Organisational Learning and Dynamics of Institutional Change Following Large-Scale Emergencies: Oman's Emergency Management System as a Case Study

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ABSTRACT

Emergency Management Systems (EMS) exist as an essential disaster risk reduction mechanism by efficiently matching resources to generated needs during crises. However, how they function in actual disaster situations and whether they adapt, evolve and learn from their own experiences have yet to be well-studied, particularly in non-Western contexts. This research is multidisciplinary qualitative research that cuts across the disciplines of disaster management, public administration, social science, political economy and management science. It aims to bring new insights into the phenomenon of organisational learning (of EMS) and the dynamics and forces of institutional change following crises. It reports findings on the nature of organisational learning following an emergency and the factors influencing institutional change.

Oman's EMS was found to be an appropriate case study as the rapidly-urbanising country has recently been struck by the reality of disasters. Secondly, it has adopted a centralised governmental command-and-control model for managing emergencies. Hence, it makes it an interesting case study to understand how this system would respond in large-scale emergencies and whether or not it evolves and learns from the experienced disasters. The primary data collection method was in-depth qualitative interviewing with key response agencies. It was triangulated with these secondary data sources: (1) emergency management 'EM' regulations, (2) EM plans and proposals, (3) official reports from responding agencies, (4) media reports about the emergencies, and (5) Twitter user-generated data for the two recent events.

First, the response of the 'formal' EMS in four consecutive cyclone emergencies was analysed. The objective was to identify systemic failures of the managerial model and the lessons that should be learned and implemented as 'organisational learning' outcomes. Concepts from chaos theory were adopted for this purpose. They were found to be capable of explaining the behaviour of the EMS in large-scale emergencies. All the interview participants agreed that the government response to cyclones Phet and Luban in 2010 and 2018 was effective. In those events, responders did not experience unanticipated challenges and could sustain communication lines and deliver aid to affected areas.

However, according to all participants, the official response to cyclones Gonu and Mekunu in 2007 and 2018 was perceived as ineffective. The operating environment during those events was characterised by the discontinuity of essential services such as roads, electricity and telecom. The formal EMS could not establish an accurate situational awareness and deliver aid where necessary. In those areas, an informal local-oriented self-organised system emerged to fill the gaps of the formal EMS.

Findings show that the government command-and-control EMS is effective under normal conditions, associated with the continuity of essential services and the limitedness of the affected area, which characterised the operating environment in the first two events. However, it was found ineffective under extreme crises due to the excessive centralisation of resources and decision-making powers within the central government, excessive reliance on governmental resources, and a prevalent culture of response-centred management. In such extreme situations, informal local disaster management took place. These key findings call for (1) localising EM, (2) engaging non-state organisations such as volunteer societies and charities, and essential services providers lessons in EM, and (3) updating the assumptions under which the system would operate. Identifying and implementing those lessons show that the EMS learns and evolves from its own experiences while neglecting them shows the existence of learning impediments.

The second analysis involved identifying and classifying post-disaster organisational and institutional changes. Findings show that single-loop learning was more prevalent in the case study, which does not entail changing management's assumptions and norms. The main forms of this learning were changing the organisational structure, adopting new technologies and increasing government emergency resources. In contrast, double-loop learning, which includes implementing the above-required lessons for the system to evolve, has not occurred sufficiently.

To identify the dynamics (i.e., the sources or drivers) of change, organisational learning theory and institutional change theory were combined in one analytical framework. Using qualitative thematic analysis as the primary data analysis method, a tension between forces that support changing the status quo and powers that resist and favour the continuation of the centralised, governmental, response-based EMS

was found to exist. Exogenous sources – the experienced emergencies, social media prevalence and privatising essential services' providers – pushed towards decentralising and localising management, engaging new actors and flattening the communication patterns. On the other hand, endogenous processes – historical circumstances of EM in the country, organisational culture and societal norms, and actors' shared perceptions facilitated the continuation of the status quo. In conclusion, the context of the place is a more influential determinant of organisational double-loop learning to occur or not.

IMPACT STATEMENT

Research findings recommend revising governmentalised centralised response-based command-and-control models used in many parts of the world. These approaches encountered extreme difficulties in reaching affected areas and delivering aid, as they were found to be highly vulnerable to critical infrastructure failures. The case study shows that the underlying assumptions of emergency planning substantially contribute to the resultant response. Planning has been based mainly on the assumption of essential services' continuity. Responders could use roads, electricity and telecom services in crises. This assumption is inconsistent with the realities on the ground. It has resulted in catastrophic consequences. Therefore, planning and designing the EMS should be based on the recurrent crisis-usual scenario in that many essential services would be unavailable for several days in several areas. Yet increasing infrastructure resilience is required; disasters necessitate a local multi-organisational model based mainly on emergency planning. Investing in local disaster preparedness can efficiently reduce disaster risks (save more lives and protect more properties). This means recognising the leading roles of local state agencies and building partnerships with volunteer organisations, charitable societies and local communities.

Secondly, this thesis shows that organisational learning from disasters is resisted by various internal factors. Misperceptions about why disasters occur and how to manage them can significantly hide the 'right lessons' and suggest inefficient changes. This case study demonstrated that people and voluntary organisations restored crises where formal arrangements failed. They are not helpless and mere beneficiaries. They can be active partners working collaboratively with state actors. Secondly, feedback from responders on the ground and lower positions (in the chain of command) is not enabled. Important feedback is simply lost. Building a culture of reporting failures begins by informing personnel that they can report them. Additionally, adopting communication technologies can also facilitate flattening the chain of command.

This case study shows that explaining organisational and institutional change requires looking at both exogenous and endogenous sources. Analysts should consider

combining rational choice and historical institutionalism views rather than adopting one. In this research, we also combined different analytical frameworks (an organisational learning framework to classify the nature of learning from crisis and an institutional change dynamics framework to identify the sources of learning impediments). Researchers and practitioners can use the combined model as a tool in workshops and exercises to recognise change dynamics and identify organisational learning impediments.

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CHAPTER 1 INTRODUCTION

1.1. Thesis Aim and Overall Structure

This thesis analyses the institutional development of Oman's emergency management system (EMS), given several recent cyclone emergencies that resulted in significant, unprecedented damages. For many reasons, it is important to understand the managerial model that an emerging nation is adopting for managing large-scale emergencies and whether it has grown and evolved based on learning from its experiences. Such an approach may empower or discourage the participation of some types of actors. It may expedite or impede specific patterns of interaction among the responding actors. It may also authorise or block the local leadership level of emergency management. Moreover, it may facilitate learning from crisis or form institutional barriers that favour the continuation of old norms instead of altering or replacing them with new ones.

Like many countries around the region and worldwide, Oman has developed an emergency management system (EMS) whose characteristics lean toward the traditional command-and-control model. However, academic literature shows that this approach has been proven deficient, and emergent models based on collaboration, participation of non-governmental actors and leadership by local agencies have been proposed instead. This thesis, first, aims to bring new insights into the functioning of such a model under four different case studies, drawing important lessons and identifying its successes and failures under different emergency conditions. It then looks into the institutional and organisational changes following those events to identify their dynamics and whether the system has evolved in response to them or has been influenced by other factors.

This thesis consists of eight chapters, as Figure 1-1 shows. It starts with a brief background of the context under which this research is conducted: Oman and cyclones as the country's principal natural hazard, which is the subject of this research. This is followed by a literature review chapter covering three relevant topics: emergency management principles and models, responses to disasters and different

conceptual and analytical frameworks used to analyse them, and organisational learning and institutional change theories. After the literature review, Chapter 3 presents the research aim, question and hypotheses, and methodology. It discusses what this thesis contributes, the nature of the research, and data collection and analysis methods suitable for this purpose. The findings are discussed in two chapters: Chapter 4 and Chapter 5. Chapter 4 presents the results of the analysis of responses to the selected four case studies and the lessons that should be learned. Chapter 5 discusses the system's evolution, outlining the observed institutional and organisational changes and analyses the dynamics and forces behind them. Chapter 6 discusses the results in light of the existing literature, and Chapter 7 summarises the main conclusions, presents policy-change recommendations and suggests new pathways for future research.

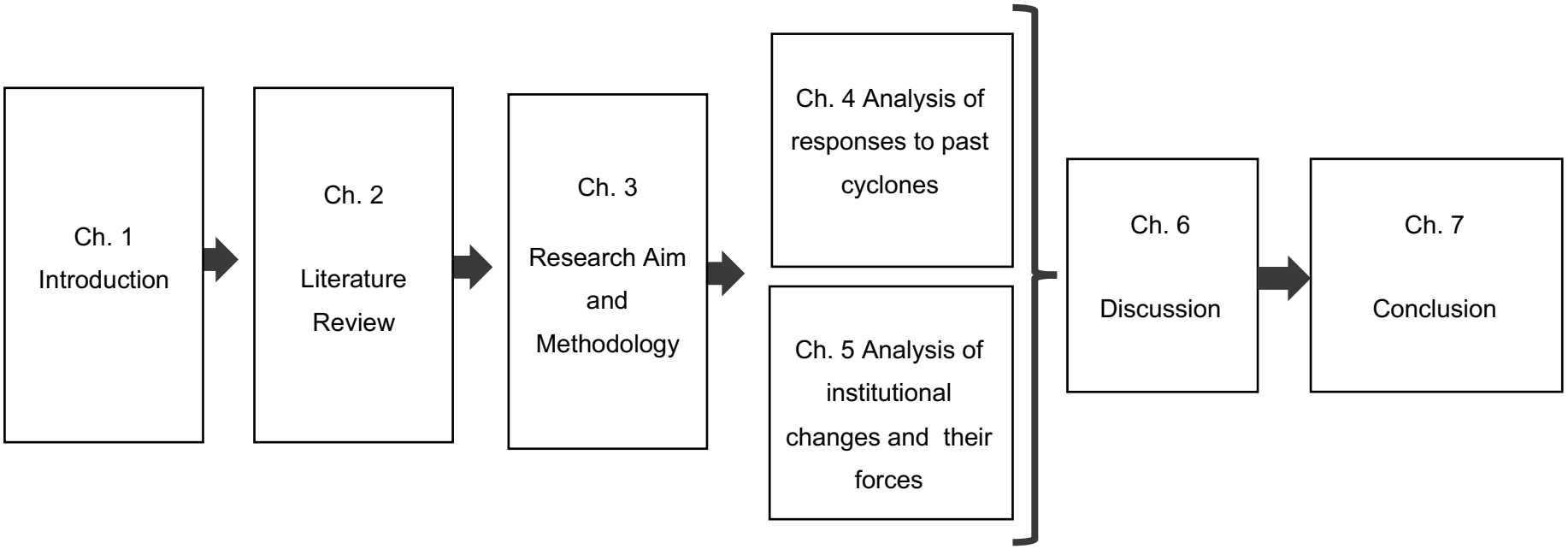

Figure 1-1 Thesis Main Chapters

1.2. Tropical Cyclones: the Major Natural Hazard in Oman

The Sultanate of Oman, or Oman, is an independent state on the southeastern edge of the Arabian Peninsula, as Map 1-1 shows. Its total area is 309.5 thousand sq. km. with a shoreline of 3,165 km from the Strait of Hormoz in the North to the borders of Yemen in the South (NCSI, 2020). Politically, it is a monarchy in which power and authority reside in the ruling royal family per the *State Basic Law of 2021*. Administratively, it includes 11 governorates or provinces: Muscat, Dhofar, Musandam, Al Buraimi, Al Dakhiliyah, Al Batinah North, Al Batinah South, Al Sharqiyah South, Al Sharqiyah North, Al Dhahirah and Al Wusta [Governorate and Municipal Affairs Decree 2020]. In this thesis, they represent the regional level and henceforth are referred to as 'regions'. Each region includes several Wilayats that can be cities or towns. In Oman, there are 61 Wilayats (NCSI, 2020). They represent the local level in this thesis, and henceforth they are called 'local administrations'.

Oman's geographical location, see Map 1-1, overlooks the Arabian Sea, the Arabian Gulf and the Gulf of Oman, along with its topographic features as an arid area with several mountain ranges, coastal areas, lowlands and deserts (Al Shaqsi, 2012; Al Housni et al., 2015). These factors have made the country physically exposed to several natural hazards, particularly tropical storms, cyclones, increased temperatures, desertification and coastal flooding (Alruheili, 2017). The country has been affected most frequently and intensely by tropical cyclones and storms that have caused large-scale emergencies.

Arabian Sea tropical storms develop most frequently over the southeastern quadrant of the sea. Once formed, they move north-west towards the Arabian Peninsula and the Gulf of Oman, north-eastwards towards Pakistan or south-westwards towards the Gulf of Aden (Membery, 2001). It is estimated that one in three approaches the Arabian Peninsula, and statistics show that storms or cyclones cross the Omani coast about once every three years. Of these, only half are likely to be true tropical cyclones (i.e., hurricanes) with sustained winds above 63kn (Membery, 2001). However, some storms could have gone unrecorded due to a lack of observations before satellite surveillance.

Map 1-1 Political Map of Oman, image: © nationsonline.org

Literature show that Oman's cyclone seasons are well known and that the storms rarely form outside the expected periods. Table 1-1 shows the number of tropical

storms and cyclones distributed by month since 1801 that have affected the Arabian Peninsula. The cyclone seasons are four weeks from mid-May to mid-June and mid-October to Mid-November (Membery, 2001). The formation of cyclones during these periods has been linked to atmospheric changes during the monsoon season (Membery, 2001; Singh et al., 2001). Membery (2001) attributes the lack of cyclones in some months to the strong south-westerly storms that blow across the Arabian Sea and cause sea temperature to drop below the threshold of 27° Celsius.

Table 1-1 Annual mean frequency of tropical storms and cyclones (wind speed ten or more 'Beaufort') over the last 200 years affecting the Arabian sea, 1801 – 2018*

Jan	Feb	March	April	May	June	July	August	Sep	Oct	Nov	Dec	Total
1	0	1	9	28	32	1	2	4	19	34	4	135

* (1801-2001) from (Membery, 2001) and (2002-2018) from own author

The frequency of intense cyclones has increased in the Arabian Peninsula. Singh et al. (2001) used North Indian Ocean cyclone data for the period 1877–1998. They concluded that intense cyclones in this area have become more frequent, posing a more serious threat to the coastal population in the region. Several scholars attribute this increase to climate change and the reduction in vegetation that leads to the continual heating of the lower atmosphere (Membery, 2002).

In Oman, the topographic and built environment plays an important role in increasing the physical vulnerability of the area to cyclone hazards. Due to the harsh, steep rocky terrain of the Al Hajjar Mountains in Northern Oman, with very little soil or vegetation, rainfall runoff is immediate, and the potential for flash flooding is high (Membery, 2002). In addition, the potential for a significant storm surge due to the vulnerability of the shallow coastline along the Gulf of Oman can cause acute coastal flooding (Fritz et al., 2009). The same areas were also found to be highly vulnerable to climate

change-induced sea level rise ‘SLR’. Under the smallest SLR [0.5 meters of SLR], about 400 square km will be inundated (Al Buloshi et al., 2014).

The social vulnerability has increased in the last two decades (Al Rasbi, 2019). A primary reason is the rapid increase in Oman’s population, from 901,000 people in 1977 to 4.6 million in 2019 (NCSI, 2020). According to the National Centre for Statistics and Information ‘NCSI’, the non-Omani population increased from 9% in 1977 to about 45% in 2019 (NCSI, 2020), significantly changing the country’s demographics. A substantial proportion of those came to work in low-wage jobs and speak languages other than Arabic (Oman’s official language) and English (the second largest spoken language in the country). Most of the population is young, and the largest proportion lives in the capital city, Muscat. While the population density in Oman was 14.9 persons per square kilometre, it was 355.4 persons per square kilometre in Muscat Governorate in 2019 (NCSI, 2020).

The expansion of the built environment has also increased the country’s vulnerability to environmental hazards. Many buildings are located on the plain overlooking the coast on the east and mountains on the west (Al Shaqsi, 2012), making them very vulnerable to storm surge, coastal flooding and flash flooding. Unfortunately, this area is the most densely populated part of the country. About 80% of the Omani population lives in low-lying areas (Al Buloshi et al., 2014). During Cyclone Gonu, which struck the country in 2007, the damage was greater to these buildings due to the combined effects of the various hazards (Fritz et al., 2009; see Figure 1-2). This is mainly attributed to Oman’s topographical situation, as 82% of the land is desert, 15% is mountainous, and 3% is coastal (Al-Qurashi, 2010; Alruheili, 2017; Al Shaqsi, 2012, NCSI, 2020). Most areas also lack resilient infrastructure against storms and floods (Alruheili, 2017).

Figure 1-2 Floods in a coastal area after cyclone Guno 2007 (Al Barwani, 2009)

A vulnerability assessment of an area to environmental hazards is a complex process characterised by various risks of subjectivity and bias. In other words, what factors should be given more weight to arrive at an accurate conclusion when evaluating the vulnerability of a place? Factors could be physical, such as geographic location and structural properties of a building; socioeconomic, such as income and access to resources; and cultural, such as perception of risk and disasters. Therefore, it is beyond the scope of this thesis to provide a thorough quantitative vulnerability assessment of the whole country. However, it remains essential to understand the physical context under which the emergency management system (EMS) operates. Consequently, it should be considered when an analysis or evaluation of the system is conducted.

The history of cyclones in Oman shows that these events are associated with devastating effects. Table 1-2 shows examples of some recent intense cyclones and their associated reported damages. The fundamental lesson learned by the government is that cyclones are serious threats, causing unanticipated devastating consequences that require expensive repair maintenance (Alruheili, 2017), and increasing governmental capacity and capability is a prerequisite to good disaster

response, especially in an environment that presents several challenges to emergency response efforts.

Table 1-2 Selected cyclones that made landfall in Oman and their estimated death toll and damages

Cyclone	**Death toll**	**Reported estimated damages**
Muscat Cyclone of June 1890*	727	Several thousand palm trees lost
Masirah Cyclone of June 1977*	105	20,000 made homeless Thousands of animals died All homes on Masirah Island were destroyed Thousands of palm and lime trees were destroyed
Cyclone Gonu June 2007	50	USD 4 billion worth of damages
Cyclone Phet June 2010	24	10,000 affected USD 1 billion worth of damages
Cyclone Mekunu 2018***	7	USD 1.5 billion worth of damages

* (Membery, 2002), ** (Membery, 1998), *** Author

1.3. Governance Structure of Emergency Management System in Oman

This section provides a brief background on the Oman emergency management system's governance structure. Chapter 5 discusses the development phases of the system from a historical point view and the various factors that have influenced its growth. Data used here emerge from the following official sources: EM regulations and laws in the country (see Appendix A), Websites of the official agencies, the national EM plan and the procedures of the operational sectors. The last two sources are not shared publicly, but the researcher was given access to view them while on their premises.

The National Committee for Civil Defense 'NCCD', established in 1988, is the national multiagency coordinating committee for managing large-scale emergencies (Royal Decree No. 32/1988). It is an *ad hoc* structure which includes 20 government organisation members. The Council of Ministers appoints them based on the recommendation of the Inspector General of Police and Customs (*Royal Decree 27/2008*). The NCCD is a national central body. Therefore, regional NCCD subcommittees operate as regional EM units that are expected to carry out emergency preparedness and response operations (NCCD, 2010). These *ad hoc* government committees are only activated in case of an emergency. They rarely convene during 'peace times' (Al Shaqsi, 2012).

The Royal Oman Police (ROP), a paramilitary agency, is the overall lead agency in this system structure (Royal Decree No.32/1988). Its head inspector is the director of the NCCD. It also hosts the National Centre for Emergency Management and the executive office for the NCCD, which was established in 2003 (Royal Decree 51/2003). Administratively, the two are the same, but the former is only activated when there is a national crisis. At the same time, the latter operates daily to carry out the NCCD's operations. There are no representations of these two structures at the regional or local levels. An *ad hoc* centre is set up in an emergency and primarily supported by the central EM centre. The former is activated during a national crisis, while the latter runs NCCD's operations daily.

Figure 1.3 shows the governance structure of the EMS in Oman. The NCCD ensures higher levels of coordination and collaboration from the different government entities. At the operational levels, eight operational sectors are supposed to cover all emergency-related needs: monitoring and early warning, media and public awareness, search and rescue ('SAR'), relief and shelter, medical response and public health, basic essential services (utilities), hazardous materials ('HAZMAT'), and disaster victims and identification and missing persons' affairs ('DVI') (NCCD, 2018). Each sector is managed by a centralised entity whose prominent role is coordinating the multiagency efforts during disaster preparedness and response. It is also expected to ensure preparedness and build the sector's capacities. Each sector includes several organisation members who should actively participate in disaster response and preparedness. The following is a brief description of each sector, primary responsibilities and main active members:-

1. The Public Authority for Civil Defence and Ambulance (PACDA) manages the Search and Rescue Sector. PACDA is administratively under the authority of the Police agency. It provides urban, marine, land and air rescue in emergencies. Several governmental organisations are members in the sector, most notably the Air Force, the Marine, Police Air, and Oman Air.

2. PACDA also manages the HAZMAT sector. It includes several governmental organisations, such as the Ministry of Environment. The sector deals with biological, chemical radiological incidents that might originate from natural or technological hazards.

3. The Ministry of Health manages the medical response and public health sector. The sector includes health departments from the civilian and military sectors. It is responsible for providing health and medical services utilising mainly government resources. Private health centres still need to be made active members of this system.

4. The Ministry of Social Development manages the shelter and relief sector. It is responsible for organising operating shelters and provision of relief materials. Recognised members of the sector are the Public Authority for Stores and Food

Reserve, Oman Charitable Organisation, Ministry of Education and Ministry of Sports.

5. The Meteorology Authority manages the monitoring and early warning sector. It is responsible for assessing natural and technological hazards, evaluating risks and providing early warning against all hazards. It includes several organisations, most notably the Seismological Centre at Sultan Qaboos University, the Numerical Forecasting Centre at the Civil Aviation Authority and the Ministry of Municipalities, responsible for monitoring floods.

6. The Ministry of Media manages the media and public awareness sector. It is responsible for disseminating information about potential risks and the instructions to be taken by people and organisations in an emergency. In addition, it is also expected to raise risk awareness among the public. Besides government news outlets, the sector includes private media companies.

7. The Public Authority of Electricity and Water water manages the essential services (Utilities) sector. It includes six sub-sectors: electricity, water, sewage, fuel, telecom, and roads. Each one of them is managed by a centralised agency. They include governmental and private companies that provide those services.

8. The forensic laboratory manages the DVI sector (disaster victims identification and missing persons affairs). It is responsible for two main tasks: providing family assistance and identifying victims and missing persons due to a disaster. Recognised members of the sectors are the Ministry of Health and the Civil Defense Authority.

There are several important observations about this governance structure. First, none of the above sectors is managed by a non-governmental body. Some private and voluntary organisations participate at the operational level in some sectors, such as the utilities sector. In addition, the private sector is not an active member of the NCCD, which is responsible for managing disasters at the strategic level. Additionally, there is no dedicated agency for disaster risk reduction. Therefore, the structure system is

a response-based rather than a preparedness and mitigation-based structure. It is activated during emergencies. Thirdly, the coordinators and managers have other daily responsibilities that are mostly not emergency-related. Some might be ministers or deputy ministers, which makes arranging meetings difficult.

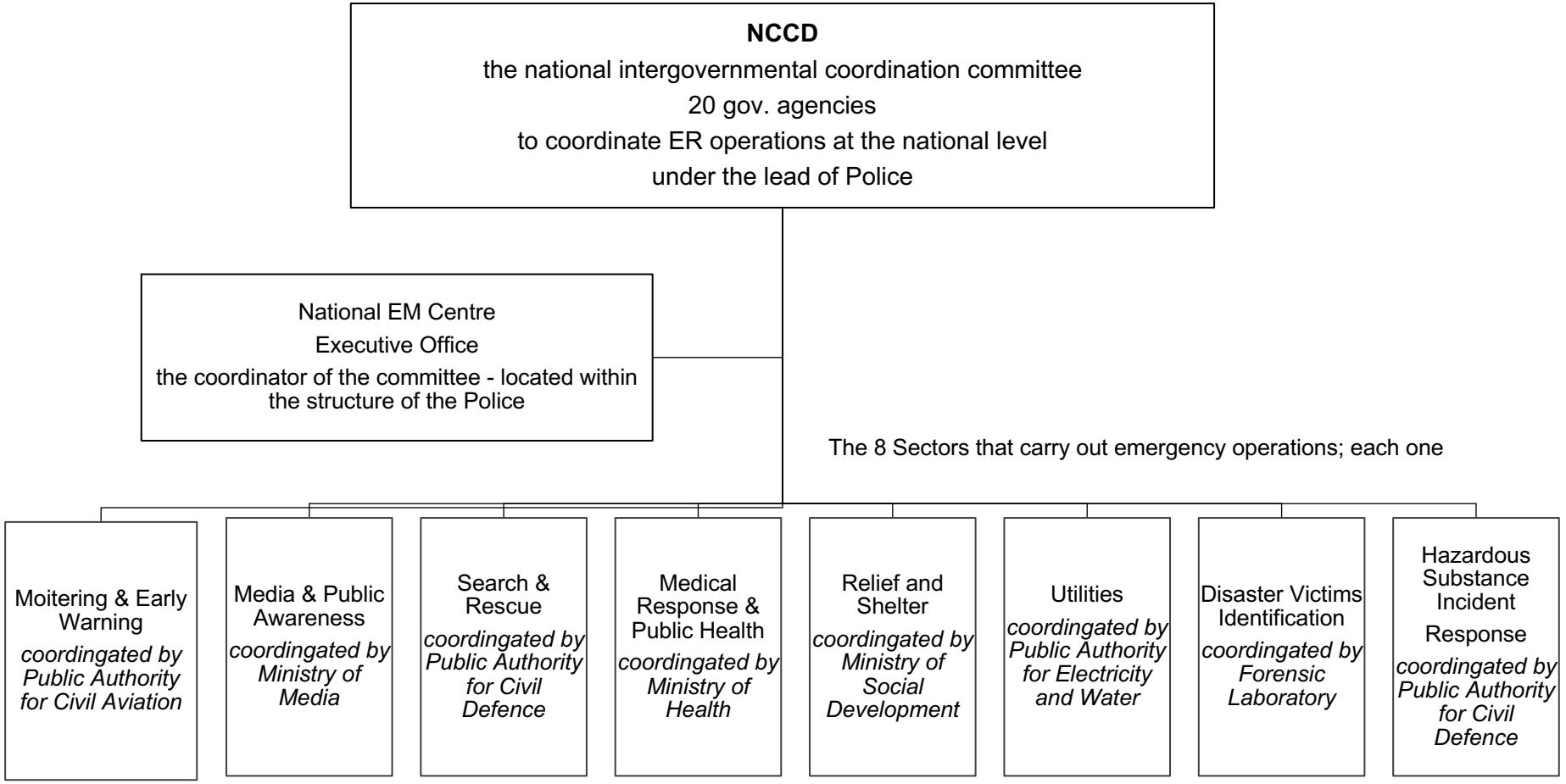

Figure 1-3 The function-based organisational structure of the 'national' EMS in Oman in large-scale emergencies

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

In order to arrive at a starting point in this research, it is essential to review the existing body of knowledge. Figure 2-1 shows the relevant topics reviewed in this thesis. This chapter starts with a review of the main works that look into the nature and features of large-scale emergencies, the demands they generate and the needs they require that distinguish them from other daily emergencies and incidents. It then reviews the types of responding actors who actively involve and participate during the response phase and the patterns of interactions that emerge. This section also clarifies the meaning of important terms used throughout the thesis, such as disaster, emergency, response and management.

