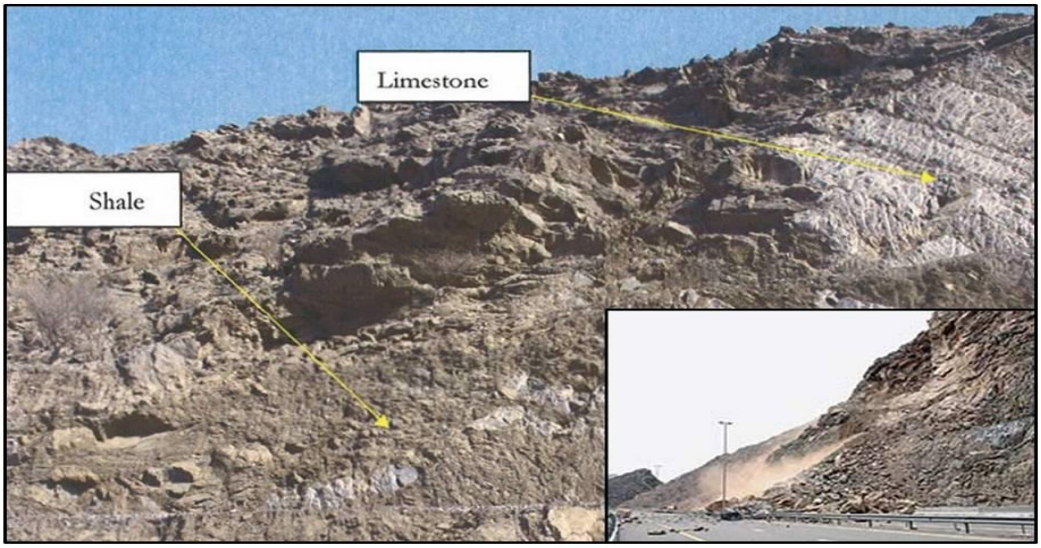

Figure 48: The rock in the vicinity of the landslide comprises Strong grey, thin medium bedded, fine grained limestones, interbedded with weak to very weak fissile slatey shales (Halcrow 2006).

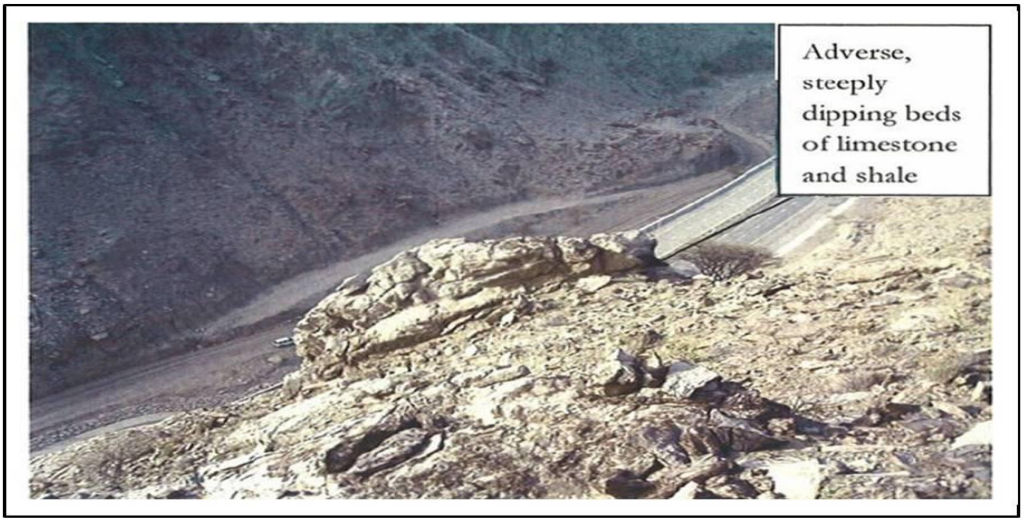

Figure 49: Steeply Dipping Adverse Bedding in Rock Exposed at Original Ground Surface above the Failed Cutting (Halcrow 2006).

Response stage

The first response by the police of Fujairah was to close the road completely for a week until the opening of a temporary route. Halcrow was appointed by the Ministry of Public Works (MOPW), to undertake an independent review of the causes of the landslide and provide a preliminary report with conclusions on the causes. This involved study of additional data and documents provided by MOPW and study by Halcrow (Halcrow 2006). The MOPW Al Tawaian-Dibba Road Draft Study report January 1998 (Sir Alexander Gibb and partners) was studied by Halcrow in the course of production of their report.

The result of Halcrow study

It is concluded that the landslide was the result of adverse geological structure. A review of the information provided indicates that, despite the fact that the route alignment was known to pass through areas of complex geology, the final design issued for construction did not mitigate against the potential/likely failure mechanisms along the route, other than in a rudimentary way, and the construction documents did not include any systematic assessment or review of the stability of the rock cuts during construction. The Contract states that design of the permanent works is the responsibility of the Engineer unless explicitly stated otherwise in the contract. No such explicit statement is made in relation to slope design and thus responsibility for design of the permanent works (including the slopes) rests with the Consultant.

However in the case of the failed slope, excavation was via mechanical means and therefore this clause may not specifically apply. Following previous rock cut failures that occurred during construction, the contractor expressed concern regarding stability of some of the cut slopes. There appears to be no record that the Contractor expressed concern about the stability of this cutting, however, since the failure occurred several years after excavation, it is possible that the Contractor (not being a specialist in design and assessment of rock slopes) did not appreciate the potential instability of the excavated rock face. Following previous construction failures, a site visit by the

Consultant resulted in amendments being made to the profiles of rock cuttings with adverse geological conditions as well as a warning as to the consequences of excavating steep cut slopes in such areas (Figure 50).

However, implementation of these revised design profiles would require the rock conditions at each cutting to be assessed by a suitably qualified person, either from the site supervision team or from the design office (Hacrow 2006). Landslides occur frequently along the Tawaian-Dibba highway during the rainy seasons in winter, so heavy rain clearly is one of the major causes of landslides in Fujairah Mountains.

Figure 50: Tawaian-Dibba Road and response stage. Picture (a) Tawaian-Dibba Road, (b) Tawaian Road, (c) The road maintenance operation (d) One of the stages of the maintenance of the road.

The lessons

The UAE government spent $ 45 Millions on the construction of this road, without a site investigation of the geological nature of the region (MOPW 2008). Many of the Fujairah population use this road on a daily basis to commute to Dubai and Abu Dhabi. The residents expressed their frustration at the daily inconvenience, and the difficulty of taking the alternative route or the diversion road. The new road was closed for more than six months until the end of 2009, and is still undergoing maintenance. Fortunately there were no injuries or loss of life.

6.4.4 The UAE Tropical Gonu Storm 2007

Introduction

Storms and cyclones when they come onto land, give rise to heavy rain, strong winds and large waves which can damage buildings, trees and cars, they can rip through entire cities. Severe cyclonic storms that begin over the tropical seas are called hurricanes in the Caribbean Sea, north Atlantic Ocean, Gulf of Mexico and Pacific coast of Mexico. They are called typhoons in the western Pacific Ocean and simply tropical cyclones in Australasia and the Indian Ocean. The naming of hurricanes began in the 1940s, while in the 1980s the practice of giving them only female names was modified to include male names (Alexander 1993).

Tropical Gonu storm in the Arabian Gulf was a rare exception because cyclones like Gonu are almost unheard of in the northern Indian Ocean basin. Most cyclones in the region form over the Bay of Bengal in India. The Arabian Sea rarely sees tropical cyclones, and when they do occur, they typically weaken and move away from the Arabian Peninsula. So the Meteorologists described Gonu as the strongest tropical storm to hit the Arabian Peninsula in 30 years (NASA 2007).

Tropical Gonu storm caused devastation along the Oman coast in June 2007 (Figure 51). The storm dropped heavy rainfall along its path, peaking at over 40 inches (1000 mm) in Oman. The worst of the flooding occurred in Oman, where most of the damage occurred

(El Rafy and Hafez 2008, Ali et al 2009). The streets of the capital Muscat turned into rivers, flipping over cars, uprooting trees and severing electricity and phone lines. Many areas in Oman were inundated with flooding particularly Moserah Island and Muscat causing severe damage. Tropical Gonu storm hit Fujairah and some parts of Sharjah and the storm initially generated winds of 160mph (260 km/h) causing significant damage in the regions of Sharm, Al Bedyah and Suhilah. Large waves breached the Fujairah coast and flooded the streets, causing chaos and panic among tourists and residents (Personal interview Fujairah Municipality 2008), (Figures 52 and 53).

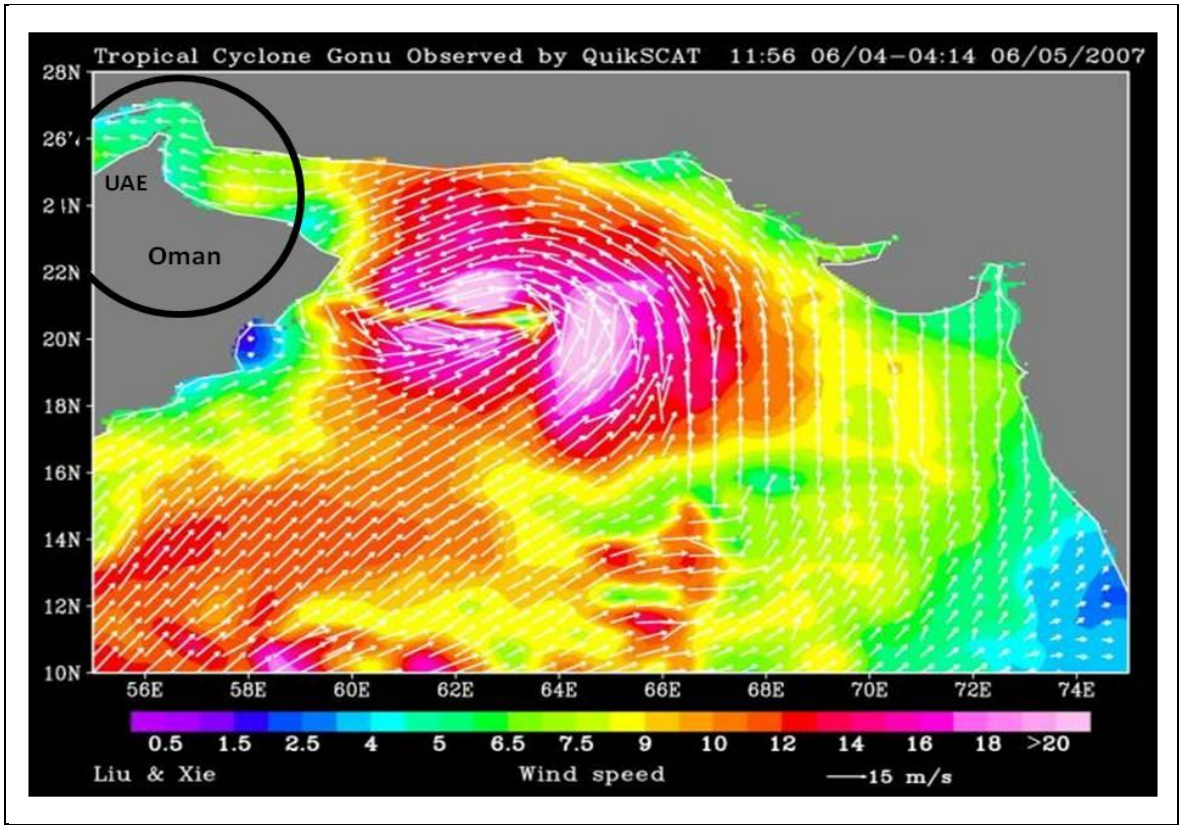

Figure 51: Wind directions and speed4-5 June (NASA 2007).

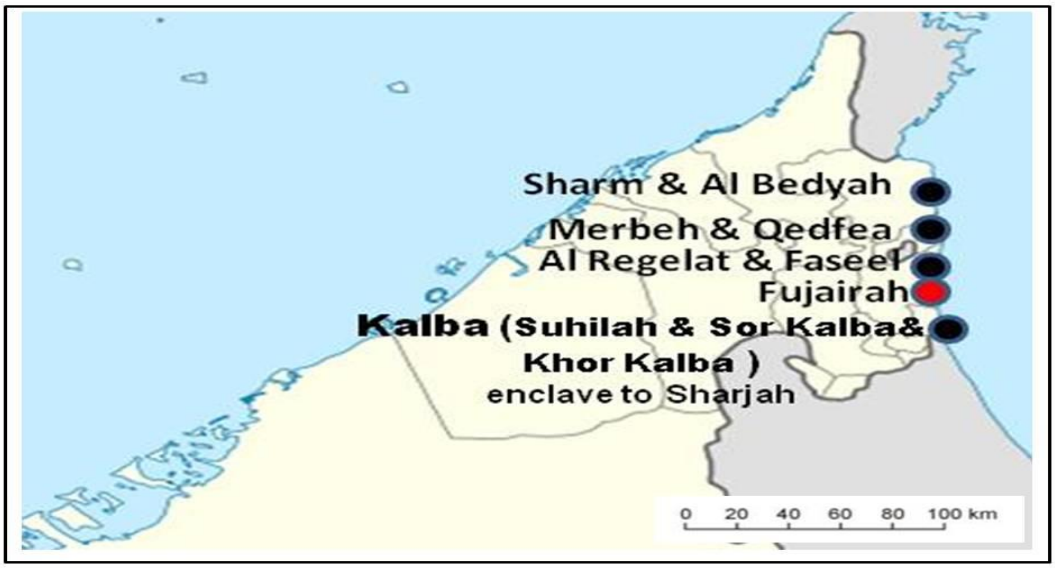

Figure 52: Map of region affected by Gonu 2007.

Description of disaster

The storm reached the Al Fujairah coast on Thursday 6 June 2007. Fujairah experienced torrential rainfall in a short amount of time. Classified as a class 5 storm, Gonu was the worst cyclonic storm recorded in the Arabian Sea and North Indian Ocean (Ali et al 2009).

The Impact and losses

According to eyewitnesses, who lived through the disaster, the deaths amounted to hundreds from the population of Oman, but precise information is lacking. The official Figures from Oman report 50 dead, 27 missing and 20,000 displaced as a result of cyclone Gonu. The hospitals of Oman had initially encountered problems with flooding and electricity cuts, particularly Annahda hospital (El Rafy and Hafez 2008), (Figure 53). Coastal areas and shores in Fujairah were evacuated and the people moved towards the higher elevated regions (Personal interview Fujairah Municipality 2008). The height of the waves caused by the tropical Gonu storm that hit the coastal areas of Fujairah was between 5 to 5.5 metres (Figure 54, 55 and 56) and in Sharm and Suhilah nearly 5 meters. These regions located in the path of the storm received damage from Gonu storm of around $ 600 million (MOPW 2007).

Figure 53: Impact of Gonu storm 2007 in Fujairah, picture (a) and (d) Kalba Road after Gonu storm (b) Car of one residents of Fujairah sinking in the waters of Gonu (c) Suhilah area is close to the shore (MOPW 2007).

Evaluation of losses and damages

- The cost of losses in the Emirate of Sharjah:

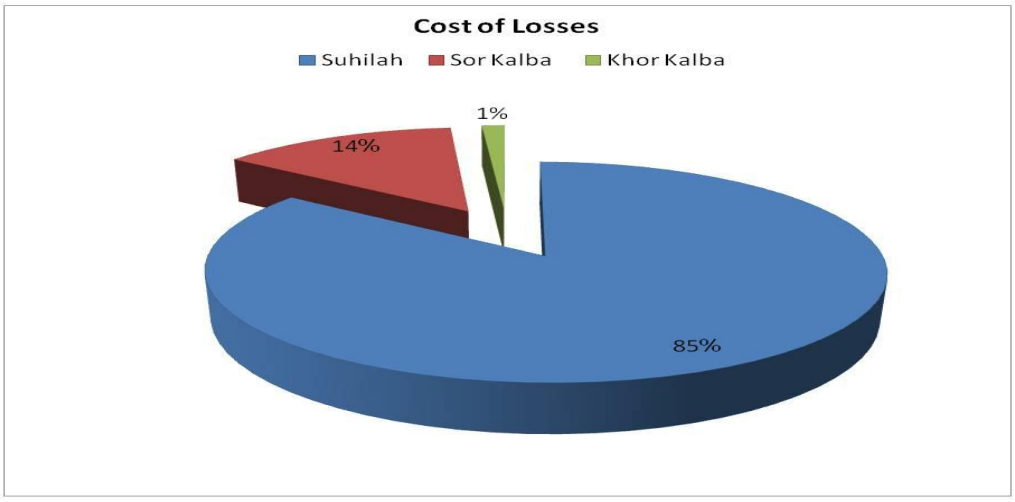

Figure 54: The proportion cost of losses in the regions of Sharjah (MOPW 2007).

- The cost of losses in the Emirate of Fujairah:

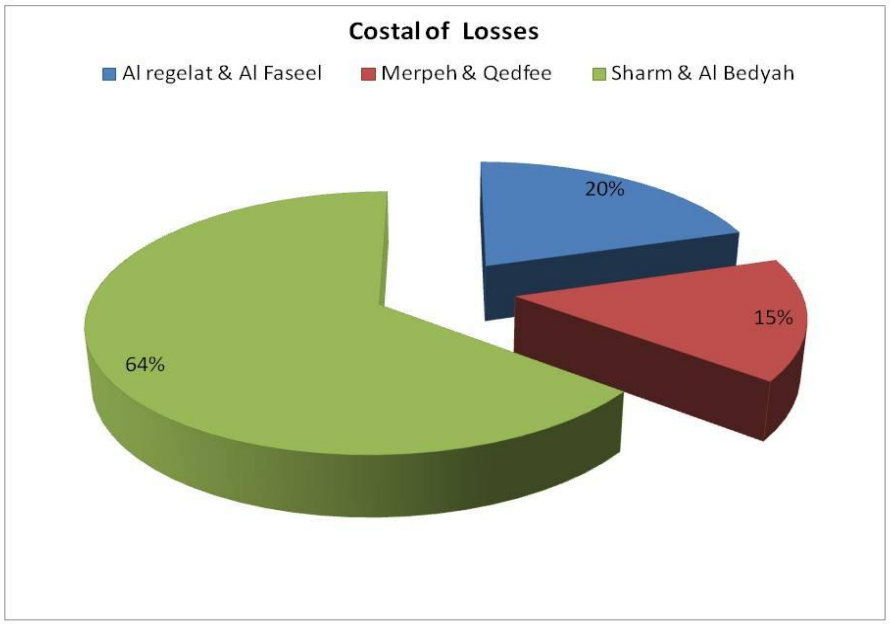

Figure 55: The proportion cost of losses in the regions of Fujairah (MOPW 2007).

Figure 56: Gonu losses in Oman, picture (a) shows McDonald's under storm water also picture (b) Nandi's Restaurant, (c) shows Street in Oman shattered and collapsed, picture (c) shows One of the houses under storm water (Magalesena 2007).

The response stage

Two days before the arrival of the storm, the UAE government declared a state of emergency between the government bodies and institutions in Fujairah as the storm was predicted to hit the coast of Fujairah. When the storm arrived police and army personnel were deployed in affected areas. Fujairah's airport and seaports were closed and all ships were told to sail to more sheltered areas until Gonu passed through.

The UAE Red Crescent prepared the schools to become safe place for those who had to evacuate from their houses. The Emirates Red Crescent was fully mobilized and held an emergency meeting with the participation of the authorities of Ministries of Transportation, Electricity in the affected provinces. The Emirates Red Crescent dispatched equipment, food and relief workers for the temporary shelters in affected areas. The Red Crescent helped evacuate about 500 people from homes in Kalba taking them to secure places. Evacuated residents, some of whom spent Wednesday in temporary shelters in local schools were all relocated on Thursday afternoon to the Institute of Applied Technology in Fujairah, then again to hotels rooms and apartments; this disrupted the evacuated population because they had to move from one place to another (Figure 57).

These was lack of transparency between the government and people with information and warnings not being widely communicated. The media bodies and officials assured the people but did not warn of the gravity of the situation. So the warning was not taken seriously by many people in Fujairah. On the other hand, the media did not broadcast any education programmes preparing people to face the storm hazard or to explain the location of shelters. The National Weather Service in the UAE did not warn the population about the storm so the government bodies faced serious problems in evacuation operations. Many of people did not want to leave their houses.

The Civil Defence had a low profile, images of police and soldiers patrolling the storm roads of Fujairah bring to mind a military operation, not a natural disaster management process. However, military forces are not the best source of civilian disaster management.

Their organization, rationale and command structures are not fully appropriate to the management of a typical civilian emergency. Hence, in most cases the military should be the forces of last resort (Al Oweysey 2007). From a general view about the response Gonu disaster, it is apparent that the disaster management system was not properly operational at that time.

Figure 57: The UAE response stage in Gonu disaster, Picture (a) shows a police car near the beach beginning of the arrival of the storm, picture (b) shows rescue team in rescue boats in the affected area and Picture (c) shows the evacuation process and Picture (d) shows soldiers of the armed forces during the response process (Dunia 2007).

Interview with Ahmed and Ali, two residents from Sharm affected by Gonu:

> "The main point that is very important and can be mentioned here is that based on the satellite images the storm had been predicted. So the people have enough time, for evacuation from their homes and to carry their personal belongings and valuables move cars from their homes to a safe place. As well as facilitate the task of security bodies, during doing of their duties in conducting rescue and evacuation. Also they can take important actions to increase their status for having more safety and to implement the right thing for decreasing the loss. The

lack of information dissemination which can be support the people to help themselves. Lack of transparency between the MOI and the population, were the focus of increase of disaster impact (Ahmed).

"Clearing and repair were also immediately started in Fujairah regions by Fujairah and Dibba Municipality, beginning from Sharm and ending in Suhilah. The Department of Public Works were responsible for road clearing operations and restoration of public utilities and services, especially in Suhilah and Sharm road. The Fujairah high-way was open completely in two days after the storm, the road was partially opened and access to the city was restored in the same day. Electric power was initially restored in some portions of the city on the same day of storm. By 2 days the power was completely restored following the destruction and temporary displacement of residents" (Ali).

The Minister of Education had called upon all schools in the UAE to participate in cleaning up the East Coast and helping the victims of the storm. The Schools promptly responded to the call and sent a group of teachers and students to Kalba and Fujairah for the clean-up on Thursday 14th June. The students picked up debris and donated food items as well as clothing to the people whose homes were flooded or destroyed in the storm. There has been no request for international assistance and the situation was well under control.

Lessons learned

The most important lessons learnt from Gonu storm response are as follows:

- Lack of public awareness and information dissemination and lack of transparency. There was lack of an efficient system for ensuring public awareness and procedures for emergency evacuation.

- Structure of disaster management in the UAE not completed.

- Difficulties of shelter and safe emergency evacuation.

- No exact system for activation of the disaster management system.

- Lack of safety and security measures.

- Insufficient training with regard to evacuation scenarios.

- Insufficient planned control and identification of responsibility because of the lack of a disaster management plan.

- Failure of Fujairah Civil Defence in response, no documentation system in government bodies.

- Lack of planning controls.

- The relief services and help in Gonu storm situation was based on the traditional approach, with improvisation and individual efforts. Relief agencies and volunteers directly distributed relief goods/assistance to the victims without coordinating with the concerned government units, adding to the confusion and resulting in duplication of efforts, unbalanced distribution of relief and other administrative problems.

- In spite of the abundance and availability of aid for distribution, such assistance encountered many obstacles because of poor coordination and multiple bodies involved in distribution. The Ministry of Social Affairs distributed tents and food supplies which was essentially part of the task of The Red Crescent and the problem of organizing the volunteers. Some camps received more meals than was required, and other camps did not receive enough meals. Furthermore, the multitude of non governmental agencies adopting the same role resulted in unorganized distribution of aid in evacuation sites.

- The disaster revealed the inability of some companies to immediately provide local rescue equipment/tools to responding teams despite their availability in the community.

- The absence of an early warning system, for having enough time to evacuate the regions when Gonu hit the region. So the people are uncertain of need for disaster evacuation. Most of the people had seen the Gonu high waves but they did not understand the significance because they were not well trained and educated.