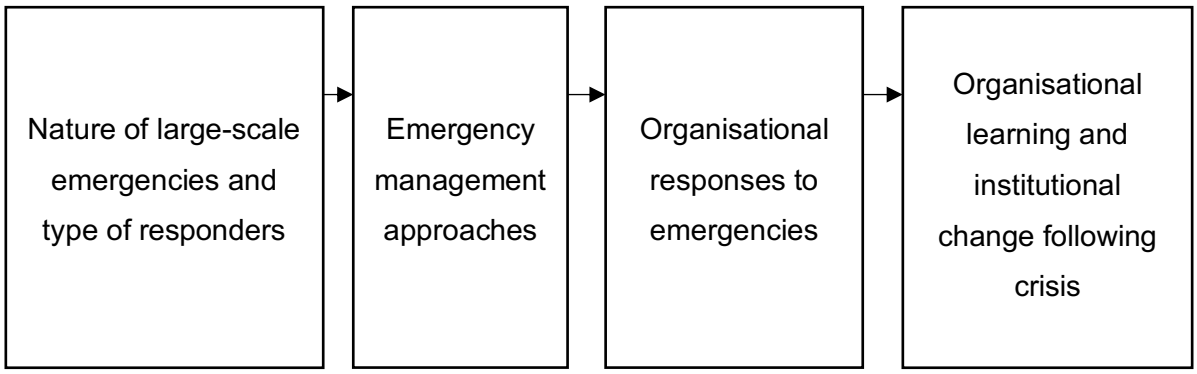

Figure 2-1 Literature review topics, presented in order of consideration.

The review in this section shows that large-scale emergencies differ from daily emergencies as they create widespread urgent needs that exceed the capacities of single organisations and in many cases of single nations. It also shows that the response should be based on local disaster management as the affected area (the theatre of operations) is always local (Alexander, 2007a; 2008a). A second important finding for an effective managerial approach is that it should be based on collaborative relationships between actors, flexible enough to expedite self-organisation at the local level and accommodate more incoming resources. Thirdly, it should also be inclusive,

allowing the participation of non-state actors, most prominently local voluntary teams and private essential services providers.

After reviewing the main works that discuss the underlying principles for effective emergency response, Section 1.2.2 delves into the existing 'applied' managerial models used in crisis management. The objective of this review is twofold: (a) to understand where the present case study – an EMS in a developing nation – is situated in this domain, and (b) to understand the relationship between the predominant 'applied' models and the principles discussed above. The review in this section shows that there are two notable management styles: the traditional classical hierarchical command-and-control approach and emergent models that call for broader participation and adopt a more horizontal pattern of interaction through the adoption of new technologies. An emergency management system would lean towards one of these models. Most studies show that the latter approach is more consistent with disaster realities though the first is more popular among practitioners.

In order to study what happened to the Omani EMS – or the managerial model associated with unique characteristics – in the selected cyclone emergencies, it is essential to review the existing theoretical frameworks used to analyse its functioning and performance during emergency response. Though several views, such as open systems theory, chaos theory, complexity theory and network theory, have been used (and they share similar conceptions, such as agents, interactions and self-organisation), the initial analysis of data shows that chaos theory is best able to qualitatively explain the behaviour of the system in the present context. The triangle relationship of (a) disaster realities, (b) formal management system interactions, and (c) informal crisis management (its actors and patterns of interactions) can be explored and deconstructed by chaos theory notions. It can provide valuable insights into the managerial model of the actual system. It could also help identify important lessons that should be learned from these events.

The fourth and final section reviews the different approaches used to study institutional and organisational changes that occur following a disaster. There is an embedded assumption within the disaster management literature that the trajectory of transformation of emergency management systems takes the form from an

undemocratic centralised, top-down militarised management to a more democratic, devolved and inclusive form of management. This is a plausible assumption. This thesis is concerned with identifying the forms of organisational and institutional changes, and it places a particular emphasis on the factors that explain the dynamics of those changes.

2.2 Large-Scale Emergencies, Principles of Management and Applied Models

Many concepts in the disaster management literature are not clearly defined, prominently those of disaster, emergency, catastrophe and crisis. This is primarily due to the vast interest of many scholars and researchers from different disciplines in studying disasters and emergencies. Nevertheless, two broad criteria distinguish between these terms: a qualitative criterion and a quantitative one (Jonsson, 2007). The former addresses the nature of the concept as a dynamic process or an outcome, whereas the latter is concerned with the magnitude of the devastation. A crisis, for example, is viewed more as a process than an outcome. If a crisis materialises, it can lead to a devastating outcome (disaster), but if managed successfully, it may amount to only a minor incident (Jonsson, 2007).

The magnitude of the devastation (the quantitative criterion) is predominant across the academic literature in regard to differentiating between these terms. According to Quarantelli (1997, p. 40), ‘the complete disruption of social life where the community is not functioning in any meaningful sense’ is termed a catastrophe. In contrast, several societal activities remain functional in a disaster despite the large-scale negative consequences. Also, according to the same author, an emergency can be managed by local resources and personnel, while a disaster and a catastrophe require assistance from external actors (Quarantelli, 1997).

The United Nations Office for Disaster Risk Reduction (UNDRR, 2009) defines a *disaster* as ’a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources’ (p. 9). The UNDRR (2009) has defined neither an emergency nor a crisis but views them both independently as ’a threatening condition that requires urgent action … [to] avoid the escalation of an event into a disaster’ (p. 13). Therefore, it can be inferred that a disaster is viewed here as a potential outcome of an emergency or crisis.

This definition of a disaster falls within the paradigm which views it as an analogy of war resulting from an external agent or aggressor (Le De and Gaillard, 2022). Therefore, it is mainly concerned with the magnitude, duration and speed of onset of the hazard (Le De and Gaillard, 2022). Disaster studies also use two other main paradigms to understand the concept of disaster. The second view relates to vulnerability. Social, physical, economic and political processes create the right conditions for a disaster to take place. Hence, a disaster is seen as a consequence of the vulnerability of society (Le De and Gaillard, 2022; Sanders, 2006). The third view relates to people's capacity and resilience to cope with hazards and adapt to changes (Le De and Gaillard, 2022). However, according to Le De and Gaillard (2022), these paradigms reflect Western constructs, calling for more diverse 'ontologies and epistemologies' on the concept of disaster.

As debating over the definitions of these terms is not within the scope of this thesis., Readers interested in further discussion are advised to review previous works (e.g. Jonsson, 2007; Alexander, 2002a; Alexander, 2007a; Perry and Quarantelli, 2005; Boin, 2004 and Alexander, 2005; Quarantelli, 1998; Le De and Gaillard, 2022). In the present context, it is important to move on from this debate and clarify what the terms mean when they are mentioned. Therefore, a working definition of each term is adopted.

Alexander's definition of an emergency has been adopted for this research due to its flexibility in covering different events of different magnitudes. It is defined as 'an imminent or actual event that threatens people, property or the environment and requires a coordinated and rapid response … (2005, p. 159) … that exceeds the capacity of normal resources and organisation to cope with it' (2002a, p. 1). An emergency can be a large-scale incident, a disaster or a catastrophe based on the magnitude of the event, as Table 2-1 shows. Minor incidents and incidents are not within the scope of this thesis, while major incidents and national and international disasters are. They are also referred to throughout the thesis as large-scale emergencies that require a higher level of multi-organisational coordinated response.

Table 2-1: The four levels of emergency with examples, based on Alexander (2002a)

	Level of Emergency	Examples	Action Required
Outside research scope	Minor Incident	A single person suffering a heart attack Household fires	Dispatch of an ambulance Dispatch of a fire truck and an ambulance
	Incident	Major traffic accident involving multiple vehicles	Coordinated response within a single jurisdiction
Within research scope	Major Incident	Cyclone Phet, Oman 2010 Grenfell Tower, London 2017	Coordinated interjurisdictional or national response
	National or International Disaster	Cyclone Gonu, Oman 2007 Indian Ocean tsunamis, 2004 COVID-19 pandemic, 2020	Coordinated national or international response

Despite the different uses of these concepts among scholars, the terms ’emergency’ and ‘disaster’ are used synonymously in this thesis and accordingly, so are emergency response and disaster response. In this thesis, an emergency or disaster response is referred to as ‘the immediate and short-term reactions of the disaster relief community to an emergency’ (Alexander, 2005, p. 168). Therefore, it would include the immediate and short-term preparedness, response and recovery reactions to an ongoing emergency. These reactions could be ‘the implementation of plans (if they exist) or use of personnel and equipment to achieve the tactical and task requirements of response to address a given threat’ (Perry, 2003, p. 406). Alternatively, they could be the spontaneously emerged reactions by formal and informal actors to save lives, reduce negative impacts, protect properties and preserve the continuation of social life (UNDRR, 2009).

Large-scale emergencies are distinguished by the widespread damage that leads to a disruption of life for a large number of people. ‘They involve major harm to the physical and social environment’ (Kreps and Drabek, 1996, p. 133) and create ‘sudden’ urgent needs that might fall outside the responsibility of a formal agency.

They can also exceed the capacity of a single government and require resources and assistance from multiple stakeholders because they tend to cross administrative jurisdictions, authority boundaries and policy domains (O'Leary, 2018).

Besides causing a wide impact and creating large-scale demands, the sequence of events in such environments is characterised by high uncertainty and complexity. The causal chain in these events is non-linear. The interactions between the hazards and the social and technical elements of the system create a complex environment under which unanticipated consequences are likely to occur (Perrow, 1999). A single agent, such as a cyclone or an earthquake, can cause cascading hazards like landslides or disruptions of the information and communications system 'ICS'. This causes additional chains of damage. This non-linearity, manifested in the multiple simultaneous interactions of hazards and risks, makes these events difficult to predict. As a result, a coordinated response with a flexible form of management that can adapt to this dynamic nature is required. These actions that involve organising and managing resources according to the emergency-generated needs are collectively labelled 'emergency management (EM)' (UNDRR, 2009). They are "the short-term measures taken to respond to particular hazards, risks, incidents or disasters" (Alexander, 2005, p. 168).

2.2.1 Principles for Managing Large-Scale Emergencies

Finding a managerial model that is effective for all nations and for the diverse range of emergencies is a challenging task (Koehler, Kress and Miller, 2014) because there are different modes of governance, various cultural and social contexts and varied economic capacities and resources. Yet, the existing state of the art does provide a group of underlying principles for an effective 'generalised' managerial approach for large-scale emergencies (Drabek, 1985; Alexander, 2002a). This is based on one central tenet: emergencies share similar features, generate similar demands and create similar needs regardless of where they occur and the nature of the trigger. Quarantelli (1997) pointed out that agent-related demands might be unique to the type of agent triggering the emergency, but the response-related demands are independent of the disaster agent. Based on these shared demands, such as effectively processing

information, rapidly forming response teams and assigning tasks, there is a solid rational basis for proposing a ‘general’ managerial model.

Across the existing literature, the evolution of EMSs can be viewed as a shift in the managerial model from an authoritarian, command-and-control, state-based system to a fully-integrated, participatory, multi-stakeholder, devolved system shown in Figure 2-2. Therefore, there is an implicit assumption that the growth pattern for an EMS follows this trajectory line, which is based on empirical research findings, as will be explained throughout this section. This shift also seems to be severely impacted by the nature and frequency of recent disasters experienced by the system (Epstein and Harding, 2020). Emergency management models fall within a continuum of these two broad modes of governance (Alexander, 2007a, 2016). It can be inferred that the transfer from an authoritarian mode to a participatory mode is described as positive growth across the existing literature.

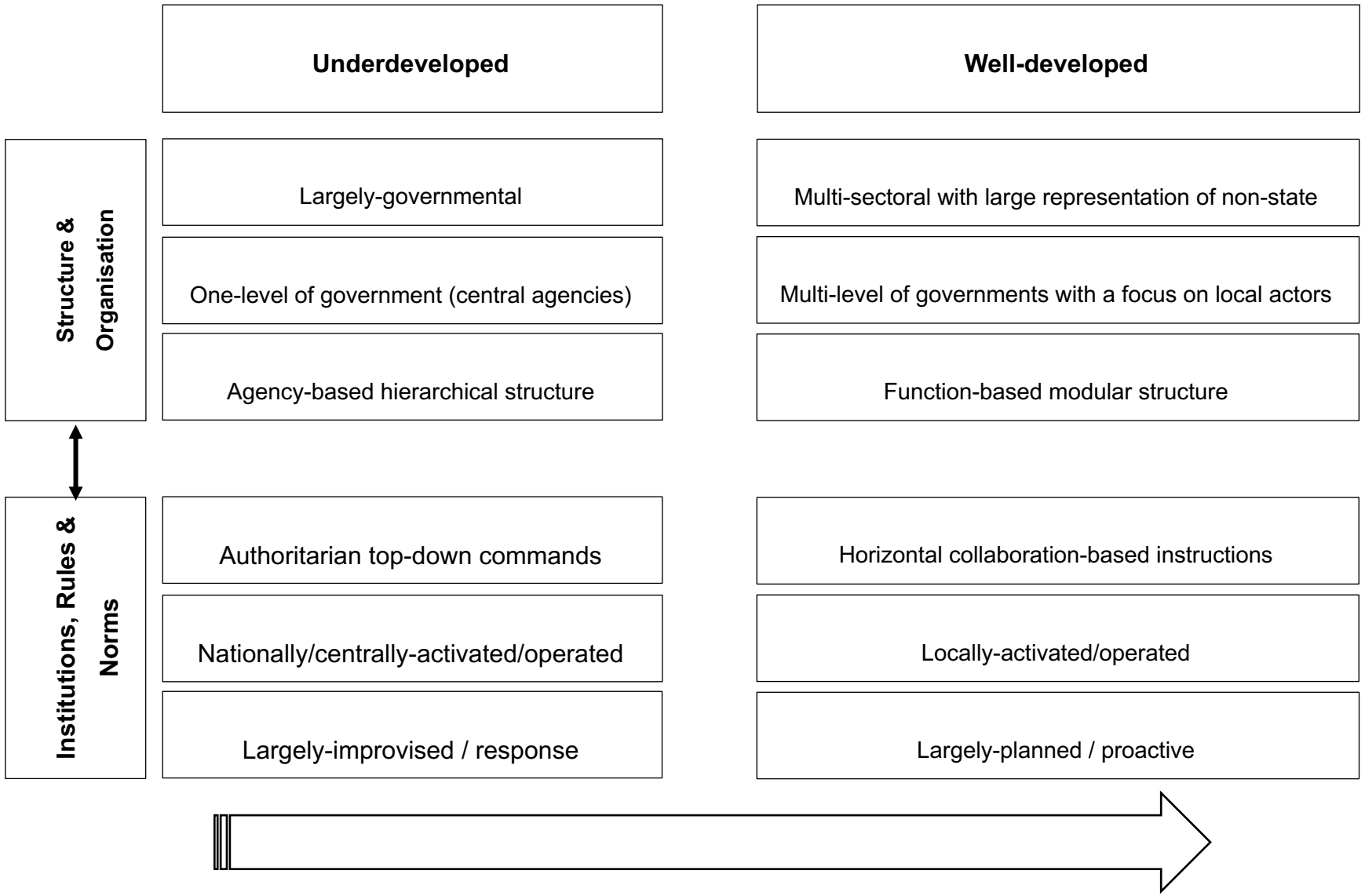

Figure 2-2 Growth trajectory for an EMS – a main assumption in this thesis based on disaster management literature

This section will provide a brief review on the importance of (a) the participation and 'inclusiveness' of non-state sectors in the formal system for managing emergencies, (b) the integration, i.e., collaboration, between participating actors, and (c) the localisation of EM. It will discuss why these elements form important phenomena for observation when analysing the evolution of an EMS. As will be illustrated, the unique features of large-scale emergencies require a management model that is based on collaborative participation, is locally focused and facilitates and integrates non-state actors. These interrelated fundamental needs for effectively managing large-scale emergencies reflect whether or not the managerial approach in addressing emergencies has evolved in response to experienced cyclone emergencies.

Before the establishment of states, ordinary people or 'the local affected community' and their neighbouring communities were the primary responders with their local capacities. They had to look after themselves under largely liberal political systems (Alexander, 2008b). During that period, states were not as capable of creating emergency management systems. They did not have the expertise and the organisation they do nowadays. At the beginning of the 1940s, many governments started protecting their people and attending to their needs during emergencies (Alexander, 2008b). Under this form of governance, the state made policies and delivered services. With the emergence of neoliberal states during the 1990s, many governments, prominently in the West, began playing a facilitating role so that people exercise self-reliance, but the vulnerable groups are provided with additional protection (Alexander 2008b). A modern DRR arrangement is "an ecosystem that has been jointly governed by stakeholders ranging from governments, non-governmental organisations, civil society and faith-based groups, scientific bodies, research institutes and universities, the private sector and local communities" (Trias, Lassa and Surjan, 2019, p.217).

This change has occurred in some parts of the world while many countries, including the present case study, still adopt a centrally-governed system for EM, where the state is the sole policy maker and the largest service provider. This norm, however, has created unwanted consequences, such as reinforcing ineffective authoritarian governance, a culture of dependence on government interventions, and a management system that primarily focuses on national preparedness rather than

building local capacities. Another important consequence of this mode of governance is the negligence of the civil society's role not only in participating in making policies but also in basic emergency response tasks.

In reality, however, individuals and groups emerge and participate during disaster response, as confirmed by an extensive body of *post hoc* disaster studies. Their engagement, whether formal or informal, is critical to the success of the overall operation. Drabek and McEntire (2003) reviewed disaster sociology studies published during 1987-2003 and found that the dominant theme is that people collectively become more unified to respond during disasters. They join or *converge* to care for each other. They are the first ones to help themselves after a disaster, and they take on disaster-related tasks. This phenomenon became known as convergence or 'the emergent phenomena' that became a focus of academic research on disasters during the 1950s to 1970s and is still current today (Drabek and McEntire, 2003).

Quarantelli (1996) confirms this finding by adding that people also collectivise, congregate and emerge to help before and after a disaster. They might, for example, gather to challenge a decision to build a new dam or contribute to a disaster recovery program. Uhr, Johansson and Fredholm (2008) analysed networks that responded to a release of hazardous materials incident and found that several active actors during emergency response were outside the official EMS. Communities also learn from disasters, build resilience, and become self-reliant if external support is cut off (Fitzpatrick, 2016). These findings highlight the critical role of individuals and communities in disaster management.

The existing literature cannot emphasise enough the importance of the meaningful participation of non-state actors and civil society in crisis management (Drabek and McEntire, 2003). Disaster management services must involve people, in a participatory manner, in maintaining their own security (Alexander, 2007a). Their involvement was found necessary and not an added luxury (McGuire, Brudney & Gazley, 2010). Neal and Philips (1995) demonstrated that without the efforts of the emergent groups during the Loma Prieta earthquake and Hurricane Andrew, the response of formal volunteer organisations such as the Red Cross would be ineffective. In addition, Nielsen (2022) found that the involvement of volunteers at the

managerial and operational levels was essential for the overall success in response to coastal flooding caused by Storm Inglof, which struck Denmark in 2017.

Many reasons rationalise the occurrence of such a phenomenon. They include the inability of existing traditional organisations and their plans and procedures to meet the newly generated demands (Auf der Heide, 1989; Twigg and Mosel, 2017), lack of planning and participants' socio-economic status (Drabek and McEntire, 2003).

The participation of individuals and social groups, such as charities and faith-based groups, in EM, is fundamental for effective emergency response. "This arrival of a wide range of resources and personnel" (Drabek and McEntire, 2003, p. 99) should be taken advantage of as they emerge to fill a need gap that the established system cannot meet: "… the higher diversity of partners an actor can reach in a network, the higher its ability to utilise different types of resources" (Nohrstedt and Bodin, 2014, p.138 citing Granovetter, 1973 and Lin & Dumin, 1986). People and social groups, therefore, should be viewed as active collaborating stakeholders and not passive beneficiaries (Alexander, 2007a) and emergency managers should plan for and include emergent structures to improve the emergency response (Neal and Philips, 1995).

Despite this general agreement in the academic literature, governments across many parts of the world still need to catch up in recognising and integrating non-state actors into the EM formal structures. This failure might be attributed to misconceptions about people's behaviour and other disaster myths (Neal and Philips, 1995), despite the fact that anti-social behaviour, such as looting and panic, has rarely been found to occur during disasters (Quarantelli, 1986). The mass media have played a significant role in the continuation of this myth (Drabek and McEntire, 2003). For example, during Hurricane Katrina, it portrayed the breakdown of society, e.g., violence, theft and anti-social behaviour, particularly focusing on the poor. Victims were seen as 'problem populations' requiring strict social control (Alexander, 2007a). Very little of the literature has empirically identified the perspectives of governmental stakeholders and the institutional barriers that impede this integration. Therefore, this thesis considers this aspect when analysing the dynamics and forces of change.

Closely related to the participation of individuals and communities is the localisation of resources and authorities in emergency management. The two phenomena become intertwined at the local level. For example, disaster management in Dominica greatly relays on the local government. Therefore, volunteerism is found to be a significant force in its EMS (Thompson, 2019). Localisation generally means making essential resources such as food, water, energy, livelihoods and money more available at the local 'community' level, and communities become less dependent on external support (Wisner and Kelman, 2015). The opposite of localisation can be seen as concentrating resources and authorities within the central 'national' government. In relation to disaster response, localisation refers to enabling and empowering local governments and organisations to manage the crisis at the lowest administrative level rather than relying on external factors.

The largest proportion of the existing works views local response to disasters as a crucial element for effective emergency management (Alexander, 2016). In practical terms, local government, local NGOs and civilian organisations, and local faith-based organisations should manage the crisis with the support of the regional and national tiers of the government when needed. In addition to making resources locally, localisation, most importantly, entails empowering local agencies with the necessary powers to take the lead in disaster response. This fact is based on several grounds. First, localising disaster response is consistent with the realities that occur on the ground. A significant finding across the disaster management literature is that 'disasters affect local communities' (Lindell and Perry, 1992), so they are 'always the theatre of operations' (Alexander, 2008a, p. 138). Therefore, emergencies should be managed at the local level (Alexander, 2015, 2016) rather than from a remote operations room that is foreign to the affected area. An EM model can only function well if it is organised at the local level (Alexander, 2008a). In addition, 'voluntarism and community involvement … provide essential surge capacity and links to community resources' (Waugh and Streib, 2006, p. 132). Neglecting them is simply a waste of resources.

In addition, during crisis times, routes become inaccessible and new needs that are urgent and required at a large scale emerge. In such circumstances, formal arrangements become unable to reach local affected areas. A local self-organising

system usually develops to manage the crisis (Koehler, Kress & Miller, 2014), whether formally legislated or not. Local agencies become, by necessity, critical actors on the ground. They are also better positioned to establish situational awareness and make critical decisions such as issuing evacuation orders and activating shelters. Therefore, building local capacities to undertake the leading management role should be the norm (McLoughlin, 1985; Alexander, 2008a). In this thesis, devolution of power and distribution of decision-making across the different governmental levels (national, regional and local) are considered important indicators of the system's evolution.

Despite the well-recognised need to localise emergency management and actively engage local actors in emergencies, imported assistance from the national government and, in some cases, from a foreign country remains the norm in many parts of the world (Alexander, 2007a). Granting powers and legitimising the local state and non-state organisations and communities to take key roles in crisis management face several conceptual and practical challenges. First, several scholars mention that the concept of localisation – specifying who local actors are and what aspects of response should be local – still requires more research to define them. So does 'contextualisation', as they could mean different things to stakeholders in different contexts (Melis, 2019). A second main challenge is that government officials claim that local actors cannot lead the response, not only the resources but also lack the ability 'to speak the proper terminology' (Hilhorst et al., 2020).

Conflicts might arise between state and non-state actors at the local level regarding claims to legitimacy as response leaders (Kuipers et al., 2020). Therefore, roles must be planned. Emergency plans are most applicable at the local level. 'A local state-led response' was found to be highly appropriate (Kuipers et al., 2020). While the majority of these studies focus on a political context that has clear different levels of government, i.e., national or federal, regional or state and local or county, such as the U.S.A., the U.K. India and Brazil, in many monarchic countries, as in the present case study, those levels are very vague. Studying this phenomenon in such contexts has received less attention. Therefore this study aims to bring new insights into who the local actors can be and what roles they can play during the response to cyclone emergencies.

In addition to localising EM and making it more inclusive through integrating relevant stakeholders such as local communities, voluntary organisations and private businesses, the third important principle that an EMS should be built upon is collaboration (instead of or in addition to command). As large-scale emergencies transcend organisational, jurisdictional and sectoral boundaries, they require agencies to operate beyond their normative scope (House, Power & Allison, 2014) in a way that is usually unfamiliar or unprecedented to their normal working (Alexander, 2016). They may have different organisational structures, cultures, practices and routines, so coordinating multi-organisational work becomes necessary for effective disaster response (Boin, 2009). Dynes (1994) suggested that disaster response can be made effective if built upon continuity, coordination and cooperation. On the other hand, lack of coordination was found to be a common factor associated with poor performance (Auf der Heide, 1989, Tierney, 1997).

The terms' coordination', 'collaboration' and 'cooperation' have been extensively and interchangeably used in many disaster studies. Including communication, they are not opposites of each other. They are positively related (Drabek and McEntire, 2003) as they share the idea of a multiplicity of actors' working together' and the commonality of the aims (saving lives, protecting properties and ensuring the continuity of life). Nevertheless, several scholars agree that they differ in the degree of integration, commitment and complexity, with cooperation at the low and collaboration at the high end of integration (Thomson and Perry, 2006). Cooperating actors, for example, exchange information and expertise but operate independently and only interact when necessary. Coordinating actors are one degree more sophisticated than those engaged in cooperation, as they integrate activities and are willing to make changes to deliver some services. Yet, they remain independent (Mandell and Keast, 2007). Alexander (2008a, p.137) also referred to coordination as "the process of integrating functions and operations by ensuring that someone is responsible for them".

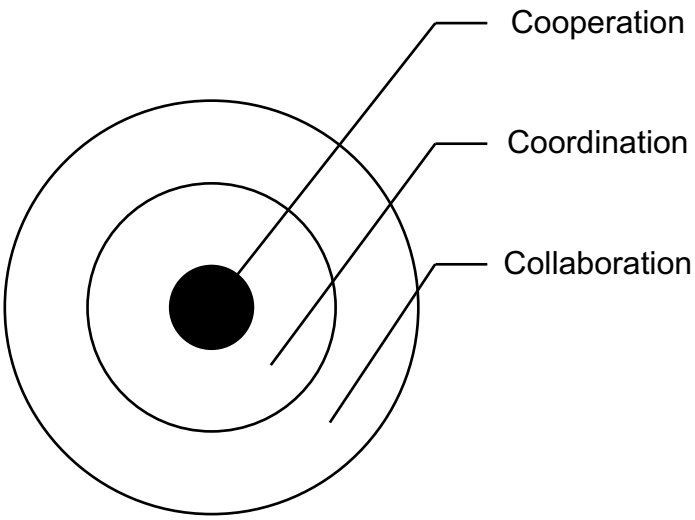

Figure 2-3 Collaboration encompassing coordination and cooperation

Collaboration is the highest level of integration and commitment in the collective decision-making and action process (Thomson and Perry, 2006). According to Mandell and Keast (2007), collaborative organisations not only integrate activities but also become interdependent with each other. Therefore, it can be inferred that collaboration, as Figure 2-3 shows, encompasses the other forms of *working together*. Collaborating parties are cooperating and coordinating. Forms of collaborating interactions across organisations exceed information sharing to include resource exchange, joint delivery of services and general interdependency. Therefore, the degree of integration – cooperation, coordination or collaboration – is an important criterion for judging how well the EMS has evolved. Collaborative management, collaborative governance, integrated management and coordinated response and participatory management are all terminologies used across the literature to describe collaborative work. In the present study, collaborative EM is used.