- The Fujairah Civil Defence had inadequate capability to cope with such a large scale disaster. It had inadequate manpower, skills, and limited equipment and authority to cope with the disaster.

6.4.5 Sharm Floods 2009

Introduction

Heavy rainfall in the arid environment of the UAE typically results in high-level discharge and flooding. In March 2009 strong south-easterly winds brought thunderstorms, lightning and heavy rain which caused flooding and led to the collapse of an old earth dam in Sharm. The relief operation conducted by the Fujairah Civil Defence and Fujairah Police was broadly effective. There was a lack of appropriate logistic support, however, and this reflects the need for better preparedness and proper planning (personal interview Fujairah Municipality 2009).

Location

Sharm town is an area belonging to the Emirate of Fujairah, it is located 25° 28 7 N - 56° 21 37 E, it is a town located in the northern part of Fujairah, around 20 km from Dibba and 50 km from Fujairah City. Sharm overlooks the Indian Ocean coast, (See Figure 58) and lies on the eastern part of the Arabian Peninsula. The population is around 2500 and the total number of houses around 120 (Fujairah Statistic book 2007).

Figure 58: Location of Sharm

Description of disaster

On March 23, 2009, an old earth dam above Sharm town collapsed. Water contained in the reservoir surged through Sharm town, inundating whole communities, blanketing farms and roads with debris, and disrupting the lives of hundreds. In its wake, the flood's damage totalled millions of dollars.

Response Stage

Fujairah Civil Defence declared a state of emergency between the Fujairah bodies and institutions during the flood. The Red Crescent was fully mobilized; it had prepared safe places in hotels and flats for those who had to be evacuated from their houses. The Red Crescent dispatched equipment, food and relief workers for the temporary shelters to affected areas. The Red Crescent helped evacuate people from homes to take them to evacuation sites. On the whole, the response and relief provided by the Fujairah Civil Defence and Red Crescent appears to have been well executed. The Fujairah Civil Defence rescued citizens trapped on rooftops, in cars, and high ground. The Red Crescent shipped a lot of tents, cots, and blankets to areas where Red Crescent camps were being set up, (Figure 59).

Figure 59: Response stage in Sharm disaster , Picture (a) and (d) shows the Red Crescent, during the distribution of urgent financial assistance to those affected by flood, Picture (b) shows the police Individual during the assistance operations and Picture (c) shows police officers organising traffic during the flood
(Hasan and Mekawee 2009).

Impact and losses

The flood created serious problems as people lost their land, their crops and their boats, the very basis of their livelihoods. Around 30 houses, 2 mosques and 10 farms, and more than 10 cars were damaged. Roads to Dibba and Khor Fakkan were cut off. Many cars and houses in Sharm and the major road from the Dibba and Fujairah were under more than 1 m of water, forcing hundreds of motorists to abandon their vehicles and seek safety on higher ground. Debris and mud were deposited in streets and all people were evacuated from their houses which suffered considerable damage. The flood affected more than 50 families in different parts of Sharm town. It washed away tens of hectares of land and damaged property worth more than ten million dollars. Because of the low gradient in the lower region, inundation was widespread and long-lasting in Sharm, floodwaters disrupted road and services in the town (Figure 60).

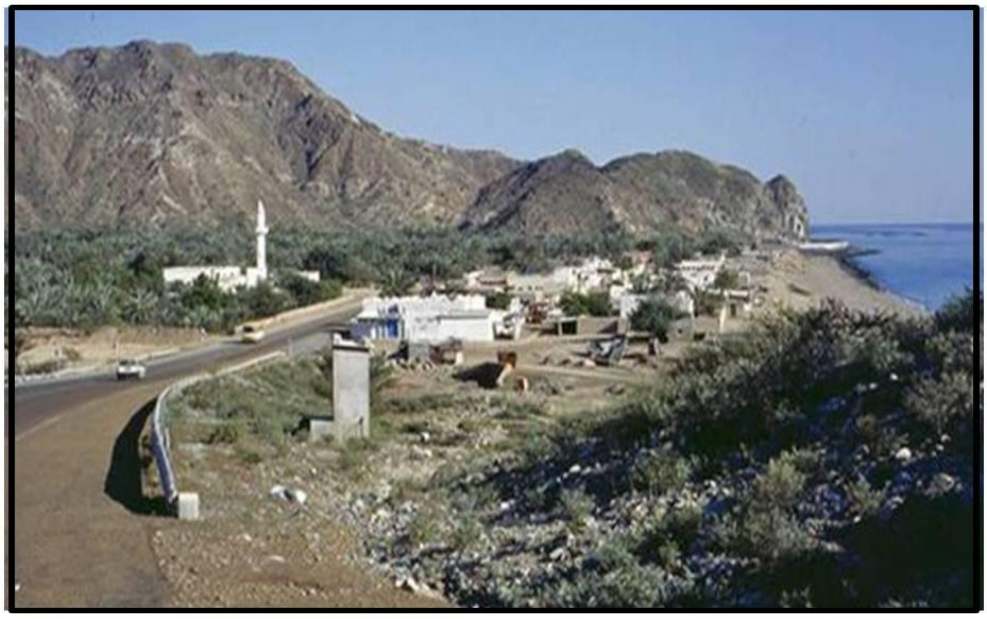

Figure 60: Sharm before disaster (Hasan and Mekawee 2009)

Estimate of flood causes

This flood was caused by excessive rain which led to the collapse of an old dam but specific details, such as those about the nature and magnitude of the hazard have yet to be analysed. The people living in Sharm town depend on fishing and agriculture as a source of livelihood, especially important for the elderly and less well-educated in the UAE. Their houses built more than thirty years ago with limited subsequent maintenance, are among the oldest in the emirate of Fujairah. Poor living conditions are often attributed to the regular floods which occur during the winter seasons and to the more typical drought with limited maintenance of buildings. The result has been that lessons have not always been learned from disaster to disaster, even within the same emirate, leading to repetition of mistakes which could have been avoided. Projects and development policies that ignore vulnerability often exacerbate disaster problems or create environmental degradation in the UAE.

6.5 Summary

- The rapid growth of the population and its increased concentration often in hazardous environments has escalated the severity of impact of natural hazards in Fujairah.

- The lack of coordination between relevant bodies such as the Police and the Civil Defence as was evident in the Al Qurayah flood 1995 and the Gonu storm 2007 needs to be addressed.

- Unsound development and environmental practices exacerbate the risk. The increasing number of quarries, around 69 quarry companies in Fujairah; is leading to environmental degradation (Fujairah statistic book 2007).

- Unplanned growth with poorly-engineered constructions makes areas vulnerable, for example some buildings in Masafi were built without planning permission. In villages like Masafi Al Beleedah, Al Qurayah, Dibba and Al Tawaian buildings are not constructed to resist earthquakes.

- Most of the natural disasters in the UAE occurred in Fujairah. For example Al Qurayah flood 1995, Masafi earthquake 2002, Al Tawaian landslide 2005, Gonu storm 2007 and Sharm flood 2009. All of these natural hazards illustrate the fact that the Fujairah area is subject to natural hazards.

- Fujairah has a previous history of tremors and earthquakes; the frequency of earthquakes in the Northern Emirates is higher than in other areas of the country. Especially Dibba and Masafi because of their location on the active Dibba fault zone. The Dibba fault is active and is capable of producing a major earthquake every 100 years and there has been no major earthquake in the last 100 years with magnitude (6 - 6.5). No one can predict when exactly it will occur, but likely to happen "sooner or later" judging by the scientific study of continual tremors.

- Smaller buildings and houses are in the greatest danger because they are typically old and poorly maintained. Especially in Dibba you can find many houses built 35 years ago with little subsequent maintenance. So there should be a general survey of buildings, especially schools, colleges, hospitals and other important and strategic points and remedial work carried out to strengthen their structure to resist earthquakes. In most countries with seismic hazard the testing of buildings is becoming mandatory, because governments realize that the seismic risk is growing due to the increase of the population and poor infrastructure. Unregulated construction and some houses and buildings are very old without maps or documents in the municipality to show their method of construction. Also growing family numbers lead to building additional rooms on to these old houses to save accommodation for their sons. This style of add-on structures forms a great danger to the house. Moreover the lack of supervision over buildings and the breach of regulations leads to increased vulnerability from natural hazards.

In short the social and environmental vulnerability to natural hazards in Fujairah can be explained by several factors. The increase in vulnerability to natural hazards is due to: population growth and density, rapid urbanization and unplanned human settlements, poor engineering of construction, lack of adequate infrastructure, social vulnerability, and inadequate environmental practices. All of these factors supported the choice of Fujairah Emirate to be case study in this thesis.

Though it may not be feasible to control natural hazards and to stop the development of natural phenomena efforts could be made to avoid disasters and alleviate their effects on human lives. While natural hazards continue, increased awareness can reduce the vulnerability of societies to these hazards. There is considerable scope for the reduction of risk through the application of disaster prevention, mitigation efforts and raising the level of public awareness and awareness of school students who represent the largest segment of society. Vulnerability assessment and public awareness in schools are essential to building an effective plan to face natural disasters. Furthermore, the role of education in reducing vulnerability is very important with regard to natural hazard

preparedness. Particularly within schools and the community schools, because this is a good environment to sow collective values. Children are among the most vulnerable to disasters particularly school children as they are generally "passive victims". Schools can thus play a pivotal role in preventing destruction and can become more disaster resistant (Ozmen 2006). This is explored further in chapter 7.

CHAPTER 7: RESPONSE CAPACITY OF FUJAIRAH SCHOOLS TO THE IMPACT OF NATURAL DISASTERS

7.1 Introduction

Mitigation of risk from natural hazards includes raising the level of public awareness and in particular education of school students who represent a large and accessible segment of society. Vulnerability assessment and public awareness in schools are essential to building an effective plan to face natural disasters. The objective of this chapter is to investigate the level of awareness of students and staff in Fujairah schools regarding natural hazards and to evaluate the response of buildings staff and students in schools in Fujairah to the last earthquake. In this chapter the capacity of the school community in Fujairah to face natural disasters is considered. The research involved a comprehensive survey through interviews with staff, students and parents of seven schools as a case study.

This survey is oriented towards a more direct contact with the students in their own environment in order to evaluate the awareness and response capability of Fujairah schools to the impact of natural hazards and to examine how a culture of prevention can be fostered and strengthened. Thus the role of education in reducing vulnerability within schools and the community at large is examined. This involved evaluation of current procedures for school staff in counselling students before, during and after natural disasters. The hazards that the schools face were assessed and individuals at schools were questioned to see whether there were emergency plans, which were regularly rehearsed. Then ways of minimizing the impact and of reducing the likelihood of natural disasters by means of a preparation scenario and miscellaneous resource booklets and lectures are suggested. This study of natural disasters preparation of schools is the first of its kind to be conducted in the UAE. Therefore the results of this study are valuable for natural disaster preparations and disaster management in the UAE.

7.2 Natural hazards and education, a global issue

Natural disasters in recent years have demonstrated the consequences of inadequate planning for children in facing disasters, particularly school children (NOAA 2009). Hurricane Andrew struck southern Florida on August 24, 1992, it was one of the worst natural disasters in modern US. Many schools in Florida were destroyed (Eugene et al 1995).

During the Northridge earthquake (M 6.7) on January 17, 1994, many Californian schools were damaged. More than 57 people died and at least 9,000 were injured. The structural damage was reported to be around 12,000 homes and 31 Los Angeles area hospitals were damaged and nine were forced to evacuate. Almost half of Los Angeles schools were damaged and costs exceeded $ 100 million. Schools suffered a range of structural damage from the earthquake; one school was so badly damaged that it had to be replaced. Furthermore, several schools developed cracks and required extensive rehabilitation (William 2001).

The Red River flood in the spring of 1997 caused the worst natural disaster in the recent history of North Dakota (USA). Thousands of people were forced to flee their homes; flooding caused over $5 billion damage to the region. North Dakota and Minnesota schools were inundated by mud and made unusable. Federal and local governments have spent millions of dollars repairing or replacing schools after the disaster. Because around 16 out of 22 local schools were flooded, students were out of their classrooms for long periods of time (USGS 2010).

The earthquake in Iran in 2003 destroyed close to 90% of Bam city's buildings, killing more than 26,000 people. Earthquake damage was not only to residential buildings but also to the infrastructure. Around 130 schools in Bam and the surrounding villages were damaged as a result of the event. Classrooms were reduced to rubble and students were unable to begin school (Flora 2006). Bam is a city in Kerman Province of Iran.

The Asian tsunami, 26 December 2004, led to a death toll of more than 270,000 people with nearly 43,000 missing and many hundreds of thousands injured and suffering disaster trauma (ISDR 2006). Schools were destroyed and more than 150,000 children were left without schools. Many people did not know to move quickly to higher ground to escape the wave and its load of debris. UNICEF has constructed and rehabilitated 107 schools, established teacher-training resource centres and improved education programmes. It has built 28 child care centres (Niles 2010).

In Hurricanes Rita and Katrina 2005 in the USA, over 5,000 children were displaced from their families due to the rapid pace of evacuation. Schools in New Orleans were severely disrupted by the effects of Hurricane Katrina. Congress gave approval to a measure that provided around $235 million to schools educating students displaced by Hurricanes Katrina and Rita and extended the deadline for schools. Under that measure, the US Department of Education was authorized to distribute up to $6000 per general education student and $7500 for each student in special education (Klein 2006).

Pakistan suffered its most damaging earthquake on the morning of 8 October 2005, when an earthquake measuring M 7.6 struck the North Western Frontier Province and Azad Jammu and Kashmir. The earthquake killed 73,000 people, some 150,000 people were seriously injured and many more made homeless. This resulted in the collapse of 6,700 schools in North-West Frontier Province. The earthquake occurred as the school day was beginning and led to the death of 18,000 children who were trapped in damaged schools (UNICEF 2008).

Natural disasters bring disruption to the study process, create chaos, disrupt continuity in development and education, claim thousands of students lives and destroy school buildings. These devastating experiences in recent natural disasters have raised awareness in many parts of the world of the need for disaster preparedness. Much effective disaster-related teaching is now taking place in many parts of the world. It is estimated that half the world's nations provide some form of teaching about natural disaster preparedness and safety in at least some of their schools (Wisner 2006). Since the

Tangshan earthquake in 1976, which killed over 240,000 people, China has required that new school buildings must withstand major earthquakes. However, when the M 8 Sichuan earthquake in China struck in 2008 it killed 69,000 people and injured more than 370,000 others. This disaster struck in the early afternoon when most students were at their desks, and young students were taking a rest (UNISDR 2009a). Thousands of the initial victims were children and students in schools (OCHA 2008b).The earthquake caused the collapse of over 7,000 schools (MCEER 2009), and the deaths of some 10,000 children. Juyuan Middle School was built in 1986, which is relatively modern, in Juyuan, a town in the county-level city of Dujiangyan, approximately 20 km from the fault rupture. The school housed 1,000 students and more than 700 died when the building collapsed. The nonductile behaviour of concrete elements, lack of structural ties, led to the building collapse. Xingfu Primary School is in the town of Xingfu, in the county-level city of Dujiangyan. It is located 15 km from the fault rupture. The building completely collapsed, killing more than 300 of the 600 people that were inside. Mianzhu Experimental School located in the city of Mianzhu, about 20 km from the fault rupture, was built of nonductile cast-in-place concrete columns and beams, and this school building did not collapse (CREW 2008).

The collapse of the elementary school in Fuxin killed 127 children and dozens of students were injured. Most of the students were the only sons in their families. The children need not have died if the school had been better constructed as most of the buildings in Fuxin including those built in the 1960's were able to survive the earthquake (Figure 61), (IHLO 2010). The architect, construction team and quality assurance inspector explained that the collapse of the school in Fuxin was on account of issues such as:

- Prefabricated slabs can collapse easily, but are cheaper. The budget is limited.
- The code requires the building to withstand M 7 earthquake, but this was M 8 earthquake.
- Party A wants the building to be delivered immediately. Who has the time to check everything out in detail? What can we do?

In different areas around Sichuan questions were raised about how rigorously such codes had been enforced during China's recent building (FORUM ASIA 2009). The main reason why the classroom building collapsed was that the blueprint did not have structural pillars that resist earthquakes. Also architectural design did not consider adequate earthquake-proof features.

Figure 61: The parents of children died when Fuxin Primary School collapsed in the Sichuan earthquake, each tightly clutching photos of their lost children (IHLO 2010).

A major earthquake M 7.0 struck southern Haiti in January 2010. In the southwestern city of Les Cayes several people were hurt when they rushed to get out of a school. It appears that the widespread damage to schools buildings was largely attributable to the lack of earthquake-resistant design (Marc et al 2010).

7.2.1 Examples from across the world addressing vulnerability of schools

In an analysis of natural hazards in relation to disaster preparedness Kapucu (2008) argues that community education on natural hazards can help a community prepare for such predictable natural hazards, and limit the loss of life and property. In preparation for effective disaster response it is not the sole duty of the government, but rather that

everyone in the community needs to contribute to an effective plan for response and preparedness. The role of education in reducing vulnerability is very important with regard to natural hazards preparedness, particularly within schools and the community schools, because it is a good environment to sow collective values. Children are among the most vulnerable to disasters as they are generally "passive victims". Schools can thus play a pivotal role in preventing destruction and can become more disaster resistant (Ozmen 2006).

As has already been discussed and has been emphasised by a number of workers (ISDR 2007) the focus of competent authorities on the role of the school community in disaster preparedness has been inadequate. On the International Day for Disaster Reduction (October 10, 2007), UNESCO and UN International Secretariat for Disaster Reduction, adopted the slogan "Disaster Risk Reduction Begins at School" with two main objectives: to make schools safer and to integrate disaster risk reduction into school curricula. Raising awareness of natural hazards is itself an investment in the future and reduces the risks of future disaster. If parents become interested in the issue of protecting schools from the effects of disasters, then the pressure increases to take steps to make sure that all schools become safe (ISDR 2007). Thus the ISDR started focusing on schools two years ago. However it must be noted schools and students have been exposed to natural hazards for many years.

Activities and mitigation efforts of countries in the field of natural disaster management show that education on natural hazards can help a community prepare for predictable natural hazards, and limit the loss of life and property. There follows some examples of relevant initiatives.

United States (USA)

Since the late 1970s, researchers and governments have been increasingly concerned about the earthquake safety of schools, and many studies have been published on the issue (Ross 1989). This work focused on design and construction in civil engineering and alterations and reconstruction. Effective disaster response management was not a

significant consideration. A good example of such an occurrence was the M 6.3 earthquake near Long Beach and Compton in southern California in March 1933. The local time of the shock in California was 6:00 pm. Fortunately, at this hour most of the schools were vacant, for many of them collapsed and suffered extreme damage (Figure 62), (USGS 2009). This earthquake provoked such public resentment against shoddy construction that the California legislature passed an act the same year to control the construction of new public schools.

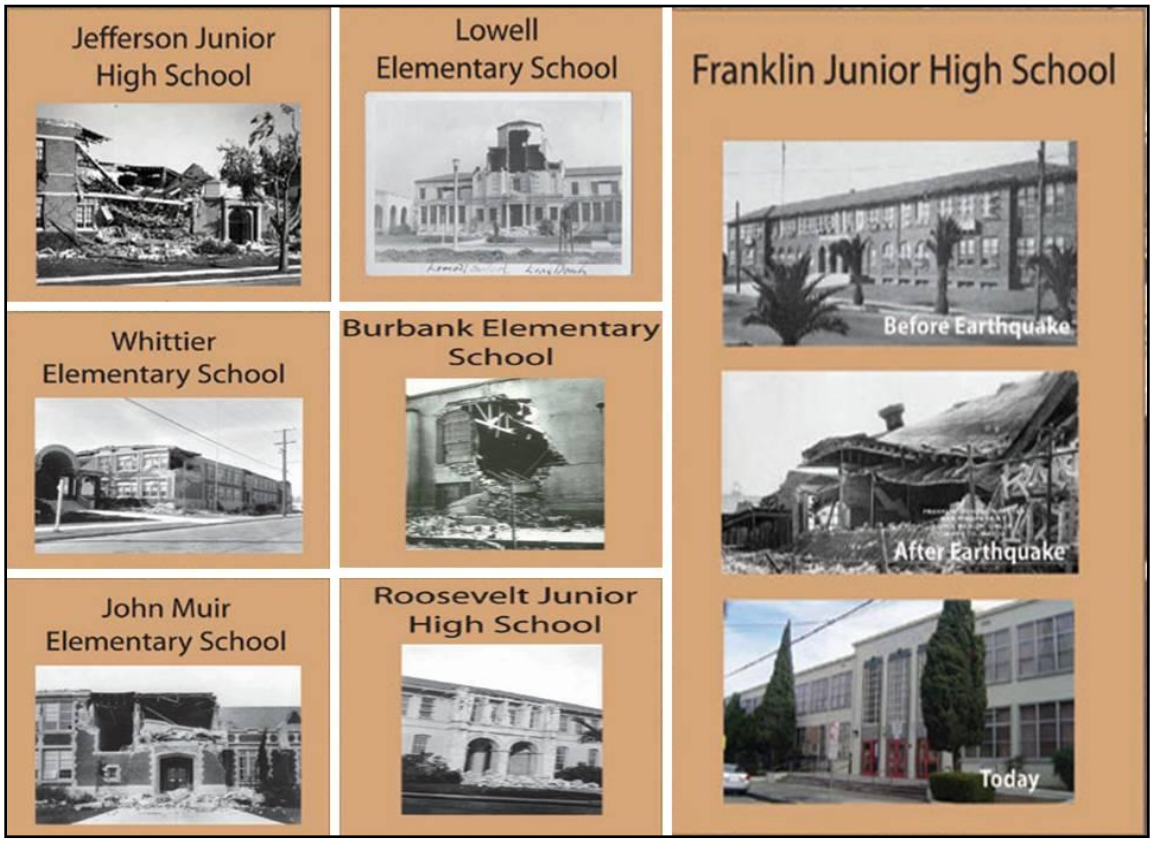

Figure 62: Pervasive and severe damage to public schools in the 1933 Long Beach Earthquake (CDC 2009)

Throughout the years in California, several steps have been taken to reduce the risk posed by older school buildings. The favourable publicity derived from the result of the toll in the 1971 San Fernando M 6.6 earthquake further encouraged the legislature and school districts to push ahead with the urgent task of replacing substandard school buildings (Figure 63). The California law is now such that nearly all unsafe public school buildings in the state have been closed, repaired or demolished (Bolt 2003).

Figure 63: San Fernando, California earthquake 1971
(USGS 2007)

In 1989 a conference was held at Buffalo, USA, entitled "Disaster preparedness: the place of earthquake education in our schools" which explored the important role of education in reducing vulnerability within schools and the community (Ross 1989). Earthquake disaster preparedness and mitigation constitute two of the important activities of earthquake disaster management, and the training and education of students represent the basic ingredients for success in response to earthquakes.

Japan

Japan, a country with strong seismicity, has made significant contributions regarding response to earthquakes and risk mitigation. Various actions have been taken by the Japanese government to mitigate earthquake disasters. At the national level, the Central Disaster Management Council formulates and executes disaster management planning and it is chaired by the Prime Minister. Municipalities and local Governments also have their own Disaster Management Councils and formulate and promote local disaster management plans (UNCRD 2009). In 1992, Japanese experts and researchers demonstrated their attention to the issue of earthquake preparedness in primary and some secondary schools (Ohmachi et al 1990). Many programmes for natural disaster preparedness seek to offer students correct knowledge and information on natural

disasters together with information about protection and mitigation (Figure 64). They also provide them with drills and practical training exercises to help them to protect themselves from, and prepare themselves for, natural hazards particularly earthquakes and provide information on how to respond.

The information and knowledge can be on seismological phenomena such as the mechanism of earthquake occurrence, seismic intensity, seismic wave attributes, magnitude of earthquakes, earthquake prediction and warning systems. Other topics covered are damage and vulnerability, measures of earthquake disaster reduction, information on emergency response, and earthquake evacuation procedures. The students are also involved as volunteers in National Disaster Day and in practical first aid exercises. The aims of these natural disaster education programmes at each school level are as follows:

- Kindergarten children are asked to follow their teachers' orders, and to follow group behaviour without being separated from their friends. They are then handed over to their parents after the earthquake (Hosseini and Izadkhah 2006).

- Primary school children learn how to use their own judgement to protect themselves. Group behaviour is also encouraged with mutual-aid communication. At the secondary level students are expected to play a role as a member of their resident communities and to participate in the comprehensive disasters drill on National Disaster Day.

- At the high school level, knowledge and information on earthquakes are taught as a part of physics or social sciences, and students are expected to participate in drills (Radu 1993).

These measures are in response to lessons learnt from the Nihonkai-Chubu earthquake, a major earthquake that occurred on 26 May 1983. At M 7.8 it caused 103 fatalities and 324 injuries (James et al 2003). The earthquake generated a major local tsunami, which was very destructive in Japan and Korea. This killed many elementary schoolchildren.

The main reason for this tragedy was that the teachers did not realize the danger of tsunami after an earthquake. The teachers faced many obstacles during the rescue operations (Kaji 1992), such as:

- The emergency information system: the command system for teachers was inconsistent and the class rooms were too far from the radio studio so that the emergency announcement was delayed; the radio equipment was out of order.

- Evacuation guidance: it was difficult to check the number of children. In particular, those who were in the health service room could not be identified. Emergency exits could not be used because they were locked, and fire protection doors were closed. Also the teachers did not know when they should instruct students to evacuate.

- Human resource management: some members of staff in the school, such as cooks or assistants, were not well organized, and the disabled students were not adequately cared for.

All these problems are related to school management for natural disasters and can be roughly categorized into three areas: role sharing during disaster response, maintenance of emergency equipment, and disaster information systems. Nowadays in most schools in Japan, natural disaster preparedness programmes are implemented once every month, and at the beginning of the study year and after the summer holidays to avoid disturbing normal educational programmes (Kaji 1992). Public education for earthquake preparedness is provided in Japan in various forms, starting with the school curricula, evacuation and fire prevention exercises, training on mutual help and collective cooperation, experiencing the movement of an earthquake in simulators, and dissemination of booklets and documentary films. There are also "Days of Disaster Prevention" throughout the year. Without such programmes, all laws, rules and regulations would not be functional or would not be able to fulfill their objectives, which should be clear, practical and attainable (Yarar 1986). Thus earthquake prone countries

should devote major efforts to formulating an educational policy to improve the ability of the social system to withstand an earthquake disaster (Boschi 1986).

Figure 64: Earthquake drill, at a Tokyo elementary school, in September, 2008, pictures (a), (b), and (c) and (d) earthquake safety procedures in the classroom (Daylife 2009).

In 2004 a Japanese and UN project, "Reducing Vulnerability of School Children to Earthquakes" project considered the safety of school children and the creation of an earthquake-resilient community in seismically vulnerable areas by renovating the school buildings, demonstrating retrofitting technology, and disaster training (MFAJ 2004).

Macedonia

The Republic of Macedonia is exposed to frequent natural disasters (Milutinovic and Trendafiloski 1998). Macedonia with its weak economy, cannot afford the high expenses required for engineering and construction. Therefore, a cost-efficient technique to improve the emergency preparedness of schools has been proposed so as to substantially reduce the impact of earthquakes (Hosseini and Izadkhah 2006). Through giving the community information, students, teachers, the school staff and parents should be directly involved in disaster response and in providing assistance in needy situations. It is also suggested that people who attend training programmes should return and teach others in their school or school districts. The objective was to give participants the knowledge and motivation to effectively teach others how to behave during an earthquake (Kuban 1992).

Monaco

Since 1996, the Directorate of Education, Youth and Sport, in close co-operation with the Monaco fire brigade, has been taking part in information work by developing awareness among schoolchildren and providing training courses for school staff. The government of Monaco pursues a strict policy on the security of persons and property, with special attention to risk prevention. The purpose is to instill a culture of security into the students in Monaco's schools, to prepare schools to cope. Every year a technical committee visits each school to evaluate and recommend what may be needed, to be safe from natural disasters. With the requirement that all new buildings, comply with earthquake safety standards. The Principality has set up an Observatory for Security in Schools and Higher Education Establishments (Jacqueline 2007).

United Kingdom (UK)

Study by Kibble (1999), conducted in the UK, discussed and examined the guidance and support offered to schools by 17 local education authorities in respect of crisis management. In that study, after outlining some of the main features of the documents studied, it suggested that the disaster management process must first incorporate public participation at the local decision-making level. Community participation in some stages of the preparation of the plan strengthens the process of responding to the disaster and

makes it more successful (Kibble 1999). For example, the case study of California's Portola Valley demonstrates that when public participation at the community level in the disaster management plan is integrated, it results in sustainable hazard mitigation (Pearce 2003).

France

The French storms in 1999 damaged around 5,500 schools, completely wrecked several secondary schools and injured many students. Following this event it was realized that preparation for natural hazards in France was inadequate. So this disaster caused awareness-raising measures to be stepped up, particularly with the introduction of the specific safety plans and disaster preparedness, which are now mandatory for all educational establishments. Also the need to involve parents was recognised so as to reduce panic reactions. This would prevent many of the phone calls, which jam the lines instead of leaving them free for the emergency services (Schleret 2007). There are examples of the use of new technologies in natural disasters preparedness.

Example 1: Stop Disasters: The ISDR has designed a game called "Stop Disasters". The Ministry for Ecology, Sustainable Development and Town and Country Planning financed its translation into French.

Example 2: Computer graphics: This is an animation project on major hazards. It uses flash animation to present major hazards such as earthquakes, storms, fire and flooding in several blocks forming an imaginary landscape. Special blocks are added to enable teachers to make optimum use of the product. Each block is independent and gives a detailed picture of the damage caused by a hazard and the responses that would have been needed to reduce vulnerability. All the images are animated and interactive (Sebastien 2007).

Algeria

The M 6.8 Boumerdes earthquake of May 21, 2003 shocked Algeria by the extent of its human losses. The earthquake should not have been a surprise neither by its impact, nor by its occurrence. The coastal region of Algeria and particularly its central section is known to be part of an active tectonic structure where the African plate collides with the Eurasian plate. Following the Boumerdes earthquake schools and educational institutions were closed in the province of Boumerdes, the eastern part of Algiers and in the western towns and villages of the province of Tizi-Ouzou. The University of Science and Technology of Houari Boumediene, the largest university of Algeria, (Morell and Maghraoui 1996), was also temporarily closed for security, damage assessment and repairs. The factors explaining the degree of damage to schools can be best understood by considering the period during which they were built. Many existing schools are masonry reinforced concrete buildings, and most of them are old constructions, which were built without any seismic provision, and thus present a high vulnerability to earthquake impact. They present, therefore, a serious threat to students. Algeria's schools may be classified into three categories:

1. The first category was built during the colonial era (1830-1962) and accounts for about 30% of the school building stock, which is characterized by advanced degradation, ageing and lack of maintenance.

2. The second category (1962-1981) was designed and built without taking into account seismic risk. Schools, which were built after independence, under the constraints of a rapidly growing population while also responding to the democratization of educational opportunity, at this time there was no seismic building code in Algeria.

3. The third category are those schools which were built according to the seismic building code and under technical supervision. This was after 1983.

After the 2003 Boumerdes earthquakes, the Ministry of Education, the Civil Protection and the Algerian Red Crescent, together with UNICEF worked together in training the

school children and teachers across northern Algeria. Several measures are being newly implemented such as the upgrade of the Seismic School Building Code, also training for measures to take before, during and after the disaster. Disaster risk reduction in the official curriculum is now prominent in the schools (Benoura 2007).

This awareness of natural hazards is itself an investment in the future and reduces the risk during future disasters. If parents become interested in protecting schools from disasters, then the pressure mounts for steps to be taken to ensure that all schools become safe (ISDR 2007).

7.3 Methodology of Survey

The location of this research is the Fujairah Education Zone (FEZ), in the UAE. The Emirate of Fujairah is particularly prone to natural hazards as discussed in Chapter six and this is why it has been selected for this survey. Fujairah includes 61 schools and around 20,522 students who are studying at various levels in educational institutions– almost one third of the total population. Therefore, educating the students, the future community at risk, is an effective strategy to disseminate safety messages to the entire population. Schools play a major role in the development of disaster-aware citizens. This survey involves a comprehensive investigation of seven schools in the case study area.

Three schools are from coastal areas, close to the sea and four schools are from mountainous areas. There are 4 girls' schools and 3 boys' schools and this includes Primary, Secondary and Elementary schools. The researcher completed a pilot survey questionnaire from a systematic random sampling selection of seven schools in the Fujairah emirate and a group of 140 students. Twenty students from each school, five teachers from each school, some students' parents, and 12 senior staff from the FEZ administration also participated. Systematic random sampling technique ensures that bias is not introduced regarding who is included in the survey (Lapin 1987). Most statisticians use various methods of random sampling in an attempt to achieve this goal. There are several different methods of random sampling. In this survey systematic random

sampling was used, because the students are one population (ages, sex, culture, location, level, religion) in each school. So each student has an equal chance of being included in the sample. The researcher used this method on teachers and students but involvement of parents depended on opportunity.

Example: Suppose the class has 100 students and you need to conduct a short survey on disaster preparedness. You decide that a sample of 20 students should be sufficient for your aim. You have their names listed on a piece of paper may be in alphabetical order. If you choose to use systematic random sampling, divide 100 by 20, you will get 5. Randomly select any number between 1 and five. Suppose the number you have picked is 2, that will be your starting number. So student number 2 has been selected. From there you will select every 3rd name until you reach the last one, number one hundred. You will end up with 20 selected students. In this simple way we can elect a representative sample or draw without personal motive or purpose, without any particular bias.

Ethical approval was obtained from the University of Bedfordshire, FEZ administration, and the parents of students, and from the police to carry out research in the schools and to interview students. Participants were informed of the aims and procedures of the research and fully informed consent implies knowledge of everything that might reasonably be expected to influence a participant's decision and this was provided. Signatures of all the students' parents were obtained on the consent forms which included a statement that participation is voluntary and participants were informed of their right to withdraw from the research at any stage, including during, or at the end of their involvement. Also the researcher reassured participants that information they provide will be made anonymous. A contact teacher was identified, who could counsel any student in case of their becoming distressed by the prospect of a natural disaster.

The survey contains 8 questions for representatives of the FEZ administration, 13 questions for teachers, 10 questions for students and 4 questions for parents. The first stage involved interviewing the Director General of the FEZ and finding out the current preparation for dealing with the impact of natural hazards. Interviews were also

conducted with relevant officials in the FEZ to gain a full understanding of the procedures. Specifically, the interviews sought answers to questions concerning awareness and response capability of schools in Fujairah to the impact of natural disasters and also how better to foster and strengthen a culture of prevention. Hence the role of education in reducing vulnerability within schools and the community at large was investigated. This involved evaluation of current procedures for schools, staff and teachers to counsel students before, during and after natural disasters and assessment of the hazards that the schools face. Staff and students of schools were questioned to see if they had an emergency plan, which is practiced regularly. Then ways of minimizing the impact and reducing the likelihood of natural disasters by the preparation scenario, miscellaneous resource booklets and lectures were suggested. Some background information concerning the interviewees and FEZ-identifying information has not been included because of the need for anonymity for the participating bodies.

The researcher visited Fujairah schools and was able to observe first-hand the impact of the earthquakes in 2002 and other new tremors in Fujairah schools, and of the Al Qurayah flood in 1995 on the infrastructure and school buildings and classrooms in the schools in mountainous regions and in coastal areas (see Figure 65). The researcher also engaged in informal discussions with the teachers, student, parents and senior government officials of the FEZ about natural disasters preparedness efforts and challenges in this area.

Objectives of survey:

1. Evaluate the response of buildings, staff, and students in schools in Fujairah to the 2008 earthquake and the level of damage.
2. Improve knowledge on how to be prepared for natural disasters.
3. Understand the level of awareness of the students and staff regarding natural disasters.

7.3.1 Survey questions

FEZ administration staff questions

1. What is your perception about the probability of natural disasters in the UAE?
2. Does the FEZ have a plan for disaster response, which instructs students, teachers and staff on what to do during natural disasters? Also do you have an evacuation plan for the schools?
3. What is your understanding of preparation for natural disasters in schools?
4. Are the schools designed to be safe from natural hazards?
5. Do you have suggestions or comments to minimize the impact of and reduce the likelihood of natural disasters affecting schools?

Teachers and school management questions

1. What is your perception of the probability of natural disasters in UAE, and what are the types of natural hazards that threaten the UAE?
2. What is your understanding of preparations for natural disasters in the school?
3. Do you know who is qualified in first aid in the school?
4. Do you talk with students' parents about natural disasters preparation?
5. Have you been affected by earthquake damage, and has your school been affected by it?
6. Do you want to learn how to protect yourself during an earthquake?
7. Do you have suggestions for or comments on how to minimize the impact of natural disasters and reduce the likelihood of them occurring in your school?

Student's questions

1. What is your understanding of the types of natural hazards that threaten the UAE?
2. Do you know the safest places in your classroom during disasters?
3. Do you have a first aid kit in your classroom?
4. Do you talk with your parents about natural disasters preparation?
5. Have you been affected by earthquake damage?
6. Do you want to learn how to protect yourself during an earthquake?

7. Do you have suggestions or comments for minimizing the impact and reduce the likelihood of natural disasters in your school?

Parent questions

1. What is your understanding of the types of natural hazards that threaten the UAE?
2. Do you encourage your children to learn about the culture of disaster?
3. Do you have any background in natural disasters preparedness?

7.3.2 The community of the survey and the samples

The research involved a comprehensive survey of seven schools in the case study area through interviews 12 from FEZ senior staff, students, teachers, schools staff support, and 40 Parents.

Three schools are from coastal areas, close to the sea and four schools are from mountainous areas. Girls' schools (4) & boys' schools (3). Number of samples: 140 students - 20 students from each school (See Table 18, 19).

School Involved	Grade levels	Type of persons involved	Number of persons involved	Amount of time per person
1- Male	Primary	Students, teachers, staff	20 - 5 – 3 Total 28	3 to 5 Minutes
2- Male	Secondary	Students, teachers, staff	20 - 5 – 3 Total 28	3 to 5 Minutes
3- Male	Elementary	Students, teachers, staff	20 - 5 – 3 Total 28	3 to 5 Minutes
4- Female	Primary	Students, teachers, staff	20 - 5 – 3 Total 28	3 to 5 Minutes
5- Female	Primary	Students, teachers, staff	20 - 5 – 3 Total 28	3 to 5 Minutes
6- Female	Elementary	Students, teachers, staff	20 - 5 – 3 Total 28	3 to 5 Minutes
7- Female	Secondary	Students, teachers, staff	20 - 5 – 3 Total 28	3 to 5 Minutes

Table 18: Operation of survey management

Government and Private Education - Emirate of Fujairah					
2007/2008					
Education type	No. of Adm. & Technicians	No. of Teachers	No. of Students	No. of Classes	No. of Schools
Government	334	1814	20522	935	61
Private	81	528	8341	367	11
Total	415	2342	28861	1302	72

Table 19: Statistics on government and private education

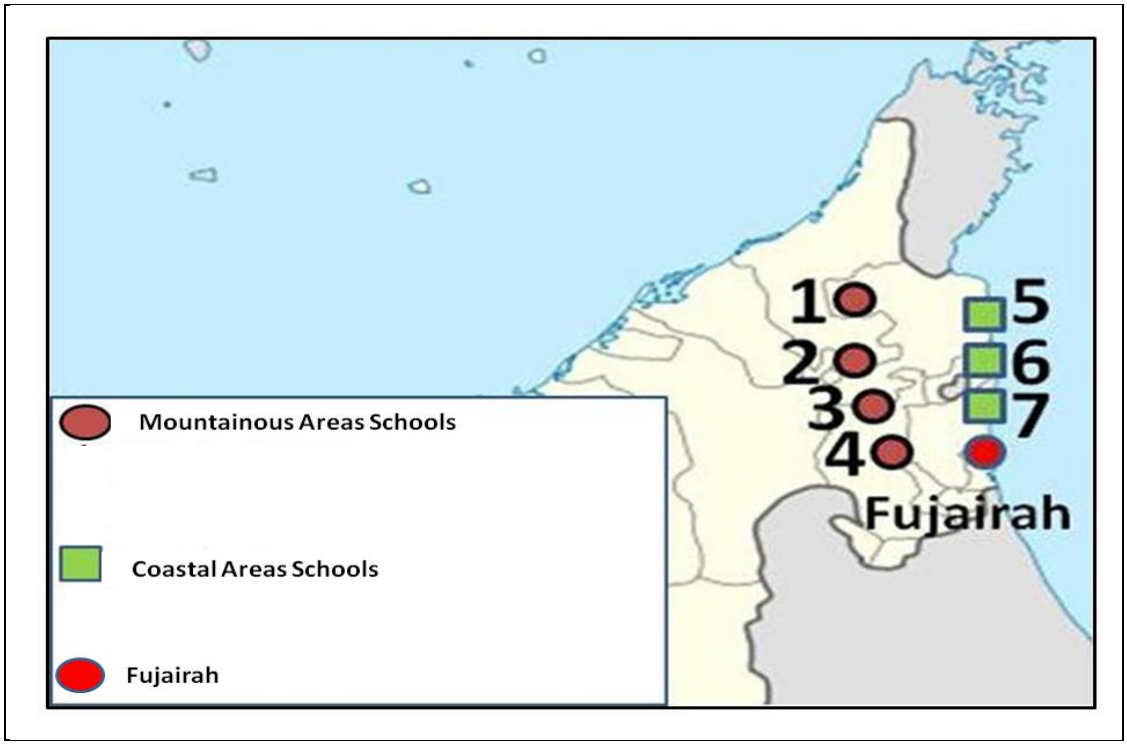

Figure 65: Map of case study- location of schools

7.4 Findings and interpretation

It was apparent that not all the interviewees were in a position to provide a strategic overview of natural disaster preparedness. However, personal reactions to recurrent natural disasters in the Emirate of Fujairah were capable of providing a real sense of the fear of these events and the need for a strategy to prepare for these disasters. The researcher considered that there were sufficient identified similarities between schools in

coastal areas and mountainous areas. However the main threat of danger in schools in mountainous areas was from earthquakes. The Masafi earthquake (2002) occurred in his area; also the active Dibba seismic fault runs through this region, which results in earthquakes. However, in schools in coastal areas, the greatest fear was of storms and floods. The Al Qurayah flood (1995) occurred in this area, as did tropical storm Gonu (2007). The replies here are compatible with the nature and quality of events that affected the Emirate of Fujairah in recent years.

Schools are a path to a better life, but they can take the lives of children if they are vulnerable to natural disasters. A single event can kill hundreds of children in schools and classrooms. Particularly the Emirate of Fujairah is prone to frequent natural disasters.
These natural hazards, together with social, cultural and other vulnerability factors, expose the population to high risk. School children in Fujairah face such natural disasters almost on a regular basis, and this is particularly so with earthquake hazard in schools in mountainous areas. A better background in preparedness and knowledge of response measures is required to help them better cope with risks.

7.4.1 Fujairah FEZ administration staff answers

1. What is your perception about the probability of natural disasters in the UAE?

The perception about the probability of natural disasters in the UAE among the directors and staff of the FEZ administration is important for the disaster preparation stage, particularly in the process of training, and the decision to take preventive measures. Peoples' perception of risk is subject to many cognitive, personal, situational and contextual influencing factors, and people need be enthusiastic about the training process (Plapp et al 2006).

Nine from 12 of the respondents chose earthquake hazard, floods and storms. The response to this question was consistent with recent event priorities for natural hazards in Fujairah. They recognized that the UAE is not safe from natural hazards as it sits close to the edge of the Arabian Plate adjacent to the Iranian plateau and the Zagros Fault zone, which is characterized by high seismic activity. Thus the staff of the FEZ administration

had a high perception about the possibility of natural disasters in the UAE. These are storms, floods and earthquakes. This result is encouraging as when people in authority have a strong consciousness of natural hazards, then they are likely to accept the need for an awareness programme.

2. Does the FEZ have a plan for disaster response, which instructs students, teachers and staff on what to do during natural disasters? Also do you have an evacuation plan for the schools?

In response to the question about the FEZ some who were interviewed were concerned that in practice there were issues.

> "A natural disaster plan for the FEZ is a necessity because the UAE is not as safe from natural hazards as has often been assumed. Furthermore, most of the UAE natural disasters occurred in Fujairah. However, this decision was not one they can take, because the UAE Ministry of Education, not FEZ, has the authority to make these decisions. The creation of a comprehensive disaster response plan FEZ-based operations unit is not easy, as it would need combined efforts, approval and support from the highest levels and leadership in the Ministry of Education in the UAE. Such a unit would need to include representatives from the Ministry of Education, FEZ, school administration, and the local or regional response teams of Fujairah police, Fujairah Civil defence, Fujairah Medical Zone. Inclusion of the latter is essential because communication with response teams would also ensure that emergency plans created by the schools do not conflict with efforts already underway. At present there is no plan to deal with natural disasters in FEZ" (Director of FEZ).

> "Natural disaster reduction is not a priority of the Ministry of Education, which also reflects the lack of awareness at schools. Furthermore, there are no federal laws requiring all school districts to have natural disaster management plans" (Deputy Director of FEZ).

This view may have been coloured by the experience of the past disasters.

> "Despite the integral nature of some schools in Fujairah in health issues and the protection of children, there has been remarkably little attention devoted to disasters preparedness in schools. There was a marked increase in the awareness of vulnerability of schools and students for example after the Masafi earthquake (2002) in the Masafi schools (Romaythah School, Masafi School) where the children and teachers fled outside their classroom, many hysterically, because they did not have any awareness with regards to natural disasters. However, the needs of school children remain largely unmet in Fujairah. The training on evacuation plans and dissemination of knowledge and skills is the key for success" (A, B and C in FEZ).

Ten from 12 of staff in the FEZ believed it would be beneficial to regularly have evacuation plans, and endorsed the need for a plan for natural disaster management, especially after the recent successive tremors in 2008 experienced in Fujairah.

3. What is your understanding of preparation for natural disasters in schools?

In response to this question some respondents were quite reactive regarding this understanding of preparation.

> "I can confirm that there is no programme from the FEZ yet for natural disasters preparation in the schools and schools have not been able to find anybody, to educate and train them on how to prepare for natural disasters. Schools and children in some parts of Fujairah suffered and still suffer from the impact of the 2002 earthquake. Unfortunately, the Masafi region included many older school buildings, particularly Rumaitha Al Ansaria Primary School and Masafi Secondary School which were also affected by the earthquake. There were cracked walls, and a state of fear and panic that seized the students and teachers and parents who gathered in front of the school. Numerous contacts were received by the FEZ administration from the schools inquiring about procedures in such a situation" (Director of FEZ).

"When other tremors hit Masafi at the end of 2008, the school of Rumaitha Al Ansaria was most damaged. Hysteria and fear prevailed with some students screaming and refusing to return to the classroom because the classroom walls were badly cracked and there were cracks in the flooring. The children and teachers remained outside the school, and the school was closed for the full day" (Deputy Director of FEZ).

"The natural disaster plan is very important for schools, because the schools can help play an important role is in this process by providing a stable and familiar environment. The support of teachers can help children return to normal activities and routines (to the extent possible), by remaining calm and reassuring children that they will be all right. This provides an opportunity to transform a frightening event into a learning experience. Despite the fact that natural disaster events may only last a short period, survivors can be involved with the aftermath for months or even years. However, there are no preparations for natural disasters in Fujairah schools" (A and D in FEZ).

4. Are the schools designed to be safe from natural hazards?

In response to the question about if the schools are designed to be safe from natural hazards, some who were interviewed were concerned.

"Actually, school buildings often serve multiple purposes in a community. They house one of most precious resources of country, our children. In addition they have a role in providing public shelters in emergencies. When a school building is vulnerable to natural hazards, the welfare of the entire community is at risk. The structural integrity of the building is important to protect the population, and students. I think most of Fujairah schools were not designed to be safe from natural hazards, particularly the older schools. For example Al Bithnah School, Al Tawaian School, Al Halah School, Rumyithah Al Ansareyya School, Om Hakeem al Ansaria, and Zobaidah School" (Director of FEZ).