Collaborative emergency management entails inter-agency work and the integration of cross-sectoral and multi-level government works. The literature points to two forms of collaboration concerning EM. One is within the governmental agencies, referred to as horizontal collaboration; one is between the government and non-state actors, referred to as cross-sectoral collaboration; and one is between the different levels of government, referred to as vertical collaboration. When society faces a shared threat,

it needs to realise its full potential capacity, gather its resources and work collaboratively to overcome the crisis. Kapucu (2005), therefore, pointed out that this collaboration should engage the active participation of non-state actors, particularly the private and voluntary sectors. It has also been emphasised that cross-sectoral collaboration should mostly occur at the local level (Waugh and Streib, 2006, Sahlin, 1992). Waugh and Streib (2006) have shown that the failure of collaboration between Homeland Security officials in the U.S. and nongovernmental disaster organisations during Hurricane Katerina was among the main factors that contributed to a generally poor response.

By exploring the nature of collaboration, scholars from social science, public administration and management disciplines have contributed a wealth of knowledge. As a multifaceted term, Thomson and Perry (2006) explained 'collaboration' by delineating its processes: governance, administration, organisational autonomy, mutuality and norms of trust and reciprocity. They argued that collaboration is a calculated, rational decision that does not occur automatically. Organisations should create a structure to govern it, and play different administrative roles to make it work (Thomson and Perry, 2006). They emphasise that, for organisations to collaborate effectively, they must understand these processes.

The need for collaboration during emergencies is based on convincing grounds. First of all, no single organisation can meet the wide range of urgent demands generated during a disaster (Bodin and Nohrstedt, 2016). They must collaborate to adapt to changing resources and needs (Nohrstedt and Bodin, 2014). During emergencies, resources are scarce and cannot meet the enormous demand. One way to adapt is by changing inter-organisational networks for maximum returns through engaging in collaborative relationships (Nohrstedt and Bodin, 2014; Lu and Li, 2019). In addition, organisations are becoming more fragmented (or specialised) in a particular set of services. Therefore the increased interdependency between them requires collaborative linkages to be built (McGuire, Brudney & Gazley, 2010).

Furthermore, extreme events are characterised by high degrees of complexity and uncertainty, which can be harnessed by forming collaborative networks that are flexible enough to enable the mobilisation of diverse resources and personnel

(Tierney, 2012). Collaboration is needed to avoid duplication of work, promote resource sharing, develop joint solutions and build trust between the different organisations (Waugh and Streib, 2006). Another important point is that collaboration-based management allows necessary flexibility to develop in the network. It allows participatory resources to be adapted to changing circumstances (Nohrstedt and Bodin, 2014). The network can be expanded to accommodate more incoming resources, which is a fundamental success factor in disaster response and recovery. As the EMS is designed to respond to different types of hazards that require the involvement of diverse actors, the network of collaboration should be flexible in terms of whom it contains.

Despite recognition of the need for collaboration, it is repeatedly identified as something that fails during the emergency response (e.g., Zhou, Huang & Zhang, 2011; Drabek, 2003; Drabek and McEntire, 2002; Lu and Li, 2019). The reasons behind this are various. First, the process of collaboration can easily be made very difficult. Aside from the political pressures and damage to critical infrastructure that could disrupt the functioning of some organisations, internal triggers were found to be main barriers to cross-organisational collaboration. They include inter-organisational conflict of interest (Jackson, Faith & Willis, 2012) or the conflict between the individual interest of an organisation and the collective interest of the system (Thomson and Perry, 2006), and overlapping organisational functions (Chen et al., 2008), unawareness of other organisations' roles (Auf der Heide, 1989), and organisations with different characteristics (Waugh, 1993; Quarantelli, 1997). In addition, centralised disaster management was found unfavourable for building and maintaining cross-sectoral collaborations (Ku et al., 2021).

The second important reason is that, as a process and result, collaboration is not well-understood among most practitioners. A general belief is that it benefits the system. However, it requires significant time, money and energy (Nohrstedt et al., 2018). Many managers are unwilling to commit time to motivate stakeholders to engage in collaborative processes. They would instead concentrate on their organisational priorities. If managers are not taking the time required seriously, the benefits of collaboration are not likely to be realised (Thomson and Perry, 2006). In addition, the confusion between collaboration and responsiveness among emergency managers

could lead to a more rigid hierarchal system (Waugh and Streib, 2006), and notions of responsiveness have been accompanied by “lower willingness to share, participate, elaborate and partner with citizens” (Vigoda, 2002, p.528).

Thomson and Perry (2006) suggested that for managers to collaborate effectively, they should understand the four collaboration processes and the issues that could arise from collaborating in a network of different actors from different sectors. For example, conflicts between individual and collective interests may occur and, should always be accepted, recognised and dealt with. Officials must understand that they hold a dual identity, achieving their missions while ensuring that collaboration goals are accomplished. Thomson and Perry (2006) also emphasised that “collaboration does not make itself”. It must be governed, administrated and based on mutual benefits that should exceed information sharing (Thomson and Perry, 2006). In the United States, to make collaboration happen across all levels of government, NGOs and the private sector, the U.S. Federal Emergency Management Agency (FEMA) established the National Incident Management System (NIMS).

It is essential to look into ways to reduce the impact of these challenges. Increasing preparedness measures, good leadership (Wedel and Baker, 1998) and increasing awareness of other organisations’ roles have all been found to be necessary. Planning for collaboration is also vital. Responders should work on increasing the awareness of their roles, capacities, needs and dependencies, simultaneously increasing their awareness of the roles, needs and dependencies of other responders. Organisations that fail to do so will be unable to interact effectively, leading to inadequate emergency response (Alexander, 2016). Building reciprocal trust is a critical factor for a successful collaboration,; therefore, joint exercises should be held frequently. Emergency managers also need to build skills in collaborative activity and network management (Thomson and Perry, 2006).

An important point about management is that collaboration without an aim is likely to fail. Collaboration involves information sharing that should aim to create a shared mental model among the different responders (Paton and Jackson, 2002). Therefore, in emergency management, it should be linked to more functional or operational terms, such as building shared situational awareness and achieving organisational

interoperability (see Figure 2-4). In fact, a shared understanding of the situation is a strong indicator of effective coordination and an essential factor for effective decision-making and operational performance (Endsley, 1995). As Endsley's (1995) conceptual model of situation awareness 'SA' is more applicable at the individual level, additional research is needed to bring new insights on information perception, comprehension and projection of future situations – the three levels of SA in relation to collaboration between different actors. Gathering information from all participants, making it available to all using a standardised platform, collectively making sense of its meaning, and jointly planning for a projected scenario are all critical actions.

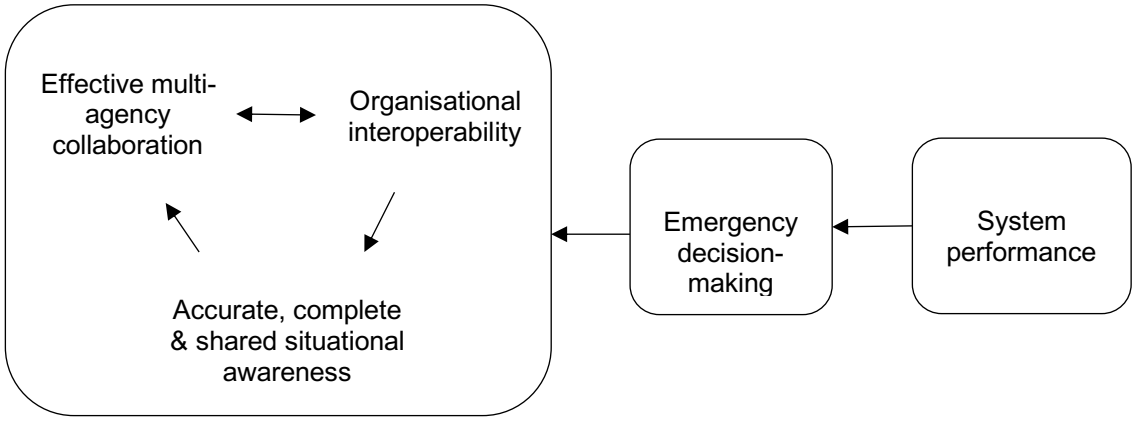

Figure 2-4 Collaboration, Interoperability and shared situational awareness

While responding actors need to interact, they must do so without falling foul of significant restrictions and conflicts. They need to be *'interoperable'* (JESIP, 2016). Interoperability has been largely associated with communication systems, but it has been recently expanded and begun to be used within sociological and organisational settings (Stegwee and Rukanova, 2003). Alexander (2016, p.85) referred to it as "the compatibility of equipment, supplies or procedures between different groups and organisations that find themselves working together, usually under unfamiliar circumstances". There has been extensive work on technical and communications interoperability, for example (Greene et al., 2013; Delaney, 2009; Cai and Dagdeviren, 1996, Greene et al., 2014). In the present work, we limit our notion of interoperability

to the setting in which two organisations or more communicate and interact within the emergency management system with respect to response operations. Therefore, we adopt a flexible definition of interoperability as “the extent to which organisations can work together coherently as a matter of course” (Pollock, 2013, p. 4).

According to House, Power and Alison (2014), the concept of interoperability holds several meanings based on the decision-making phase. For example, during the situational assessment phase, it means that the organisations involved have a common operational picture. At the phase of executing the plan, it means that they have a shared understanding of collective accountability and the interdependency of tasks (House, Power and Alison, 2014). Therefore, for an EMS to be described as interoperable, its actors must share a common understanding of what the situation presents and a common operating picture regarding what tasks need to be achieved, by whom, when, and how they will be achieved. The key to achieving interoperability is effective collaboration and coordination among the different responders (Alexander, 2016; Chen et al., 2008).

There have been tremendous efforts to understand the phenomenon of collaboration (Nohrstedt and Bodin, 2014), particularly in the business domain. In public administration, there is an increasing need to understand how collaborative relationships are built and maintained and how disaster experiences influence the dynamic and collaboration process. However, understanding why public administrators would collaborate with other sectors and organisations and how the cross-sectoral, cross-organisational collaboration change following extreme events requires further attention. Therefore, collaboration, as the highest degree of integration among responders on the one hand and between them and non-state actors on the other, is a phenomenon under observation in this research.

2.2.2 Applied Managerial Models For Large-Scale Emergencies

The previous section highlighted essential principles for an efficient and effective managerial model for emergency response, but these are not easily translated into practice. Quite the contrary, as will be described in this section, applying these principles in many countries is subject to plenty of institutional barriers. Scholars and researchers emphasise that organisational structures and institutions from various sources (such as the socio-political domain) influence the selection of participating actors, the strategies of interaction and the distribution of powers among them. A brief review of the common models that are widely implemented and regularly compared across the academic literature is provided in this section.

The first is the *command-and-control* approach. Regardless of its various names, such as the civil defence model (Alexander, 2002b, 2007, 2008a, 2008b) or the bureaucratic model (Schneider, 1992, Drabek and McEntire, 2003, Neal and Philips, 1995, Quarantelli, 1998), it is based on a central assumption that chaos is the predominant environment for disasters and emergencies. It assumes the 'confused victims' image during a disaster that people are confused, dazed, in panic and might behave irrationally (Rodrigues, Quarantelli and Dynes, 2007). This image is, in fact, rare and contradictory to the findings of the research literature (Scanlon, 2007). It, therefore, assumes that the best way to carry out emergency operations in a chaotic situation is to bring order through strict command-and-control measures (Dynes, 1994). As a result, military and paramilitary agencies are found appropriate lead agencies under this conceptual model. It is also built upon the assumption that standardised channels and procedures are the effective means that enable government organisations to respond within a short period successfully (Schneider, 1992), and consequently, unofficial or 'emergent' channels and procedures should be avoided as they could lead to more chaos and ineffective response.

The command-and-control structures' existence, continuation and popularity could be attributed to several reasons. From a functionalist view, they do work during routine emergencies and incidents where the generated demands do not cross-jurisdictional and sectoral boundaries (Nohrstedt and Bodin, 2014). Under this model of

management, responsibilities are distributed among the different ranks and units (Alexander, 2008a) as it follows the bureaucratic classical management theory, which is "rationally oriented" (Drabek and McEntire, 2003, citing Britton, 1989). Moreover, when they do work in such situations, and responses are perceived to be successful, they are reinforced, invigorated and deemed effective for all situations. Secondly, 'history matters' (Thelen, 2004) when trying to understand the current institutional configuration of a system. The historical circumstances have led to the emergence of the civil defence model due to the Cold War (Neal and Phillips, 1995) to protect governments from air raid attacks (Alexander, 2002a). In other words, historical circumstances have placed the emergency management field on a particular path.

In fact, after World War II, the predominant view of disasters was as 'a duplication of war' caused by an external agent or aggressor (Gilbert, 1995; Le De and Gaillard, 2022). People became more concerned about enemy attacks. These social and historical circumstances favoured a management approach that leaned towards an authoritarian militarised or paramilitaried approach (Alexander, 2002b). Therefore, many of the founding leaders of modern emergency management, such as civil defence managers, originated their careers in the armed forces (Drabek and McEntire, 2003). In fact, the U.S. Civil Defence Act of 1950 was initially related to preparation for war. However, later in 1976, it was amended to allow using its assets and resources for 'natural' disaster preparedness (Canton, 2007).

As command-and-control models address and uphold the role of the government in disaster management (Schneider, 1992), their supporters prefer centralised power, hierarchical decision-making, rigid communication protocols (Alexander, 2008a), paramilitary leadership (Dynes, 1994, Neal and Phillips, 1995) and a reliance on standard operating procedures (McEntire, 2007). If things go wrong during the response, the solution usually lies in reconstructing government organisations' structures and roles (Drabek and McEntire, 2003). In other words, solutions are not radical as long as decision-making authority remains centralised within the government and the power structure is not threatened.

Though some scholars and a large number of practitioners prefer these disaster management models (Drabek and McEntire, 2003), there have repeatedly been

criticism. Scholars investigated how such a system could lead to detrimental consequences, e.g., expanding ineffective governments and creating inter-organisations competition (Drabek and McEntire, 2003). According to Alexander (2002b), this approach is inefficient in tackling large-scale emergencies that cross jurisdictions. It is highly centralised and inflexible and has focused on protecting governments and certain social groups rather than the ordinary people who are likely to be the most affected by disasters. Imperiale and Vanclay (2019) mentioned that the practised command-and-control model fails to observe the disaster risk reduction principles. This approach has also been associated with negative attributes such as a high degree of centralism, secrecy and allowing people to be mere passive beneficiaries of the system rather than active stakeholders (Alexander, 2007a). It also ignores private sector organisations and individuals' crucial roles in emergency management activities (McGuire, Brudney & Gazley, 2010).

Neal and Phillips (1995) reviewed the literature of forty years of multidisciplinary work and conducted 150 in-depth interviews with EM organisations. They concluded that a command-and-control approach in managing large-scale emergencies leads to an ineffective response. They pointed out that this model ignores findings from the literature and is based on false assumptions. For example, the governmental response occurs in a vacuum, and society breaks down during disasters (Neal and Phillips, 1995). Therefore, it has led to misguided conclusions (Drabek and McEntire, 2003). In addition, collaboration among the different responders is complicated in these top-down 'control-oriented' models as their leaders tend to undermine the legitimacy of networked response systems (Nohrstedt et al., 2018).

Finally, and most importantly, this approach assumes that *the ad hoc* emergence of groups and tasks is counterproductive (Dynes, 1994; Neal and Phillips, 1995). Therefore, it cannot recognise and manage such things (Quarantelli, 1998). In addition, the analyses of real emergencies show that agencies cannot easily follow their normative guidelines and, in many instances, have had to rely on emergent groups and strategies to meet urgent demands. The wide range of factors mentioned by Koehler, Kress and Miller (2014) shows that the planned response system is probably not the one that functions in a disaster. Instead, a 'locally self-organising' system might emerge. Therefore, emergency managers should encourage the new

'emergent' forms and speed up the self-organising response (Koehler, Kress & Miller, 2014).

The deficiencies of this approach in managing large-scale emergencies have been gradually recognised (Alexander, 2002b), largely among academics. As a result, many scholars have advocated an alternative approach to emergency management: the emergent approach (Drabek and McEntire, 2003; Mileti, 1989). Different models of it exist, such as the human resources model (Neal and Phillips, 1995), the civil protection model (e.g., Alexander, 2002b, 2007), the descriptive model (Uhr, Johansson & Fredholm, 2008), the adaptive model (Jung, Song & Park, 2018) and the community-engaged model (Loewenson et al., 2021). Despite the different terminologies, their differences are not significant and therefore are not addressed here. However, it is important to explain how these models differ from the traditional command-and-control approach.

According to Drabek and McEntire (2003), the emergent approach is built upon the findings of analyses of actual emergencies. Its managerial style is largely participatory as it considers non-state actors and civil society active stakeholders in crisis management and encourages their participation. In such models, communities are actively engaged in emergency planning and response (Duque Franco et al., 2020; Loewenson et al., 2021), and operations are based mainly on inter-organisational cooperative efforts (Alexander, 2007a). On the other hand, the command-and-control structures were found to be antagonistic to inter-sectoral collaboration, as they create unwanted competition, which is not in the interest of the affected people.

In addition, due to their rigidity, the bureaucratic processes and routine procedures associated with the command-and-control approach are ineffective, especially when extreme unanticipated events occur (Schneider, 1992). These hierarchically-structured systems cannot adapt to the dynamics of disasters (Comfort, 2007) and cannot address all the needs generated in widely affected jurisdictions. This rigidity is manifested in prohibiting new organisational structures that usually emerge in crises (Neal and Philips, 1995). Emergency response organisations, as a result, have repeatedly 'violated [their] own normative procedures … to fill a bureaucratic gap' and have often restructured themselves after disasters (Neal and Philips, 1995, p.329).

Imperiale and Vanclay (2019) analysed the response to the L'Aquila earthquake that struck central Italy in 2009 and found that the command-and-control approach failed to achieve the desired disaster risk reduction aims.

Similarly, Hurricane Katrina clearly illustrated how bureaucratic procedures had very negative implications for the response despite having a sophisticated multi-hazard warning system and well-developed scenario planning. Bureaucracy resulted in a delayed response, underestimated evacuation and sheltering needs, and poorly managed outside assistance (Alexander, 2007a). Jung, Song and Park (2018) analysed the Sewol ferry disaster and found that bureaucratic procedures embedded in the Korean EMS caused deficiencies in early-warning systems, which resulted in significant fatalities.

In contrast to the command-and-control method that encourages centralised, hierarchical decision-making, the emergent approach calls for more devolution of power and distribution of decision-making authority (Alexander, 2007a) through empowering lower governmental levels, regional and local, to make critical decisions. Therefore, it is more consistent with the principle of localising disaster response. In a centralised civil defence system, local authorities in the affected community area do not usually get to make the decisions (Alexander, 2007a). As a result, local knowledge, expertise and resources are replaced by imported assistance (Alexander, 2007a), which is usually less connected with the local people and lacks essential knowledge about their needs.

Civil protection models have emerged as a reaction to the accumulative effects of disasters as militarised models have been unable to meet people's demands (Alexander, 2008a). Nevertheless, they acknowledge and implement "the twin foundations of preparedness and improvisation" (Kreps, 1991) by allowing several ways of organising (Britton, 1989). Existing works show that horizontally-structured decentralised systems create more flexibility that would improve the effectiveness of the whole system. An EMS should be flexible and decentralised enough to allow new organisational structures to meet new demands (Neal and Philips, 1995).

Other critical external factors contributing to the transfer to a more flexible, decentralised, horizontal model have been recognised. Most importantly, the increasing advancement of communication technologies and social processes demands a more horizontal chain of command (Alexander, 2008). This also corresponds with the finding by McGuire (2006) that the dominant form of organisation within the broader compass of public management is changing in correspondence with societal changes. During the agricultural age, the hierarchical organisation emerged, while during the industrial age, the bureaucratic organisation emerged, and during the information technology age, the collaborative organisation emerged (McGuire, 2006). In addition, global disaster frameworks such as the Sendai framework have also advocated collaboration, local empowerment and participatory management. They have advised governments that actors from the private and voluntary sectors should work collaboratively to mitigate and reduce disaster risk (Hermansson, 2017).

Scholars have called for a balanced approach that ensures commands and instructions are followed and, at the same time, encourages collaboration and participation by all stakeholders (McGuire, Brudney & Gazley, 2010). Such managerial models can have a blend of characteristics derived from both approaches. One model that emerged with a mixed character is the incident command system (ICS). The ICS focuses on coordinating necessary actions and making resources potentially available in a jurisdiction (Perry, 2003). It is a function-based rather than an agency-based structure (Alexander, 2002a, 2008a; Perry, 2003). Operations under this system are decentralised, while crisis management is centralised. Nevertheless, the ICS is an offshoot of the military command model. Centralised decision-making and a hierarchical chain of command still exist, but the command is instituted directly at the emergency site by the incident commander (Alexander, 2008a). Local emergent groups were found to be difficult to integrate into the response (Moynihan 2009). In addition, many civilian organisations do not prefer to be commanded and, consequently, are hesitant to collaborate under such a system. Despite the several benefits of the ICS, it tends to lean towards the authoritarian approach and should not be viewed as a prototype of participatory management models.

As illustrated, the EM model, along with its associated features, has implications for how emergency response operations are directed and how emergency aid is delivered

(Alexander, 2007a). The model involves not only a group of instrumental actors but, most importantly, a group of underlying rules that enable or disable the engagement and participation of some actors over others. They, for example, could favour central governments over local ones through resource access and decision-making. In many parts of the world, including the developed world, local governments are not authorised to make critical decisions such as declaring a state of emergency. The rules embedded within the management model could also discourage or encourage voluntary efforts in crisis management.

The managerial style, as well as its organisational structure, was undertaken by a government to manage crises and influence the flow and patterns of collaboration and interactions among participants. The command-and-control culture does not create a collaborative form of management (Alexander, 2008a). Instead, it creates unwanted competition among organisations (Drabek and McEntire, 2002) and consequently affect the delivery of emergency services to its beneficiaries. This is primarily due to structuring the different actors in the EMS into different vertical levels and possibly creating an imbalanced distribution of power. Alexander (2008a) also showed that the flow of coordination under the command-and-control model follows a hierarchical order that does not create inter-level coordination among the different stakeholders at the different levels. Waugh and Streib (2006) identified several conflicts arising from implementing this model in the US emergency management system after creating the Department of Homeland Security. They concluded that the model creates an organisational culture that does not support collaborative processes, which was evident during the response to Hurricane Katerina.

Despite extensive criticism, the command-and-control approach still exists in many parts of the world, including Oman. The collaborative, all-stakeholder, locally-oriented approach, which is found to be more consistent with the reality of disaster, is not yet widely replacing the classical model. Reviewing this topic enables the researcher to understand the management model in this case study and better relate it to the existing state of the art. Recognising it and its associated qualities forms an important element in explaining how such a system behaves in real emergencies, which is one of the objectives of the present work. Moreover, understanding whether a system has evolved along this continuum involves understanding its management style.

Table 2-2 shows the main differences between authoritarian command-and-control and emergent collaborative-based management models. This table is not an exhaustive list, but it highlights how the two differ. This is also not to say that management models must strictly follow only one of the models, but it emphasises that a management model will tend to lean towards one or other of them.

Table 2-2 Major differences between command-and-control and collaboration-based models for managing emergencies (based on disaster management literature such as Alexander, 2002a, 2002b, 2007, 2008a, 2015; Rodriguez, Quarentelli & Dynes, 2007; Schneider, 1992; Drabek and McEntire, 2003; Neal and Philips, 1995; Quarantelli, 1998; Moynihan, 2009; Perry, 2003; McGuire, Brudney & Gazley, 2010)

Management Model / **Features**	**Classical Command-and-Control**	**Collaboration-based**
Underlying Assumptions and Values	The situation must be controlled, and order must be established first. Bureaucratic procedures must be followed to achieve the above objective. Undermines the role of non-state actors as they bring chaos and should be kept to a minimum.	The self-organisation process occurs, and procedures must be flexible to support this process. Local participation and local knowledge are important and should be utilised.
Structure	Hierarchical organisation of participating agencies	Non-hierarchical, horizontal, modular integrated networks or working teams
Actors/Roles	Clear distribution of responsibilities The state forms policies and provides the majority of services. Other actors are passive beneficiaries.	Multi-actor governance Non-state actors have active and clear roles. Resources should come from several sources.
Information flow pattern	Top-down tight and strict control of information flows in a vertical pattern.	Flexible sharing of information horizontally and vertically.
Availability of Plans	Plans are sacred documents accessible by high officials.	Plans are accessible to all, even the public knows what to expect
Communication, Coordination Collaboration	Central classical state-based coordination	Highlights the importance of cross-sectoral collaboration and coordination among all stakeholders.

2.3 Approaches in Studying EMS Responses to Large-Scale Emergencies

This thesis aims to understand how the system – a centralised command-and-control governmental system – responded to four cyclone emergencies that recently struck Oman. This is important for two reasons: (a) to identify the failures and lessons from each event, and (b) to compare them with the formal changes that took place after each emergency in order to find out whether or not the right lessons were implemented. This section reviews the dominant approaches for studying and analysing how EMSs function and respond to large-scale emergencies: network theory and social network analysis, complexity theory, systems-based theories and chaos theory. It provides a rationale for adopting chaos theory for qualitatively analysing emergency response.

One of the most widely used frameworks to analyse emergency response is *network theory* and its associated analytic tool, *social network analysis* 'SNA' (Jonsson, 2007; Abbasi and Kapucu, 2016; Bodin and Nohrstedt, 2016; Varda et al., 2009; Uhr, Johansson & Fredholm, 2008). Its advocates claim that the functioning of the overall system can be understood through the investigation of its structural 'social' relationships among its interacting agents (Varda et al., 2009). The process starts with identifying agents and whom they interacted with during a response operation. Then, through mathematical algorithms, with the help of software, the degree to which network actors connect and the structural makeup of the overall collaborative relationships are calculated (Varda et al., 2009). Therefore, it could be inferred that SNA is a physics-based statistical analysis of the social relationships that occur at a specific time. The result is usually a set of social network diagrams displaying connections such as friendship or collaboration ties.

Uhr and Johansson (2007) used SNA to map friendship relationships among emergency responders. Opdyke et al. (2017) used it to evaluate resource-sharing between organisations in two periods after a disaster. SNA has also been used to study the changes in inter-organisational response networks or how the networks

evolve, using socio-diagrams taken at several periods (Abbasi and Kapucu, 2012, Abbasi and Kapucu, 2016).

Bodin and Nohrstedt (2016) showed that during emergency response, actors select partners to collaborate with based on the nature of the interdependency of tasks. The pattern selected influences the performance of the whole system. They concluded that finding a good fit between collaborating networks is more important for performance than professionalism and prior expertise (Bodin and Nohrstedt, 2016). However, the good fit may depend on the evaluation context. Their applicability to different social, cultural and political backgrounds is not tested and remains questionable. In other words, the good fit may vary from one case to another.

Though this approach has been extensively used, it appears to have many limitations. It merely looks at the internal structure of a network. It does not consider the circumstances that existed during the emergency and the role of the external actors who might have facilitated the emergency response. Furthermore, measuring a consistently changing property could lead to unreliable conclusions. In addition, SNA focuses on the number of interactions and ignores several important aspects, such as the quality of the relationship or the level of interaction. The results produced by this approach do not capture the actors' motivations for collaboration (Hermansson, 2017). Also, in most cases, the strength of a relationship, such as friendship or trust, is ranked subjectively based on the research participants' perceptions. Also, the phrases used to describe relations, e.g., important vs very important relationships, are not equally understood. Therefore, the results could provide a misleading representation of what happened. As with most multivariate statistical analyses, SNA is plagued with the issue of "the dimensionality of the problem". Previous scholars have tried to study the whole 'network' of those who participated in emergency response but have studied only one organisation (Uhr, Johansson & Fredholm, 2008).

SNA is suitable for cross-sectional analyses designed to capture interactions at a single point in time. This research adopts a longitudinal case study. In addition, it does not look at the affected community or area. It primarily concentrates on the institutionalised response system. Therefore, an integrated approach that combines the governmental institutionalised system and the collective behaviour of the public is

an appropriate viewpoint from which to investigate the response to an emergency. SNA was not found suitable to address the research question and was therefore not used as an analytical tool in this thesis.