"Most of Fujairah schools were built more than forty years ago, and the only kind of maintenance they receive is that the exterior is painted every year. A good example of increased vulnerability in schools was the school of Rumaitha Al Ansaria, which suffered from a high level of damage. The classroom walls are very badly cracked and there are cracks in the flooring. Overall, the schools of Masafi and Dibba suffered the effects of the earthquake that struck the region in March 2002. However, most of the school buildings in Dibba also have structural problems related to lack of maintenance" (Deputy Director of FEZ).

"The present situation of vulnerability reduces the capability of such school buildings to resist additional forces in the future as might be expected as a result of earthquakes. Thus there is a need to pay special attention to most of the schools in Fujairah, particularly these that have been affected by previous earthquake actions. In short, the Fujairah schools are not designed to be safe from earthquakes and other natural disasters" (D, C, and F in the FEZ).

5. Do you have suggestions or comments to minimize the impact of and reduce the likelihood of natural disasters affecting schools?

In response to the question about suggestions or comments to minimize the impact of and reduce the likelihood of natural disasters, the following were suggested.

a. A comprehensive earthquake disaster mitigation training capacity building programme for community development with special focus on students and schools. Also inclusion of disaster risk reduction in schools.
b. Construction of new schools, and removal of the old schools.
c. Retrofitting and maintenance of damaged new schools, particularly Dibba and Masafi schools.
d. Monitoring and evaluation of school buildings in Fujairah through the Ministry of Public Works.
e. Raising awareness among different sectors in relevant agencies such as the health sector, civil defence and police force in Fujairah.

f. Preparation of an integrated education project put out by the Ministry of Education related to preparedness for natural disasters. For example, an annual competition among all schools in the UAE.
g. Provision of weekly classes as part of the curriculum to foster the culture of awareness of natural disasters.
h. Natural disaster management is not only about shelters and distribution of blanket, medicines and evacuation operations. It is also about education, awareness generation, mitigation strategies, community participation and lifestyles. Education and awareness generation in schools is a cost-effective method in reducing the impact of natural disasters. The country needs to focus on risk reduction strategies and prevention to face these hazards. The government needs to incorporate natural disasters management as one of the essential components in the education operation in the UAE.

7.4.2 Teachers and school management answers

Data were collected through individual interviews; the researcher went to the seven identified schools and interviewed school directors in their offices. At the beginning of the interview, the purpose of the study was explained. Natural disasters can be especially traumatic for school children. Experiencing earthquakes, floods, or storms, is frightening even for adults, and the devastation to the familiar environment can last for a long time. Teachers can help play an important role during this by providing a stable and familiar environment. Support from teachers can help students return to normal life, and provide an opportunity to transform a disaster into a learning experience.

1. What is your perception of the probability of natural disasters in UAE, and what are the types of natural hazards that threaten the UAE?

In response to this the following responded:

> "I can confirm that the UAE is subject to natural hazards, particularly earthquake hazard because the earthquake is the main hazard" (Directors of schools 5 from 7).

"Yes, the UAE is vulnerable to natural hazards and the evidence for what I have said, natural disasters that have occurred in the past. The earthquake and flood and storm are the main hazards" (Teachers 30 from 35). This view may have been coloured by the experience of recent events.

2. What is your understanding of preparations for natural disasters in the school?

In response to the question about the understanding of preparations, most who were interviewed were pessimistic.

"Nothing has been done to prepare for natural disasters in schools in Fujairah"(Directors of schools 7 from 7).

"I can confirm that most schools in Fujairah did not include any awareness training on natural disasters such as earthquakes, storm, and floods" (Teachers 31 from 35).

"Fujairah schools do not have any procedures for management of natural hazards during emergency events except for fire evacuation plans in some schools. Moreover, there is no material in the school curriculum at all study levels relating to natural hazards or methods of protection from natural disasters. Also they do not know the safest places in their classroom during disasters because there are not any regularly rehearsed emergency plans for the event of an earthquake" (Teachers A,B and C from mountainous area).

3. Do you know who is qualified in first aid in the school?

In response to the question about who is qualified in first aid in the school?

"I do not know, but it good to give this question for teachers" (Director of school 6 from 7).

"Yes and there is a private nurse from Fujairah Medical Zone in all schools who support students and teachers" (Teachers 25 from 35).

"No" (10 Teachers in schools in mountainous areas).

According to the responses of the teachers in the Fujairah school samples it can be seen that most of them know the students qualified in first aid in each class. It is worrying that the school directors did not know.

4. Do you talk with students' parents about natural disaster preparation?

Most who were interviewed were negative in this response.

> "Unfortunately, the key persons who are in the position to make decisions in the FEZ have not taken the preparedness levels for natural disasters and awareness into consideration" (Directors of schools 4 from 7).

> "Without the order or decisions coming from FEZ, the teachers couldn't talk with parents on sensitive issue like disaster preparedness" (Teachers 31 from 35).

5. Have you been affected by earthquake damage, and has your school been affected by it?

Most who were interviewed were concerned particularly in mountainous schools.

> "Yes" (Directors of school 3 from 4 in mountainous schools).
> "No" (Directors of school 2 from 3 in area coastal schools).

> "The situation of Fujairah schools indicates that the school buildings are not in a good condition, to face natural hazards. Particularly the older schools, such as Al Tawaian School, Al Halah School and Rumaithah School and Al Bethnah School" (Teachers 22 from 35).

> "Mountainous areas schools were affected by earthquake damage from the Masafi earthquake of 2002, particularly Rumyithah Al Ansareyya School and Al Bithnah School (see Figures 65, 66). They were in a worse condition than others with major cracks in the classroom walls and cracks in flooring. It suffered the effects

> of the earthquakes that struck the region, but also has structural problems related to lack of maintenance. That some schools do not have the safety equipment and other schools where there is fire and safety equipment was not working due to lack of maintenance, and we do not know how to use them. Inadequate in emergency exits compared to the number of students" (10 teachers in mountainous schools).

Many teachers are not happy with maintenance of schools, but were reluctant to talk about it for fear of recrimination. One school in the coastal area converted a emergency exit to a warehouse.

6. Do you want to learn how to protect yourself during an earthquake?

All who were interviewed did wish to learn.

> "Yes" (Directors of schools 7 from 7).
> "Yes" (Teachers 35 from 35).

Most of the teachers in the seven schools were enthusiastic about this, and expressed their desire and their need to learn how reducing risk could be practiced by teachers. There is a great deal that a teacher and their students can do to take care of themselves during and after natural disasters, particularly earthquakes. Nobody can do anything to prevent earthquakes, but they can be prepared to cope with them. Teachers can also help themselves and their students to do many things that will make schools safer during and after earthquakes.

Figure 66: Rumaitha Al Ansaria Primary School in Masafi.

7. Do you have suggestions for or comments on how to minimize the impact of natural disasters and reduce the likelihood of them occurring in your school?

> "There are many uncertainties that numerous teachers have, because they thinking about the future, how they will react in the event of disaster in the future, and they do not have any knowledge in disaster preparedness. Also they believe that as teachers, they must develop their own support systems so that they will be better equipped to assist students to deal more successfully when disaster strikes" (Directors of schools 2, 4 and 6).

> "We would like to see training programmes in and scenarios to foster preparedness for natural disasters in schools as well as some obligatory courses in the school curriculum. They also feel the support and contribution of local bodies, such as Fujairah Civil Defence, Fujairah Medical Zone and other relevant bodies is appropriate because the schools are the best places for students gain the awareness and knowledge of how to protect themselves from the natural disasters particularly from earthquakes" (Teachers 20 from 35).

> "Another issue is that of students with special needs. Most of the older schools in Fujairah are not equipped for such students. On the other hand many such students study in these schools. We suggested that special needs students should not be excused from participating in earthquake scenarios. Students who are deaf, blind, or have impaired mobility especially need experiences, which build confidence in their ability to avoid and cope with risks" (Teachers A, B, C, H, G, L).

It is clear from these responses that teachers consider that these is a need for them to be more engaged in natural disaster preparedness. The requirement of special needs children needs to be considered.

7.4.3 Student's answers

1. What is your understanding of the types of natural hazards that threaten the UAE?

Most of students appear to be concered regarding this issue considered that despite the belief that natural hazards were unlikely to occur the majority believe that earthquakes, floods and storms would threaten their personal safety.

- (55 student from 80 said earthquake in mountainous schools).
- (45 students from 60 said storms in coastal schools).
- (10 students said floods in coastal schools).

Most students chose earthquakes, particularly students in schools in mountainous areas. Students from the coastal schools chose floods and storms; the response to this question was consistent with recent event priorities for natural hazards in Fujairah.

2. Do you know the safest places in your classroom during disasters?

In response to the question about the safest places in class during disasters.

"I do not know"

- (70 students from 80 in mountainous schools).

- (50 students from 60 in coastal schools).

Most of students did not know the safe places in the classroom, with the exception of ten students from the coastal schools who had simple information about earthquake safety. The source of their information was the Internet, such as:

- If you are in the classroom, take cover under desks or tables, and keep calm.
- Stay away from windows, walls, and glass, anything that could fall, such as furniture or lighting.

3. Do you have a first aid kit in your classroom?

In response to is question about if they have a first aid kit in your classroom?

" No"

- (45 students from 80 in mountainous schools).
- (42 students from 60 in coastal schools).

Unfortunately there are no first aid kits in classrooms in most of the schools, and reliance is solely on the school nurse and the assigned treatment room.

4. Has the teacher trained you on how to act during natural disasters?

In response to this question.

"Nobody educated us"

- (77 students from 80 in mountainous schools).
- (57 students from 60 in coastal schools).

Students in schools in Fujairah do not have procedures to follow during natural disasters because other than running through a fire evacuation plan in some schools, the teachers have not trained them on how to act at such times. However, we cannot blame the teachers, as there is no material in the school curriculum at any study level relating to

natural disaster culture or to methods of self-protection. Most teachers said that without instruction coming from Fujairah Education Zone, the teachers they could not engage students on sensitive issue like disasters preparedness. So students also do not know the safest places in their classrooms in case of an earthquake and there are no regularly practiced emergency plans.

5. Do you talk with your parents about natural disasters?

In response to this question.

"No"

- (72 students from 80 in mountainous schools).
- (60 students from 60 in coastal schools).

Unfortunately, parents did not talk with their children on this topic with the exception of 8 from schools in mountainous areas, specifically from Rumaitha School. They linked the earthquake with an Act of God because most of the people do not pray to God.

6. Have you been affected by earthquake damage?

In response to this question.

"No"

- (18 students from 20 in school 2 in mountainous area).
- (12 students from 20 in school 3 in mountainous area).

In the Masafi earthquake, 2002 which shook the Masafi region, most of the children in Rumaitha School were affected by damage and loss in their houses and classrooms. The earthquake affected most classrooms, but Rumaitha Al Ansaria School had a high level of damage. Also most of the classroom walls are now cracked and there are cracks in the flooring (Figure 67).

Figure 67: The effects of earthquake on Rumaitha School, pictures (a, b, c, d) shows effects in classroom.

7. Do you want to learn how to protect yourself during earthquake?

In response to is question.

"Yes"

- (18 students from 20 in school 2 in mountainous area).
- (20 students from 20 in school 3 in mountainous area).

Most of students in the sample of schools were very enthusiastic and expressed their desire to learn about safety during natural disasters. They also expressed their willingness to accept the process of training and learning and feel that training to cope with disasters is indispensable in schools.

8. Do you have suggestions or comments to minimize the impact and reduce the likelihood of natural disasters in your school?

In response to this question the students were eager for more lectures and scenarios that might contribute to spreading the culture of disaster awareness among teachers and students. Also they would like to see material in the school curriculum relating to natural hazard culture or methods of protection during natural disasters at all study levels.

Furthermore, they expressed interest in the maintenance of some schools which are in earthquake prone areas.

7.4.4 Parent Responses

1. What is your understanding of the types of natural hazards that threaten the UAE?

In response to this question.

> "The cause of earthquakes is the work of the jinn (ghosts) in some old schools, and old houses because we felt a lot of earthquake in 60 or 70 years ago" (Parents 15 from 20 from mountainous area).

> "The cause is acts of god, like punishment from God because people move away from Islamic religion, prayer and there is proliferation of sin" (Parents 35 from 40 from coastal and mountainous area).

The influence of culture on disaster preparedness can be seen clearly. As natural disasters events are seen as 'Acts of God', meaning that only the God can help them. The vulnerability of the communities to natural hazards is strongly influenced by cultural and societal factors and increases the percentage of loss in the event of natural disasters. The notion of the 'Act of God' and divine punishment is currently prevalent in Fujairah, particularly among the older generation. The parents in Fujairah do not believe in natural hazards, and that what is happening from earthquakes, floods and storm is a natural process, but retribution because people are moving away from Islamic religion. Around 80% of the parents are subject to a denial process regarding natural disasters, particularly those from mountainous areas.

2. Do you encourage your children to learn about the culture of disaster?

In response to this question.

- "Yes" (Parents 13 from 20 from mountainous area).
- "Yes" (Parents 19 from 20 from coastal area).

Around 23 of the parents agreed to support their children in learning about the culture of disaster in school. On the other hand, they stressed the need to teach children more about the Islamic religion because they believed that adherence to religion reduces the occurrence of disasters and protects the country. Thus it can be seen that the vulnerability of the communities to natural hazards is strongly influenced by cultural and religious factors, which can increase the percentage of losses in the event of natural disasters. Fujairah's population has strong religious faith, particularly the inhabitants of mountainous areas, where most people are poorly educated. So it can be seen that if we try to improve preparedness for natural disasters without adherence to the religion of Islam, this will be very difficult.

3. Do you have background in natural disasters preparedness?

In response to this question.

> Certainly, yes, because they are Muslim and can confirm that the best method of natural disaster preparedness is adherence to religion, prayer, and avoid sin. In the past, when people were more conservative and were more committed to religion and to prayer, there were no earthquakes and no disasters. New generation parents agree with old generation but are also concerned about their children's reaction to the natural disasters, and how to help them cope with the information and their emotions and children need to feel safe (Parents 30 from 40).

7.5 General Findings

At the end of the analysis of results related to the dimensions of preparedness for disasters, these general conclusions have been reached:

1. The research findings regarding gender dependency did not reflect differences between the views of the male and female. Thus there is no great distinction in natural disaster preparedness dependent on gender. This is explained by the fact that the UAE culture does not differentiate between males and females in a big way, and that women have the same rights as men. Furthermore, most schools are

mixed, especially at the primary level. Thus natural disaster preparedness does not significantly differ between the sexes.

2. Result of interviews reveals that the preparations to face natural disasters in Fujairah schools are poor. Also in most school buildings the walls are weak and most roofs could crumble and collapse even if an earthquake did not exceed M 6. This is particularly the case with Rumaithah Al Ansaria School, Al Halah School, and Al Bethnah School, in the mountainous areas. Schools could play a significant role in the protection of students and also could be used as temporary shelters if they were safer. The collapse of school buildings could cause a high toll of human lives.

3. The role of Civil Defence in awareness of natural hazards in school is very important. Unfortunately, all training for natural disasters in schools was based only on evacuation for fire and neglected the role of civil defence training in teaching students to confront natural disasters such as earthquakes, floods and storms. There is a weakness in Civil Defence in the UAE in promoting readiness in confronting natural disasters, which is evident in the lack of preparedness in schools and in the lack of awareness during the recent natural disaster events.

4. Unfortunately the FEZ has neglected to establish a generation educated in awareness of natural disasters through lectures and seminars that might contribute to spreading the culture of disaster among teachers and students. Additionally nothing is included in the FEZ strategy relating to natural disasters and the poor maintenance of some schools. The result of interviews indicates that natural disaster education and safety measures protecting from earthquakes in the Fujairah schools are almost non-existent. The frequent occurrence of earthquakes in Fujairah increases the seriousness and danger due to this issue. Many studies have proved that earthquake education from an early age in school can be a suitable vehicle for increasing knowledge of preparedness for natural disasters

and helps expand a future "safety culture" in the country (Izadkhah and Hosseini 2006).

5. The survey results indicate that most teachers and students consider the best way to prepare school community to cope with such disasters is to avoid long theoretical lectures and launch directly into group work based on actual experience and comprehensive scenarios and drills, followed by analyzing successes and failures. To sum up, the emphasis must be on the need to combine theoretical training with specific practical preparations for each school, involving teachers, students and parents.

6. The overriding theme that emerged from this study is that while respondents generally are aware of the risk of natural hazards, they are ill-prepared for a natural disaster event. More than seven years after the Masafi earthquake of March 2002, the Fujairah schools remain relatively unprepared to face natural disasters.

Although the researcher and the covering letter to the survey assured individual survey confidentiality, many teachers and directors may not have responded with all the truth, because of security concerns or fears of liability. Furthermore, some teachers (male) would not complete the survey because of security concerns. The responses of many interviewees might have been influenced by the assurance of confidentiality. This study indicates that there are several important preparedness deficiencies in school disaster plans in the Fujairah emirate. Results of interviews show that the preparations to face natural disasters in Fujairah schools are poor. Also most schools buildings are structurally vulnerable to earthquakes.

7.6 Summary

Coastal areas				Mountainous areas			
Actions	School **1**	School **2**	School **3**	School **4**	School **5**	School **6**	School **7**
Disasters Plan for school	No	No	No	No	No	No	No
Drill and Kind of Drill	Yes Fire and Evacuation	Yes Fire	Yes Fire	Yes Fire	No	Yes Fire	Yes Fire
Drill reviewed or updated	Annually	Annually	Annually	Annually	-	No Scale	Annually
School Nurse	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Natural Disasters Drill	No	No	No	No	No	No	No
School maintenance	Annually	Annually	Annually	Annually	Annually	Annually	Annually
Type of maintenance	Paint walls and electrical	Paint walls	Paint walls	Pain walls	Paint walls	Paint Walls	Paint walls
First Aid Kits in Class Room	No	No	Yes	No	Yes	No	No
Communication with Parents in relevant situations	No	No	No	No	No	No	No
probability of the natural disasters in UAE	Strong earthquake	Strong earthquake	Strong earthquake	Middle earthquake	Strong Flood& storm	Strong storm	Strong Storm& storm
lessons on natural disasters preparedness in the curriculum	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing
Do you want to learn how to act during the earthquake	Yes	Yes	Yes	Yes strongly	Yes strongly	Yes	Yes strongly
The safest places in your class room during the disasters	Unknown	Some places known	Unknown	Unknown	Unknown	Unknown	Some places known

Table 20: Summary of survey (group responses)

Schools could play a significant role in the protection of students and also could be used as temporary shelters, if they were safer. The important role of civil defence training, in teaching students to confront natural disasters is neglected. Furthermore, the FEZ has neglected to establish a generation educated in awareness of natural disasters through lectures and seminars that might contribute to spreading the culture of disaster response among teachers and students. The emphasis must be on the need to combine theoretical training with specific preparations for each school, involving teachers, students and parents. More than seven years after the Masafi earthquake of March 2002, the Fujairah schools remain relatively unprepared to face earthquakes.

The social and environmental vulnerability to natural hazards in Fujairah Schools can be largely explained by these principal factors:

- lack of awareness, no training or preparation in response to natural hazards,
- structural integrity of buildings and no regular safety inspections
- conservative religious explanations of natural events leading to a fatalistic attitude within the community.

CHAPTER 8: THE RESPONSE CAPABILITY OF THE UAE POPULATION TO THE IMPACT OF NATURAL HAZARDS

8.1 Introduction

Understanding the perceptions of the population is critical in establishing an effective response to the impact of natural hazards. This chapter involves a comprehensive survey of the population of the UAE, through questionnaires with both men and women of the urban and rural populace, in order to obtain information on the awareness with respect to natural disasters and the level of preparation amongst the people. The purpose of this survey is to evaluate and assess the capacity of the local community in the UAE to respond to natural disasters, and to propose a strategy for the dissemination of knowledge and to raise public awareness. This information is critical in investigating the current preparedness of the population and in suggesting ways of minimizing the impact of disasters. The chapter ends with a discussion of the findings of the survey highlighting areas in need of attention.

8.2 Questionnaire approach

The questionnaire is an inexpensive way to gather data from a potentially large number of respondents. It is a well established tool within social science research for acquiring information on participants' social characteristics, standards of behaviour or present and past behaviour, attitudes and beliefs and reasons for action with respect to the topic under investigation (Bird 2009). Often it is the only feasible way to reach a number of people large enough to allow statistical analysis of the results (Bulmer 2004). Within natural hazards research, the questionnaire is a popular tool for acquiring information on perception and knowledge. Examples of the use of the questionnaire survey instrument within natural hazard research projects are: Awareness of earthquake hazard in Los Angeles, USA, by Lindell and Whitney (2000); the Cairns Cyclone in Australia, by Anderson (2003); the Celje Flood in Slovenia, by Brilly (2005); the Washington Tsunami in USA, by Johnston et al (2005), and a recent study of Montserrat, Caribbean Volcanic eruption by Haynes et al (2008).

The purpose of this survey is to gain information which will assist in the evaluation of the response capability of the UAE to the impact of natural hazards. This information is critical in investigating the current preparedness of the population in the face of natural hazards and to suggest ways of minimizing the impact of natural disasters. The sample size is 1067. The sample size calculator is determined using a standard algorithm which is based on the percentage points of the normal distribution (Creative Research Systems 2010). This sample size is large enough to be reasonably confident that the stratum represents the population (sSee the main survey). For non-literate participants the questionnaire was conducted orally.

First contact was in the form of a covering letter from the researcher, a first step in building rapport. The researcher introduced himself to respondents giving his credentials, explaining the study and why it was being conducted, indicating how long the questionnaire will take to complete and the intended use of the survey results. Furthermore, it was emphasized that no harm will come to them as a result of their participation and that they have the right to anonymity and the right to refuse to answer questions. The probability sampling method was used, with a confidence level of 95% and a Confidence Interval of 3 (see section 8.4).

The survey included some closed questions often used for quantitative results, yet they are typically difficult to construct but easy to analyse. Also closed questions allow comparisons and quantification, are easy to administer, easily coded and analyzed, and avoid irrelevant responses. Open questions were used to give the freedom and spontaneity of answers, which invite participants to share their understandings, experiences, opinions and interpretations, as well as their reactions. With qualitative results, it is easy to construct the questions but difficult to analyze (Sarantakos 2005). Prior to commencing the main survey a pilot survey was undertaken with a sample size of 100.

8.3 The Pilot Survey

The pilot survey involved personal interviews and questionnaires (men and women) in both urban and rural areas, and it was focused on 3 emirates in the UAE, The survey questions are listed in Table 21. The pilot survey population involved 40 persons from Fujairah, 30 persons from Dubai and 30 persons from Sharjah, and the pilot survey was undertaken with a sample size of 100. The selection of the numbers and distribution of samples in the pilot survey was random.

The purpose of the pilot survey was to:

- Establish if the questions generated the right information.
- Establish if questions were unambiguous and effective.
- Evaluate the effectiveness of the questionnaire as a whole in achieving the desired objectives.
- Help determine the most appropriate sample size for the main survey.

The survey targeted cafes, community centers and mosques and university students and staff. Overall, the questionnaire took approximately 25 minutes to complete which was acceptable to the participants.