The second theory used to explain the behaviour of complex systems, such as the emergency management system, is complexity theory. According to this, a system's behaviour can be governed, described and predicted by a universal law. 'System' here refers to a group of a single type of agents, while a group of systems is referred to as a population (Cohen and Axelrod, 2000). Each group has a law that explains its reaction in a given context. Its agents follow that common rule, and the interaction of several systems creates complex behaviour. Most researchers who have adopted this framework view complexity as ontology, hence as a system characteristic, 'making the reality of the system complex' (Bergström, Uhr & Frykmer, 2016).

The focus when using this approach is to explain how complexity manifests itself in the EMS (Comfort, 1994; Comfort, 1995). One of its most important concepts is 'self-organisation', described by Comfort (1994, p.403) as 'a spontaneous emergence of a new order in the dynamic rapidly-changing contexts'. As some events during emergency response might be unpredictable, uncertain or constantly changing, 'spontaneous efforts could take place to bring order to a chaotic environment' (Comfort, 1995, citing Kauffman, 1993, p. 1). Therefore, it is necessary to identify when, how and why it occurs. Self-organisation is usually manifested in improvised, unanticipated communications and interactions between different agents as an attempt to manage or control the situation. Complexity theory contends that understanding the functioning of a system and how it has evolved during a disaster response is achieved through understanding how self-organisation has occurred. Recommendations to improve the system arise through finding and supporting the right conditions that would facilitate this process and prevent the conditions that could hinder it.

In order to identify the dynamics of self-organisation during the response to the Pittsburgh Oil Spill disaster in 1988, Comfort (1994) analysed the responses of agencies based on two elements: (a) the 'boundaries of the system' (Comfort, 1994, citing Kauffman, 1993), which are identified through the number of actors present, the

frequency of interactions among them and the goal of action, and (b) 'the characteristics of the environment' in terms of event, time, location and operating conditions. Comfort identified which factors facilitated the self-organisation process and were sufficient to hold and exchange information and what flexibility could adjust behaviour to dynamic changes (Comfort, 1994). Similarly, Comfort (1995) found several key factors that helped accelerate self-organisation processes during the response to the Maharashtra earthquake of 1993 in poor rural regions of India. These included a national satellite communications system able to support communications in a disaster context, strong participation of voluntary organisations reinforced by a faith system that promotes humanitarian values, and a professional corps of educated public administrators.

A recent development of complexity theory is *the complex adaptive systems theory*. Cohen and Axelrod (2000) developed a framework to explain the behaviour of complex adaptive systems based on three interacting processes: the variation of agents and the strategies they follow in responding to their surrounding environment, the interactions that occur between those agents, and the mechanisms of selecting the interacting agents. The important concept in this theory is *self-adaptation*, which is a form of the self-organising process. Corbacioglu et al. (2016) used this theory to examine Turkey's response to the 2006 avian influenza crisis. They found that organisational flexibility and cultural capacity are required to promote the efficient flow of information and assess the self-adaptation of the emergency response system.

The 'original' complexity theory looks into the behaviour of the individual actor or seeks to understand the system's behaviour through a single agent. However, the theory's subsequent developments show an apparent migration from this reductionist way of thinking to a holistic approach with greater emphasis on studying the interactions between the different actors and the systemic properties produced rather than studying each component individually (Jonsson, 2007). In this sense, it moves closer to the systems-based approaches. The application of complex adaptive systems theories in disaster studies is still at an early stage. More research is needed to explore their potential in analysing responses to disasters. Another development of complexity theory is chaos theory, which will be discussed later in this section and used in this thesis to analyse the responses of the EMS in Oman during four cyclone emergencies.

First, let us briefly illustrate what systems-based theories offer and how they differ from complexity-based and network theories.

Systems-based theories such as general systems theory, system dynamics and systems thinking have been used to analyse emergency responses (Patriarca, Bergström & Di Gravio, 2017; Abrahamsson, Hassel & Tehler, 2010; Jackson, Faith & Willis, 2012). Functional relations and the dependencies between the systems' actors are the fundamental factors in understanding the system's overall behaviour. One key point about this approach is that complexity stems from the functional interactions between actors rather than from the physical structure, as in social network analysis. Similar to the concepts of 'self-organisation' in complexity theory and 'adaptation' in complex adaptive systems, *self-regulation* means that these systems correct themselves or 'maintain their form and function under duress' (Alexander, 2002a p.86).

Using systems dynamics, descriptively and qualitatively, Abrahamsson, Hassel and Tehler (2010) built a graphical representation of a response operation (consisting of actors, tasks they carried out, resources and infrastructure they relied on) to restore electricity during a storm that struck the west coast of Sweden and Norway. Though authors may have understood the system's internal interdependencies, its behaviour was difficult to interpret. Patriarca, Bergström and Di Gravio (2017) also mapped the functional relations among actors who were involved in a railway incident. With the help of a newly-developed analytic tool called the functional resonance analysis method (FRAM), they showed how dependencies and interactions occurred between the different actors that had led to the incident. Again, external factors that helped facilitate the response phase were not considered.

While the systems-based approach provides a systematic attempt to map the EMS, it provides a partial representation of the system, as it is used to map a single operation of the system. An aim of this research is to explain why the system behaves the way it does, a knowledge gap that requires more empirical work. Systems-based theories focus on the relationship between agents, which are very important but very limited, as people interact based on a set of institutions, which are the underlying rules such as written procedures and latent rules that originate from the managerial model and

its culture and norms. In addition, this approach does not look at the system's initial state before the emergency event, which is also significant as a means of explaining the rationale for analysis.

Chaos theory, or nonlinear systems theory, has also been used to explain systemic responses to emergencies (Kiel, 1995; Koehler et al., 2014; Priesmeyer and Cole, 1996). Though it originates from the physical sciences, it has recently been adopted to explain the behaviour of socio-technical systems (Farazmand, 2001; Sellnow et al., 2002). There are several reasons for this. The original theory has witnessed several transformations that have made it more appropriate for studying social phenomena. It has migrated from a 'pure' reductionist view of the world to adopt a more holistic approach similar to open systems theories. It has progressed from a purely positivist view of reality to a constructivist one that is more appropriate to understanding social phenomena. These changes in its epistemological and ontological underpinnings have made it more applicable to qualitative studies.

Built upon the assumption that the situation during a disaster can be chaotic, responses can be random (Priesmeyer and Cole, 1996), but they can be explained by identifying '*cosmology episodes'* or identifying when *bifurcation points* occur, along with the process of *'self-organisation'.* A cosmology episode has been mostly described as the shared perception of responding actors that 'the universe is no longer a rational, orderly system' (Weick, 1993, p.633) or 'the shock at the magnitude of the crisis' (Sellnow et al., 2002, p. 269). It simply means that people feel they have never been in such a situation before (Weick, 1993). At that point, a bifurcation point, a sudden qualitative change (Koehler et al., 2014), can occur, leading to a new state of the system, the chaotic state, or, as some might call it, a near-chaotic state. This situation can be followed by a self-organisation process designed to re-establish order or form a new system out of chaos (Kiel,1995). Some also view this as a consequence of bifurcation (Sellnow et al., 2002).

In addition to these concepts, the theory also gives particular attention to the notions of '*strange attractors'* and *'initial conditions'*. The former refers to the properties of stability that help re-establishing order (Adams and Stewart, 2015), or 'agencies that aid the establishment of renewed order' (Sellnow et al., 2002, p. 269), but 'strange'

because they originate outside the planned or predesigned formal legislated system. When examining the impact of Hurricane Katerina on the functions of a police department, Adams and Stewart (2015) found that breaches of the levee system and failures of communication systems were bifurcation points that led to the collapse of organisational functions. With the help of strange attractors (the U.S. Army and the National Guard), a new system of order began to appear (Adams and Stewart, 2015). More research is needed to illustrate the nature of strange attractors and whether they are actors or other means by which order is re-established.

In addition to placing emphasis on strange attractors, chaos theory pays special attention to the system's initial conditions. They help explain the system's overall functioning under extreme events and, therefore, must be acknowledged in such analyses. As these conditions might be very broad or multi-layered, they must be explained carefully and justified. In the EM domain, they may refer to emergency planning and preparedness measures. Identifying the factors that caused the situation to be chaotic and the conditions under which it was able to regain order are meaningful activities that should feed into the organisational design and behaviour (Farazmand, 2001). Institutionalising the identified lessons should feed into disaster planning and preparedness. The theory offers great potential but requires more empirical analysis. Therefore, in light of its flexibility and strong basis, it can be applied in this research to fulfil one of the objectives.

Chaos theory shares several notions with complexity and open systems theories. They consider emergency response dynamic and evolving, a phenomenon that moves quickly from one state to another. Also, they all agree that an unstable system can regulate, adapt or correct itself if the right conditions are present. However, a point of departure is quantitively modelling the requisite behaviour. Complexity theory focuses on quantitively modelling the behaviour of one agent and then generalising this to others. Open systems theory focuses on modelling the interactions among agents when they face an external threat and must deliver their objectives. Chaos theory focuses on understanding the combined impact that stems from the external threat and the initial internal conditions of the system (e.g., planning and preparedness) as it moves to the resultant state. While some of its advocates support using it for quantitative analysis, some require more qualitative data to elucidate its processes.

The logistical equation used to model the behaviour of complex systems has been used to model the dynamic transition from an ordered state to a chaotic state (Koehler et al., 2014). A series of *iterations*, i.e., scenarios or different behaviours of the system, can be generated (Priesmeyer and Cole, 1996; Adams and Stewart, 2015; Kiel, 1995; Koehler et al., 2014; Mueller, 2003). However, its application in disaster management still needs to be determined by further empirical research, as several key questions remain to be answered, most importantly, when does an organisation enter the chaotic state or how do we know that an organisation is at the bifurcation point (Koehler et al., 2014).

This section has reviewed the main theories used to explain the responses of complex systems to emergencies. Table 2-3 summarises what would guide us in understanding this research's path. The approaches mentioned share several commonalities, such as holistic rather than reductionist thinking. They also share important concepts, such as emergence, system, dynamics and complexity. However, significant differences exist between them (Phelan, 1999). Table 2-3 provides a broad distinction between these approaches.

Table 2-3 broad fundamental differences between complex system, or non-linear, theories, modified after (Jonsson, 2007; Phelan, 1999) and supported by several sources

Theory	Epistemology / ontology	Attitude towards complexity	Analysis Approach	Examples within the EM Domain
Complexity theory	A positivist theory is that social phenomena can be scientifically obtained and verified using quantitative methods. Ontological reality and underlying universal laws not only exist but also control and predict it.	Complexity arises due to the interactions between agents following a general 'universal' simple law	Agent-based 'bottom-up' approaches where the analyst is focusing to identify the simple rules that govern the agent behaviour that represents the whole	(Comfort, 1995; Bergström, Uhr & Frykmer, 2016; Dugdale et al., 2009)
Systems theory	An interpretivist theory; however, there is room for consensus that reality can be 'agreed upon'	Complexity arises due to changes in the number of agents and degree of interactions between them	Top-down feedback (and feedforward) based approaches	(Abrahamsson, Hassel & Tehler, 2010; Patriarca, Bergström & Di Gravio, 2017; Hollnagel & Fujita, 2013)
Network theory	A postpositivist theory that social phenomena are influenced by the researcher's own background, and can be observed via quantitative and qualitative methods	Complexity arises due to the structural properties of the network, and small failures could escalate to disasters	Network-based analysis where the investigator focuses on the structural property of a network to interpret complexity	(Kapucu, 2005, 2006; Bodin & Nohrstedt, 2016; Kapucu et al., 2010; Uhr, Johansson & Fredholm, 2008; Varda et al., 2009; Wang, Qi & Wang, 2014)

Chaos theory	Some see it as a branch of complexity theory, but it has migrated towards more holistic views. Reality can be described. The behaviour of the system can be categorised within 'boundaries' and can be predicted.	Complexity arises due to the impact of environmental stressors on the system and interactions among agents	The analyst focuses on the impact of hazards on the system & its initial conditions, and its ability to function under chaos through re-establishing order	(Priesmeyer & Cole, 1996; Adams & Stewart, 2015; Kiel, 1995; Koehler, Kress & Miller, 2014; Mueller, 2003; Sellnow, Seeger & Ulmer, 2002)

2.4 Disasters, Organisational Learning and the Dynamics of Institutional Change in the Emergency Management Field

The second aim of this thesis is to identify the institutionalised changes and understand their dynamics after they go through important learning opportunities (namely, cyclone emergencies). This section reviews the main conceptual and analytical frameworks that examine organisational and institutional change in relation to disaster experience. The meanings of organisations, institutions and institutional change in organisational settings are first addressed. Then, a discussion of literature that examines the factors, dynamics and conditions under which an institutional change takes place is presented. This section identifies limitations and knowledge gaps within this line of research.

The section concludes by highlighting the importance of considering the roles of three phenomena: (a) emergencies and exogenous factors, (b) policymakers' 'rational' choices and preferences, and (c) the influence of evolutionary processes, e.g., historical and cultural circumstances when attempting to analyse the dynamics of institutional changes that take place after a crisis.

2.4.1 Dynamics of Institutional Change in Organisational Settings

An organisational-institutional perspective is adopted to identify and examine how emergency management has evolved in Oman. The emergency management system is an organisation of actors or agencies with a common objective. Their interactions are governed by rules (North, 1994; Scott, 2014) that may constrain, empower and guide their thoughts and actions. Therefore, there is an embedded assumption that actors do not act randomly but follow the rules of the domain, which structure the collective behaviour of the system. These rules are important to identify because they explain the engagement and collaboration strategies between actors. The rules are not necessarily formal or written. Many are tacit, informal and unwritten, but they are implicitly agreed upon and largely practised by actors.

As organisations go through crises and emergencies, rules that shape the configuration of a system may also experience pressure to change. For example, membership rules that specify actors and their roles may change to allow the participation of more or new organisations or may expand the role of an agency. Another example is changing the information disclosure rules to allow wider information sharing between agencies. On the other hand, many rules may remain persistent regardless of their efficiency in reducing disaster risks. Understanding these dynamics would enable us to explain the rationale behind the current 'conceptual model' of EM in this case study. An institutional view, as will be illustrated here, helps us to understand this important phenomenon.

There has been a substantial amount of work on organisations, but it is important here to agree on a clear definition of what we mean by this term and what it entails in the present work. An *organisation* is an instrumental body structure that includes a group of actors working together, or at least should be working together, towards a common shared objective. The governance structure determines how actors relate to each other, the skills they require, the mechanisms of coordination and the strategies that are followed to accomplish the common objective (North, 1994). Scott (2014) provided an extensive overview of the evolution of organisation studies. A dominant theme is that an organisation is a formal setting with its own rules but is also an open system influenced by its surrounding conditions. There has been a focus on studying single organisations, but little effort has been made to study these phenomena – organisational and institutional change – in a multi-organisational governmental context. Also, empirical research is always needed, as the most significant proportion of this work has been conceptual and theoretical.

In relation to institutions, which can be seen as part of the organisation, scholars differ in their conception despite the prevalent use of institutional analyses across different disciplines, such as political science, economics and social sciences. Hayek (1973) considered them as 'shared expectations in society'. Individuals act in a certain way because they are expected to act that way. North (1990) viewed them as 'the rules of the game in society'. Greif (2006, p.30) defined them as "systems of social factors that conjointly generate regulatory behaviour". Other scholars group rules, norms and beliefs under the institution's definition (Aoki, 2001; Greif, 2006).

Institutions that exist in a context need to be understood, as they can be causes or constraints that regulate behaviours and interactions of actors or agents within that domain. They can influence the outcomes of such interactions (Voss, 2015). Three elements can be identified in these definitions: (a) actors or agents who were created in the first place due to the incentives that founded the institutions (North, 1994), who follow those rules and, at the same time, through their interactions carry along, dissolve or create new rules, (b) the domain, game or context whereby interactions take place and where institutions are applied, and (c) institutions or rules that share rules which regulate actors' behaviours.

Different types of institutions exist. Tuomela (1995) and Searle (1995, 2005) observed a difference between norms and rules based on the notion of *'collective intentionality*'. An actor behaves, or perhaps merely thinks, the way he or she does in the group to which he or she belongs because he or she believes others have similar intentions (Hodgson, 2006). These might include saving lives in EM. That is what is expected from him or her to achieve the collective goal (Searle, 2005). There is a shared collective intention, which in many cases is unwritten. While rules and norms impose some enforcement on individuals, rules imply clear sanctions. An external authority, such as a political entity, may impose them when the rule is not followed (Tuomela, 1995). On the other hand, norms do not necessarily imply clear sanctions, but if they are not followed, discomfort or marginalisation may be experienced by the individuals (Hodgson, 2006). The distinction between norms and rules has been further investigated in several works (Tuomela, 1995; Searle, 1995, 2005; Hodgson, 2006, Ostrom, 2005). In the present work, both are considered for analysis whenever they appear in the data, as both are treated as institutions.

Hodgson (2006) made a distinction between a rule and a law. For a law to become a rule, it needs to gain the *'customary status*' of a rule because many laws exist on paper but are not followed by individuals. Hence, these laws cannot be used to explain peoples' actions as they are ignored. Hodgson (2006) concluded that the definition of an institution is still subject to conceptual debates, similar to debates on the definitions of truth and justice (Searle, 2005). Therefore, a distinction between formal and informal rules is necessary. In crises, for example, as explained earlier, many formal rules are replaced by informal ones as they were found to be inapplicable in such situations.

In the present work, to clarify the meaning of institutions, a well-recognised definition offered by North (1990) is adopted that institutions are "the rules of the game in a society, or more formally, are the humanly devised constraints that shape human interaction… reduce uncertainty by providing a structure to everyday life" (p.3). Institutions differ from personal rules, e.g., going to bed at a specific time or brushing teeth once or twice a day. They are shared between the members of the domain or society. They are agreed upon, either explicitly or implicitly. The interactions between personal rules and institutions are important but not addressed here. Institutions are based on social interactions between actors (Voss, 2015). While there is a predominant view that organisations and institutions are distinct from each other, the present work adopts the view that organisations include institutional structures such as rules, norms, practices and beliefs, along with other components such as technical and managerial aspects (Voss, 2015). Institutions, in that sense, are elements of organisations.

Understanding the institutions in any emergency management domain, at the national and agency level, is very important as they are the basis of the system's configuration. Formal rules are salient and codified in the organisation's laws, policies, ministerial orders, plans and procedures. Emergency management legislation enforces organisations to behave in a certain way, for example, to share some information and exchange certain resources. Informal rules are latent, such as beliefs and routines that are not easily recognisable. A norm in the policing agency in Oman, for example, requires police officers to communicate with the same or lower ranks while interacting with higher ranks should only be taken when there is a necessity. These rules are not written but are expected to be followed, and sanctions are expected if violated. Hence, unwritten rules might influence actions more than written ones.

Following those rules, policymakers may establish their views (opinions) and actions as *legitimate* to themselves and others, such as the government and the public. These rules legitimise the exercise of authority (Scott, 2014). *Legitimacy* is defined as "a generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman, 1995, p.574). It is an outcome of complex institutional-cultural frameworks (Scott, 2014). An agency does not allow the

participation of volunteers in crisis management because they are not legitimised by law. Their participation is not desirable. Also, the military's engagement in civil contingencies may be considered appropriate or not appropriate based on the dominant rules in a society.

A feature of institutions that makes them an important phenomenon for observation is that they are relatively stable (Aoki, 2001) and not easily changed. If they change following a disaster, they may cause a significant shift in how things are organised and governed. Institutions persist because "they are carried forward by interacting individuals" (Scott, 2014, citing Hughes, 1939, p.26). As described by Wells (1970, cited by Hodgson 2006), they are "a type of social structure" that is important because they help us understand why actors perceive and behave the way they do (Searle, 1995). They are powerful analytical vehicles for understanding forces that resist new changes. By constraining some behaviours, they enable others (Hodgson, 2006). In most cases, these rules are followed without considerable thought (Hodgson, 2006) as they become embodied in the organisational values and routines.

Formal rules, in organisations' studies, could be classified based on the level or layer of institutionalisation. Ostrom (2005) developed a multi-level taxonomy of institutions based on constitutional, collective choice and operational rules. Constitutional rules specify actors' types and the underlying principles for making collective choice rules (Voss, 2015). In Oman, royal decrees are examples of this type of rule, as they specify the actors of the national EMS. Collective choice rules specify actors' roles and the institutions for policy making (Voss, 2015). An example, in this context, is the emergency management plan. It specifies the primary roles of the actors based on collective decisions taken by the actors themselves. Operational rules are particular to operations carried out on the ground. They help implement the decisions of the higher levels (Voss, 2015). Recognising the different levels of institutions is vital, as these must not conflict with one another. Incompatibility or tension between them could result in inefficient rules and unexpected outcomes (Ostrom, 2005).

Institutions are vulnerable to environmental threats and strong internal forces despite their relative stability. Studying processes and dynamics of institutional change is a well-established line of research, particularly among institutionalists and

organisational scholars and researchers. Different theories have been used to identify, classify and understand institutional change and the forces that enable them. However, the empirical literature scarce on disaster management that adopts an institutional-based perspective to explain the organisation and configuration of existing emergency management systems. Part of this work aims to contribute knowledge within this area of interest.

Several approaches to explaining institutional change have emerged (Coccia, 2018; James, 2016; Scott, 2014), particularly during the 1930s and 1940s. This development was driven by political scientists who tried to explain the emergence of new political regimes and governance systems, economists studying markets and resource management, and sociologists studying social change. Due to the wide range of interest in different disciplines, several conceptual models came to exist to explain *why, when and how* institutional change takes place. In a broad sense, they seem to agree on the central point that institutions shape human interactions in a domain (Sanders, 2006; North, 1990) and are subject to change. However, they seem to differ on the selection process that determines which institutions remain, change or dissolve. The selection process could be attributed to a central mechanism, such as a political entity or a decentral mechanism that is randomly agreed upon or has evolved through interaction between actors.

The goal here is not to provide a comprehensive review of all institutional change theories, as this would be a very ambitious aim beyond this thesis's capacity. Moreover, it has been attempted by different scholars, e.g., Scott (2014), Pierson (2004) and Coccia (2018). Instead, the focus here is on the relevant views that may provide analytical means for explaining the organisational setting of emergency management in Oman. Two prominent views that are well-established in the existing literature are discussed and compared here: (a) the design-based (Coccia, 2018) or rational choice approach (Sanders, 2006; Thelen, 2004), also known as the agent-led form of institutionalism (James, 2016), and (b) the evolutionary-based (Sanders, 2006; Thelen, 2004) or collective-choice approach (Scott, 2014), also known as historical institutionalism theory (Sanders, 2006).

According to the rational choice view and rational adaptation theories such as contingency theory and resource dependence theory, institutions are selected, calculated and rationally chosen by actors due to a response to environmental changes and threats (Hannan and Freeman, 1984). It can be noticed that this view places a considerable emphasis on the role of actors in making new changes. For example, actors design a new rule to improve performance, reduce cost or legitimise a new activity, or at least they intend to do so. However, they could also select institutions to protect their own interests and powers or maintain control over labour (Hannan and Freeman, 1984). According to this view, institutional change is attributed to a central mechanism, such as a political entity (James, 2016), or a standards-setting agency, such as a regulator. Any analysis that adopts this view focuses mainly on actors' roles, influence and preferences.

Despite its importance in providing 'functionalist explanations', this view has been extensively criticised (Powell and DiMaggio, 2012; Coccia, 2018). First, it studies institutional development and change from a snapshot of history and therefore tends to ignore influential elements stemming from historical circumstances and cultural underpinnings (Sanders, 2006). Opponents claim that actors do not select freely from the set of rules, routines and procedures (Powell and DiMaggio, 2012). These selections are an outcome of historical and cultural processes at any particular moment. This view also assumes a positive relationship between an actor's intentions and the creation of a new rule. The outcome of institutional changes does not necessarily mirror individual intentions. In fact, the literature shows that outcomes may be decoupled from the intentions of individuals (Hannan and Freeman, 1984).

The second prominent view that has gained wider attention and that is regularly compared to the rational or collective choice approach (Scott, 2014; Bhatnagar, 2014) is historical institutionalism (HI). As an evolutionary-based approach, HI attributes institutional changes to a decentralised mechanism (Coccia, 2018). It also attributes 'the empowerment of actors' to the same mechanism. In other words, the powerful actors are powerful due to evolutionary processes. Rules are evolved in an evolutionary manner, and they give actors powers. The subsequent selections are outcomes that become agents of change. As stated by Thelen (2004), there is an

element of chance that involves agency and choice in creating new institutions. Once a path is taken, it is hard to reverse. Therefore, history is very important in this view.

The building blocks of HI theory are path dependence, positive feedback mechanisms, critical junctures and punctured equilibrium (Sanders, 2006). Its main idea is that institutions undergo periods of stability (i.e., institutional equilibrium 'IE') *punctured* by periods of instability due to experiencing 'critical junctures'. These may be referred to as 'turning points' or 'unsettled times' (Capoccia and Keleman, 2007). They are critical periods, and critical decisions are usually taken in response to them. They are critical because they place institutional arrangements on paths or trajectories that are then very difficult to alter (Pierson, 2004; Thelen, 2004). A main notion of HI is that administrative reforms largely depend on the historical path that led to the current administration (Sanders, 2006; Pierson, 2000; Thelen, 1999). This phenomenon is described as 'path-dependence'. The reforms are path dependent, and it is necessary to understand them as they create institutions, i.e., rules and norms that could facilitate or constrain change. Therefore, HI employs much more narrative, and its casual chains are longer (Sanders, 2006).

Path dependence has gained prominence in explaining how choices, even single ones, made in the past play critical roles in the situation we are in today (Mahoney and Thelen, 2009). Therefore, important changes occur incrementally (Mahoney and Thelen, 2009), but they can materialise when the window is open in moments of crisis. Streeck and Thelen (2005) reviewed a collection of institutional change studies. They argued that major changes are due to the gradual accumulation of small changes that create 'tipping points' for a major change to occur. According to this view, the dramatic changes after a crisis are not sudden outcomes. Instead, they have been incrementally accumulated, and crisis times have merely opened a window for them to take place (James, 2016).

Historical circumstances such as civil wars and conflicts enable the formation of a certain government regime that remains the norm for a very long period of time. Due to crises and emergencies, new rules might emerge, and old ones might dissolve to adapt to new conditions. Yadav (2016) showed that new gender-relations rules emerged after the civil war in Nepal. These gave women more agency and rights. The

new rules are a “product of concrete temporal processes and political struggles” (Thelen, 2004, p. 26). The new actors with more agency might also influence the selection of new changes. In relation to the selection of new rules, the interaction between evolutionary processes and actors is very fluid and dynamic. In the EM domain, the decision to mandate military retirees to form EM organisations placed it on a path that resulted in creating militarised management models. Such decisions are difficult to reverse. In fact, these actors will reinforce a militarised approach to managing disasters by selecting new rules. In addition, ‘superficial’ positive disaster response feedbacks reinforce inefficient institutions.

In line with this view, population ecology theory explains the change of organisational structures in order to adapt to new environmental changes (Salimath and Jones, 2011; Hannan and Freeman, 1977). Adaptation occurs through selection and replacement processes (Salimath and Jones, 2011, citing Carroll, 1988). These authors claim that the forms that persist and spread across the population are ‘the best fit’ for that context. On the other hand, Random transformation theory claims that organisational changes occur due to endogenous processes. They could be coupled with organisational leaders’ desires and demands and threats to the environment (Hannan and Freeman, 1984). In relation to how useful it can be, according to this view, the transformation to a new structure or adoption of a new strategy is, in fact, random. If an innovation turns out to be useful, it is retained and is likely to spread across the population (Hannan and Freeman, 1984). An example within the emergency management domain is the Incident Command System (ICS). As it has proven effective in managing fire emergencies in the USA, it has been adopted by many governments to combat fires and respond to other hazards such as hurricanes and earthquakes. How useful the ICS is for other political and social contexts than where it was originally developed and for managing non-fire crises remains an open question.