1- What do you think the causes of natural disasters are? (Open question)

2- In your opinion what is the most likely natural hazard faced by the human race at this time? From: Earthquake, Storm, Flood (Closed question)

3- Have you attended a public lecture in raising awareness of natural disasters? (Closed question)

4- Have you attended or participated in any scenario with Civil Defense to face natural disasters? (Closed question)

5- Do you know how to protect yourself if there is an earthquake? (Closed question)

6- Do you know what you should do before, during and after an earthquake? (Closed question)

7- Do you think that you have enough information on natural hazard preparation? (Closed question)

8- What is the most dangerous natural hazard facing human society at this time? Explain please. (Open question)

9- How well do you think your family is prepared for a natural hazard? Please tick one of the options below. (Closed question)

10- How often do you speak with your family about the prospect of a natural disaster? (Closed question)

11- What is the extent of knowledge your family on the subject of first aid? (Closed question)

12- How would you rank preparation of your family for a natural hazard? "Please rank each item. From: High, Medium, Low" (Closed question)

13- In what year was your house built? (Closed question)

14- When was the last time you had maintenance done to your house? (Closed question)

15- Do you know where the safe place in your house is if an earthquake occurs? (Closed question)

16- Have you taken out insurance for your house to cover for natural hazards? (Closed question)

17- We would like to hear from if you have any further comments. (Open question)

Table 21: Pilot Survey questions

8.3.1 The results of the pilot survey

The main finding of the pilot survey are:

- *What do you think the causes of the natural disasters are?*

The causes of natural disasters, according to the survey are:

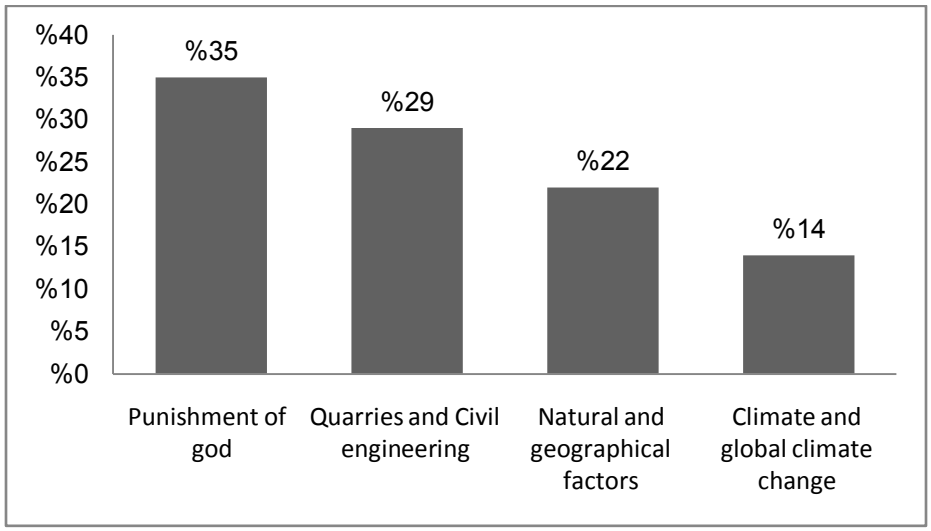

Figure 68: Perception of the causes of natural disasters

The results indicate that the most cited cause of natural disasters was punishment of God 35% (Figure 68).

In the past when earthquakes occurred and damaged towns or a tidal wave destroyed coastal villages, or other great disasters occurred, people thought it was due to the anger of God. These disasters were perceived as divine punishment for immoral behaviour or punishments like those which come from God as signs and admonishments. So the cause was “Acts of God" and the solution to pray to God for help and provide redemption (Smith 2004). So natural disasters remain to many mysterious and unpredictable. This thought still exists in Muslim and Arab countries and this was borne out by the survey. The survey results revealed the lack of awareness regarding the causes of natural hazards and this lack of understanding increases vulnerability. Many people expressed interest in

the survey. The results of the study on the UAE preparedness to face the impact of natural disasters raise important questions about the role of culture.

- *In your opinion what is the most likely natural hazard faced by the human race at this time?(Earthquake, Storm, Flood)*

These are the most likely of the natural hazard facing the humanity at present, according to the responses of the samples which are in the following order:

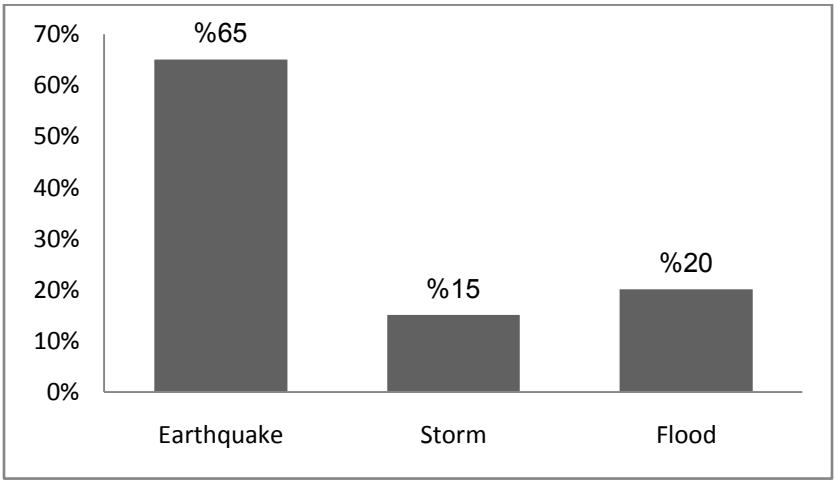

Figure 69: Most likely natural hazard faced by the human race at this time

The results indicate that earthquakes (65%) are considered the most likely natural hazard (Figure 69).

- *How would you rank preparation of your family for a natural hazard?*

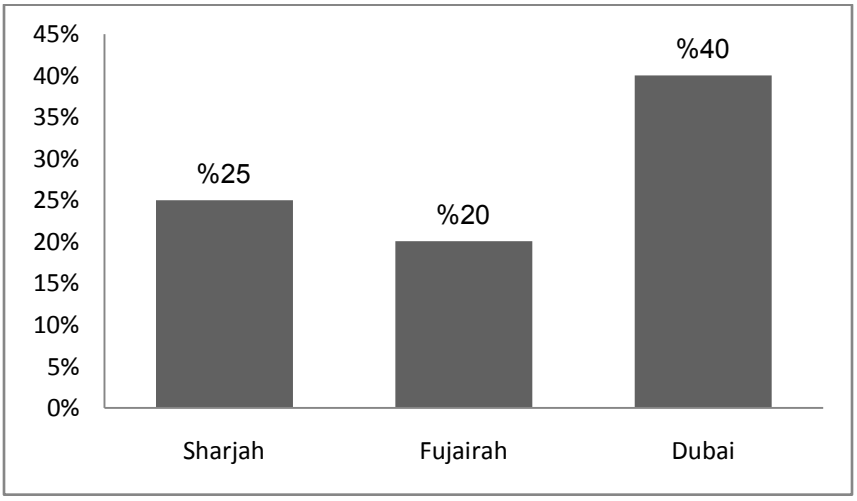

Figure 70: Percentage in the three emirates who rank their preparation for natural hazards as high (Note 15% population did not provide a response)

The results indicate that even in Dubai, the most developed of the three emirates, only 40% ranked the preparation of their family for natural hazards as high (Figure 70).

The survey reveals the weakness of preparation to face natural hazards and lack of awareness especially in Fujairah. The vulnerability of the communities to the impact of natural hazards is strongly influenced by cultural and societal factors particularly seeing God as an agent of punishment.

8.3.2 Recommendations of the pilot survey

The survey explored the level of awareness of the population with respect to natural disasters and how the community as a whole is prepared.
Following the pilot survey the following changes were made:-

1-An amendment to the title of the study was introduced; the heading was formerly "survey" but now (Questionnaire survey - Evaluation of the response capability of the

United Arab Emirates to the impact of natural hazards). It is now easier to understand the aim of survey.

2-All personal details were in open questions. There were no options (religion, age, academic level, nationality), and answers were not coded, electronic data entry therefore was difficult. So in the major survey all personal details by options and answers are coded. So the analysing of data and electronic data entry therefore will be easy.

3- During the planning phase of survey, the researcher must make important decisions regarding quantitative statistical analysis. Researchers traditionally set the [alpha] level at 5, although some researchers use more stringent (i.e. 1) or more relaxed (i.e. 10) levels. When setting the level of significance, the researchers are determining the level of accuracy required. If researchers set the [alpha] level at 1, it means that they are willing to be wrong only one time out of 100. When researchers set the [alpha] level at 5, it means that they are willing to be wrong five times out of 100 when rejecting the null hypothesis. It is important to remember that all statistical testing is based on the concept of probability (Beyea and Nicoll 1997). In this survey a stratified random sampling method was used with a confidence level set at 95% and a confidence interval of 3.

8.4 The main survey

Population in the Survey Area: 4,106.427 (Teadad 2007).

Sample size needed: 1,067

Distributed between the emirates as follows: This sample size needed is **1,067** because this sample size is large enough for us to be reasonably confident that the stratum represents the population. Depending on the proportion of the population in each Emirate, from the total population of the UAE see (Table 22).

This Sample Size Calculator is presented as a public service by the Quality Department of the Dubai Police. They use it to determine how many people should be interviewed in a survey in order to obtain results that are representative of the total population. Before using the sample size calculator, there are two terms that have to be known: the confidence interval and the confidence level. Once these are known the calculator will determine the sample size for a given confidence interval. .A confidence level of, for instance, 99% means that the sample estimate will faithfully represent the population 99% of the time, whereas a 95% confidence level means this will occur 95% of the time (Creative Research Systems 2010), (Figure 71).

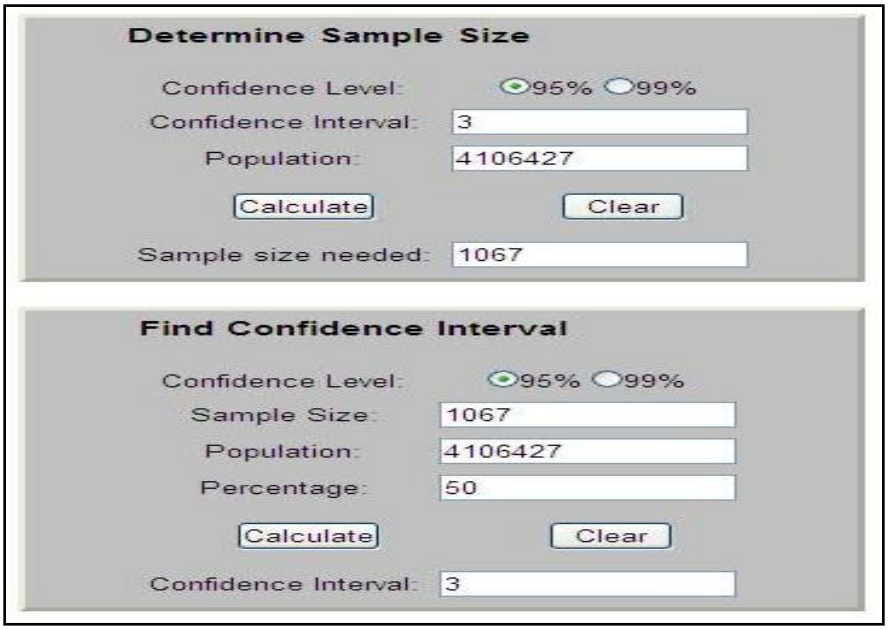

Figure 71: The Sample Size Calculation Program, The sample size Calculator is determined using a standard alogrithm which is based on the percentage points of the normal distribution (Creative Research Systems 2010).

The Emirate	Required Number of Samples with percentage	The actual number of the population
Abu Dhabi	364 = 34%	1399484
Dubai	343 = 32%	1321453
Sharjah	206 = 19%	793579
Ajman	54 = 5%	206897
Ras Al Khaimah	55 = 5%	210063
Al Fujairah	33 = 4%	125798
Um Al Quwain	13 = 1%	49159
Total	1,067	4,106.427

Table 22: Table shows the number of population in each emirate,
with the size of the sample taken in the survey.

8.4.1 Criteria and method of sample investigated

The researcher will want not only to examine the results from the overall population, but also understand the differences between key demographic subgroups within the population. For example, the researcher might want to understand the differences between male and female or Rural and Urban attitudes.

The population was divided into a number of groups. The principal division was at the level of the individual emirate: Fujairah being classified as rural; and Abu Dhabi, Dubai, Sharjah, Ajman, Um Al Quwain and Ras Al Khaimah being classified as urban. Within each emirate the sample was then sub-divided equally between men and women.

A structured random sample approach was adopted. Ideally participants should have been selected from population as a whole, but data which includes information on both citizens and expatriates are not generally available. It was recognised that in an Arab culture sending out questionnaires according to a random design would lead to a minimal response. To achieve a high response rate and to overcome this constraint, it was decided

to approach potential participants in public places (see below). In the six urban emirates people either live and/or work in the principal urban centre and the sample is, therefore, broadly representative of the population as a whole. In contrast in Fujairah, where the population is more dispersed the sample was split between the two main population centres, Fujairah City and Dibba. The survey targeted cafes, community centres and mosques, university students and staff. Muslim clerics, and unemployed men and women were selected randomly depending on the number required from each emirate. Due to the length of the questionnaire and the nature of the closed/open questioning, face-to-face delivery was considered most appropriate. The response rate of 90 % was collective, and around 80% from ages were between 20- 40.

The population was divided into strata, the main division being rural and urban. Also within each Emirate data were further grouped into male and female categories. The resulting information can be combined to obtain an estimate that is more precise than might be expected from a random sample of the entire population.

For the evaluation of the level of awareness of the UAE population to the impact of natural hazard, a stratified random sample was employed. The population of the UAE is grouped into two strata consisting of all populations, Rural and Urban; the Rural in Fujairah emirate (Fujairah City, Dibba), and the Urban in other Emirates. From each stratum, a random sample of population will then be selected. Abu Dhabi: (Urban). Required Number of Samples: 364 it includes 182 Male and 182 Female.

- The selection of the numbers of samples was statistically on confidence level 95% and Confidence Interval of 3.

- The samples were distributed by the utilization of Stratified random sample in the probability method (George 1989), whereby the selected samples were in proportion to the UAE population, which is dependent on the size of population in each Emirate as a proportion of the total population of the UAE.

The purpose of the survey is to evaluate and assess the capacity of the local community in the UAE to respond to natural disasters, and to propose a strategy for the dissemination of knowledge of natural hazards and to raise public awareness of natural disasters. There are numerous benefits in using the survey method for conducting research on the various aspects of natural disasters in the UAE. For example, the survey paved the way to the identification of the information actually needed to understand the problems to be addressed, as well as to determine their causes and possible solutions. As the respondents were anonymous, the survey gave communities a good opportunity to voice grievances more freely and openly and in this way helped clarify certain issues which had been unclear previously. Although such studies have been conducted in many countries in the past, this study is the first of its kind to be conducted in the UAE. Therefore the results of this study are valuable for natural disaster preparations and disaster management in the UAE.

The survey focused also on the impact of the tropical Gonu storm in 2007, because it was the last natural hazard which affected the UAE prior to the survey, and there were great economic losses. Also many people lived through this event, so they could easily recall events. Significant damage was caused in some regions of Fujairah and in one small region of Sharjah (Suhailah). So the survey regarding the objective three (see below): evaluating the response of the UAE to the Gonu storm 2007, included only two emirates Fujairah and associated enclaves of Sharjah. This has prompted the need to establish what interventions will reduce the damage in the event of future natural disasters.

The survey consisted of five demographic questions (gender, age, religion, birthplace, education attained). The survey objectives are:

1. Determine the level of awareness of the public regarding natural disasters.
2. Determine the awareness of the public regarding preparedness for natural hazards.
3. Evaluate the response of the UAE to storm Gonu in 2007 and level of damage.

Before conducting the questionnaire, participants were required to read a letter which explained the questionnaire's purpose and content; it said they could withdraw from the survey if they wished. Furthermore, no participant would be identifiable through publication of the results. All questions in the survey were written in both Arabic and

English. No major defects in questionnaire design were apparent during this main survey. No problems arose with respect to question wording. Overall, the questionnaire took approximately 20 minutes to complete which was acceptable to the participants. However, some participants did not fully comprehend certain questions, particularly those who were uneducated, and those 20% aged between 55-70 years old.

The Questionnaire included a section for free text *Suggestions and Comments*. This was completed by around 60% of respondents and provided valuable additional information.

8.4.2 The main survey sample investigated

Questionnaire survey - Evaluation of the response capability of the United Arab Emirates on the impact of natural hazards	
Research and Study form	
Date	2007
Subject	Opinion poll on the dangers of natural disasters in 2007
Objectives	1. Determine the level of awareness of the public regarding natural disasters. 2. Determine the awareness of the public regarding preparedness for natural hazards. 3. Evaluate the response of the UAE to storm Gonu in 2007 and level of damage.
	• Scale of the objective one: Determine the level of awareness of the public regarding natural disasters. 1. Perception of most likely natural disasters in the UAE. • Scale of the objective two: Determine the level of awareness of the

	public regarding preparedness for natural hazards. 1. Adequate information to address natural dangers 2. Measuring the desire to insure personal property (home, vehicle) against natural disasters. 3. Knowledge of how to face the risk of natural disasters 4. Knowing the authority responsible for dealing with natural disasters 5. Keenness to watch programmes featuring awareness of the risks of natural disasters. • Scale of the objective three: Evaluate the response of the UAE to storm Gonu in 2007 and level of damage. (Fujairah which include Sharjah enclave of Kalba). 1.Definition of people at risk before the storm strikes 2.Proper preparation to face risk from the storm before it strikes 3.Proper preparation to face risk from the storm while it is in progress 4.Proper preparation to face risk from the storm after it has struck 5.How homes weathered the storm 6.The speed of return to normal life 7. How prepared individuals were to face the aftermath of the storm
	Option for free text *suggestions and comments*
Community of Study	The UAE Population
Population	The total population of the UAE stands at 4,106,427, according to the last census in the country.
Sample size needed	• (1,067) from all the emirates comprising the UAE
Method of Selecting	• stratified sample method in the probability method, on confidence

Samples	level 95% and Confidence Interval of 3
Tools	• A written form in the field
Prepared by	Dubai Police – Quality Centre

Table 23: Methodology of main survey sample

8.4.3 The Findings

- ***The Objective one: Determine the level of awareness of the public regarding natural disasters.***

- What is your perception about the most likely natural disasters in the UAE?

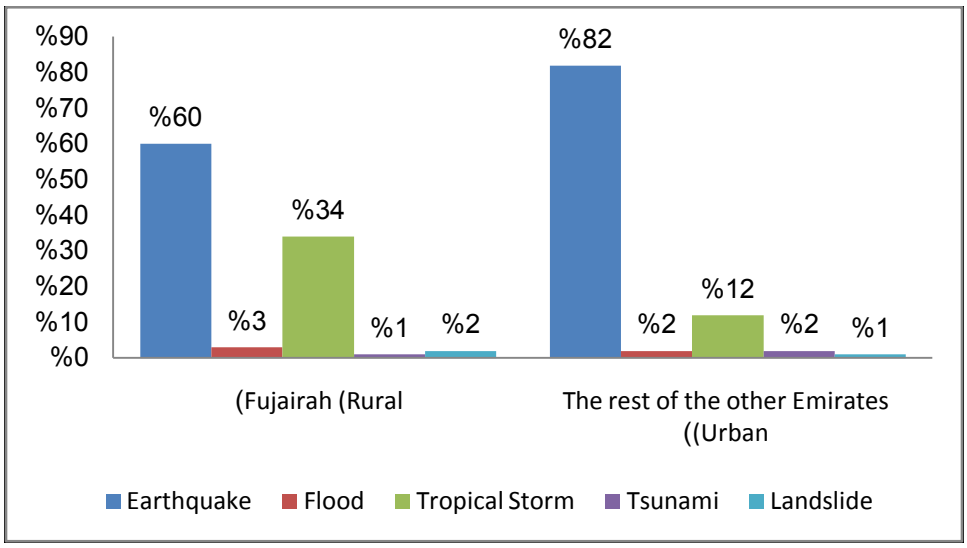

Figure 72: Perception about the most likely natural disaster in the UAE

(Note, 1% in urban population did not provide a response)

This analysis indicates that in this survey earthquakes are considered to be the most likely natural hazard. The response to this question was consistent with the natural hazards which occurred most recently in the UAE, for example earthquakes in 2002, 2004, 2006, 2007 and tremors in January 2008, and tropical storm Gonu in 2007.

It is surprising that more people in the urban emirates regarded earthquakes as most likely than the people Fujairah despite the recent Masafi earthquake that occurred in this emirate. This could be due to the higher level of education in the urban emirates leading to greater awareness (Figure 72). Also, the recent impact of Gonu storm in Fujairah would have been fresh in peoples' minds.

The perception of the most likely of natural disaster amongst males (31%) and females (29%) in (Rural), males (40%) and females (42%) in (Urban) selecting earthquakes, so it is similar. Also male (19%) and females (15%) in (Rural), males (7%) and females (5%) in (Urban) said Tropical storm. There is little difference between the genders.

- ***The objective two: Determine the awareness of the public regarding preparedness for natural hazards:***

- What is your understanding of preparation for natural disasters in the UAE?

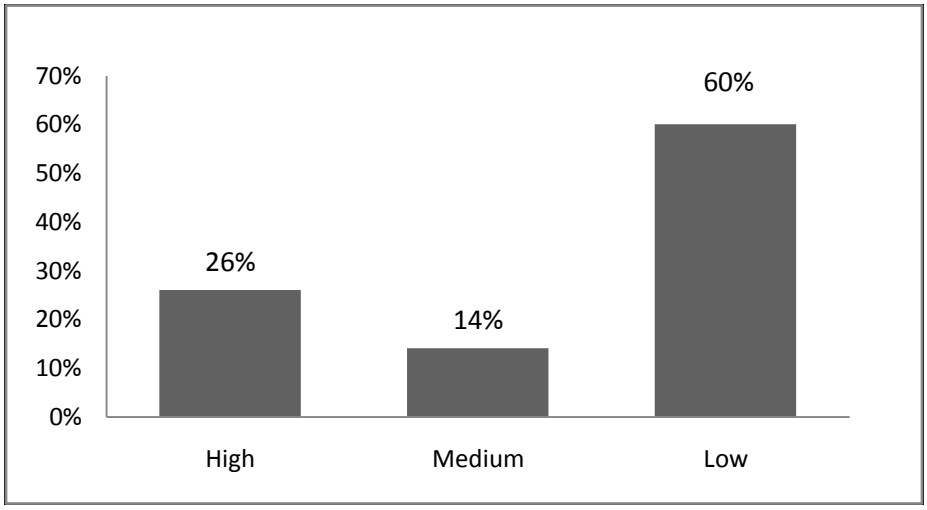

Figure 73: Understanding of preparation for natural disasters in the UAE.

The results in (Figure 73) indicate a low level of understanding among the people. In the *suggestions and comments* of the survey 33% from the participants said that there is a lack of focus on programmes covering natural disasters in the media in the UAE.

In understanding the preparedness for natural disasters in the UAE, there is a slightly higher understanding amongst, males (32%) than females (28%) but the difference between the genders is small.

- If you have knowledge about the preparation for natural disasters, What is the source of your information? (you can choose more than one)

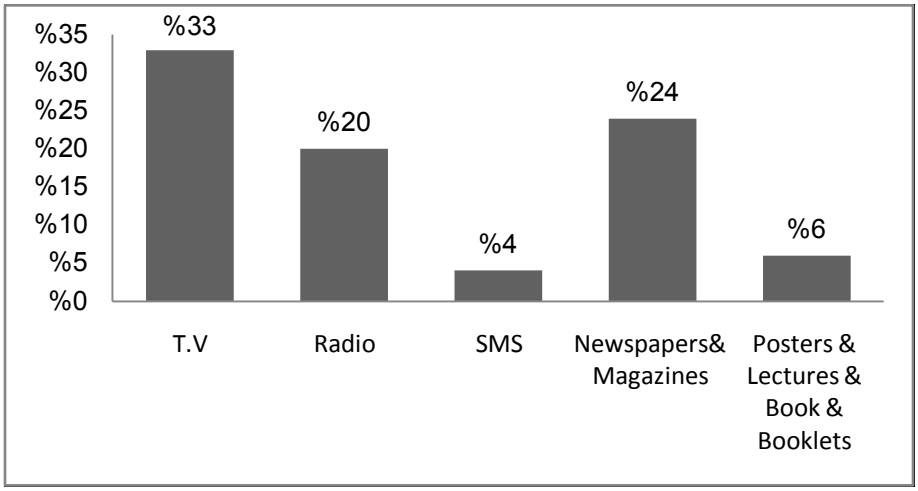

Figure 74: Sources of information on preparedness for natural disasters
(Note 13% from population did not provide a response)

The results of the survey indicate TV is the most important source information (Figure 74). From the *suggestions and comments* around 16% of the respondents received information via television from outside the country. There is a lack of focus on programmes covering natural disasters in the TV in the UAE. The results indicate that comprehensive disaster education has not been provided and that audio-visual means are probably the most effective tool for disaster education.

During a disaster the battery radio is the most important and effective method of disseminating information (FEMA 2008). The survey results indicate a low number of people who listen to the radio in the UAE, just 20%.

- What is your awareness level about what you should do in the following cases in the case of a natural disaster?

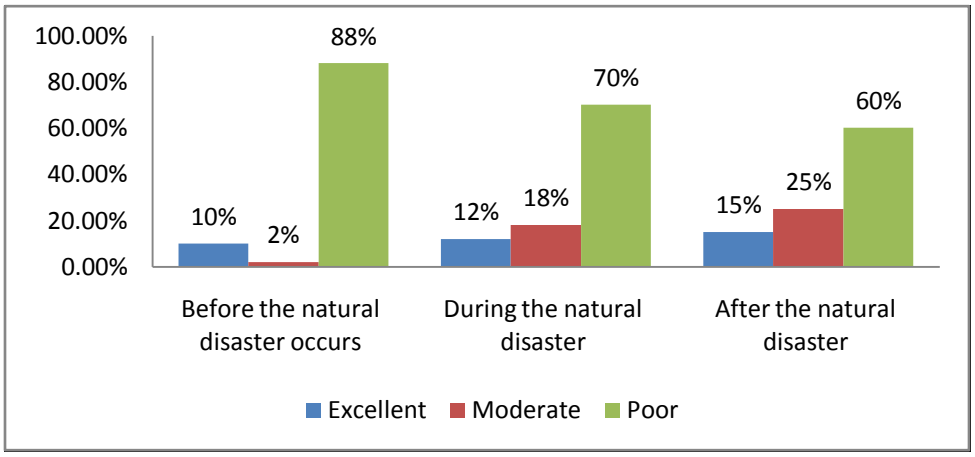

Figure 75: Awareness level about what you should do in the following cases in the case of a natural disaster is as follows, about what should be done at various stages

The results (Figure 75) show a lack of awareness, particularly in the before disaster stage. This probably reflects UAE policy which is to focus on reaction and response.

This neglect of raising awareness is something the government needs to reassess. Often Muslim communities consider that natural disasters such as earthquakes, tsunamis and storms are a punishment from God and a sign of His anger. Also many people regard mosques as suitable evacuation sites; it seems that people place a great deal of confidence in religious facilities. Does this mean that Islamic countries continue to see natural disasters as random, freak events and that they are not prepared to deal with natural hazards and take steps to minimize the risk? Comparing the result to the outcome of the survey asked of the Sri Lanka population in 2005 under the title (Tsunami public

awareness and the disaster management system of Sri Lanka). Of the respondents, 15 % attributed tsunamis to the "wrath of god."

In the *suggestions and comments* part in this survey 25% of the participants indicated that the cause is punishment from God because people move away from Islamic religion, prayer and there is proliferation of sin. Also 30% from Fujairah rural area and 15% from the urban emirates consider that natural disasters events are 'Acts of God', meaning that only God can help us.

> "natural disaster is a punishment from God, so only God can prevent natural disasters, because God controls the weather. God controls the skies and the rain, controls the wind and God has power over all nature. So God is in control of all things. So to stop disasters the people should rely on God is goodness and pray" (respondent in *suggestions and comments*).

In Fujairah (rural) 20% (*suggestions and comments*) suggested that the large number of discos and nightclubs, spread of alcohol and adultery, and the people turning away from religion and the small number attending Prayers in mosques is a major cause of natural disasters.

The UAE society is deeply religious, particularly in Fujairah. These results confirm and ratify the result in the pilot survey showing the influence of Arabic and Islamic culture on disaster preparedness. This reflects the impact of such social and cultural values on awareness level of natural hazards (Tetsushi et al 2006). The survey results confirm the outcome from the survey on the ministries and agencies. The Civil Defence reaction policy for facing natural disasters neglects the awareness stage which precedes the natural disasters and the importance of this stage in preparing the community to mitigate the risk.

- <u>Do you insure your properties against natural disasters?</u>

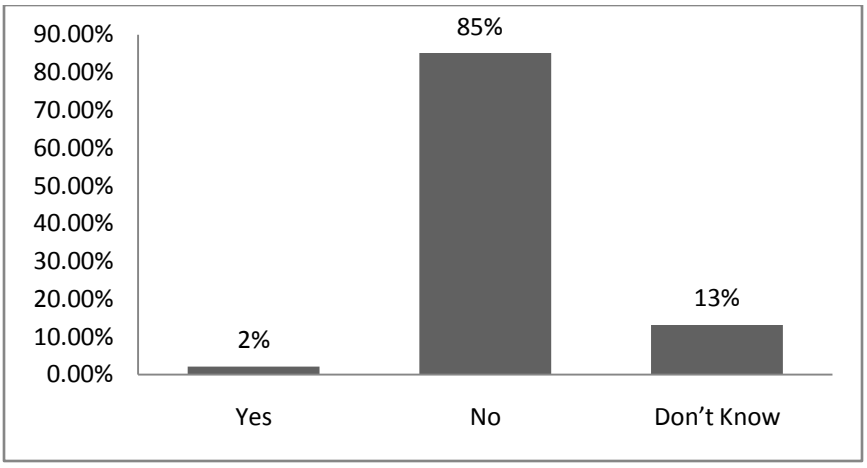

Figure 76: Do you insure your property against natural disasters

From the *suggestions and comments* more than 20% of the respondents rejected the idea of insurance from natural disasters. This is satisfactory only if they do not need insurance, because in the case of natural disasters there is government intervention, so they know that the government would compensate them.

Also in the *suggestions and comments* 25% relate insurance to Islamic beliefs and they consider that insurance involves an element of uncertainty and, hence, in a sense is related to gambling which is prohibited by the Holy Quran, and it also involves charging interest which is also considered non-Islamic and to be almost the same as usury.

- Do you watch programmes on natural disasters?

-

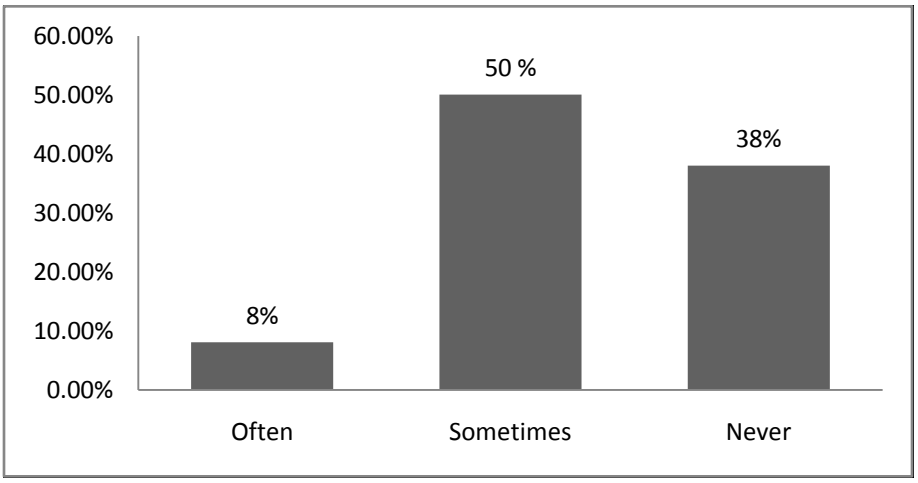

Figure 77: The responses of persons who watch programmes on natural disasters (Note 4% population did not provide a response)

This poor response (Figure 77) may explain the poor level of level of understanding of natural hazards, which raises of vulnerability through a lack of awareness. The issue of watching programmes on natural disasters and the culture of preparedness for natural disasters is very important in raising awareness.

However, the people who did watch these programmes often did so on Oman TV channels as is shown by events such as tropical storm Gonu in 2007. Natural disaster programmes on TV are an important source of education that can improve levels of preparedness to tackle unforeseen natural disasters. They provide people with resources and information about natural disasters facing the country, and provide resources for parents to help them to answer difficult questions and to comfort their children.

- <u>In the event of a natural disaster in your area what is the responsible agency?</u>

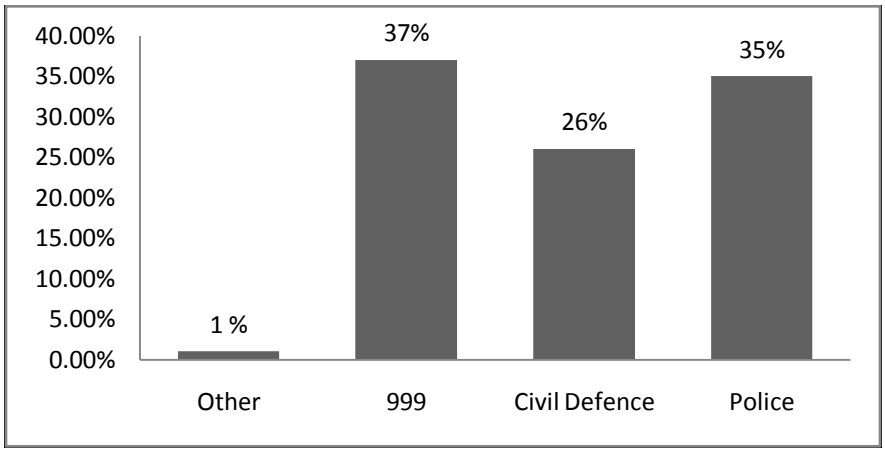

Figure 78: Perception of agencies responsible in the event of a natural disasters (Note 1% from population did not provide a response)

The subject of the knowledge of the government body responsible for protection during natural disasters is very important. The majority of the population (Figure 78) does not know which government body is responsible for their protection in such circumstances. The role of Civil Defence body is not sufficiently recognized and this needs to be addressed by means of lectures, meetings and training. Hence the 37% of people in the UAE prefer to call the emergency number (999) in the event of natural disasters (Figure 78).

- ***The objective three: Evaluate the response of the UAE to the storm Gonu 2007 and level of damage.***

In 2007, UAE was impacted by the Gonu storm which resulted in a lot of damage (see Chapter 6).

- <u>Were you satisfied by the warning you received before the Gonu storm?</u>

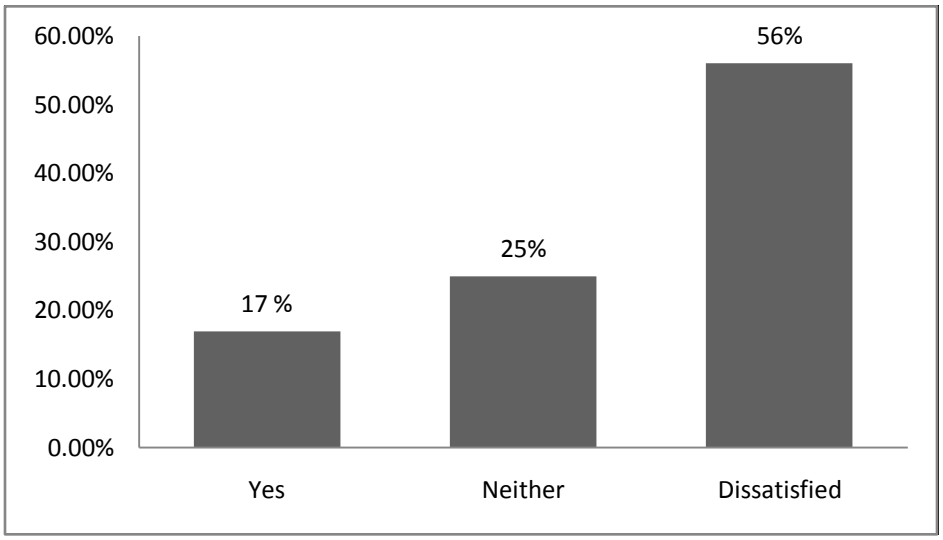

Figure 79: The satisfaction of the warning that was received before the Gonu storm (Note 2% from population did not provide a response)

It is clear that there was a lack of interest from the relevant authorities with the process of awareness-raising and sending out warnings before the arrival of Gonu storm, as can be seen from these results (Figure 79).

- Have you been affected by Gonu storm damage?

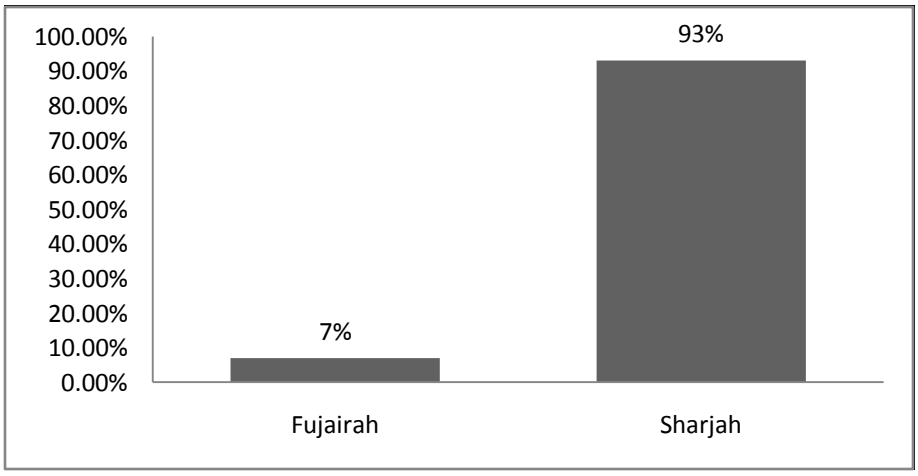

Figure 80: Respondents affected by Gonu storm damage

Tropical Gonu storm hit Oman and the UAE on 6 June 2007 with fierce winds and torrential rains. Significant damage was caused in some regions of Fujairah and in one

small enclave of Sharjah within Fujairah. In the sample of the population in this survey, most of those affected were from the Suhilah region in Sharjah, which meant it received greatest damage from storm Gonu 93% (Figure 80).

Answers in the comments included, of the 239 survey respondents, 70% reported damage ranging from complete loss of household items down to pots and pieces of furniture together with vehicles, livestock, farms. A numbers of the respondents 30% reported structural damage to their houses. The loss of property was generally the most traumatic result of the Gonu storm.

- How long did it take for life to return to normal in your area?

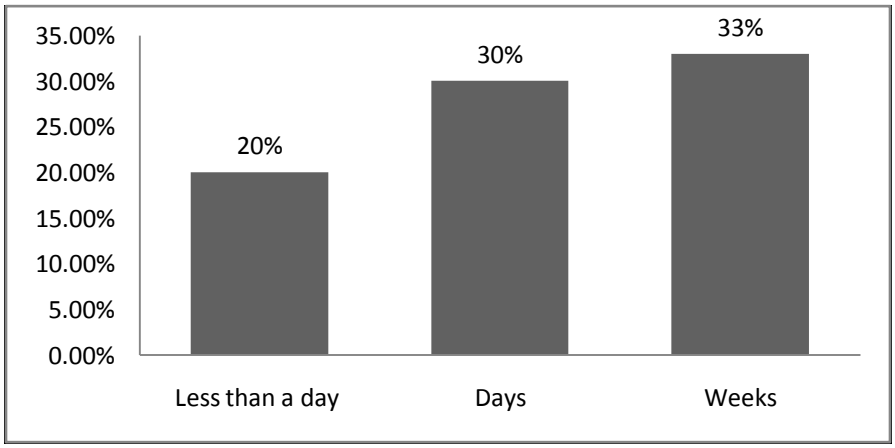

Figure 81: Length of time it took for life to return to normal in the area
(Note 17% from population did not provide a response)

From (Figure 81) it can be seen that for most people life returned to normal quickly. The longest anyone said it took was only weeks. So the post – disaster response was good the UAE must therefore focus on the 'before disaster' and 'during disaster' stages.

More than 10% of the respondents in their *suggestions and comments* indicated that when storm Gonu hit in 2007, there were coordination problems during the relief and rehabilitation phases. Although officials did their best to perform their duties, their lack of experience and the lack of a disaster management system kept them from achieving

productive results. A small number of (5%) respondents indicated that, the food provided by the Red Crescent, was not equally distributed among the shelters; some shelters receiving more meals than needed whereas other shelters did not receive enough. Also that the sick people and the elderly did not receive meals appropriate to their state of health.

Moreover, around 10% in their *suggestions and comments* indicated that the material assistance provided by the Red Crescent and charities showed favouritism in the distribution of the assistance, only giving them to either their family members or relatives. Also there was no evidence of any systematic effort at reaching the most vulnerable or those who had suffered the greatest damage from Gonu. There was reportedly a patchwork of relief deliveries based in part on personal relationships. Contingency plans need to be formulated to remedy this lack of coordination.

- Are you now better prepared to face natural disasters?

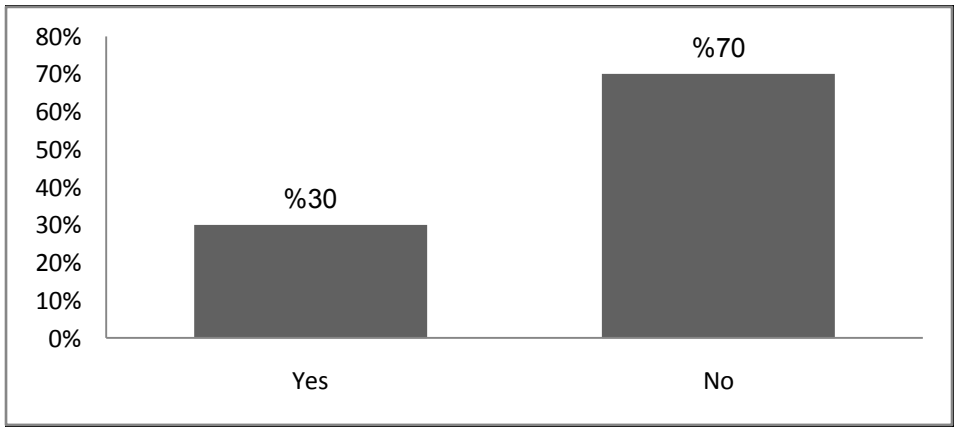

Figure 82: The result of whether they are now better prepared to face natural disasters.

Remarkably, not one of the respondents reported sickness in the family as a consequence of the storm. Furthermore, 70% of them reported doing nothing to protect themselves from future storms, primarily on account of their perceived inability to take meaningful precautions (Figure 82).

"we do not anticipate greater loss in the future because I have lost my sons cars, furniture, and my sheep and my boat and water flooded my son's new house, I have been completely ruined. Nothing is left" (Respondent from rural area).

"there can be no meaningless suffering for the Muslim, whether the suffering is caused by mankind or by a natural disasters. God will choose to protect us from the effects of these natural disasters or allow them to continue as part of His law. God will not intervene and see what our reaction is. More often than not, Muslims will turn to God at times of needs and despair. We may not always know why natural disasters happen, but we can be assured that in all God gives us reward about our patience of disasters"(Respondent from rural area).

"the God can intervene and prevent the effect of natural disasters, but he is testing us on how we react; therefore, if we remain steadfast and put our full trust in God then we will get closer to God. On the other hand, if we curse and blame God for our loss, then we have failed the test and moved further away from God" (Respondent from rural area).

"natural disasters are strong signs of dissatisfaction by God and a punishment against wrongdoers. All Muslims should be pious, modest and compliant and avoid being evil because God will punish sinful people, especially those who over do it and commit intentional sins" (Respondent from urban areas).

This study found that the residents feel the need for better dissemination of information. Around 30% of respondents in their *suggestions and comments* think that, it is important to introduce disaster education in schools in order to raise public awareness of disaster reduction. Also 20% feel that, if textbooks on disaster education were distributed to children at school, their parents might also read the textbooks and then be better informed.

The fact that 30% consider that they are now better prepared is good but it could be much higher especially since storms do not strike suddenly as earthquakes do, and the government has sufficient time to prepare. The fact that the force of the storm was less than when it hit Oman decreased the impact. The results show that one year after the Gonu storm there was no change in the proportion of awareness for the population and the survey results reveal that there is weaknesses in preparedness to face natural disasters.

8.5 Discussion

Lack of awareness regarding the causes of natural hazards is clear. In the pilot survey 35% related the cause of natural disasters to punishment from God whereas only 22% related these disasters to natural and geographical factors. The cultural context plays an important part in influencing perception and this is discussed further below. In the main survey (Figure 72) earthquakes were identified as the most likely hazard followed by tropical storms and this is not surprising following the recent Masafi earthquake and Gonu storm.

Lack of preparedness is particularly evident in the pre-disaster stage (Figure 75) and from the comments of participants to this question a significant number in the rural emirate (30%) and a lesser proportion in the urban emirates (15%) consider that natural disasters are acts of God and the risk can only be minimised by being more religious. Indeed in the response to the question on whether they insure their property against natural disasters (Figure 76) 85% said no and though in their *suggestions and comments* 20% said this was because they believed the government would compensate them, 25% said that they considered that insurance was a form of usury and therefore prohibited by the Holy Quran.

There is a lack of awareness knowledge about the preparation for natural disasters and the survey results indicate a low number of people who listen to the radio in the UAE, just 20%. However, during a disaster the battery radio is the most important and effective method of disseminating information. TV is the most important source of general

information (Figure 74). There is a lack of focus on programmes covering natural disasters in the TV in the UAE, around 16% of respondents received information via television from outside the country. The results indicate that comprehensive disaster education has not been provided and that audio-visual means are probably the most effective tool for disaster education.

There was little evidence of interest from the relevant authorities with the process of awareness-raising and sending out warnings before the arrival of Gonu storm (Figure 79). More than 10% of the respondents in their comments indicated that when storm Gonu hit in 2007, there were coordination problems during the relief and rehabilitation phases. Follow up response was good and the UAE must therefore focus on the 'before disaster' and 'during disaster' stages. It can be seen that for most people life returned to normal quickly. The longest anyone said it took was only weeks (Figure 81). The results show that one year after the Gonu storm there was no change in the proportion of awareness for the population and the survey results reveal that there is weaknesses in preparedness to face natural disasters.

8.6 Summary

The main points from the survey are:

- The results indicate that the most cited cause of natural disasters was punishment of God and "Acts of God" and the solution is to pray to God for help. This thought still exists in Muslim and Arab countries and this was borne out by the survey. The vulnerability of the communities to the impact of natural hazards is strongly influenced by cultural and societal factors particularly seeing God as an agent of punishment.

- The results indicate a low level of preparation for natural hazards among the people. This is probably a reflection of the UAE policy which is to focus on reaction and response.

- There is a lack of focus on programmes covering natural disasters in the TV in the UAE. So activating comprehensive disaster education is important and that audio-visual means are probably the most effective tool for disaster education, especially radio because. During a disaster the battery radio is the most important and effective method of disseminating information.

- The role of the Civil Defence is not sufficiently recognized and this needs to be addressed. The subject of the knowledge of the government body responsible for protection during natural disasters is very important. The majority of the population does not know which government body is responsible for their protection in such circumstances.

- It is because around one quarter of respondents relate insurance to Islamic beliefs on gambling that the uptake of insurance is restricted, particularly in the rural emirates and this reflects the influence of social and cultural values on vulnerability.

CHAPTER 9: CONCLUSIONS

9.1 Introduction

This chapter summarises the general findings from the thesis and relates these to the objectives. In addition key recommendations are presented together with areas identified for further study.

The outcomes of the objectives are summarized in the sections as follows: *Determine the structure, responsibilities and procedures for Civil Defence in the UAE* in Section 9.2; *Undertake assessment of vulnerability and awareness regarding natural disasters in the school community* in Section 9.3; *To determine the perception and understanding of natural hazards in the UAE population* in Section 9.4 and in Section 9.5 *Identify the natural hazards that affect the UAE and evaluate the impact of recent natural disasters*.

Emerging from the research three themes are identified and these are considered in Section 9.6. Recommendations for improving disaster management in the UAE are presented in Section 9.7 and suggestions for further work in Section 9.8.