Despite the growing interest in historical institutionalism (Powell and DiMaggio, 2012), it has received its share of criticism. A main argument is that analyses adopting the HI view tend to underplay or overlook the creative role of actors, despite the claim of its advocates that HI instead places actors in a social-historical setting (Sanders, 2006; James, 2016). They are ‘powerful’ actors because they were historically and culturally made. Similarly, some parties are not empowered because, in the past, a path was

selected that made such parties the way they are. Therefore, it undermines actors' accountability and places them in the 'victims' position. Mahoney and Thelen (2009) argued that there is a need for a general model that comprehends both sources of change.

There has been an extensive theoretical discussion about institutions and the debates between the two theories (e.g., Sanders, 2006; Hodgson, 2018; James, 2016, Streek and Thelan, 2005, Mahoney, 2000) but empirical analysis lags. Also, institutional change theories offer valuable analytical vehicles applicable in the political economy and political science disciplines. In the disaster management domain, there is a growing need to develop causal propositions to locate the source of change (Mahoney and Thelen, 2009). Literature is scarce in this field. In addition, both exogenous and endogenous factors must be addressed in an institutional change analysis and the need to bridge the two views into one analytical needs to be addressed (Voss, 2016).

In the present work, we consider both aspects to understand their influence on the selection of institutional changes. It is not possible to understand the current administrative structure without acknowledging the history behind its existence. Simultaneously, the role of individuals in supporting and dissolving institutions cannot be overlooked. Acknowledging both provides the flexibility needed to address the phenomenon under study adequately. This would also enable us to understand whether the changes are evolutionary or rationally chosen and whether they happen in response to a series of disaster experiences or following a planned trajectory of growth and transformation.

2.4.2 Disasters, Organisational Learning and Institutional Change in EMSs

Organisations should avoid committing the same failures or at least minimise the impact by learning from their own experiences and failures (Carely, 1992). They should also learn from the experiences of others who are part of the collective EM system. They should develop new institutions or dissolve the inefficient ones to optimise performance and enhance effectiveness. *Organisational learning* (OL) is a very important line of research concerned with how organisations learn, change, adapt

and evolve. As it is linked to performance and long-term success (Argote and Miron-Spektor, 2011), it is critical to the survival of organisations. Unlike learning by individuals, organisational knowledge, which is a product of OL, should not become lost when individuals leave the organisation, as it should be encoded in the organisation's routines, processes, procedures and rules (Desai, 2010). Therefore, OL is largely about institutionalising new ideas that emerge from experience, turning them into part of the organisation.

Organisations undergo experiences throughout their lifetimes. In order to function and perform better, they should utilise the knowledge that emerges from these. This relationship between an experience OL and organisational change is depicted in Figure 2-5. However, as will be shown later in this section, this process is not as simple as it may seem because it is confronted by many factors that make organisational learning difficult.

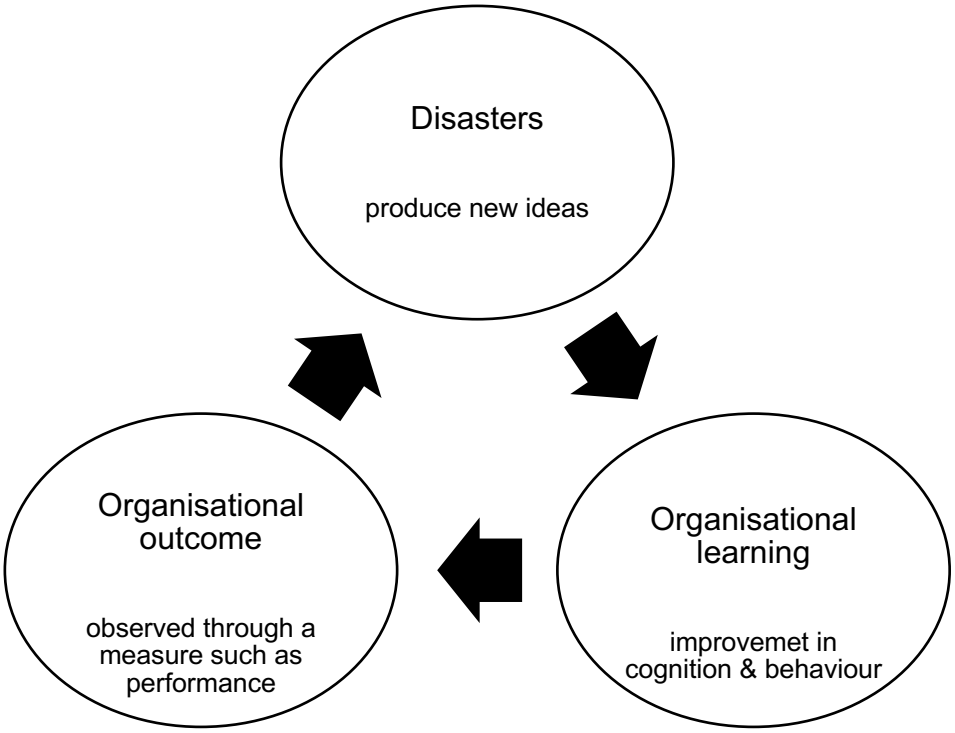

Figure 2-5 The triangle of OL based on organisational learning curve literature

OL spans a wide range of disciplines, and therefore different views on this concept have emerged. Some scholars perceive it as a change in the organisation's performance (i.e., organisational behaviour, such as how a task is performed or service is delivered). Others see it as a change in the organisation's knowledge - i.e., a change in organisational cognition, manifest, perhaps, as changes in the risk perceptions and awareness of hazards (Zhou et al., 2018; Argote and Miron-Spektor, 2011). These perspectives are complementary; they interact rather than contrast with one another (Zhou et al., 2018). In addition, organisational learning can be viewed simultaneously as a process and an outcome (Schilling and Kluge, 2009).

The view of OL as a change in an organisation's performance is the dominant one. Lampel et al. (2009) emphasised that learning should involve identifying the lessons *and* using them to improve performance. 'Learning occurs whenever errors are detected and corrected' (Argyris, 1995, p.20). Christianson et al. (2009, p.846) described it as a dynamic process involving ongoing revision of knowledge "in ways that improve organisational performance". According to this view, OL occurs when organisation members change their beliefs and actions after experiencing an event.

Several scholars have described OL as developing new procedures, routines, rules (Levitt and March 1988), new practices, systems, strategies (Crossan et al., 1999; Lawrence et al., 2005) and new effective communication structures (Carely and Harrald, 1997), while others consider refining existing skills as an OL outcome (Argote and Miron-Spektor, 2011). In this research, we consider OL as a change in the organisational "knowledge that can manifest itself in changes in cognition or behaviour" (Argote and Miron-Spektor, 2011, p. 1124). Therefore, organisational learning is largely about 'exploration' rather than 'exploitation' (March, 1991).

One of the most recognised frameworks to explain OL is Crossan, Lane and White's (1999) 4I model (Figure 1-5). It conceptualises OL as four processes: intuiting, interpreting, integrating and institutionalising that are related in feedback and feed-forward loops across three levels of learning: the individual, group and organisation levels. The members of an organisation first intuit and then interpret the experience and failures associated with it. Due to their frequent interactions, an integrated understanding of what that experience means should be established. The final process is that the organisation institutionalises and codifies this knowledge into new routines, processes, rules and procedures. Therefore, learning occurs when new ideas are institutionalised.

Organisations undergo experiences throughout their lifetimes. In order to function and perform better, they should utilise the knowledge that emerges from these. This relationship between an experience OL and organisational change is depicted in Figure 2-5. However, as will be shown later in this section, this process is not as simple as it may seem because it is confronted by many factors that make organisational learning difficult.

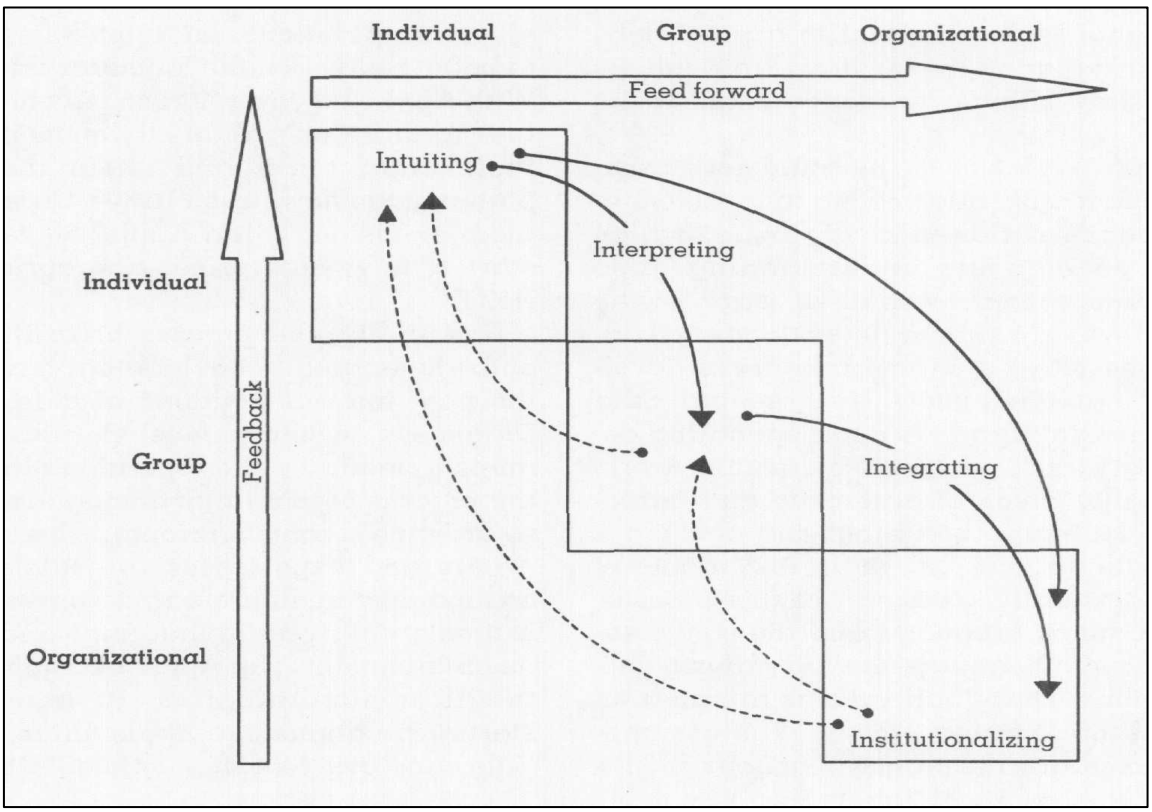

Figure 2-6: Organisational learning as a dynamic process – the 4I Model (Crossan et al., 1999)

The model helps us understand how learning from an event occurs within the organisation. However, it places the researcher in a position to attribute changes to the event, as it does not address the socio-political influence on the selection of changes. In addition, its central concept is *strategic renewal*, which implies that organisations must explore new ways in order strategically to renew themselves (Crossan et al., 1999; March, 1991). This idea is derived from research on private businesses, usually driven by the need to maximise economic profit. Public sector agencies, on the other hand, operate in a less competitive context and are not necessarily encouraged by strategic renewal and organisational survival. Normative persuasion and the existence of professional norms-setting authority were found more enforcing mechanisms for change within government agencies (Provan and Milward, 1991). Nevertheless, economic profit can be applied at the macroeconomic level between the governmental and non-governmental sectors. Understanding why this phenomenon can occur in a public sector context represents a knowledge gap that requires further research.

Organisations learn not only through their own experiences but also indirectly through the experiences of others (Huber, 1991), which is termed 'vicarious learning' (Madsen, 2009). For example, the failures of others could be turned into a new policy that forces organisations to follow a new standard and consequently avoid the same failures. Similarly, an organisation may adopt an information management system that has been proven to work well for other organisations. This phenomenon has been very well observed across different industries (Madsen, 2009), with special regard to aviation accidents (Haunschild and Sullivan, 2002), railway crashes (Baum and Dahlin, 2007) and nuclear plant accidents (David et al., 1996). Madsen (2009) found that an effective mechanism for vicarious learning occurs through the changes in safety regulations following a disaster, as regulations would apply to both affected and unaffected organisations. This change mechanism is possible if there is a regulator, such as a telecom or electricity authority. However, in many cases, government agencies that offer emergency services lack an overall standard-setting authority. Therefore, looking into public sector organisations and whether or not this type of learning occurs remain an important research subject requiring more attention.

Since the emergence of OL, several lines of research have developed within the organisation science and management domains. An important one concerns the relationship between OL and the different types of experience that trigger learning and change within organisations. Experience can be broadly classified into two types: experience from routine events such as daily or regular operations, exercises, training and simulations, and experience from non-routine events such as major failures, large-scale emergencies and extremely rare events (Desai, 2010). The former type could be defined as 'the repetitive experience gained by an organisation's members as they engage in routine operational activities to assemble the organisation's core product or service' (Desai, 2010 citing Argote, 1996, 1993, p.204). An example of direct experience within the EM field is the daily civil protection operations such as fire suppression and emergency rescue and the daily emergency medical tasks.

Examining the relationship between 'daily' operating experience and OL has received substantial attention. A general finding is that organisations improve their performance in a domain as they gain more experience in that domain (Madsen, 2009). This pattern has been well-documented across different industries, such as finance, medicine and

manufacturing, with different organisational outcomes as a measure of learning, such as quality of service and speed of task delivery. The learning mechanisms from these routine events differ from those from disasters or rare events (Madsen, 2009), as the latter lacks the repetitive nature that characterises the former (Desai, 2010). Therefore, a wider range of impediments can obstruct learning from disasters.

Another type of experience derived from routine events is practical experience, such as from training, exercises and simulations, which aim to produce knowledge that can be utilised to increase response capacity. They enable participants to test their tacit knowledge under simulated contexts. As many actors participate, each may have a different mental model and situational awareness. These joint exercises may facilitate a shared mental model and offer a platform to challenge their procedural knowledge (Paton and Jackson, 2002). Despite continuous calls to write down emergency operations procedures, the literature shows that procedural knowledge is very hard to verbalise and is more likely to be obtained through experience (Paton and Jackson, 2002).

Experience from non-routine events, the second type of experience that feeds into OL, is a recognised theme within institutional change studies. It tells us that disasters and crises open a window for new and possibly transformational changes. These are viewed as unfreezing events because they cause organisations to reconsider their existing rules, procedures and routines (Carely & Harrald, 1997 citing Schein, 1972). Carely & Harrald (1997). Organisations learn from disasters in leaps rather than gradually over time. Alexander (2002a; 2008a) mentioned that significant changes are seen during the so-called ‘window of opportunity’, which immediately follows a crisis due to a catalyst effect of emergencies. New legislation and restructuring of governmental organisations can be seen in such periods. In many countries, emergency management has evolved in response to specific emergencies. For example, the 2004 Indian Ocean tsunami triggered the development of a global early warning system for all types of hazards (Fearnley and Dixon, 2020).

Italian civil protection witnessed significant institutional changes after experiencing a series of devastating earthquakes (Alexander, 2008b). It, as a result, evolved from an *ad hoc* commissariat that was purely reactive to a Ministry of Civil Protection, then

to a national department that received instructions from the Council of Ministers (Alexander, 2008b). In addition, the responsibility for coordinating EM services has devolved from provincial to local levels. In the USA, emergency preparedness, as it is known there, has also undergone different phases of evolution (Alexander, 2002b; Waugh and Streib, 2006) in response to particular large-scale emergencies. Since the 1950s, it has evolved towards a more civilianised, collaborative, flexible system, developing beyond the bureaucratic top-down model (Waugh and Streib, 2006). However, it began to militarise and nationalise following the Cold War (Beresford, 2004 cited in Alexander, 2007a). More recently, in response to the 11 September 2001 terrorist attacks and the aftermath of Hurricane Katerina, emergency preparedness policies in the USA began to lean back towards a more authoritarian command-and-control model that limits the participation of individuals and non-state actors (Alexander, 2002b; Waugh and Streib, 2006). When the Federal Emergency Management Agency (FEMA) was brought under the Department of Homeland Security, it dramatically changed its organisational culture towards one dominated by militaristic norms.

Two conflicting views exist concerning whether or not organisations learn from emergencies. Several studies show that extreme events trigger learning that could lead to an organisational change (Lampel et al., 2009; Desai, 2010; Madsen, 2009; Christianson et al., 2009; Zhou et al., 2018). Christianson et al. (2009) found that the EM activities of a museum were audited in response to interruptions caused by rare fires. Similarly, Zhou et al. (2018), adopting Crossan et al. (1999) 4I model, showed that a utility company learned through the interruptions caused by the 2012 Northern Italian earthquakes. By interviewing participating actors, they showed how the integration and transfer of knowledge took place between the different knowledge repositories (individuals, groups and the organisation). They concluded that earthquakes triggered an audit of the organisation's knowledge repositories (Zhou et al., 2018).

Another view is that it is very difficult to interpret the appropriate lessons (Lampel et al., 2009; Desai, 2010; Madsen, 2009). The claim that organisations make *critical* changes *successfully* when undergoing extreme experiences has been a matter of debate and research for a long time (Hannan and Freeman, 1984; Desai,

2010). While these two views seem to contradict one another, a reconciliation between them can be reached through understanding Argyris's classification of organisational learning. According to Argyris (1977; 2004), two types of OL exist: single-loop and double-loop learning. The former is most likely to occur following emergencies as it is about changing techniques and procedures.

In contrast, double-loop learning is less common and requires a serious challenge to existing governance norms. It is about changing the underlying assumptions, beliefs and possibly the nature of the organisation (Argyris, 1977). The existing literature seems to agree that there will always be some form of change following an extreme event, but whether or not the form will be beneficial or needed is a different question. Again this goes back to the definition of organisational learning as whether it must entail the ability to identify and implement the right lessons. Adopting random transformation theory, Levitt & March (1988) claimed that OL is random in relation to the improvement of performance. It could lead to better performance but does not necessarily do so. Therefore, the relationship between OL and performance may not be positively correlated.

A form of learning that was found to occur following a disaster shows that experiences help build mental models of these events, which could enable actors in similar situations in the future to form accurate situational awareness (Endsley, 1995). As they build a mental model, actors focus on the most relevant information rather than being distracted by the high volume of information. They would rely on accurate sources of information. Then, they would make sense of it based on their understanding of similar situations. Accordingly, they would project possible scenarios based on these two essential processes. Paton and Jackson (2002) mentioned that operational effectiveness relies on mental models derived from emergency experiences.

Similarly, the absence of mental models (the absence of experience) increases the difficulty of establishing an accurate and complete SA and consequently making the right decisions. According to Endsley (1995, p. 34), 'There is evidence that an integrated picture of the current situation may be matched to prototypical situations in memory and that each prototypical situation corresponds to a "correct" action or decision'. This mechanism has been termed a 'pattern-matching' mechanism. An

experienced emergency manager, for example, would be more able to classify an observed flash flood into an exact mental representation based on his or her experience. This classification would provide him/her with detailed information about the severity of the flood and, accordingly, would initiate a course of action. On the other hand, someone who has not experienced flash flooding may not achieve this classification level and would consequently absorb less information about the same observed element.

Mental models require knowledge to be kept with the members of the organisation. Individuals leave organisations at any moment for a variety of reasons. Thus, this important knowledge should be translated into organisational learning so that it is retained and widely shared among its members. The existing literature shows that organisational learning from crises is not easy (Carley & Harrald, 1997). Several intertwined barriers could stem from the nature of the disasters themselves, as well as from the organisation and its preferences and the context in which it operates, especially the socio-political environment. Understanding and recognising those impediments and how they are generated is an important process that facilitates organisational learning and institutional change.

First of all, despite being an important source for learning, disasters do not provide an in-depth and comprehensive experience due to their rarity and specificity. Learning occurs when disasters have become similar recurrent phenomena, perhaps involving the same hazard, such as a hurricane or a landslide or a pandemic. For this reason, learning from them has been described as ‘categorical learning’, as an organisation learns category by category (Carely & Harrald, 1997). However, this logic undermines the actors’ ability to extend the experience from one type of event to another. Hence, this remains an argument that is wide open for further inquiry. Nevertheless, experience and learning from disasters must be complemented by other learning tools, most notably scenario-based planning (Alexander, 2002a; 2016).

Some scholars have also paid particular attention to differences between organisations regarding their capacity to learn, known as *‘organisational learning capacity’.* As Christianson et al. (2009) claim, ‘learning from the event’, as is found to be more prevalent across the largest proportion of the existing literature and in

practice, implies that learning entails studying the event itself and not the organisation that was involved in response to it. Therefore, they call for replacing that term, and the mindset associated with it, with ‘learning through the event’, arguing that the latter implies that an organisation should make sense of the event and understand what it is saying about its organisational structure, strategy, leadership and culture. The difference between learning from disasters and learning through disasters lies in shifting the focus away from studying the event to studying the organisation in which OL should be occurring. In the present research, the aim is not only to understand what stakeholders learned about cyclone emergencies but also what they learned about their existing systems in light of their experiences.

In relation to organisational learning capacity, another important differentiator between organisations is the relationship between the two types of experience: non-routine events and routine ‘daily’ operations. Addressing the conflicting theories about whether organisations learn from failures, Desai (2010) showed that organisations with high routine operating experience benefit more from failures of rare events than those with low operating experience. Consequently, they will respond better to future disasters. As many emergency responders are engaged daily in non-emergency work, they should conduct regular emergency training and exercises to familiarise themselves with this different environment and their roles in it.

Another important aspect that is gaining more attention regarding why learning the right lessons is not taking place originates from institutional change theories. According to the historical institutionalism view, *inefficient* institutions persist because they are reinforced by positive feedback (Thelen, 2004). First, many EMSs are largely designed for coping with fairly predictable events but fail to perform well under unscheduled extreme events (Nohrstedt et al., 2018). Performing well under fairly-predictable events reinforces the perception that these systems are effective, particularly in societies where governments like to be praised for their efforts. In addition, they are reinforced by higher institutions and, most importantly, by cultural norms, religious beliefs and political ideologies. Identifying those positive feedback loops is important in understanding the underlying processes for creating institutional resistance to new and needed changes.

Furthermore, organisations are selective and tend to focus on certain aspects at the expense of others (Lampel et al., 2009). As explained by Crossan et al. (1999), this selectivity can manifest itself in any of the four processes of OL, namely intuiting, interpreting, integrating and institutionalising. These processes are all confronted by several barriers. Table 2-4 shows the key findings of a systematic review by Schilling and Kluge (2009) of the institutional barriers that could originate from individuals, organisations and the societal-environmental context.

Table 2-4 Barriers to learning from emergencies. (Modified after Schilling and Kluge, 2009).

Barrier level	**Examples**
Individuals/Personal	Perceived irrelevance of new change for future Lack of knowledge to implement the new change Perforated memories Past experiences of conflicts Low level of trust Cynicism towards the new change New change viewed as a threat Perception of disasters as outliers (Lampel, Shamsie & Shapira, 2009) Perception of people as passive beneficiaries
Organisation/Structure	Lack of time and resources Poor communication among different levels of responders (Wankhade, 2012) Inconsistent with organisational strategy and policies Lack of clear responsibility Conflicting organisational responsibilities Unfamiliar tasks to lead agency Absence of standards-setting authority
Society/Environment	Rapid technological change Structural and technical difficulties Inconsistent with the predominant mode of governance The politicisation of disasters (Broekema, 2016) complexity nature of events (Desai, 2010)

Rational choice theorists place emphasis on actors and their powers and preferences when explaining learning impediments in organisations. New changes can be viewed as threats to existing actors, particularly in primitive institutions (Colson, 1974; Posner, 1980, cited by North, 1991; Lawrence et al., 2005). Ayres (1944) explained how individual wealth, status and power patterns could create strong resistance to new

changes. As some actors enjoy a certain status and degree of power in current institutions, they may favour institutions according to their interests (North, 1990). Therefore, according to this view, institutionalising new ideas learned from emergencies could face resistance from the actors themselves.

Adopting Crossan et al. (1999) model of OL, Lawrence et al. (2005) identified the powers of 'influence, force, discipline and domination' exercised across different organisational levels by actors. These important dynamics facilitate or hinder organisational learning (Lawrence et al., 2005). Powerful actors influence how events are interpreted by affecting the costs and benefits associated with each interpretation. They then force a range of options and make them available to other members by exploiting existing organisational hierarchies and legitimacy. While these powers could hinder OL, as Lawrence et al. (2005) argued, they should be utilised to overcome potential resistance and support the institutionalisation of newly learned ideas.

On the other hand, historical institutionalists attribute learning impediments to historical and cultural factors. For actors, the set of selections has been influenced by the path a system has taken in the past. For example, it could be difficult to apply a democratic emergency management system in a political context where an authoritarian system of governance is dominant. This hypothesis requires more empirical analysis, which the present research will endeavour to provide. A recognised phenomenon within organisations that create internal resisting forces that prevent adaptation to dynamic changes is 'structural inertia' that itself is an outcome of an 'ecological-evolutionary process' (Hannan and Freeman, 1984).

Most existing works on OL have focused on private enterprise. On the other hand, public agencies are large bureaucracies that operate in a less-competitive environment and are driven by other motivations. In the business domain, fierce competition exists to dominate or hold a significant market share. Some organisations may not survive. Therefore, learning from failures to achieve strategic renewal is linked to organisational survival. The situation might be different with public agencies, as they are supported and funded by governments. More research is needed to understand how and what public agencies learn from large-scale emergencies. Section 3.6.2 discusses the conceptual and analytical framework adopted in this research.

2.5 Conclusion

Large-scale emergencies, if not managed properly, could result in disasters, causing widespread impacts and disrupting social life for a large number of people (UNDRR, 2009; Quarantelli, 1997; Kreps and Drabek, 1996). Because they create widespread needs that cross administrative, geographical, organisational and sectoral boundaries (House et al., 2014; O'Leary, 2018), they require specific response-related demands, as found earlier by Quarantelli (1997). One way of reducing their risks and fulfilling those demands is having an effective response system that is built upon cross-agency and cross-sectoral collaboration (Alexander, 2002b; 2005) that allows the participation of multiple stakeholders (Nohrstedt and Bodin, 2014) and integrates the three levels of government, a system that is flexible enough to adapt with the dynamic nature of emergencies through accommodating emergent human and material resources (Drabek and McEntire, 2003). Secondly, as disasters affect local 'communities' (Lindell and Perry, 1992), an effective response system should be based on local disaster management (McLoughlin, 1985; Alexander, 2007a; 2008a, 2016) that recognises the important roles of local state and non-state actors and builds local capacities and incorporates local knowledge. Such an approach effectively facilitated and expedited self-organisation within affected local communities (Comfort, 2007).

In reality, these principles are not easily translated into practice. Alexander (2007a) showed that the managerial model would fall between two modes of management: authoritarian state-based command-and-control and participatory collaboration-based approach. While researchers and scholars advocated implementing the latter model as it was found to be more consistent with disasters' realities, the former is more popular among practitioners (Drabek and McEntire, 2003) for various reasons, as mentioned earlier. Therefore, there is a plausible general assumption in disaster management literature that the evolution or a 'positive' growth of an EMS can be viewed as a shift in the managerial model from the former to the latter, moving towards the identified principles, as Figure 2-2 shows. However, there is a scarcity of empirical studies investigating this phenomenon – evolution as a consequence of experience. This case study aims to bring new insights into whether this happens and whether the

command-and-control EMS in Oman has evolved along this trajectory after experiencing several cyclone emergencies.

This objective is accomplished by examining the response to four consecutive cyclone emergencies to identify the right lessons to be learned and, second, identifying the actual changes and their dynamics and forces. Several theoretical frameworks were reviewed, including network theory, systems theory and complexity theory. Chaos theory was found more appropriate for studying emergency response. It helps focus on the initial factors and conditions (before the crisis), the emergency conditions and external factors that explain the system's behaviour. Failures of response and lessons to be learned can be identified through chaos theory's notions. As its application is early in disaster management (Farazmand, 2001), this research aims to address the gap when a system enters a state of chaos and the factors that facilitate self-organisation (Koehler et al., 2014).

The review also covered the different approaches used to study organisational learning and institutional change. The conclusion is that many scholars and researchers call for a balanced approach to studying institutional change (Sanders, 2006; Pierson, 2004; James, 2016). They call for an approach that considers the roles of actors and the roles of the context that influences the selection of changes. Therefore, three forces of change are considered here: (a) emergencies and other exogenous factors, (b) rational selections and preferences of policymakers, and (c) influence of the 'context' that includes historical-cultural circumstances. Whereas most of these studies have been largely theoretical, there is a need for more empirical work regarding emergency management. In addition, there has been a focus on studying single organisations. However, little effort has been made to study this phenomenon – organisational and institutional change – in a multi-organisational governmental context.

CHAPTER 3 RESEARCH AIM AND METHODOLOGY

3.1 Introduction

This thesis addresses one of the neglected issues in disaster management: institutional learning and change in the context of emergency management following a series of emergencies. As discussed in the previous chapter, most of the literature either focuses on examining a single event or studying organisational learning within the private sector domain, in which the context is different. In addition, most studies evaluate learning based on the domain's existing best practices. While there is a wide range of studies that rely on observations and secondary-sourced data, there is an ongoing need to study responses to actual emergencies, how the EMS was organised on the ground, who was actively involved, and what lessons were learned from them.

This thesis adopts a qualitative research approach by collecting qualitative data using multiple methods. These are primarily in-depth interviewing, supplemented by participant observation and official data, as summarised in Figure 3-1. All data were analysed thematically and qualitatively with the guidance of several hypotheses. The research outcome is a model of EMS at the local levels and a conceptual framework detailing the relationships between institutional learning dynamics, emergencies and other influencing factors. This chapter introduces the research aim, question and guiding hypotheses, followed by a discussion of the research methodology, data collection methods and data types considered appropriate to tackle the research question. After this, there is a discussion of why the thematic analysis was chosen. The section will also cover the theoretical and analytical frameworks that have guided the research process. Limitations and challenges encountered by the researcher are discussed throughout the chapter where applicable.

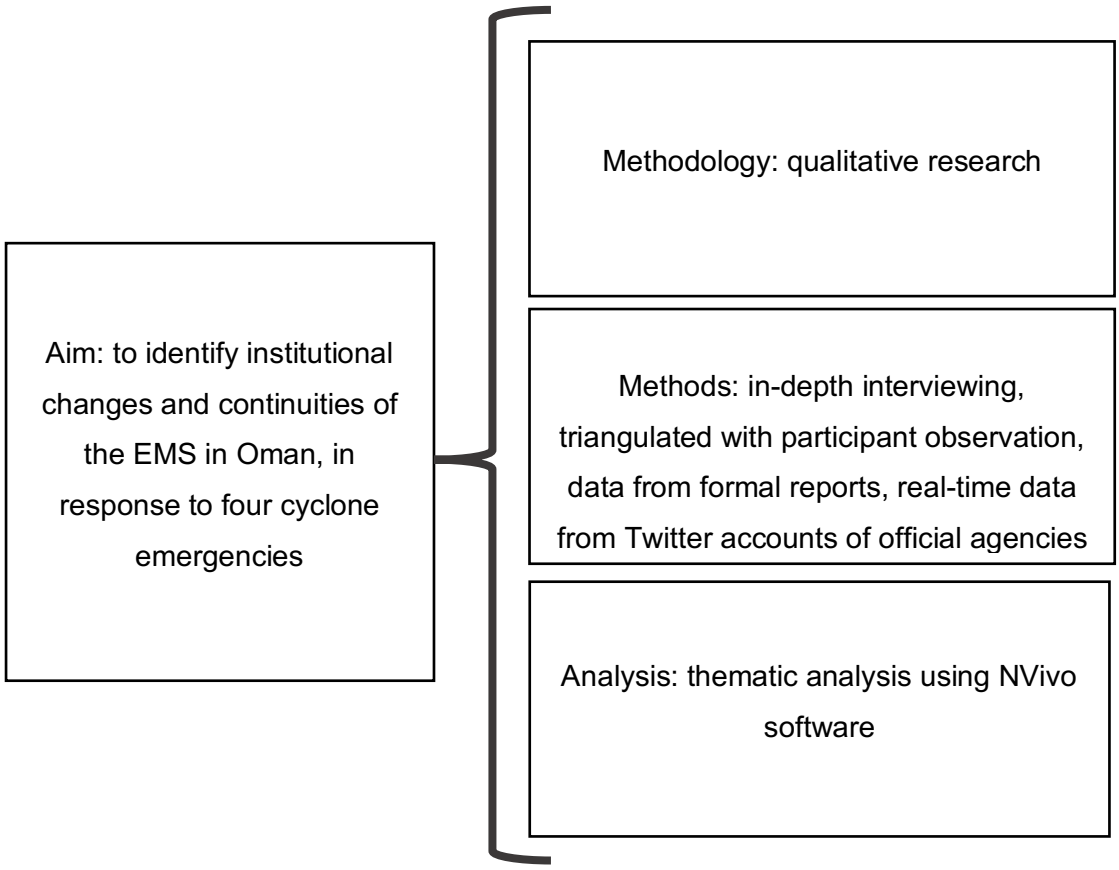

Figure 3-1 Research Aim and Methodology

3.2 Research Aim, Questions and Propositions

This thesis aims to understand whether Oman's emergency management system (EMS) has evolved in response to a series of cyclone emergencies. This aim was broken down into three main objectives: (a) to identify how Oman's command-and-control system functioned in four cyclone emergencies in order to consider its successes, failures and lessons; (b) to identify the nature of learning of the formal system and the dynamics and forces behind them; and (c) to recognise the persistent practices and continuity of norms that have remained unchanged and what factors enabled their continuation. In order to recognise the roles of emergencies and identify the roles of other forces, this work investigates the phenomenon of organisational learning from emergencies and subsequent institutional change.

Figure 3-2 illustrates the three interconnected objectives and the analyses adopted to arrive at an answer to the research question. First, the four selected cyclone emergencies (Gonu 2007, Phet 2010, Mekunu 2018 and Luban 2018) were thoroughly studied to identify the differences in response to each event through characterising: (a) the *existing* management system, i.e., the actors who were actively involved whether planned or spontaneously emerged, and the main preparedness measures and response operations that were carried out, and (b) the emergency conditions that existed during these events as they set out the context or the theatre of operations under which the responding agencies operated.

Through exploring the relationship between the emergent response and the emergency conditions, important inferences can be drawn regarding whether the formal system functioned well under the different emergency contexts, whether the formal actors met the needs, and whether the planned procedures had broken down. Section 3.6 explains the theoretical and analytical frameworks adopted for this purpose. The findings of the comparative analysis of responses, presented in Chapter 4, set out the underpinnings for the next objective as they present the right lessons that should be implemented regarding the organisation of emergency management in Oman.

The second objective is identifying the main institutional and organisational changes following these events. Then, a comparison between the findings of the first and second analyses – comparing the implemented changes with the changes that should have been implemented – was conducted to understand the nature of changes and continuities and the dynamics behind them. Section 3.6 explains the theoretical and analytical frameworks adopted for this purpose – to answer whether institutional learning has taken place and, if so, what its dynamics were and, conversely, what impeded it.

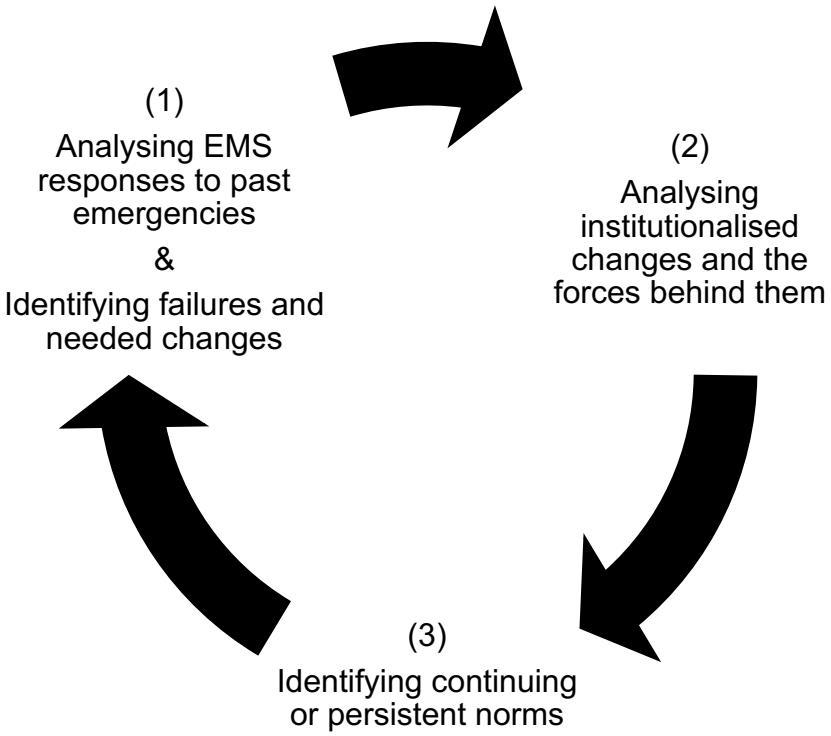

Figure 3-2 Data Analysis Process

This research is guided by the overall question: how has the EMS in Oman (a command-and-control central governmental system) changed and evolved after experiencing a series of cyclone emergencies? In order to answer such a question, it had to be broken down into the following four components:-

- What were the failures and lessons of the EM command-and-control system that should be learned from its response to the selected cyclone emergencies? How were they overcome during the response phase?
- What were the main forms of institutional change occurred following these cyclone emergencies? When and how did they take place?
- Were the proper lessons found, identified and implemented? If not, what factors were impediments to learning?
- What forces, sources or dynamics have influenced the institutional development of the EMS in Oman, i.e., what is the managerial model?

In qualitative research, the use of questions is more frequent than the use of hypotheses (Chigbu, 2019) as it is more associated with generating hypotheses than testing them (Sullivan & Sargeant, 2011). However, many qualitative scholars still recommend using them in qualitative research, claiming that: (1) qualitative hypotheses do not need to be tested or (2) they do not need to be tested quantitively (Chigbu, 2019; Sullivan & Sargeant, 2011). The researcher adopts the view that explicitly stating hypotheses in qualitative research is important as they limit the scope of research, which is very important and guides the researcher to focus on studying relevant phenomena. Two sets of hypotheses were developed. The first set (hypotheses 1a and 1b) are related to the analysis of EMS responses to the selected cyclone emergencies. Hypothesis 1a states that there is a relationship between the functioning of the EMS and the emergency environment. In this case study, the EMS is a command-and-control system that represents the classical model of centralised governmental approaches with the lead of a paramilitary agency. It is hypothesised that its functioning is associated with emergent emergency conditions. Hypothesis 1b indicates a relationship between the emergence of adaptive management forms and the formal system's functioning during emergency response.

> **Hypothesis (1a):** During highly disruptive natural hazard impacts, the formal command-and-control governmental model for managing emergencies functions poorly in terms of delivering the required aid and successfully managing the crisis.

> **Hypothesis (1b):** When the formal system fails, a new form of management of the adaptive locally-based kind emerges to fill these gaps.

The second set (hypotheses 2a, 2b and 2c) are related to organisational learning from crisis and institutional change. Hypothesis 2a states that there is a positive relationship between organisational change and the occurrence of emergencies. This hypothesis derives from existing literature, as discussed in section 2.4, that major organisational changes occur during the window of opportunity that follows the emergency response. Hypothesis 2b states that the pre-existing socio-cultural and political norms of

management influence the nature of changes implemented after a crisis. Hypothesis 2c postulates that there is an associative relationship between identifying and implementing lessons and the context or action area in which this occurs.

> **Hypothesis (2a):** Most institutional changes occur following large-scale emergencies during the 'window of opportunity' (Alexander, 2002a; 2008a).
>
> **Hypothesis (2b):** Most changes are consistent with the socio-cultural and political norms of the existing management model: 'single-loop learning' is dominant, and 'double-loop learning' is rare (Argyris, 1977).
>
> **Hypothesis (2c):** Internal resisting forces mean that important lessons from crises are barely identified and inadequately institutionalised.

3.3 Methodology

A qualitative case study was found to be an appropriate strategy to approach the research question. It is a well-established strategy for theory building. Hult and Walcott (1990) analysed the Challenger disaster to develop a new theory of governance networks, and Burke (1986) cited by Bailey (1992), used it to analyse the evolution of the Environmental Protection Agency in order to advance his theory of bureaucratic responsibility. Case studies have also been increasingly used to test hypotheses qualitatively (Chigbu, 2019; Flyvbjerg, 2006). Here, it was found consistent with the philosophy of science adopted in this thesis that social phenomena are of the interpretive variety and that reality and knowledge should be understood in the social context in which the phenomena occur (Thiel, 2014). The aim is to obtain detailed, rich and extensive descriptions of the phenomenon under study, and a case study research strategy has been able to achieve this aim (Thiel, 2014). Qualitative data are needed to build theoretical bases, 'the building blocks' for new theories, or to further develop existing theories (Yin, 2009). This is certainly the case for the growing field of

institutional evolution and change in relation to emergency management. The objective is to understand the phenomenon and its influencing factors and describe them before theorising and testing them. They are considered concrete qualities rather than abstract quantities (Kvale and Brinkmann, 2009).

There is a substantial discrepancy among scholars on the definitions of institutional change and organisational learning from crises and how these could be measured quantitatively. In fact, measuring changes is described as a subjective process that could produce misleading results. Therefore, qualitative data are needed to help formulate better criteria for measuring changes. Hence, qualitative research was found to be the most suitable to achieve the aims of this study. The qualitative method is about finding themes within a dataset. They and the relationships between them should explain the phenomenon, why it occurs, or when and how it occurs. These themes and the relationships identified between them are outcomes of qualitative research. However, they are not necessarily causal relationships. Nevertheless, they remain propositions related to the phenomena. The regularities found could be followed by a subsequent quantitative analysis to assess whether they are real or occur merely by coincidence (Bryman, 2015).

In qualitative work, researchers' ontological and epistemological positions guide the research in a particular direction and influence its conclusions (Chigbu, 2019). The researcher's preconceived ideas, views, knowledge, skills and methods of investigation can influence the research (Chigbu, 2019; Marsh & Furlong, 2002). Therefore, it is important to clarify the ontological and epistemological positions adopted for this research. The present work follows an interpretative philosophy of knowledge which states that social systems are fundamentally different to those of the natural sciences and, therefore, cannot be subjected to the same scientific inquiry (Bryman, 2015). The epistemological position in this thesis, as in many qualitative research studies, is that reality is socially constructed and agreed upon based on the experiences of research participants who witnessed the events and the changes that occurred after them. As Phelan (1999, p. 242) put it, 'The closest we can get to ontological reality is a shared agreement about experiential reality'. The evolution of the EMS is viewed through their experiences but corroborated through the analysis of legislation, official plans and reports. Therefore, to study institutional transformation,

this research utilises a top-down approach. It uses coordinators' lived experiences to capture what occurred in these events and what changed afterwards, i.e., whether there was significant learning from emergencies.

The first assumption in this research design is that the phenomena under study, institutional and organisational responses and change, occur in an intertwined cluster of influencing factors and, therefore, cannot be isolated to be examined. They need to be studied within their context, as it forms an important source in explaining the phenomenon. The system's complexity due to internal and external interactions affects our understanding of what happened and why it happened (Abrahamsson et al., 2010). Hence, factors should not be considered in isolation. The second important assumption is that while institutional development and change are viewed as a continuous process rather than a final goal, the broad foundations on which the EMS should be built, as found by reviewing the existing literature, are considered criteria that guide the trajectory of growth.

3.4 Methods

This thesis is multi-method qualitative research. Several data sources were used, but in-depth qualitative interviewing with key response agencies was the primary method. It was found appropriate for collecting primary data for this work. It was consistent with the research aim and chosen methodology and very appropriate to the context in Oman. First, it allows one to approach the dual objectives of this research with each participant, namely, understanding the governmental responses to selected past cyclones and identifying the institutional changes in the emergency management system. Also, interviewing allows the interviewer to explore 'complex issues in the subject area by examining the concrete experience of people in that area and the meaning their experience had for them" (Seidman, 2006, p. 16). Interviews enabled the researcher to probe for further in-depth explanations to understand people's perceptions.

This method for collecting data from government officials was found to be more appropriate than surveys. As it is relatively rare to encounter a culture of research in

Oman, particularly among government officials, a very low response rate to surveys was enjoyed by previous studies (Al Shaqsi, 2012). Also, many concerns were raised regarding surveys' ability to capture genuine multi-organisational work (Nohrstedt and Bodin, 2014), as participants may view the concepts of organisational learning and collaboration differently. Some participants said they had never been involved as research informants before. Furthermore, interviews allowed the researcher to discuss sensitive issues with the participants, such as barriers to learning and failures of response, which is exceptionally important where the participants are senior or middle management government officials who are being asked about performance.

The interview process was systematic, following the seven steps recommended by Kvale and Brinkmann (2009). These are thematising an interview, designing, interviewing, transcribing, analysing, verifying and reporting. The translation was also performed while transcribing interviews, as they were originally conducted in Arabic. An interview guide was first prepared, and a pilot study was conducted to assess it. Three interviews were conducted with operational middle-level police officials who were actively involved with Cyclones Gonu 2007 and Phet 2010. They coordinated the response on the field. The pilot interview helped the researcher to re-phrase several questions, add new ones and delete vague phrases. Appendix B – Guide for interviewing emergency management government stakeholders was used at the beginning of the research. Table 3-1 includes the main topics that were discussed.

Table 3-1 Main Topics discussed with research participants

1	Agency's EM roles, tasks and objectives
2	Resources, CIs and other actors' outputs that were relied on to perform own's tasks
3	Planning and preparedness measures before cyclone's impact
4	Direct and indirect impact of the cyclone on EMS and actor's individual tasks
5	Forms of challenges and failures encountered during emergency response
6	Perceptions on system's performance during response
7	Lessons learned and changes that were made after each event and changes that still need to be implemented
8	Perceptions on disasters, why they occur and how they should be managed

9	Perceptions on the roles of non-state actors e.g., private businesses, NGOs and local communities during emergency response Other issues and challenges during emergency management

Validity and reliability have always been a subject of criticism in qualitative research. Hence, serious attempts should be made to establish rigour. Most evidently, participants' memories of the past can be fallible, and their accounts can be influenced by personal biases and value judgements (Abrahamsson et al., 2010). Data triangulation was used as a methodological solution (Thiel, 2014; Bailey, 1992; Yin, 2009). The consistency of opinions was also analysed. Interviewees' qualitative data were triangulated with other sources of data. First, participant observation and notes from actual visits to control rooms and emergency management centres were used to corroborate some data. The researcher had the opportunity to visit the national emergency operations centre, the medical emergency operations centre, the early warning and monitoring centre, the HAZMAT operations centre and the national forensic laboratory. These visits allowed the researcher to observe the work on the ground, systems and procedures used in these control rooms. Notes from these visits were imported into the NVivo software and used for the thematic analysis in conjunction with other data sources.

Secondary data were also used. First, laws, decrees and regulations related to EM in Oman were collected and analysed (see Appendix A – Main emergency management regulations in Oman). The researcher also had access to several emergency plans and proposals that are not accessible to the public, see Table 3-4. Official reports from responding agencies about the events and media reports that followed the emergencies were also collected and analysed, see Table 3-4. Being recent events, for Mekunu and Luban, it was possible to capture real-time data from the official Twitter accounts of responding agencies, which was achieved via the NCapture plugin used in conjunction with the NVivo Package. In qualitative research, several data sources are used to increase the internal validity of data sets. Each source of data was given a reference code.

Table 3-2 Other data sources used in this thesis in conjunction with primary data from in-depth interviewing

Official EM Documents (OD)	**Code**	**Tweets from official Twitter (T) Accounts published during the event***	**Code**	**Secondary Sources (SS)**	**Code**
The national emergency management plan	OD1	@PACAOMAN Public Authority for Civil Aviation	T1	A Report on the Super Cyclonic Storm "GONU" during 1-7 June 2007 published by India Meteorological Department.	SS1
		@PACDAOman Public Authority for Civil Defence and Ambulance	T2		
Operational emergency response procedural plans	OD2	@RoyalOmanPolice Royal Oman Police	T3		
		@nccdoman National Civil Defence Committee	T4		
EM Laws and regulations	OD3				
		@OmanMeterology Meteorology Department in PACA	T5	Oman News Reports	SS2
Official alerts, notifications and warnings published by National Centre for Early Warning	OD4				
		@OmanNews Oman TV News	T6	(Al Hatrushi and Al Alawi, 2011)	SS3
		@Atheer_Oman Atheer Media			
		@MOSD_Page Ministry of Social Development	T7	(Alhinai, 2011)	SS4

* for cyclones Mekunu and Luban

3.5 Participants

Once the interview guide was modified, key participants were approached. A purposive sampling technique was consistent with the research aims and methods. In contrast to random sampling, as used in quantitative research where the sample is randomly selected based on certain variables, the sample here is selected "to examine the phenomena where it is found to exist" (Coyne, 1997, p. 625), where the researchers "go to the groups which they believe will maximise the possibilities of obtaining data and leads for more data on their question" (Glaser, 1978 cited by Coyne, 1997, p. 625). The coordinators of the operational sectors were targeted based on their role, authority and experience. They were chosen because they experienced these events and the responses to them, and they were involved in recommending policy changes, see Table 3-2. Therefore, it is assumed that they obtain knowledge that could help answer the research questions. In addition to theoretical sampling, some participants pointed out other 'important' officials who should be approached, and thus a snowballing sampling technique (Uhr et al., 2008, Wang et al., 2014) was followed, and further participants who were actively involved in the response operations were identified and interviewed.

Table 3-3 Agencies selected for in-depth interviewing

Agencies interviewed	**Legislated role in the EMS**
Police Department	Lead agency in EMS; coordinates overall emergency response
Health Department	Manages and coordinates medical response and public health
Civil Defence Authority	Manages and coordinates search and rescue sector Manages and coordinates HAZMAT operations
Army	Supports several EM functions, most visibly search and rescue
Meteorology Department	Provides forecasts, early warning, alerts, notifications and analysis reports

Social Development Ministry	Manages and coordinates shelter and relief operational sector
Local Municipalities	Mostly affected area during Cyclone Gonu
Media (TV & Radio) Department	Manages and coordinates information and awareness sector
Local Experts and retired EM practitioners	Heavily involved in the development of the system

As the objective is not necessarily to generalise findings to a population but to generalise findings to theoretical propositions (Yin, 2009), the sample size in qualitative research is much smaller than that is used in quantitative studies such as statistical inquiries (Thiel, 2014). In qualitative research, data collection, translation, transcription and analysis are time-consuming processes. Therefore, it is important to target the right candidates to reduce quantity but maintain data quality (Bryman, 2015). The number of participants was not established at the beginning of the study, as there should always be room to add more of them. However, in qualitative research, 'there are two criteria for enough': sufficiency and saturation of information (Seidman, 2006, p. 55). The first criterion refers to the idea that the sample should represent the different ranges and sites in the population. The second refers to the point at which the interviewer ceases to learn anything new from further informants (Seidman, 2006; Mason, 2010). These two criteria provided an important guideline for the sampling process. By the end of the research, 19 in-depth qualitative interviews had been conducted, with an average length of about 1.5 hours per interview.

Participants represented the EMS operational sectors in Oman. They originated in civilian, paramilitary and military agencies. Table 3-3 shows important information about the participants. Ten participants were sworn police officers, and nine of them were civilians. Views from different sectors were important to obtain to reduce selection bias. It also included local emergency management experts and retired senior officials who participated in decision-making. All participants had at least ten years of experience. Hence, they were found suitable to observe institutional and organisational changes, when they occurred and how they were introduced. In addition, several emergency responders who worked on the ground during crisis response were interviewed. Thirteen participants were males, and three were females, which reflects the gender disparity in the EM sector in Oman.

Before conducting the fieldwork, all ethical approvals were obtained following UCL guidelines. Accepted ethical standards included informed consent, benefit not harm and confidentiality (UCL, 2021). Participants listed in Table 3-3 were invited to participate in the study and verbally asked to give consent. They were informed about the purpose of the study and how it will be conducted. They were informed of their rights, most importantly, the right to withdraw at any time and to oppose voice recording. All participants, but one candidate, agreed to participate. All agreed to be recorded, but some asked to stop recording while disclosing some information they did not want to be recorded. They consented that all information could be used for analysis. They were informed about anonymity, and that recordings were to be destroyed after they were transcribed.

Table 3-4 Participants' Information

#	Participant	Code	Gender Male/Female	Nature of work Police/Civilian	Work experience (years)	Interview duration
1	Sector coordinator 1	SC1	Male	Police	25	1 hour and 15 minutes
2	Sector coordinator 2	SC2	Male	Police	21	1 hour and 17 minutes
3	Sector coordinator 3	SC3	Male	Civilian	23	1 hour and 2 minutes
4	Sector coordinator 4	SC4	Male	Police	24	1 hour
5	Sector coordinator 5	SC5	Male	Civilian	27	1 hour and 39 minutes
6	Sector coordinator 6	SC6	Male	Civilian	15	1 hour and 6 minutes
7	Sector coordinator 7	SC7	Male	Civilian	28	1 hour and 5 minutes
8	Sector coordinator 8	SC8	Male	Civilian	29	1 hour and 21 minutes
9	Emergency Manager 1	EM1	Male	Police	18	1 hour and 44 minutes
10	Emergency Manager 2	EM2	Male	Police	12	1 hour and 17 minutes

11	Local expert 1	LE1	Female	Civilian	20	1 hour and 30 minutes
12	Local expert 2	LE2	Female	Civilian	30 (retired)	1 hour and 9 minutes
13	Local expert 3	LE3	Male	Military	30 (retired)	1 hour
13	Local municipality administrator	LA	Male	Civilian	23	2 hours
14	Emergency responder 1	ER1	Male	Civilian	14	1 hour and 13 minutes
15	Emergency responder 2	ER2	Female	Civilian	18	35 minutes
16	Emergency responder 3	ER3	Male	Police	16	1 hour and 3 minutes
17	Emergency responder 4	ER4	Male	Police	13	1 hour and 18 minutes
18	Emergency responder 5	ER5	Male	Police	13	1 hour
19	Emergency responder 6	ER6	Male	Police	16	1 hour

3.6 Case and Events Selection

The emergency management system (EMS) in Oman was found to be a suitable case study to address the research question and contribute new knowledge that feeds into the theoretical and conceptual discussions on organisational learning and institutional change as a consequence of learning from emergencies. First, most research on the institutional development of emergency management systems has been conducted in the USA and Europe. In contrast, cases from Asia and other parts of the world are still very neglected (Nohrstedt et al., 2018). Theoretical assumptions regarding the transformation from authoritarian approaches to more collaborative, 'democratic' management forms were originally developed in the West (Hermansson, 2017). Al Manji (2018) looked at the management system in Oman but did not study its dynamics of change. Neither did she analyse its responses to actual emergencies. It is necessary to study such phenomena and their underlying assumptions under differing social, political and economic contexts. Such analyses will likely result in exploring the varied barriers and influencing factors of institutional change and organisational learning from crises. This should be the case in the context of Oman.

Oman has a public administrative system characterised by the centrality of decision-making, rigidity of procedures and hierarchical communications, which makes it representative of many nations that share these features. The socio-political context encapsulating the EMS is also very similar to that of many countries in the region and worldwide. In fact, the command-and-control approach to managing disaster response is one of the most dominant styles in the developing world and among various developed countries, as illustrated in the literature review chapter. Therefore, the higher level of abstraction to which this case belongs (Thiel, 2014) can be the domain of management that is largely governed by command-and-control norms and authoritarian practices. The organisations allowed the researcher 'to come and take a peep' (Thiel, 2014, p. 91). Being an insider of the same culture and government was an important factor that enabled the researcher to obtain primary data related to sensitive topics such as failures during emergency response and challenges in implementing new ideas.