9.2 Effectiveness of Disaster Management in the UAE

Determining the structure, responsibilities and procedures for Civil Defence in the UAE was the first objective investigated in this research and the findings are presented in Chapters Four and Five.The general findings from the thesis regarding the investigation of disaster management bodies in the UAE are summarized in Table 24.

1. Civil Defence	a. Weakness of the Federal Plan to face disasters. The Federal Plan is not based on a systematic study, and does not properly evaluate experiences from other countries. Moreover, Civil Defence is much more concerned with evacuation operations at the expense of other interventions. It has not fully taken on board its primary role as a leader during natural disasters. In the

	Federal Plan, Civil Defence is required to organise relationships between different competent authorities and this is not reflected in current practice. Civil Defence is facing a lack of clarity in delineation and operation of distinct responsibilities. There is some confusion and duplication in the roles of the Civil Defence and the police in facing natural disasters. b. Shortage of individuals and equipment in some Civil Defence departments especially in the smaller emirates. Equipment and logistic support for use during disasters is not distributed among Civil Defence departments of the individual emirates on the basis of likely need. The shortage of specialised human resources in the field of natural disasters management in the Civil Defence creates a formidable obstacle especially in smaller emirates. Readiness in some emirates is limited. A programme of awareness in some emirates does not exist. There is no overall strategy for directors of Civil Defence to follow. c. Relationships, communication and transparency at an operational level among the Civil Defence in the seven emirates are limited. There is no collaboration or transparency or exchange of expertise or experiences in the Civil Defence. d. Civil Defence in the smaller emirates cannot be compared with that of larger emirates, where there is strong local support, equipment and advanced technology. e. The reaction policy for responding to natural disasters does not pay sufficient attention to the awareness stage which should precede natural disasters. Several of the criticisms were based on the highly bureaucratic structure of the current disaster management system. f. Most training for natural hazards is based solely on evacuation in response to fire, and there is a neglect of the critical role of the Civil Defence in confronting natural disasters such as earthquakes, floods and storms. There has been no analysis of

	previous natural disasters that have occurred in the UAE. Furthermore, the responsible authorities have delayed identifying places of evacuation. This has recently been made more difficult because of rapid building construction in the UAE. g. There is lack of knowledge about natural hazards amongst the Civil Defence authorities particularly about those hazards confronting the UAE. The scarcity of information, accurate maps, and lack of detailed study of the natural hazards in the UAE is an issue. This causes great difficulties in the process of disaster response. Knowledge and understanding is needed to facilitate decision-making when disasters strike. All directors of Civil Defence in smaller emirates and the majority from the larger emirates agreed on this point. h. Most officers and Civil Defence personnel in smaller emirates have no background in the disciplines required to manage a disaster. The issues that this raises are explored in reviewing the results of interviews in chapter four.
2. The supporting Ministries and National Institutions	a. The preparedness of Ministry of Public Works to handle natural hazards is an issue. There is a lack of a seismic code for buildings in most of the UAE, particularly for buildings older than 30 years. There is no general law or legislation to require owners, contractors and engineers to build according to contracted specifications for earthquake hazard. b. Nothing included in the Ministry of Education strategy relates to the security of students from the effects of natural hazards. There is no material in the school curriculum, relating to natural hazards or methods of protection. With regard to the safety of school buildings and their ability to cope with earthquakes, there is poor maintenance of some schools especially in the countryside and more distant territories which are more subject to earthquakes, such as in the emirates of Ras Al Khaimah and Fujairah. No committee or team in the Ministry of Education has set up a training programme to enable the ministry personnel and staff to manage responses.

	(This is explored further in Chapter 7, see also Section 9.3). c. Regarding the preparedness of Ministry of Health, there is a lack of doctors and nurses in most UAE hospitals, which is considered to be an immense obstacle to their readiness to confront disasters. Nursing and medicine are marginalized, compared to other professions, in the UAE. Most hospitals are suffering from severe shortages in staff. d. The Ministry of Social Affairs, does not have a clearly defined role in the Federal Plan. This is clear in the duplication of tasks, and duplication between the ministry and the NGO aid associations such as the Red Crescent. In addition there is an issue between the Ministries of Social Affairs and Finance, through the complicated procedures in payment and financial aid for those affected during disasters events. e. There is a lack preparedness in the Ministry of Energy-Electricity & Water, because this ministry did not request the Civil Defence authority or the Ministry of Interior to discuss natural hazards with them. It is regrettable that some Electricity & Water managers in smaller emirates neither know the contents of the Federal Plan for confronting disasters nor are they clear about their responsibilities. f. Regarding the preparedness of the National Crisis Emergency Management Agency the terms of reference indicate that it has no specific role concerning natural disasters. They have no procedures for monitoring and surveillance of hazards. Furthermore, there are no processes of consultation and analysis. Awareness of the needs of the local communities economic and social will be critical in ensuring policies are appropriate and realistic. In short the problem is not the preparation of plans and formulation, but implementation. g. The Emirates' Red Crescent is ready to respond to disasters. It understands the need for co-ordination between the participating departments and recognise the importance of leadership, whether this be Police, Civil Defence or the armed forces.

	h. Regarding the preparedness of Emirates Volunteers to support responses to natural hazards, the cooperation between volunteers and the federal and regional authorities pose a number of problems and some confusion. The major factor is the lack of know-how about cooperation between volunteers and federal and regional bodies. Also, volunteers are not sufficiently involved in training initiatives. Furthermore, there is lack of encouragement by the concerned authorities towards the importance of the volunteer role (chapter 5).

Table 24: General findings from the UAE bodies

From these general findings significant concerns are:

- There is a mismatch between responsibilities as set out in the Federal Plan and the understanding of the relevant competent authorities. At an operational level there is lack of clarity of responsibilities and relationships between Federal authorities and the individual emirates.
- The policy for managing natural disasters focuses on the response and reaction to an event. Insufficient attention is paid to raising awareness of natural hazards and developing a strategy for increasing preparedness to mitigate the risk.
- There is a lack of systematic training for the relevant bodies and their personnel. There also needs to be implementation of scenario training to evaluate the effectiveness of procedures and the operation of relevant bodies.
- The lack of understanding of senior staff of the role of their ministries as set out in the Federal Plan is a major concern.
- There needs to greater urgency in the implementation of the role of the National Crisis Emergency Management Agency.

9.3 Preparedness for Natural Disasters in Schools (Fujairah Emirate)

The objective to *undertake assessment of vulnerability and awareness regarding natural disasters in the school community* was achieved through a detailed investigation in Fujairah emirate which has been subjected to a number of natural disasters over the last

15 years (Chapter 7). Mitigation of the risk from natural hazards includes raising the level of public awareness and, in particular the education of school students, who represent a large and accessible segment of society. Vulnerability assessment and raising public awareness in schools are essential to building an effective plan to respond to disasters. The Emirate of Fujairah in particular is prone to frequent natural disasters. The personal reactions to recurrent natural disasters in the Emirate of Fujairah reflected a real sense of the fear of these events and the need for a strategy to prepare for these disasters (Chapter 7). The findings from Fujairah schools survey are:

a. In Fujairah schools remarkably little attention has been devoted to disaster preparedness. There is at present no programme from the Fujairah Education Zone (FEZ) for natural hazard preparation in schools. The UAE Ministry of Education, not FEZ, has the authority to make decisions regarding the curriculum. The creation of a comprehensive disaster response plan FEZ-based operations unit is not easy, as it would need combined efforts, approval and support from the highest levels and leadership in the Ministry of Education in the UAE. At present there is no plan to deal with natural disasters in FEZ (For more information see chapter 7, Fujairah FEZ administration staff answers).

b. Most of Fujairah's schools were not designed to be safe from natural hazards, particularly the older schools in the mountains area. Most Fujairah schools were built more than 40 years ago, and the only kind of maintenance they receive is that the exterior is painted every year. Many of the school buildings in Fujairah have structural problems related to lack of maintenance. The present situation of vulnerability reduces the capability of such school buildings to resist additional forces in the future as might be expected as a result of earthquakes. The Director of FEZ confirmed that there is no programme from the FEZ for natural disaster preparation in schools. The Masafi region includes many older school buildings, particularly Rumaitha Al Ansaria Primary School and Masafi Secondary School which were affected by the 2002 earthquake. There were cracked walls, and a state of fear and panic among the students, teachers and parents who gathered in

front of the school. Al Bithnah School, Al Tawaian School, Al Halah School, Rumyithah Al Ansareyya School, Om Hakeem al Ansareyya, and Zobaidah School are vulnerable to earthquakes.

c. Schools in the coastal area have very limited safety equipment and in other schools there is fire and safety equipment which is not working due to lack of maintenance. There are inadequacies in the number emergency exits when compared to the number of students. Many teachers are not happy with maintenance of schools, but were reluctant to talk about it for fear of consequences. One school in the coastal area converted a emergency exit to a store area. Thus there is a need to pay special attention to most of the schools in Fujairah, particularly these that have been affected by previous earthquake actions. In short, the Fujairah schools are not designed to be safe from earthquakes and other natural disasters.

d. Most directors of schools (5 out of 7) indicated that the UAE is subject to natural hazards, particularly earthquake hazard, also 55 students out of 80 (in mountainous schools) saw earthquakes as the main natural hazard. All directors of schools said nothing has been done to prepare for natural disasters in schools in Fujairah. Fujairah schools do not have any procedures for management of natural hazards during emergency events except for fire evacuation plans in some schools. Moreover, there is no material in the school curriculum to allow the study of natural hazards or methods of protection from natural disasters.

e. Among parents (35 out of 40) consider that natural disasters to be Acts of God. This was particularly the view of the more elderly and those from the more traditional mountainous areas. They consider the response should be a return to more religious behaviour and in school, children should be taught more about religion.

Significant issues arising from the survey of natural disaster preparedness in schools in Fujairah are:

- there needs to be a systematic process of regular inspection of school buildings and procedures with regard to health and safety with respect to natural hazards,
- this needs to include evacuation plans which are regularly practiced,
- the school curriculum needs to provide for awareness-raising with regard to natural hazards, and
- the medium of education could be a valuable contribution to addressing issues around traditional cultural beliefs that do not recognize the causes of natural hazards.

9.4 Natural hazard awareness among population

Population awareness is critical in any effective response to the impact of natural disasters. The objective *to determine the perception and understanding of natural hazards in the UAE population*, therefore, is of particular importance (Chapter 8). The principal findings of the comprehensive survey are:-

a. The survey indicates that earthquakes are considered to be the most likely natural hazard in the UAE.

b. Many natural disasters in the UAE have been interpreted by the population in a traditional Islamic manner as judgments and punishment. People from religious traditions in the UAE fall back on traditional explanations and religious interpretations in an effort to make sense out of what is simply a tragedy. The pilot survey results indicate that the most cited cause of natural disasters was punishment of God 35%. In the *suggestions and comments* section of the Main Survey 25% of respondents considered that natural disasters are Acts of God and this view is stronger in Fujairah, the rural emirate.

c. With regard to property insurance (e.g. house and car) against natural disasters, 85% of the population surveyed do not take out insurance. This study shows that in the *suggestions and comments* 25% relate insurance to Islamic beliefs and they

consider that insurance involves an element of uncertainty and, hence, in a sense is related to gambling which is prohibited by the Holy Quran, and it also involves charging interest which is also considered non-Islamic and to be almost the same as usury. This again reflects the importance of cultural influences.

d. The results of the survey of residents indicate that there is a lack of focus on programmes covering natural disasters in the media in the UAE. From *suggestions and comments* around 16% received the information via television from outside the country. There is a lack of focus on programmes covering natural disasters in the T.V in the UAE. The results indicate that comprehensive disaster education has not been provided and that audio-visual means are probably the most effective tool for disaster education.

e. The majority of the population does not know which government body is responsible for their protection in natural disasters. The subject of the knowledge of the government body responsible for protection during natural disasters is very important. The role of the Civil Defence is not sufficiently recognized and this needs to be addressed. Hence 37% of people in the UAE prefer to call the emergency number (999) in the event of natural disasters.

f. It is clear that there was a lack of interest from the relevant authorities in the process of awareness-raising and sending out warnings before the arrival of the Gonu storm. The percentage of those satisfied with the warning given before storm Gonu was 56% as can be seen from these results (Figure 79). For most of these their main source of information was Oman TV, not UAE TV channels.

Significant issues arising from the survey of the population are:

- lack of preparedness regarding natural hazards which in part is influenced by traditional Islamic beliefs,
- lack of awareness of natural hazards reflecting lack of information, and
- lack of understanding of the role of the Civil Defence and where to seek information and guidance regarding natural disasters.

9.5 Lessons from Fujairah case study

The Fujairah Emirate is particularly at risk from natural hazards, most of the recent natural disasters in the UAE have occurred in Fujairah, such as Al Qurayah flood 1995, Masafi earthquake 2002, Al Tawaian landslide 2005 and Tropical Gonu storm 2007 and Sharm flood 2009. Fujairah was selected to investigate the objective *to identify the natural hazards that affect the UAE and evaluate the impact of recent natural disasters* (Chapter 6). Fujairah is not a prosperous emirate and not able to finance the costs of relief and reconstruction by its own means and has to rely on support from the UAE government. Life in this Emirate is quite traditional and the economy is supported by subsidies. The rapid growth of the population in Fujairah and its increased concentration, often in hazardous areas, has escalated the severity of the impact of natural disasters in Fujairah. Unplanned growth with poorly-engineered construction has increased vulnerability. For instance, some buildings in Masafi were built without planning approval and most buildings are not constructed to resist earthquakes.

The following issues are of significance:

- the lack of coordination reported during the response to Al Qurayah flood in 1995 still appeared to be an issue in the response to the Gonu Storm in 2007 and it is evident that evaluation of effectiveness has not informed practice,
- there is a need for systematic natural hazard assessment to inform planning.

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9.6 General themes emerging from the research

9.6.1 Influence of Islamic culture regarding understanding of natural disasters.

The influence of Islamic culture influencing attitudes and behaviour regarding natural hazards and natural disasters emerged as a theme from different strands of this research. The survey of the population revealed that traditional views are held by a significant proportion of the population and this is particularly the case in Fujairah, the rural emirate. The view that natural disasters are not the result of natural processes but are Acts of God and are visited upon the population as a punishment for sinful and immoral behaviour is very much in line with traditional views regarding the 2004 tsunami as recorded by Al

Naggar (2010) and discussed in Chapter 2. This theme also emerged in the investigation of attitudes of parents of school children in Fujairah emirate, particularly in the mountainous areas. Earthquakes were not natural events, indeed some respondents talked of *jinn* (ghosts) possibly reflecting pre-Islamic influences. Their response to ways of mitigating risk was to require the children to be more religious.

Another influence of Islamic culture that arose from the research was the concept of *haram*, activity prohibited by Islam. It was apparent from the survey of the population that one reason why people did not insure their property was that this involves uncertainty and is therefore not allowed by Islam. This is in line with the work of Thomas (2005) researching into responses of the Agadir earthquake in 1960 discussed in Chapter 2 where the concept of earthquake prediction was associated by some with fortune telling and therefore again prohibited by Islam.

To address these issues and raise the level of awareness and the improve preparedness will requiring engaging with the local culture. This will involve working with Islamic scholars and religious leaders to enable better understanding to develop and allow measures to be accepted that will reduce vulnerability.

9.6.2 Issues of natural hazard management within a federal structure

Issues of lines of responsibility and accountability commonly occur between federal and regional bodies. Policies and practices vary widely across federal, state, and other entities. So the role of these bodies, their organisation and relationships and how they interact to handle natural disasters is very important. This is particularly relevant with regard to the UAE with its unique federal structure and for the Civil Defence which straddles the federal and emirate structures.

This research has shown that the role of the Civil Defence in the UAE as the lead organization in disaster management set out in the Federal Plan is not reflected in practice, in part because other bodies do not recognise its lead role. This causes

confusion and duplication in the roles among the work of the Civil Defence and police. The research has shown that there is difficulty in managing natural disasters in the UAE, because of the intervention of different bodies in a haphazard way, especially between federal and local bodies. In addition distribution of resources is based on federal hierarchy rather than assessed need.

This confusion between the roles of different agencies, particularly between federal and regional agencies, has been recognized in other countries. It is clear that integration among the federal and local bodies was an issue in the case of Katrina Hurricane 2004 (USA) it took days for all the necessary authorities to link up communications and disaster plans and this resulted in accentuating losses in the affected areas (Litman 2006). Training and exercises among the federal and regional bodies can mitigate at least some of this confusion and can improve understanding of the roles of different bodies. The issue of the management of disaster risk is linked to broader current debates over the relative roles of the federal and local government in ensuring collective security from natural disasters.

There needs to be a clear delineation between regional and federal roles, and an understanding of the need for effective channels of information flow to relevant agencies. There is a need to work on the integration of the roles of regional and federal agencies to ensure that there are clear lines of accountability and management, and effective provision of information sources linked to relevant users. The government response to natural disasters is complex and multi-dimensional in nature. The government response should include federal and local officials, in anticipation of coordination across levels of government.

Natural disasters are situations characterised by massive political disruption and often by the absence of coordination and cooperation among federal and local institutions, non-governmental organisations and multilateral agencies. It is apparent that losses in natural disasters are exacerbated by political instability and incoherent organizational response.

Arrangements, among federal and local bodies in disaster response, must work to develop agreed norms and protocols that can regulate interventions. To address this issue the Spanish have established the Civil Defence as a specialist non-armed unit within their armed forces, the "Unidad Militar de Emergencias" (UME). It is a military unit, established by resolution of the Council of Ministers on October 7, 2005. Subsequently, by Royal Decree 416/2006 of 11 April, establishing the organization and deployment and is deployed as a permanent joint force within the military. Its main mission is to intervene anywhere in the country to contribute to the safety and welfare of citizens, along with other state institutions and public authorities, in cases of serious risk and disasters. It is not viewed as an armed military unit by the public and, therefore, does not carry the connotation of armed law enforcement. This removes the difficulties in deploying standard military units which was evident in the response to the Gonu Storm. This provides a Civil Defence unit within a clear command structure (UME 2010). It is suggested that the model of Spanish practice would be worthy of further consideration.

9.6.3 Importance of education and the school community in reducing vulnerability to natural disasters

As set out in the review in Chapter 6 the impact of natural disasters in recent years across the world has demonstrated the consequences of inadequate planning for children in facing disasters, particularly school children. Vulnerability assessment and public awareness in schools are essential to building an effective plan to face natural disasters. This research has shown that there is much scope in reducing vulnerability to natural hazards in Fujairah schools. The evaluation, however has shown that there is potential for education in schools to act as a vehicle for improving understanding and awareness in the community as a whole.

As part of this research, in response to this identified need, the researcher initiated a project developing the role of the Fujairah schools with regard to natural disasters preparedness and a "Disaster Risk Reduction Begins at School" initiative was launched in 2008. This explored the important role of education in reducing vulnerability within

schools and the community, and the training and education of students represent the basic ingredients for success in response to earthquakes.

In the UAE the author launched the first Arabic website to foster the culture of natural disasters on the level of Arab countries, adopted the slogan "Disaster Risk Reduction Begins at School" in preparedness to face earthquakes in his project in Fujairah schools. Raising awareness of natural hazards is itself an investment in the future and reduces the risks of future disaster. The researcher established the first project to raise awareness of earthquakes in the UAE. Twenty schools benefited from this and more than 15,000 students participated in practical and theoretical exercises. Community education on natural hazards can help a community prepare for such predictable natural hazards, and limit the loss of life and property. The role of education in reducing vulnerability is very important with regard to natural hazards, particularly within schools and the community schools, because it is a good environment in which to sow collective values. Children are among the most vulnerable to disasters as they are generally "passive victims". Schools can play a pivotal role in preventing destruction and can also be more disaster resistant.

This project drew attention to the issue of earthquake preparedness in the selected primary and secondary schools. Information on natural disasters together with advice about protection and mitigation was provided. Drills and practical training exercises to help them to protect themselves from and prepare themselves for natural hazards particularly earthquakes were run. This included information on emergency response, and earthquake evacuation procedures and in practical first aid exercises and involved demonstrations by the police and ambulance services. For more information regarding the author's project see the CD in the back of the thesis.

9.7 Recommendations for improving Disaster Management in the UAE

Following the research, a number of recommendations are made

1. **Test the effectiveness of the Federal Plan and executive plans (High Priority).**

The Civil Defence should test the effectiveness of the Federal Plan and its executive plans through an annual joint exercise programme to practice mock disasters nationwide. These trials should evaluate the positive and negative. In addition there needs to be a process for evaluating responses to disasters.

2. **Lines of responsibility between Civil Defence and other bodies (High Priority)**

Ensure clarity in lines of responsibility between Civil Defence and other bodies and the role of federal government and emirates in responding to disasters.

3. **Civil Defence in the UAE must have an effective Website.**

The Civil Defence in the UAE must have one effective website (http://www.dcd.gov.ae/). Civil Defence needs to be informed so it can utilise such developments for the better management of natural disasters. This website should include information on; software; activities and videos; weather and meteorological warnings; encourage volunteers, and all other information related to awareness of natural hazards. Also in learning to use this new communication tool between Civil Defence and public, this could become the primary instrument for the spreading of a culture of disaster prevention and awareness in the UAE.

4. **Earthquake risk needs to be assessed (High Priority)**

Earthquakes pose a risk to the UAE and earthquake risk is worthy of careful consideration. The analysis of survey indicates that in the survey earthquakes are considered to be the most likely natural hazard (See chapters 7, 8). Earthquakes pose risks such as damage to homes, buildings and infrastructure. These hazards must be assessed without delay in order to mitigate the consequences of earthquake damage. Also public awareness of earthquakes hazards and safety must be developed. Natural hazard losses are primarily the result of building and infrastructure failure (GDDA 2004).

5. **There must be law and legislation in the UAE that would require building in accordance with a seismic code**

There must be a law and legislation in the UAE that would require building in accordance with a seismic code and to require owners, contractors and engineers of the building to build according to the contracted specifications for earthquake hazard. The seismic code for the buildings should be mandatory.

6. **Raise the public awareness in schools (High Priority)**

Natural disaster awareness in schools has to be included in the school curriculum. Various types of programmes should be launched in order to raise the public awareness of the students and school staff. School staff must be also fully aware of the different intervention phases in response to natural disasters, including first aid to victims, emergency assistance and coordination with the public security services. Schools can be regarded as one of the ideal places for conducting disaster awareness activities and an appropriate atmosphere and environment for learning (See chapter 7). School buildings in Fujairah needs to be subjected to a survey by civil engineers to evaluate their structural integrity. Ten from 12 of staff in the FEZ believed it would be beneficial to regularly have evacuation practices, and endorsed the need for a plan for natural disaster management, especially after the recent successive tremors in 2008 experienced in Fujairah.

Natural disaster management is not only about shelters and distribution of blankets, medicines and evacuation operations. It is also about education, awareness generation, mitigation strategies, community participation and lifestyles. Education and awareness generation in schools is a cost-effective method in reducing the impact of natural disasters. The country needs to focus on risk reduction strategies and prevention to face these hazards. The government needs to incorporate natural disasters management as one of the essential components in the education operation in the UAE.

7. **Specific reference to natural disasters for the National Crisis Emergency Management Authority**

The NCEMA needs to make specific reference to natural disasters and implement procedures for monitoring and surveillance. Furthermore, there needs to be an initial process of consultation and analysis to identify the economic and social needs of the local communities. This will be critical in ensuring policies are appropriate and realistic.

8. **Federal grants and subsidies from the government to small emirates should be increased**

Federal grants and subsidies from the UAE government to small emirates must be increased. The economies of these emirates are based around subsidies and federal government grants, distributed by the central government. It is necessary to increase subsidies and federal government grants for small emirates.

9. **Activate the role of mosques, religious scholars in the field of natural disasters preparedness (High Priority)**

In Islamic countries those responsible for Civil Defence need to work with the imams and preachers to activate the role of mosques, religious scholars in the field of natural disasters preparedness. The imams need to activate the role of the mosques in raising awareness of natural disasters. This can be done by drawing society's attention to the importance of preparedness to face natural hazards in the Friday sermon. This includes correcting misconceptions and developing a rational awareness of natural hazards.