Similar to most countries in the region, Oman is a rapidly developing, fast-urbanising state. Economic expansion due to the oil boom resulted in large-scale projects and a high degree of urbanisation. These developments caused significant changes in the built environment. High-rise buildings, massive urban areas and sophisticated infrastructure created new physical vulnerabilities that were largely absent in previous epochs. As a result, emergencies began to appear more frequently. Dealing with them was a new challenge in Oman, similar to many Asian countries (Delias and Daly, 2016). Thus, it would be interesting to understand how the emergency management arrangements of a developing nation have evolved as the devastating realities of disasters recently struck it. This makes it a good case study whose insights can lead to a good understanding of organisational learning and institutional change from which other nations can learn.

Many innovations have been developed in the West and adopted by developing nations under the perception that they are effective. This is certainly the case with classical bureaucratic command-and-control models of management. When these innovations come in contact with different contexts, they can be met with challenges or further facilitated and strengthened by other societal norms. Few studies have looked into these issues. This case study is interested in bringing new insights into the

influence of innovations developed in the West on shaping the management models in the developing world. It would have been more appropriate to consider several case studies (several nations), but this was not possible due to time and travel constraints. The alternative was to select as many cyclone emergencies as possible.

The selection of events in this research is based on the fact that they are the most frequent and severe natural hazards that the country has encountered so far. Cyclones and tropical storms have caused widespread disruption and drawn political attention in the last 20 years. Changes during such times are evident (Alexander, 2015; Voss, 2016). They present 'information-rich cases' (Patton, 1990), forming good research opportunities. While it is always advised to take a longer time frame to observe changes (Nohrstedt and Bodin, 2014; Robinson et al., 2013), it is impossible to include all cyclone emergencies in this research. Therefore, four important cyclone events were selected in this analysis: Gonu 2007, Phet 2010, Mekunu 2018 and Luban 2018. The first two were the first experiences for the research participants, while the last two were recent events. It is also recommended to include as many events as the research permits to capture the wide range of conditions created by cyclones, i.e., the different theatres of operations. In addition, it is essential to include early and recent experiences to understand the changes in the institutionalised EMS. A longitudinal analysis is necessary to capture the learning curve of the emergency management system. A cross-sectional approach was inappropriate as it only provided a snapshot of the system.

3.7 Data Analysis

This section will first explain the procedure for analysing the collected data and then discuss the rationale behind selecting thematic analysis as the primary method for data analysis. It will then explain the theoretical and analytical frameworks developed to study emergency response and analyse organisational learning and institutional change. It will conclude by discussing this research's main challenges and limitations and provide recommendations for future research.

3.7.1 Thematic Analysis

Established as a flexible tool for coding qualitative data regardless of the researcher's epistemological position (Braun and Clarke, 2006), whether it is constructionist or realist, thematic analysis was found to be an appropriate method for this qualitative research. Unlike a grounded-theory approach that merely implies induction, thematic analysis has also been found flexible regarding the method of analysis, whether inductive or deductive (Braun and Clarke, 2006). Flexibility in analysis enables the analyst to benefit from existing theoretical frameworks and identify new concepts. Following a strict form of deductive analysis might prevent a researcher from assigning new codes to an important piece of data. The thematic analysis offers this needed flexibility, and for this specific privilege, it became an established and common approach for qualitative data analysis (Bryman, 2015). It can also be used regardless of the theoretical framework of the research as it is not bound by a specific theory (Braun and Clarke, 2006), as the case, for example, with grounded theory analysis. It can be used both as a constructionist and realist method. It is used in this research as both, making it a suitable method for the research aim. The two objectives – analysing emergency responses and thematising experiences and meanings by the participants – can be carried out in one analytical framework using thematic analysis. '... thematic analysis can be a method that works both to reflect reality and to unpick or unravel the surface of reality' (Braun and Clarke, 2006, p. 81).

Furthermore, a common objective in qualitative studies is identifying recurrent data themes. However, a great proportion of them does not show the thematic process in great detail, which makes it very difficult to evaluate their work (Braun and Clarke, 2006). Therefore, the thematic analysis provides a systematic way to code qualitative data, which enables an evaluator to track the whole process and contributes to the establishment of rigour in qualitative research. As Braun and Clarke (2006) recommended, for readers to understand how themes were reached, the analyst must make several decisions explicitly clear. First, a theme must capture something important in the dataset in relation to the research question. It does not have to appear across all data items, and it does not have to be mentioned by all participants, but it should be prevalent. It also must contain an important meaning relevant to the phenomena under study. Compared to content analysis, a quantified measure of

prevalence is unnecessary (Braun and Clarke, 2006). It can be represented as ‘many participants’ or ’a number of participants’, or ‘the majority of participants’ (Braun and Clarke, 2006).

The analytical procedure employed in this research follows the generic guide developed by Braun and Clarke (2006), as this was found to be systematic and inclusive of the main steps required for qualitative research, beginning from the transcription of interviews and ending with the construction of the final report. In addition, following a systematic method for coding data helps establish rigour in qualitative research, which has been a critical requirement..

3.7.2 Form of Analysis and Analytical Frameworks

The relationship between theory and case study has been described as uneasy (Thiel, 2014). First of all, the view that "data are not coded in an epistemological vacuum" (Braun and Clarke, 2006, p. 84) is held by the researcher. No analyst could approach a piece of research without preconceived world views. Therefore, in the present study, data analysis began as a deductive process with a top-down or theory-driven coding technique. In addition, induction, a bottom-up or data-driven form, was also used to code data that did not fit into any existing conception. The different theories and views, and their underlying assumptions, that guided and inspired the coding process are addressed in the following section.

What is an emergency management system (EMS)?

Before explaining the analytical frameworks, it is important to clarify the meaning of an EMS in the context of organisational learning and institutional change and to specify the level and unit of analysis. The EMS in Oman, the case study in this research, is viewed as an open socio-technical system. Technically, it is a group of actors working collaboratively to meet the emergent yet urgent demands produced when a disaster strikes (Abrahamsson et al., 2010). Socially, it is a group of interacting institutions and rules (Scott, 1995). Secondly, it is an open system incubated in a larger socio-political system. Thus, its behaviour is influenced not only by the demands of emergencies but

also by the institutions and rules of the larger medium under which the system operates (Ostrom, 1990). As the literature review explains, emergencies require specific management norms, while the socio-political context might specify other norms. Therefore, these two domains can be viewed as resources available to responding actors and guide and constrain their actions.

The EMS is thus an intricate system whose complexity stems from linear and non-linear interactions of various sources. Its members are heterogeneous and include organisations, individuals, artefacts, critical infrastructure and other elements (Ropohl, 1999). In addition, the "emergent systemic properties" produced when organisations of different cultures join together to form a multi-organisational system further contribute to this complexity (Checkland and Scholes, 1990). Viewing the EMS as an open social system guided the analysis to focus on studying it as a whole rather than each component in isolation (Alexander, 2002a). It emphasises systemic causes of errors (Reason, 2000). It also pushes the researcher to look at the emergency conditions under which the actors worked (Abrahamsson et al., 2010; Patriarca et al., 2017) and the system's institutions that could explain its behaviour. For example, some rules prevent actors from sharing specific information.

The system, therefore, can have multiple representations. Structurally, it contains several participating actors. Functionally, it transforms inputs into outputs. Hierarchically, it consists of subsystems and is part of a supersystem (Ropohl, 1999). Socially, it is a set of institutions and their rules. Thus, there is no visual representation that can mirror reality. Rasmussen's Abstraction Hierarchy (AH) was adopted to establish the units and levels of analysis. Through its two dimensions, decomposition and abstraction, the EMS can be decomposed into subsystems, e.g., organisations, individuals and physical components. Its functions can be broken down from general to more specific ones.

Following Rasmussen's AH logic, the analysis here is implied at the "functional purpose, abstract function and generalised function" levels and not at the "physical function and physical form levels" (Rasmussen, 1985, Abrahamsson et al., 2010, Patriarca et al., 2017). The functional purpose is the overall intended effect of the system on its environment, while the generalised function is the generalised process

of the system and its subsystems. Table 3-4 shows the appropriate unit and level of detail in data analysis.

Table 3-5 Level of Analysis in this study

Unit of analysis	Level of details
Participating Actors	The organisational level: providers of emergency management services in the country, e.g., police, civil defence, army, the health ministry
Tasks or functions	The functional purpose 'or the objective of the system', e.g., protecting and saving lives and properties, continuation of essential services, and generalised function 'or the function of the overall system and subsystems', e.g., providing relief material, searching and rescuing individuals, transporting support during evacuation, search and rescue, medical response, and providing weather forecast

Two analyses were conducted in this thesis. The first focused on analysing the response of the EMS to four selected cyclone emergencies and aimed at identifying the lessons and failures that should have been learned from these events. The second analysis focused on organisational learning and institutional change. It aimed to identify the forms and dynamics of change that followed these emergencies and whether the right lessons were implemented or hindered by learning barriers. The following sections discuss the analytical procedure and rationale behind the theories and frameworks adopted.

Framework for analysing emergency response

Analysing the responses of the EMS to the four cyclone emergencies was largely inspired by chaos theory. Although it was not purposefully chosen as a theoretical framework before collecting data, its concepts frequently appeared relevant to the dataset. It proved a suitable framework capable of explaining the system's behaviour by tracing its initial conditions, the hazard's impact on the system and the resultant response. As a recent development in the social sciences domain (Farazmand, 2014), its applicability, particularly in disaster management, remains an open question for further research. In explaining emergency response, its new sets of tools (Priesmeyer

and Cole, 1996) require more empirical data, particularly to address important knowledge gaps such as when a system is entering a chaotic state or what qualitative changes could lead to that transfer or under what conditions the process of self-organisation occurs. This analysis aims to bring more insights into these issues in the context of emergency response.

Chaos theory was found among the few approaches that emphasise the system's initial state (i.e., before the cyclone impact or crisis) and consider it an important element that explains the resultant response. Its embedded assumption is that a system's behaviour is not a sudden consequence but an effect of its initial state. This point was consistent with the overall philosophy of the emergency planning principle in disaster management. This analysis included the adequacy of long-term emergency planning and the immediate preparedness measures to mitigate the cyclone's impact and reduce the demand for emergency services, most prominently emergency evacuations and warnings. In addition, as four cyclone emergencies are included in this analysis, it would be interesting to find out whether the system's initial state changed. It is assumed that learning from past emergencies should feed into improving the system's initial state.

Figure 3-3 shows the overall framework for this analysis. The theory's three main notions are *'bifurcation points', 'cosmology episodes'* and '*self-organisation'.* The first describes a situation 'when things start to get out of control' or 'when formal arrangements fail' or where the system's character, direction, or structure is fundamentally disturbed (Sellnow et al., 2002 citing Murphy, 1996). The self-organisation process is a phenomenon that describes when a new form of organisation emerges in order to adapt to new norms. The analysis focuses on identifying the conditions associated with the occurrence of bifurcation points and factors that enable the emergence of new forms of adaptive management. Identifying 'the right' changes to be implemented at the institutional and organisational level should stem from drawing the right lessons from this critical period of the response.

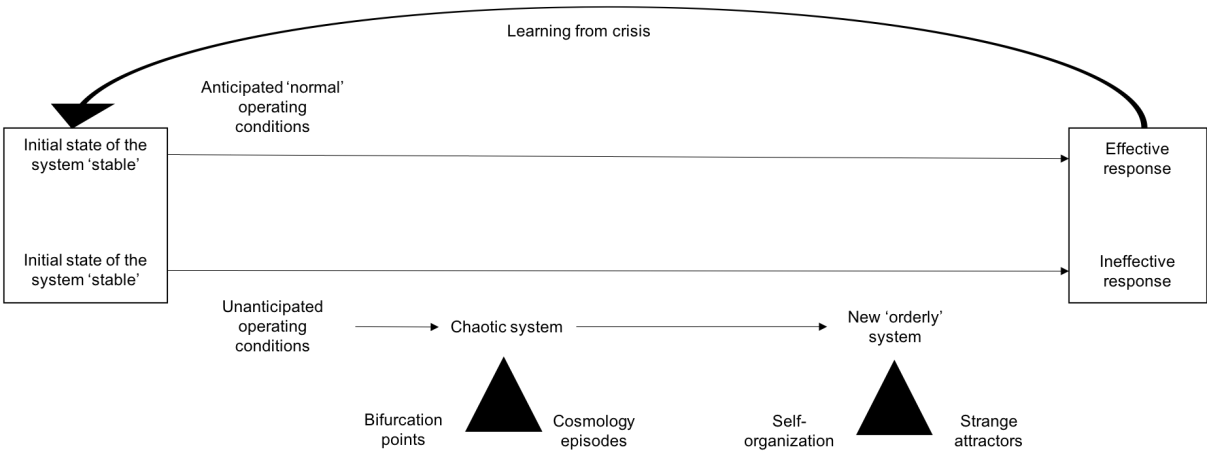

Figure 3-3 Framework for analysing emergency response (created by the author based on chaos theory concepts).

Several limitations have been associated with chaos theory. In this research, attempts were made to limit their impact. First, as its logistic equation (used to develop hypothetical scenarios) could result in a relatively subjective view of reality, it was avoided. Instead, the different scenarios were recognised by analysing four real cyclone emergencies. Secondly, while chaos theory is not usually used to identify or classify organisational and institutional changes, examining the system's initial states in four different but consecutive cases was possible. The theory does not specifically examine the relationships between the different responding actors. However, failures of coordination and collaboration have always been used to explain the processes of bifurcation and self-organisation. Furthermore, under this theoretical view, a condition is usually described subjectively, particularly in participant observation research designs. In this thesis, most research participants must agree upon the condition, which becomes an 'agreed' reality. Similarly, in many studies, the system's current state is described as "stable", e.g., regardless of its current capacity, as in Priesmeyer and Cole (1996). This is avoided in the present work because the current state is compared to the findings of the literature review regarding principles for managing large-scale emergencies.

Framework for analysing organisational learning and institutional change

The second aim of this research involved classifying organisational learning triggered by crisis and thematising the forces of institutional change in this case study. In order to achieve this objective, an interdisciplinary framework was developed by combining Argyris and Schon's (1974) organisational learning model and Ostrom's (2005) institutional analysis and development (IAD) framework, see Figure 3-4. The IAD framework is a well-established framework widely used by social scientists and policy analysts to understand institutional changes in various sectors (Ostrom, 2005; Milchram et al., 2019). The framework is flexible and not bound to a specific sector. It has investigative utility as it helps one to look into the various elements of an institutional context, such as actors, their roles, external drivers and socio-economic settings (Milchram et al., 2019).

Integrating learning feedback loops (double-loop and single-loop learning within the IAD framework) enabled the researcher to address the dual objectives of this analysis, namely identifying the forms of organisational learning from crisis and the facilitating or obstructing forces behind them. Single-loop learning refers to changes in the techniques and strategies of the existing system. In contrast, double-loop learning refers to changes in the underlying governance assumptions, core values and norms (Argyris, 1977). As this thesis intends to bring more insights into the ongoing debate about whether organisations learn from a disaster, it is important to identify what organisations mean by learning from a crisis and what forms of learning from past cyclone experiences they refer to.

In addition, this structured framework enabled the researcher to highlight the roles of exogenous forces and endogenous processes behind the observed changes and the continuation of existing rules and procedures. There has been a call to combine these two perspectives of institutional change to produce a more in-depth and balanced analysis. Combining both perspectives was found to be consistent with viewing the EMS as an open system that is not only influenced by internal forces but also by drivers stemming from its surrounding environment. Therefore, the two sources of change were taken into account. The first one, which stems from the rational choice

perspective, is the ‘agency of actors’, such as a higher political authority and powerful actors, in forming rules and making choices. The second perspective originates from historical institutionalism or path-dependent perspectives on processes that have historically evolved in ways that can influence the selection of new approaches to managing emergencies. In other words, the current EMS in this case study was explained by identifying the roles of three domains, as shown in Figure 3-4.

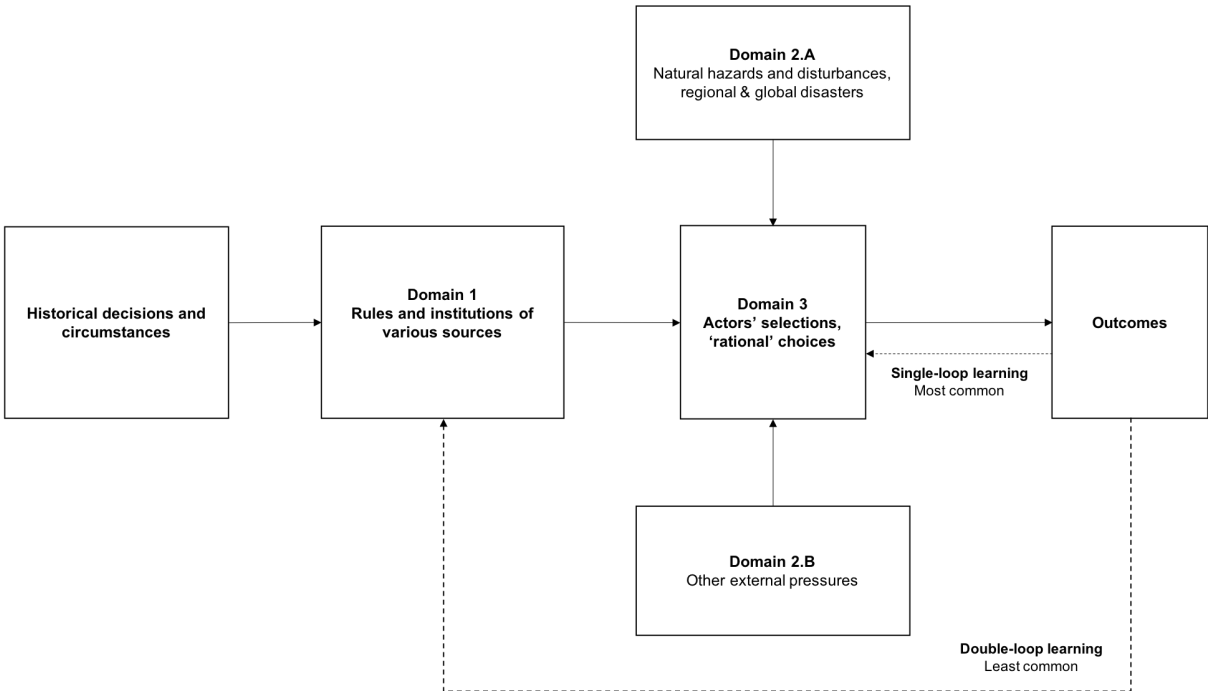

Figure 3-4 Framework for analysing organisational learning and institutional change dynamics based on Ostrom (2005) and Argyris (1977)

3.7.3 Analysis Process: Developing Codes and Themes

The analysis began with the data familiarisation process, which included several steps. The researcher first translated interviews from Arabic into English. At the same time, they were transcribed verbatim into Microsoft Word and saved directly in the UCL OneDrive, which is protected by the researcher’s username and password. Due to time limitations, 16 interviews were translated and transcribed, while three were only listened to and summarised. Translation by the researcher instead of gaining external help was found to be very important for data familiarisation and analysis overall. Data were then corrected and cleaned by listening again to each recording. In order to

ensure confidentiality and anonymity, the names of interviewees were anonymised by assigning them a code. Also, the names of other persons mentioned in interviews were pseudonymised or removed. Then, all transcriptions were imported into the NVivo-12 software, a qualitative analysis tool. Figure 3-3 shows a screenshot of the main navigation page of the software. The first column shows the files and sources where data came from. The second column shows the codes and themes that were developed during the analysis process, while the third column shows the excerpts that make up each theme/code.

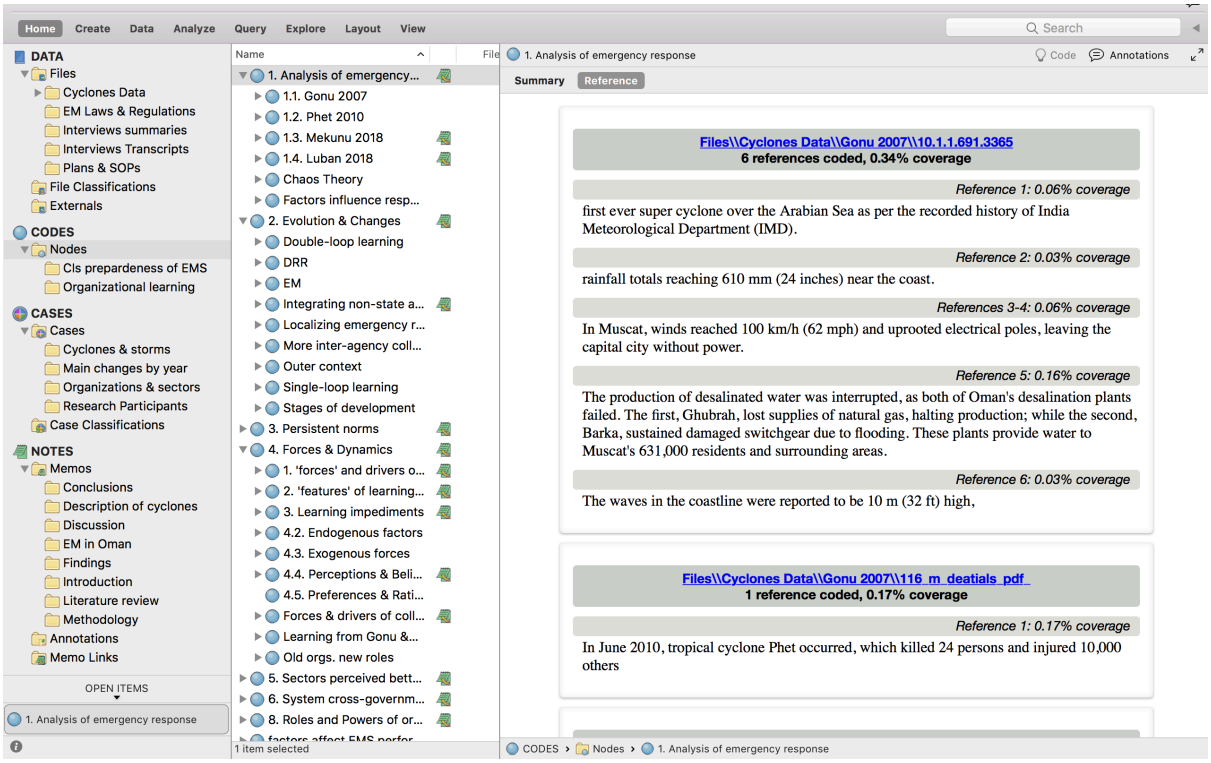

Figure 3-5 A screenshot of NVivo 12 main navigation page

Each interview transcript was read twice, and a summary of key topics discussed in each interview was developed. Reading the whole interview and summarising key points prior to a detailed coding was found to help understand the data's key themes, which helped to accelerate the coding process, which is time-consuming. In qualitative research, *coding* is assigning a label to a text portion, giving it a name that describes it or its meaning. Boyatzis (1998, p. 63) defined a *code* as 'the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way

regarding the phenomenon'. It involves organising data into meaningful groups (Braun and Clarke, 2006 citing Tucket, 2005) relevant to the phenomena under study. The groups are referred to as themes. Codes could have one extract from one source or more. They could include excerpts repeated on several occasions illustrating an aspect of the phenomenon. They could also include excerpts participants emphasised as important, or they resemble findings in previous studies, or they highlight a concept or theory.

3.7.4 Method used to develop descriptive narratives for cyclone events

First, the sequence of events for each cyclone emergency was described before the governmental response to them was analysed. This narrative included the cyclone's features, such as rainfall and windspeed data, cascading hazards, such as landslides, rockslides and flash floods, and its impact on the system and the critical infrastructure that the system depends on. The subsequent section described the initial state of the emergency management system, which included emergency planning and preparedness activities. Building these descriptions followed a systematic qualitative approach. The software 'NVivo' assisted in achieving this objective using its organising and sorting features. First, four themes or categories were created representing the cyclone emergencies 'Gonu, Phet, Mekunu and Luban', as Figure 3-6 shows. Secondly, the data sources (interview transcripts, official EM documents, Tweets published by official Twitter accounts during the events, participant observation notes and secondary data sources) were imported into NVivo. They were read and coded deductively according to the themes. The coding involved taking excerpts from the data sources (see the explore diagram in Figure 3-6), placing them in the right event category, and assigning them labels (codes), see Table 3-4, Appendix D – Themes and Codes and Appendix E – Definitions of codes.

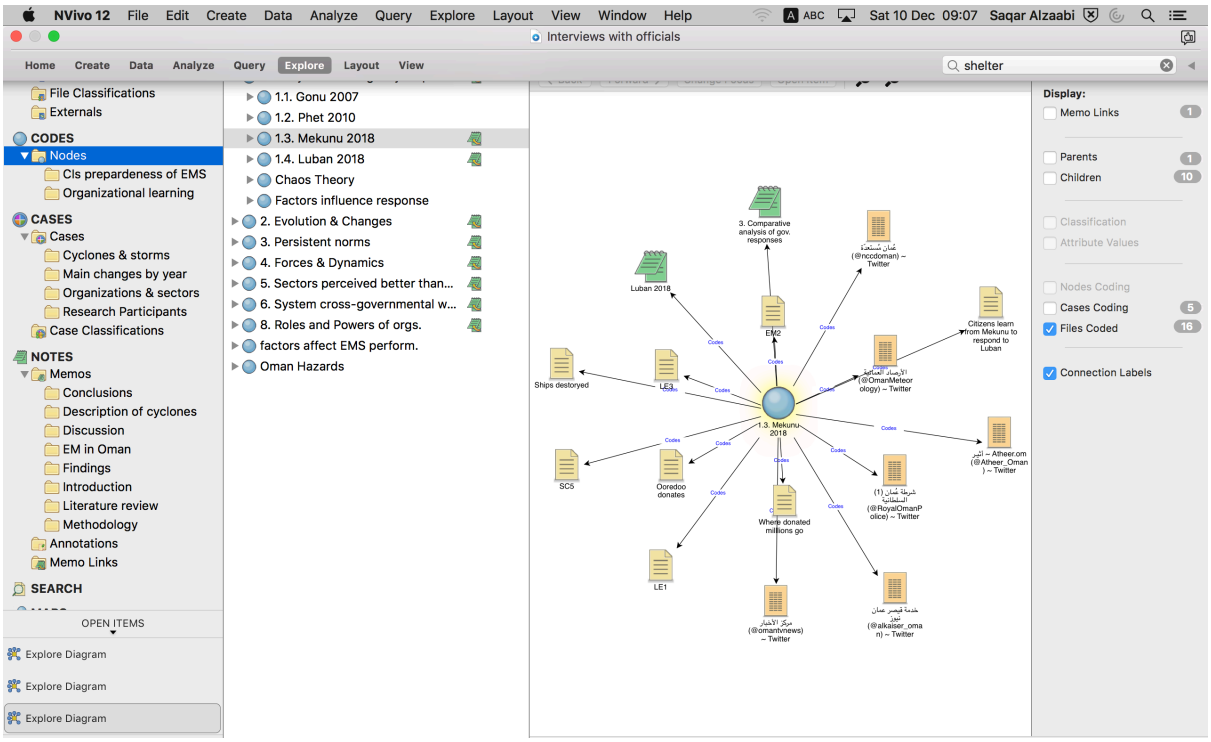

Figure 3-6 A screenshot NVivo software showing the categories of cyclone events and an explore diagram

By the end of this process, three main sub-themes were created for each cyclone emergency: (a) an introduction which included the cyclone's characteristics and impact, (b) the initial state of the emergency management system, which included emergency planning and preparedness measures, and (c) the emergency response, which included governmental and informal response. The information that built these descriptions came from a data source. The source, when used is referenced whenever used in this thesis, as Table 3-4 and Appendix D – Themes and Codes show. It was important to use several sources for data as a triangulation strategy to ensure data validity.