9.8 Suggestions for further work

This thesis has identified several fields where further research is required. The following are two fields that provide challenging and relevant research opportunities:

a. Natural disasters have a huge impact on social and economic welfare. Policies to manage them need to be integrated in terms of fiscal and economic capabilities. So the governmental and non-governmental bodies should have the ability to respond in a timely and flexibly manner by allowing them to be scaled up as

needed. Evaluations of fiscal and economic capabilities in the UAE are very important in future. So future work is very important in exploring and streamlining natural disaster management in the UAE. These and other insights will help strengthen bodies' responses and allow agencies and teams better to respond to natural disasters.

b. The Islamic theology and natural disasters are important. Many historic natural disasters in Islamic countries have been interpreted by their victims in the traditional Islamic manner, as judgments and punishment. This thesis found that the people from religious traditions in the UAE fall back on traditional explanations, and religious interpretations, in an effort to make sense out of what is simply a tragedy. So evaluation of the role of the Muslim clergy, Mosques and the General Authority of Islamic Affairs regarding natural disasters is critical because this information can be used to mitigate the risk. Such knowledge will help strengthen bodies' responses and allow agencies and teams to have a better natural disasters response.

9.9 Contribution

This project provides one of the first evaluations of the capability of a Middle Eastern country to respond to natural disasters. The analysis has shown that though there is a Federal Plan for Disasters there is little specific focus on natural hazards. Ministries not directly involved with the Civil Defence were sometimes unclear regarding their roles. At an operational level there is confusion and lack of clarity regarding responsibilities and lines of authority between different bodies and between Federal and emirate structures. The Civil Defence was very much focused on response with little effort devoted to reducing vulnerability through awareness-raising, hazard assessment and monitoring. This study which involved surveys of the population and the school-age education sector allowed the opportunity to investigate the Islamic cultural context. Building on existing research into the impact of specific natural disasters in the Middle East, Iran, Pakistan and the Asian Tsunami, all of which revealed the importance of Islamic cultural

influence, this research demonstrates that even in a prosperous and developed Islamic country traditional beliefs still play an important role in inhibiting initiatives to mitigate risk, though this was most pronounced in rural areas.

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Appendix A: Federal Plan to Face Disasters 2005 and the Authorities of Federal plan

Federal plan to face impact natural disasters

Definition of Public Disasters

Federal Law No. (3) of 1979 and the amendments thereof concerning Civil Defence defined the phrase "Public Disasters" as "any fire, flood, collapse, earthquake, storm, force majeure, or any sudden occurrence that may threaten lives, public or private properties."

Scope of Application

The scope of plan application includes "the occurrence or potential occurrence of a public disaster." This also includes the state of emergency that exists before the occurrence of a potential disaster that can be predicted to enable the official bodies to take the measures to raise the proper state of readiness to encounter such disaster in light of the available information.

Potential natural disasters

Fires, Floods, Earthquakes and Storms and Landslides.

Purpose of the plan

- To coordinate efforts between competent bodies nationwide and organize their instant interventions to respond to a natural disaster that has actually happened or may potentially occur.
- This objective shall be achieved by:
- Organising the relations between the competent authorities and Civil Defence, and to define their roles and duties in accordance with various legislations, and in compliance with the nature of their activities.
- Defining the executive measures and set the priorities in relation to face the natural disasters, eliminating their consequences and ensure the return of normalcy to the affected area with the knowledge of the competent bodies and relevant organizations in coordination with Civil Defence.

Mission

The Civil Defence shall take the necessary measures to protect people, as well as public and private properties, maintain the safety of transportation and communication, ensure regular work progress at public facilities during emergency, protect public and private buildings, installations, organizations as well as national wealth resources, and take preventive measures and necessary actions to encounter risks and contain them or alleviate and ultimately eliminate their effects.

Implementation

Competent Authorities will be charged with planning implementation:

Acts to face natural disasters are a joint national responsibility of various government and non-government organizations, in addition to the role played by the volunteers in circumstances that require calling upon their assistance.

These organizations have been classified by the Civil Defence Council into commanding, cooperating and technical bodies as the circumstances and conditions of the disasters and risks may require.

Details of the duties

The duties of the competent bodies have been defined by the Civil Defence Council according to their respective jurisdictions.

Coordination Instructions:

- General Coordination
  In all cases the general Civil Defence department shall undertake general coordination with the competent Authorities in accordance with the powers and authorities delegated to them by the legislator in this regard.

- Direct coordination between various bodies
  All competent bodies shall work together by means of official coordination and cooperation agreements or any other agreements of whatever form with the object of coordinating efforts, organizing communications mechanism, overcoming obstacles that may encounter the implementation of their duties in the process of facing natural disasters.

- Coordination with the Armed Forces.
  The Armed Forces shall not be required to intervene except in urgent situations, in view of other vital duties that they have to undertake.

Cases of Armed Forces intervention

- The first Situation:
  The Armed Forces are required to intervene as cooperating bodies to participate in some human and material potential. In this case, the Federal Plan will remain valid, and the field command will continue to be in the hand of the body (Civil Defence) assigned for this task in accordance with the stipulation of the plan.

- The second Situation:
  The Armed Forces are required to intervene as a commanding body with all of its capabilities and plan, in light of the inability of the civil defence with all their available capabilities to face and overcome the disaster. In this case the alternative plan prepared by the Armed Forces shall go into effect. The situation will be under the control of a commander designated by the General Command of the Armed Forces.

Method of requesting Armed Forces to intervene in activities to face disaster:

- The first Situation:
  The Armed forces being a cooperative body: Request shall be channelled through the representative of Armed Forces in the Civil Defence Council according to existing coordination and cooperation agreements and approved work patterns between the Armed Forces and Civil Defence.
- The second Situation:
  The Armed Forces as a commanding body: Request is channelled by the Minister of

Interior to the Minister of Defence with the approval of the higher Authorities.

Issuing instructions:
Each of the above mentioned bodies shall issue the instructions that organize the work of their respective teams in light of the coordination agreements made between each of the bodies and other bodies.

Issuing disaster alarm:
A potential disaster or a disaster that actually happened shall be reported to the competent Civil Defence operating rooms to take the necessary measures. Information concerning the potential of a disaster comes from several sources such as meteorology stations – stations of worldwide monitoring – local police etc.

Declaration of a disaster:
Declaration of a disaster in the UAE shall be made by decision of His Excellency the Minister of Interior, in his capacity as Chairman of the Civil Defence Council. This decision implies the following measures:

- Activating the bilateral or multilateral agreements in relation to receiving assistance from GCC countries or friendly countries worldwide.
- Activating the policy of accepting external aid from international organization, if necessary.
- Request for experts and special equipment from overseas to encounter the disaster if necessary.
- Organizing human resource volunteer work from UAE citizens and residents to offer assistance in Civil Defence operations, takeover properties and means of transportation etc., and to supply the general Civil Defence department and local committees with information machines and equipments, and to accept donations and grants…etc.

Post-operations report:
When the disaster comes to an end the competent commanding authority shall submit a post-operations report to the Civil Defence Council informing it about all the measures that have been taken to encounter disaster. The report shall also outline the obstacles difficulties and negative aspects and lessons learnt.

Practicing on mock disasters:
The Civil Defence in coordination with the central operations department at the Ministry of Interior shall test the effectiveness of the Federal Plan and its respective executive plans through an annual joint exercise program to practice on mock disasters nationwide as well as at the levels of individual emirates and cities to check the level of training performance, readiness and availability. These trials shall be evaluated and positive and negative points shall be recorded and proper solutions shall be put into effect to address them.

Administration and Finance.

a. Ration supplies

- The Ministry of Economy & Commerce in coordination and cooperation with

competent food organizations and companies shall devise an executive plan to offer necessary food to the victims or monitor the strategic reserve for the population in times of emergencies.

- The Ministry of Electricity and Water in coordination with electricity and water Authorities shall provide drinking water and alternative energy sources in the areas.
- The Ministry of Labour and Social Affairs in coordination with the Red Crescent Society and all public utility societies, national organizations, volunteer and boys scout organizations; women associations shall provide social welfare to children and families, victims of the disasters.
- Each competent body shall provide relief requirements, rations, fuel, water, medical care, spare parts and raw materials that are necessary for its respective teams operating in the site of the disaster.
- The administration and finance department of the Ministry of Interior shall undertake the following:

  - Provide a reserve stock of necessary shelter tents in coordination with the competent Authority.
  - Allocate necessary budgets to provide relief requirements for the police forces called upon during emergency times in terms of food and accommodation in coordination with the competent Authorities, and to provide necessary professional personnel to undertake cooking activities and the like.
  - Provide medical support where necessary.

(b) Financial support

Federal support

The Ministry of Finance and Industry shall undertake the following:

- Provide the expenses of the necessary measures undertaken by the Civil Defence and allocate funds in the name of Civil Defence in the general budget. After such funds are allocated, committees shall be formed to meet these requirements according to clearly defined priorities.
- Financial allocations designated by the ministries, Authorities and competent public corporations in their annual budget to carryout their obligations provided for in the plan. This shall be in coordination with the General Department of Civil Defence because it is the competent technical body with respect to the quality specifications and size of requirements.
- Provide the necessary financial expenses to meet the cost of rations for the forces at times of emergencies.
- Any other duties that the ministry may be charged with.

Local support:

- Phased financial plans prepared by Local Civil Defence Committees to meet the requirements for the implementation of the Federal Plan within their respective jurisdictions using local financial resources.
- Donations and grants offered by individuals and organizations in compliance with the applicable financial regulations.

Leadership and Communications

(a) Leadership

- Decision making authority

Decision making authority, including evacuation decision shall be entrusted to Civil Defence Council in the event of the occurrence of the disaster that includes the State or several districts thereof. This shall be done through the central operation room of Civil Defence or any other location designated by the Chairman of the Council. The local Civil Defence committee shall perform the same in the event of limited disaster situations within the emirate under its jurisdiction.

- Crisis management

The Minister of Interior shall handle the security related crises arising from the disaster.

- Command in the field
- The General Department of Civil Defence. In light of the authorities and powers vested by the legislator in the General Civil Defence department in the process of encountering disasters, the department shall take command in most cases in the regional and field operation rooms depending on the location of the disaster.

The implementing bodies of the plan shall carryout the field activities to deal with particular aspects of the disaster in accordance with the roles designated to them, whether as a commanding body, assisting body or technical body in compliance with the provisions of certain legislations and according to the nature of such bodies' activities or the particular nature of the crisis location.

Communication:

<u>Communication between competent bodies:</u>

The Ministry of Transportation shall coordinate with emirates Telecommunication Corporation to undertake the following:

- Develop and upgrade communication systems and maintain link between the operation rooms of competent bodies.
- Devise a plan to ensure continuity of communication services under disaster conditions, and avoid pressure on communication network.
- Secure communication between disaster areas, other districts, and competent Authorities encountering the disaster.
- Lay down a plan to repair all breakdowns arising from communication networks due to disasters.
- Provide adequate number of technicians to secure instant repairs of all breakdowns.
- Provide suitable communication media at shelter camps.
- Prepare communication executive plans and alternatives in the event of the failure of existing systems, and coordinate with the Ministry of Interior (Communication department) to provide the required alternative channels from the satellite communication systems to use when necessary.
- Coordinate with competent bodies to provide the necessary communication requirements for government and population activities and to devise the necessary measures that secure the safety and continuity of such services.

Field communication:

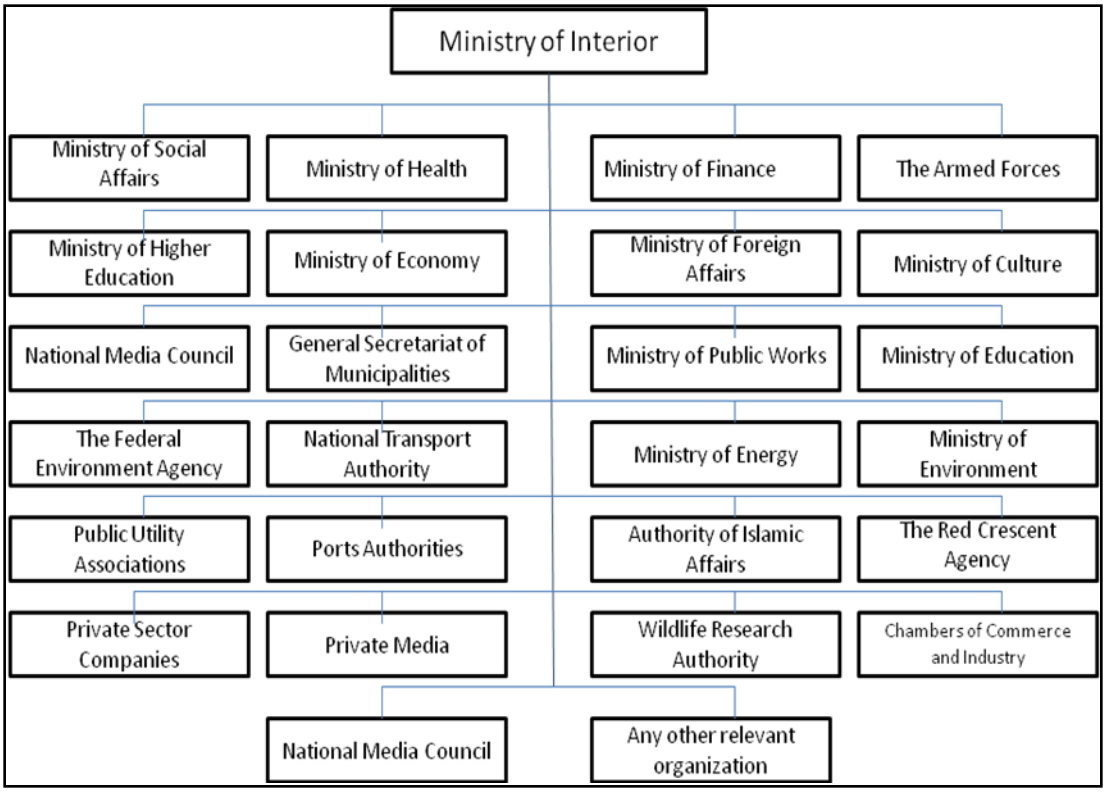
The Communication Department at the Ministry of Interior shall undertake the following:

- Maintain communication between all operating and participating units, in coordination and cooperation with the Directorate of Signal at the General Command of the Armed Forces.
- Develop communication networks and systems, and make them available in all kinds and facilitate information and data exchange between ministry organs, and between the Ministry of Interior and the competent bodies.
- Set up field communication centers to maintain control, fast performance and data exchange between the field command and subordinate commands of the competent bodies.
- Consolidate work frequency at time of disaster so that all bodies can operate on one frequency designated for that purpose.
- Coordinate with Emirates Telecommunication Corporation to provide the necessary satellite communication channels to be used as an alternative when necessary.
- Train civil personnel on the use of alternative communication equipment.
- Coordination with wireless, communication and internet enthusiasts to utilize their efforts and resources alleviating the intensity of disaster.

Coordination

Pursuant to Federal Law No. (1) Of 1995 amending certain provisions of Federal Law No. (3) Of 1979 concerning Civil Defence issued on 11/3/1995.

Table 25: Federal plan to face disasters 2005



Fugire 87: The Authorities of Federal plan

Appendix B: Survey about the Natural Hazard 2007

تقييم مدى قدرة دولة الإمارات العربية المتحدة على رد الآثار الناتجة عن الأخطار الطبيعية

استبيان متعلق بالأخطار الطبيعية ٢٠٠٧

Survey About The Natural Hazard 2007

Evaluation of the response capability of the United Arab Emirates to the impact of natural hazards

الكوارث الطبيعية أحداثٌ مفاجئةٌ سببها عوامل بيئيةٍ متمثلة بالأخطار طبيعية التي من الممكن أن تحدث في أي وقت وفي أي مكان.و قد تكون مسبوقة بإنذار مبكر أو مفاجئة، مما تؤدي إلى خسارة جدّيّة في الأرواح والممتلكات. و تتمثل هذه الأخطار الطبيعية في الزلازلُ والإنفجاراتِ البركانيةِ، والفيضانات، والأعاصير، والرياح العاتية وأمواج تسونامي العارمة أو النيران برّية أو الجفاف والمجتمعات التي استعدت لهذه الأخطار قلّلت من نسبة الخطر والخسائر.

Natural disasters are extreme , sudden events caused by environmental factors (natural hazards) they can happen at any time with little or no warning also they can cause serious injury to people and property . Natural hazards include volcanic eruptions earthquakes , floods, tornadoes, wind storms, tsuname, and wild fires. Natural disasters exert an enormous toll on the society and on development. Societies who are prepared for such Events minimize risk and toll.

الأهداف

Objectives:

- **معرفة وفهم مستوى الوعي عند العامة بما يتعلق بالكوارث الطبيعية**
- Determine the level of awareness of the public regarding natural disasters.

- **تطوير وتحسين المعرفة بما يتعلق بالاستعداد لمواجهة الأخطار الطبيعية**
- Determine the awareness of the public regarding preparedness for natural hazards.

- **تقييم عملية استعداد ومواجهة أجهزة دولة الإمارات لآثار إعصار جونو 2007**
- Evaluate the response of the UAE to the storm Gonu in 2007 and level of damage.

شكرا لمنحنا جزءا من وقتك لإستكمال عملية المسح آملين أن نحصل منك على إجابات و آراء صادقة تساعدنا في عملية التطوير والوصول للنتيجة المرجوة

Thank you for giving us your time to participate in completing this survey and hope you will give honest and open answers to help us in developing the provided. Your answers will be dealt with in total confidentiality.

الإمارة

- **Region:** ❑ Abu Dhabi أبوظبي ❑ Dubai دبي ❑ Sharjah الشارقة ❑ Ajman عجمان ❑ Ras Al khaimah رأس الخيمة

❑ Fujairah الفجيرة ❑ Umm Al Quwain أم القيوين

الديانة

- **Religion :** ❑ Muslim مسلم ❑ Christian مسيحي ❑

الجنسية

- **Nationality:** ❑ UAE الإمارات if Other specify.....

الجنس

- **Gender:** ❑ Male ذكر ❑ Female أنثى

الفئة العمرية

- **Age category:** ❑ 20 years or less 20 أو أقل ❑(21-30) years من 21-30 ❑(31-40) years من 31-40 ❑ (41-50) years من 41-50 ❑More than 50 years أكثر من 50

المؤهل التعليمي

- **Educational qualification :** ❑ Elementary & less ابتدائي أو أقل ❑ Preparatory إعدادي ❑ University & above جامعي ❑ Secondary ثانوي

Determine the level of awareness of the public regarding natural disasters.
معرفة وفهم مستوى الوعي عند العامة بما يتعلق بالكوارث الطبيعية

- **What is your perception about the most likely natural disasters in the UAE?**
بمفهومك ما هو مستوى احتمالية حدوث الأخطار الطبيعية بدولة الإمارات

❑ High عالي ❑ Medium متوسط ❑ Low منخفض

- **What is your perception about the probability of the following natural disasters in the UAE?**
بمفهومك ما هو مستوى احتمالية حدوث الأخطار الطبيعية التالية بدولة الإمارات؟

Earthquake الزلزال	Flood الفيضان	Tsunami التسونامي	Storm الإعصار	landslide الانهيارات الأرضية

- **What is your understanding of preparation for natural disasters in the U A E?**
  ما هي نسبة معرفتك عن الإستعداد للكوارث الطبيعية في دولة الإمارات؟

❑ High عالي ❑ Medium متوسط ❑ Low قليل

Determine the awareness of the public regarding preparedness for natural hazards.
تحسين وتطوير المعرفة بما يتعلق بالاستعداد لمواجهة الأخطار الطبيعية

- **What is your awareness level about what you should do in the following cases in the case of a natural disaster is as follows :**
  ما هو مستوى وعيك عما يجب عليك أن تفعله في هذه الحالات

Before the natural disaster occures : قبل حدوث الكارثة الطبيعية	❑ Excellent ممتاز	❑ Moderate متوسط	❑ Poor ضعيف
During the natural disaster: أثناء حدوث الكارثة الطبيعية.	❑ Excellent	❑ moderate	❑ poor
After the natural disaster has happened: بعد حدوث الكارثة الطبيعية.	❑ Excellent	❑ moderate	❑ poor

- **Do you insure your properties (house, car…etc) against natural disasters?**
  هل أمنت ممتلكاتك (بيتك، سيارتك، .. الخ) ضد الأخطار الطبيعية

Yes نعم No لا Don't know لا أدري

- **In the event of a natural disaster in your area what is the responsible agency?**
  في حالة حدوث الكارثة الطبيعية في منطقتك من هي الجهة المسئولة التي تلجأ إليها

❑ Police الشرطة ❑ Civil defence الدفاع المدني ❑ 999 999 ❑ Others :(please mention)…… إذا كانت أخرى أذكرها

- **Do you watch programmes on natural disasters?**
  هل تتابع البرامج المتعلقة بالكوارث الطبيعية

❑ Often غالبا ❑Sometimes أحيانا ❑ Never لا أتابع

If you have knowledge about the preparation for natural disasters, please answer the following question:
إذا كانت لديك معرفة بكيفية الإستعداد للأخطار الطبيعية الرجاء جاوب على الأسئلة التالية؟

- **What is the source of your information: (you can choose more than one)**
  ما هي الطريقة التي اكتسبت منها هذه المعلومات أو ما هو مصدر معلوماتك؟ مصدر المعلومات يجب أن يكون من دولة الإمارات (يمكنك اختيار أكثر من إجابة).

❑Newspapers & magazines صحف ومجلات ❑ TV تلفاز ❑SMS رسائل قصيرة ❑Books & booklets كتب وكتيبات ❑ Posters ملصقات ارشادية ❑ Radio راديو

Evaluate the response of the UAE to the storm Gonu in 2007 and level of damage

تقييم عملية استعداد ومواجهة أجهزة دولة الإمارات لآثار إعصار جونو 2007

In 2007, UAE has faced the Gonu storm which has resulted in a lot of damages and according to our desire to reduce the damage in the event of a future natural disaster please answer the following:

في عام 2007، واجهتْ الإمارات العربية المتحدة عاصفة جونو التي أدّتْ إلى الكثير منْ الأضرار . و لرغبتِنا في تخفيض الضرر عند حدوث كارثة طبيعية مستقبلية ولما هذا القسم من أهمية الرجاءُ أجبنا على التالي:

- **Have you been affected by Gonu storm damage?**
  If your answer is "Yes", please answer the following questions
  هل تأثرت أو طالك الضرر من جراء إعصار جونو إذا كانت الإجابة نعم رجاءا جاوب على الأسئلة التالية

  ❑ Yes ❑ No
  نعم لا

- **Were you satisfied by the warning you received before the Gonu storm?**
  هل أنت راضي عن عملية التحذير(الإنذار) الذي وصل إليك قبل قدوم إعصار جونو

  ❑ Yes ❑ Neither ❑ Dissatisfied
  نعم غير راضي مستاء

- **How satisfied were you with the instructions and guidance you received?**
  هل أنت راضي عن الأوامر والتوجيهات التي تلقيتها

  ❑ Satisfied ❑ Neither ❑ Dissatisfied
  راضي غير راضي مستاء

- **Was your house damaged Guno Storm?**
  هل تأثر منزلك باعصار جونو

  ❑ Severe ❑ Some ❑ None
  كثيرا قليلا لا

- **How long did it take for life to return to normal in your area?**
  كم استغرق من الوقت لعودة الحياة إلى وضعها الطبيعي في منطقتك

  ❑ Less than a day ❑ days ❑ Weeks
  أقل من يوم أيام أسابيع

- **Are you now better prepared to face natural disasters?**
  هل أنت الآن أفضل استعدادا لمواجهة الكوارث الطبيعية

  ❑ Yes ❑ No
  نعم لا

- **Suggestions and comments**
  ملاحظاتك واقتراحاتك

Figure 88: Survey About The Natural Hazard 2007

Appendix C: Published chapter (United Arab Emirates: Disaster Management with Regard to Rapid Onset Natural Disasters)**.**