CHAPTER 4 ANALYSIS OF RESPONSES TO THE SELECTED CYCLONE EMERGENCIES

4.1 Introduction

The objective of analysing the emergency response to the selected cyclones was to find out how well the system worked in responding to these emergencies. It was hypothesised that new management forms emerge when the institutionalised EMS fails to achieve its aim and deliver its services. Therefore, it was essential first to understand whether that happens and, if it does, under what emergency conditions. Identifying the management model and associated emergency conditions is important knowledge that should feed into the management model required for effectively managing emergencies triggered by natural hazards.

This analysis, as illustrated in Chapter 3, was inspired by chaos theory as it was found to offer framing 'analytic' tools capable of explaining the response of systems under extreme conditions. It does so by deconstructing the change of the system from a state of order and stability to a state of disorder and instability due to the occurrence of *cosmology episodes* and then back again to a new state of order through a *self-organising process*. *A cosmology episode* is when a *bifurcation point* – a qualitative change – occurs when things start to be out of control from the perspective of the responding agents. The self-organisation phenomenon describes when a new form of re-organisation emerges to adapt to the new demands that were not met by the formal 'planned' procedures. Section 3.6 discusses the details of the theoretical framework, and Figure 3-3 shows the analytic framework adopted for this analysis.

It was impossible to include all cyclone emergencies in this research. Therefore, four important events were selected, Cyclones Gonu 2007, Phet 2010, Mekunu 2018 and Luban 2018, see Figure 4-1. The first two were the first experiences for the research participants, while the last two were recent events. It is recommended to include as many events as the research permits to capture a wide range of conditions created by cyclones, i.e., the different theatres of operation. In addition, to understand the

changes in the institutionalised EMS, it was essential to include early and recent experiences to capture the learning curve of the emergency management system.

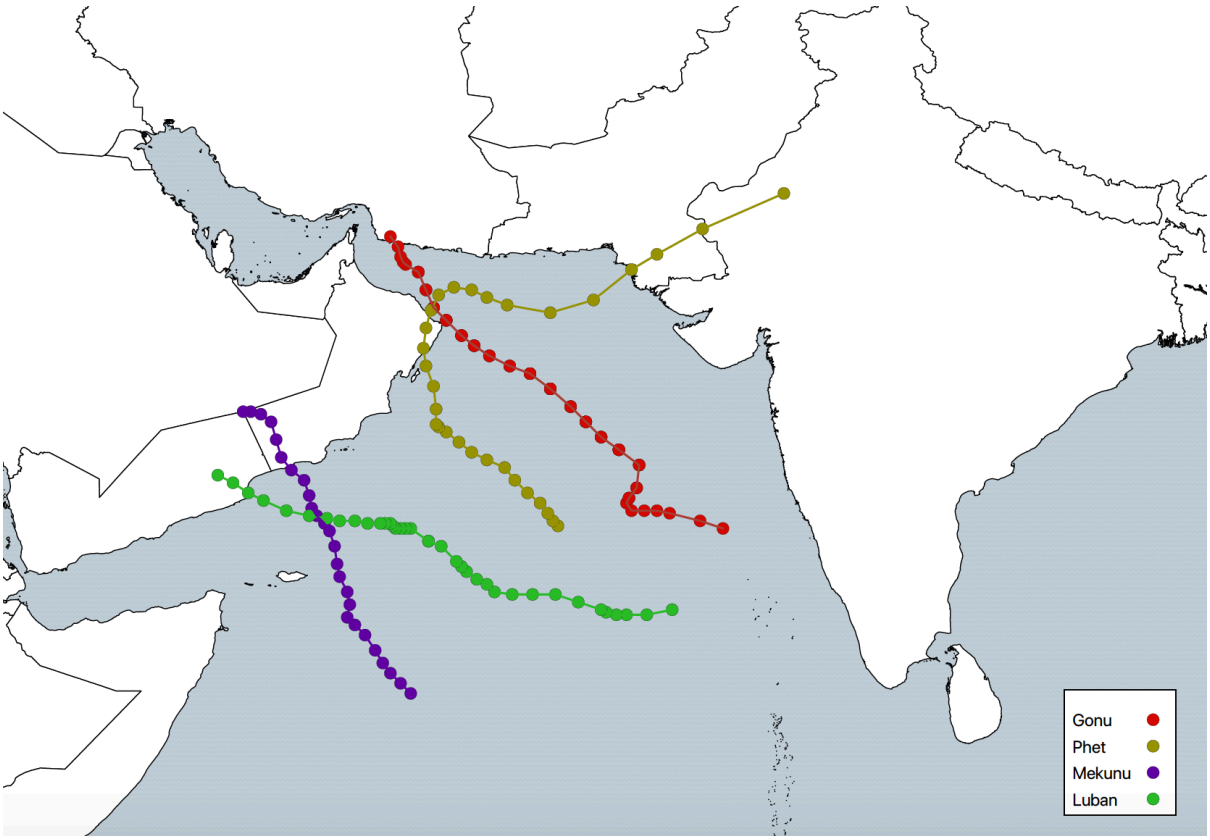

Figure 4-1 Map showing cyclones' tracks

In the following sections, the case studies are presented chronologically. Each one includes a brief introduction to the cyclone event, an analysis of the governmental response, which will include the initial state of the system prior to the landfall of the cyclone, the emergency conditions during the response, their impact on the system, and the resultant type of response that occurred. As cyclones affect large areas, the analysis focuses on the worst affected ones where the EMS was mostly needed. This is not an evaluation of the response but an analysis of the critical points at which the system was most under duress. These points form the most important learning opportunities to redesign and improve the system. The last section includes the findings of this comparative analysis, which will form the foundations for CHAPTER 5. Comparing the implemented changes to the results of this chapter, i.e., the changes that should have been implemented based on this empirical analysis, offers an

opportunity to understand the nature of changes that make it to the institutionalisation level and those that do not. Then one can discuss the learning impediments in this case study and the heuristics of drawing lessons from emergencies, including the forces behind those changes.

4.2 Cyclone Emergencies Impact on EMS and Resultant Response

4.2.1 Cyclone Gonu 2007

Most participants described Cyclone Gonu as the first opportunity for them and for the modern state of Oman to encounter a major emergency triggered by a category-five cyclone striking its capital city, where the largest concentration of the population lives. It was among the rarest and most severe cyclones on record that have affected the country. Fortunately, it weakened to a category-three cyclone before making landfall on 6 June 2007 (SC8). The last similar event occurred in 1890 (Bailey, 1988). High mortality and severe damage were also recorded back then, but as participants in this study did not experience it, most said they were unaware of it. Participants describe Gonu as:-

- 'an opportunity and a challenge' male emergency manager (EM1)
- 'an experiment, one in a kind, unique' male sector coordinator (SC4)
- 'an experiment; a lesson we have learned from' male sector coordinator (SC7)
- 'a turning point' male sector coordinator (SC5)
- 'Gonu revealed many things for us.' female local retired expert (LE1)

Gonu caused widespread shock among the government actors and society, as the devastation was unimaginable to most people. The president of the country had to address the nation, which rarely occurs outside a scheduled programme. Records of past cyclones and storms began to appear and circulate across the media. It turned out that Oman is no stranger to tropical cyclones and severe storms. However, the interval between them is quite large, which makes them exceptional visitors rather than regular events. According to Kwarteng et al. (2009), a cyclone is expected to affect Muscat, the country's capital city, once every ten years.

Following the usual tracks of most cyclones, Cyclone Gonu was also forecasted to make landfall near the eastern coast of Al Sharqiyah South Province (SC8). Unexpectedly, as expressed by many participants, it changed its track towards the capital city. The cyclone's wind speed ranged between 100 and 260 km/hr; rainfall was recorded as between 200 to 610 mm in different parts of the region; waves in the coastline were reported to be around 10 metres high (SS1). The cyclone vacated the

country on 8 June, leaving behind catastrophic losses. Fifty people died, 27 were reported missing, and around 20,000 were affected (Al Shaqsi, 2012). The infrastructure was badly damaged. The economic loss was estimated to be around USD 4.2 billion (Al Buloshi et al., 2014). Among the causalities were emergency personnel and foreign workers. Gonu became the worst natural hazard impact in the memory of the people of Oman. It became the reference point for disasters, a model of what a disaster looks like. After this critical juncture in the history of disasters in Oman, new structural changes began to be formulated, shaping a 'new and modern' emergency management system. Organisational and institutional changes are discussed in Chapter 5.

Given this brief context, the following section analyses the governmental response to Cyclone Gonu. It is preceded by an initial discussion of the state of the EMS before the cyclone made an impact. Next, a discussion follows of the conditions created due to the cyclone's impact and the resultant response under the new conditions. The data used to develop this section was based on the testimonies of the participants, notes of the researcher and secondary data sources, as detailed in Chapter 3.

Initial State of the EMS

Despite a long history of severe storms, all participants agreed that there was no disaster management authority and no written emergency plan across the different governmental levels, national, regional and local. At that time, the so-called system was based on utilising existing administrative structures by forming an *ad hoc* temporary committee at the national level as a multi-agency coordinating team, referred to as the National Committee for Civil Defence 'NCCD'. It is formed when there is an emergency and is made up entirely of government entities under the lead of a paramilitary agency, the police. At this national level committee, there was no representation of non-state stakeholders such as members of the voluntary sector or private businesses or local communities.

The majority of the resources of the responding actors were largely centralised in the national government (Muscat). The other ten governorates of Oman substantially

lacked emergency response capacities. Therefore they largely relied on the mobilisation of resources and response teams provided by the central government. The Wilayats, the lowest administrative level in the country, had no emergency response capacities. In addition to centralised resources, the multi-agency coordinating committee only convened at the national level. Crisis management was planned to take place in a far-away control room at the central command premises (EM1 and EM2). There were no crisis management committees, operations rooms, or emergency plans at the regional and local levels. Furthermore, there was a clear shortage of specialised heavy equipment and teams of trained responders needed in any emergency (SC2).

During the meetings that preceded the event, in an improvised manner, responsibilities were assigned, and response teams were formed and distributed across several command posts. Roles were assigned verbally and assumed to be understood by the different actors. However, most participants mentioned that they did not know they had a role in crisis management until they were called to those meetings. They also said that they were not aware of other agencies' roles. They attributed this lack of awareness to the rarity of emergencies and the absence of joint training.

Gonu was not forecast to strike Muscat (SC8). The sudden change of its track was a surprise to responders. The shock, as they described it, was that the affected area turned out to be the capital city, which had a denser population and built environment and is home to critical national and international offices. Furthermore, emergency response teams had already been mobilised from Muscat to the Eastern Governorate, where the cyclone was forecast to strike (EM1 and SC8). Evacuation orders had also been issued for those areas, and people had already been evacuated and provided with shelters in areas that were expected to be safer. Several research participants described how the sudden change of the cyclone's track left them with very few hours to reposition their 'forces'. They had to issue new evacuation orders, set up new shelters, and redirect most resources and response teams back to Muscat.

Days before the impact, official warnings and alerts were issued, but only in two languages, Arabic and English (SC8). However, there was a great number of foreign

workers whose native languages were neither of these. Therefore, it was a striking fact that most fatalities were not native speakers of the warning languages. In addition, the warnings were brief and merely included the cyclone's track and classification, whose meaning was, and largely still is, unclear to most ordinary people. Instructions on 'what to do' or 'where to go' were substantially lacking. Warnings were disseminated through government television and its only radio channel. Following a top-down pattern, the communication of warnings was highly centralised. There were no alternative means of communication, such as through social media platforms, as is usually the case nowadays.

Based on the forecasts, evacuations were issued for several areas, largely those located along the coast, as they were judged the areas mostly exposed to cyclone hazards. Although the cyclone did not strike it, Masirah Island was evacuated as it is not easily accessible. The easternmost strip of the Eastern Governorate was also evacuated. The areas located on the coastline in Muscat Governorate were asked by the authorities to evacuate (SC8). All participants agreed that due to the sudden change of the cyclone's track, the time was very limited for a full-scale evacuation. The inland areas were deemed safer, so no evacuation orders were considered necessary there (SC8 and EM1). In fact, people evacuated from the coastal areas were taken inland. A sector coordinator (SC8) who experienced several cyclone emergencies described this evacuation as follows:-

> 'Masirah was always the affected area in Oman. Reaching it was not easy (during normal times). Therefore, it was evacuated. Most were taken to schools in other areas that we forecasted to be safer in _____. But the cyclone still came to them [laughing]. People were not so happy about what we did. But that was the procedure. We had to do what in my opinion was the right procedure.'

Despite the short window of preparedness, the government acted rapidly by declaring four days off for administrative agencies, schools and private businesses. Thousands of citizens then left the capital city, where they usually work, heading back to their areas of origin and hometowns. This decision, described by some participants as one of the wisest actions taken, greatly reduced the impact of the cyclone and the demand for emergency services within a few hours. This decision was a form of an indirect call

for evacuating the capital city, as 70% of its population came originally from other towns.

Emergency Conditions and Impact on the EMS

At midnight of 6 June 2007, Gonu began impacting the towns in Muscat and south of the Eastern Region. Several participants described the first three hours as 'a period of time in which nature does its work, and nothing can be done except to wait'. During that time, the response teams were on standby, waiting for the storm to dissipate. Around 3:00 am, large areas in Muscat and the Eastern Region became inundated, and hundreds of houses flooded. People living in two-story houses had to escape to the second floor, while those in one-story houses went to the roof to seek shelter. These people stayed in their houses because the authorities did not ask them to evacuate. No warnings were issued for these areas. Following this, the operations control room at the central command began receiving large numbers of calls in several areas in Muscat from people stranded in their houses asking for rescue. The absence of warnings resulted in no evacuation for these areas, significantly increasing the demand for emergency rescue.

Similar to most response teams, search-and-rescue teams were positioned at a few command posts, largely in the headquarters of the central agencies (EM1 and SC2). They had to be mobilised from these locations to the affected areas. These activities indicate that responding agencies assumed that ground transport would be available or would not be severely damaged in the crisis phase. As the water level was too high, roads became heavily flooded with water, debris and hundreds of cars that were washed away and began to pile up. Therefore, SAR operations could not be performed using vehicles as most roads became impassable (SC2). Air rescue was also difficult due to the strong wind (LE3). A scenario in which an urban city becomes a lake was not anticipated. Hence, rubber boats became the sole means of moving and rescuing people, but they were severely limited (EM2, SC2, LE3 and ER1).

Thus far, the EMS had not encountered a critical failure. As participants from the EOC described, it had control of the situation as long as operatives received information

from the sites and directed resources to where they were needed. Within a few hours of the impact,

the water level in the area where the central command was convening had suddenly risen, as flash flooding occurred when water in the *Wadis* stopped flowing smoothly to the ocean and flowed back towards the city as bridge piers, tunnels and culverts became filled with debris (EM1, ER2 and SC8). The area witnessed a significant increase in the built environment with many new roads and bridges. In addition, the paths, the dry riverbeds where flash flooding usually flow, were not cleaned before the impact (SC8 and EM1), which resulted in an unprecedented flood in the Qurum area where the central command was located.

The inundation of the EOC was an 'existential' episode in which emergency personnel whose job was to direct resources and attend to the public's needs became in need of rescue themselves, causing a critical failure of the EMS or what was referred to, according to chaos theory, as a bifurcation point of the system. As the central coordinating room became unavailable, directing resources were severely impacted. These events brought the system to a state of disorder. Participants who were in that centre described how the operation became a matter of personal survival as they lacked the means of mobility.

After several hours, the EOC operators and lead agency personnel at the main command post could reorganise with the help of *strange attractors.* At that critical point of urgency, the Army, the Air Force and the Marines accelerated the re-organisation process. They provided rubber boats and heavy rescue equipment and helped transfer EOC personnel to a higher-ground building. An improvised operations room was set up. Another important factor that facilitated the re-organisation process, as mentioned by all participants, is that the lead agency had a large pool of resources as it was the largest force so that an operations room could be set up in any of its buildings. The re-organisation process took several hours.

In addition to the collapse of the operations room, the telecommunication systems began to fail in Muscat and the Eastern Governorate due to falling electricity poles and rising floodwater, as most participants described. There were no backup power

generators in the telecom base stations (SC5). Their functioning was dependent on the availability of power. Ordinary people and most responders depended on the telecommunications service as the main means of communication. Two telecom providers existed at that time. One completely broke down, and the other had limited coverage and a weak signal. Despite the availability of satellite telephones, they were not distributed before the event. The communication between responding agencies was disrupted and lost for several hours.

Planning was neither based on understanding the different possible scenarios nor on the different threats that could impact the response system, such as disruption of essential services. Through their practices, responding agencies assumed the continuity of services and, if disrupted, that it would be temporary. Some of them stated that they did not know that disruptions in electricity or telecom would severely impact them, and some stated that they did not know how much they relied on infrastructure services. Consequently, and due to a lack of experience and technical knowledge, they did not have alternatives to their reliance on essential dependencies, such as electricity, telecommunications, water supplies and main road links.

In the ambience of a new theatre of operations, responding agencies found themselves in inconceivable situations. They were assigned a generic role, but they were caught by the large devastation and began engaging in any task regardless of their jurisdiction. Many participants described their performance by saying, “We were trying to do anything” or “We were more engaged in clearing water and debris from the roads rather than carrying out our own work”. As with most emergencies, many new needs were not assigned to any actor, largely due to a lack of proper planning. It became evident to responders that emergencies generate new needs and great demand.

As most participants said, many emergency-related tasks were not understood or obvious, so they were not assigned to any agency. Hence, emergency-related demands require prior planning, including, for example, the logistics of emergency relief items and sheltering operations. The lack of prior planning for emergency-related demands caused a widespread duplication of efforts. Most participants described how they had no idea what a cyclone emergency looked like, what needs would arise and

what resources would be required. They described how they could not project what was likely to happen as they had never been through a similar event in their lifetime. A mental model of what possibly was going to happen was lacking. Underestimation of impact was prevalent. In fact, as some participants described, there was some dark humour that this would happen.

During lost communication between the lead agency and response teams on the ground, the Army managed the crisis by coordinating search-and-rescue tasks, particularly air command (LE3). Usually, they are not the ones whose main responsibility is to provide disaster-related services in civil contingencies. In such extreme situations, their engagement was fundamental in restoring the system from a chaotic state.

The cyclone triggered many landslides and rockslides that caused the collapse of the mountain road which connects Qurayat and Al Amerat, the two Wilayats on the outskirts of Muscat Governorate, to the main city, Muscat (EM1, EM2, SC5 and SC8). The only logistics supply line was cut off. Responding agencies had to use that road to attend to the different requests coming from these areas. It was neither possible to deliver relief items nor to carry out rescue operations using the institutionalised EMS. The procedures of responding agencies became irrelevant in such circumstances as the areas had become physically isolated. With the breakdown of telecommunication services, the new central EOC could not establish situational awareness of what was happening in these areas. As a result, they became physically and communicationally isolated, which caused another bifurcation point in the system. The situation in those areas was dire. They were not asked to evacuate as they were deemed safer, but the cyclone hampered them, while the coastal villages that had to evacuate were slightly affected. As a result, hundreds of houses were destroyed. People in these areas became desperate for rescue and shelter. Evacuation orders were taken based on a subjective evaluation and not based on a vulnerability assessment of the areas, and that was still largely the case in subsequent periods.

Locally, at the Wilayat level, the local administrations were not prepared to manage a crisis. There was a great shortage of relief items, especially water. In addition, there was inadequate preparedness in terms of shelters. It became increasingly clear that

there had been an underestimation of impact and a lack of proper planning. They had very limited local resources and no specialised response teams, no SAR teams, no medical response teams, no media coverage teams, no shelter and relief teams and no prior experience in emergency response (LA1, LE1, EM1). As resources were centralised in the capital city, the plan was reactive in the sense that resources would be mobilised once required. However, in such conditions, that was not possible.

People in Qurayat and Al Amerat, as well as in many parts of Muscat Governorate, found themselves in precarious situations. They were expected to be the recipients of the service from the government. They were, and still largely are, viewed as passive beneficiaries. It is, therefore, important to understand how the situation was managed. What occurred in these areas? Did the self-organisation process take place? And if so, in what form? Gaining insights from these critical moments enable us to acknowledge the most important lessons that should be learned, particularly in managing crises at the local level.

As the formal central EMS was absent due to the new emergency conditions, an informal structure emerged out of chaos to fulfil the unmet urgent demands. The informal system operated locally and consisted of a new lead agency with irregular actors that horizontally interacted with each other. In the absence of state actors, they performed critical tasks. They had to address the gaps as they are critically related to people's fate and livelihoods. This nuclear formation was the backbone of emergency response, and its occurrence confirms the importance of managing disasters at the local level where the impact was.

The formal lead agency is usually the police, but the local Governor's Office, the Wali Office, became the lead agency in these circumstances (EM1, LA, SC8, ER2). The Governor's Office is a civilian entity under the authority of the Ministry of Interior. It works closely with the locals and regularly meets the community's leaders, i.e., the village Sheikhs. It is also responsible for social development and welfare at the local level. The Wali, who was interviewed in this thesis, was present. He had initiated the crisis management organisation and played the emergency manager role, forming teams, designating tasks and pooling resources from different sources. Among the critical improvised decisions he undertook was preventing local food and water

factories and supermarkets from selling to the public. He asked that all transactions go through him and be distributed to where they were most needed.

Unlike the institutionalised system, volunteer teams comprised the largest proportion of the local informal structure. They came spontaneously in large numbers from the affected areas. In addition, the Wali, due to his relations with local Sheikhs, had invited anyone who could help. They carried out critical tasks, including rescuing people, distributing relief and providing shelter. Without the participation of volunteers, there would not have been a re-organisation of the situation. In fact, an entire village was completely flooded. Volunteers rescued its residents and supplied them with shelter and food for three days. Indeed, the Governor's office and the local state actors played important roles, but non-governmental 'informal' actors became the most active responders in the isolated areas. The local Wali or municipality administer (LA), who 'informally' led the emergency response in a Wilayat that became isolated for several days, described this phenomenon as follows:-

"At 1:00 am (6 June), when the cyclone was striking... At 8:00 am the whole area was flooded, around 8 meter … During the three following days, life was similar to a primitive life; no services, no communication with external world. For three days, the situation was not known by the central government. They were not able to know what happened and what was happening in _____. We slept over the roofs. Some villages were completely isolated as service roads connecting them to the town centre were completely destroyed … what people did was very incredible. Even a pregnant woman gave birth in her house as there was no access to the hospital … we worked as one cell."

In addition to volunteer participation in the isolated local areas, volunteers from the Wireless Communication Society could connect the central EOC with the shelters in those areas using a technique not employed by the official responding agencies (EM1, SC8). With the help of a strange attractor, the formal system could receive important information and therefore acquire better situational awareness of what was happening in the isolated areas.

This case study showed that a centralised command-and-control system that highly relies on governmental resources and the availability of routine essential services is vulnerable to extreme conditions. The response to cyclone Gonu showed that disaster risks could be significantly reduced by three key strategies: emergency planning, participatory model of management and localising disaster response. An evolving EMS should learn from its own experiences by identifying and implementing the right lessons. Table 4-1 summarises key learning lessons from the Gonu experience.

Table 4-1 Gonu's organisational learning lessons

Failure	**Lesson**
During the crisis, the mostly affected Wilayats became isolated for several days. Emergency services could not reach them.	Emergencies should be managed at the local level. Building local emergency management capacities is a must. Local disaster management should be the focus rather than focusing on the national/central level.
During the crisis, new informal actors emerged and played important emergency-response roles.	The government should involve non-state actors such as volunteers, professional societies and NGOs in disaster management.
Communication failures occurred due to reliance on grid electricity. Responders were unable to establish situational awareness.	Responders should plan for electricity and communication failures and invest in new ways of backing up essential services such as satellite communication and power generators.
Responders highly improvised doing any tasks, whether relevant or not. Many needs were unmet.	Planning for emergencies should be the basis for emergency response. Responders should be aware of their own roles and the roles of others. Having a written emergency plan is a must. Joint training should be regularly conducted.
Most fatalities were speakers of languages other than Arabic and English (the warnings' languages). Thousands of people were trapped in their flooded houses and did not evacuate.	Warnings should be more inclusive. Languages such as Urdu and Bengali should be included. Conventional and digital means should be used to disseminate alerts and warnings. Warnings should be based on vulnerability assessment as many houses are in lowland areas.
Inadequate emergency resources	Emergencies require resources that might not be used during normal times, such as rubber boats, emergency power supplies and satellite communication technologies.

	A dedicated authority responsible for disaster management should be discussed/considered. Planning and preparedness can be enhanced if a dedicated entity is responsible.

4.2.2 Cyclone Phet 2010

On 3 June 2010, three years after Cyclone Gonu, cyclone Phet made landfall as a category three cyclone near Sur, the administrative capital of Al Sharqiyah South Governorate, located 200 km south of Muscat. It produced its largest impact in an area also affected by cyclone Gonu in 2007. Phet was the second cyclone experienced by the participants in this research. Most of them mentioned that they were surprised to endure another cyclone in their lifetimes. However, they all agree that it was a 'great relief' for them, as the capital city was not directly affected, highlighting that the scenario would have been more severe if it had required a larger mobilisation of resources and had caused more damage. Some participants describe the cyclone Phet experience as follows:-

> 'We have been through Gonu. We entered Phet and we were ready. The operation was easy.' A sector coordinator (SC8) who experienced several storms and served more than 30 years in the government sector.
> 'And during Phet, we already benefited from the experience of Guno.' A sector coordinator (SC7) who worked in the government Media sector.
> 'During Phet, we did not face great challenges. The lessons learned from Gonu, we tried to implement some of them…' An emergency manager (EM1) who was involved in running response operations during Goun and Phet.

In Phet, the maximum wind speed reached 230 km/h in Sur, while rainfall was recorded between 176 mm and 450 mm on Masirah Island over 24 hours (Al-Hatrushi & Al-Alawi, 2011). Generally, rainfall over 50 mm daily will likely cause widespread flooding in arid- semi-arid Oman (Kwarteng et al., 2009). The strong wind and heavy rainfall were also coupled with high waves reaching about eight metres, as reported on the eastern coast of the region. During the early morning of 5 June, the storm dissipated, and the country was left with 24 reported deaths (Alhinai, 2011), including members of the emergency services and two missing people (SC8, EM1). Vast areas were inundated, and thousands of homes were affected. Despite an estimated economic loss of around USD 480 million (Al Shaqsi, 2012). damages were viewed as much lower than those caused by Gonu.

Initial State of the EMS

Most research participants repeatedly mentioned how they learned from their experience of Gonu. Many examples were given, but the most frequent one was that they began to understand their own roles and realised that other organisations also have an important role in emergency response. They described how their awareness increased and encouraged them to talk to other agencies. Most participants mentioned an increase in coordination during the response. However, they simultaneously asked for more coordination before and after an event, during the phases of both planning and recovery.

Learning by individuals is important, but it is largely not shared among the different working teams or integrated within the existing institutions. In addition, it is easily lost when individuals leave their organisations. Though Cyclone Gonu triggered a call to review the national system for EM, as most participants mentioned, the time gap was too narrow to make the changes properly before Phet. Therefore, institutional and organisational learning was minimal. Emergency planning has not changed much since Cyclone Gonu in 2007. Emergency plans were still absent across the different levels of government, with continued duplication of efforts and lack of clarity in designating roles, as identified in the previous event. Several draft laws had been prepared before Phet and, in fact, before Gonu, but they had not been issued for some reason. Various participants suggested that another ‘disaster’ was perhaps needed to accelerate the issuance of emergency plans. Similarly, exercises and drills, particularly joint training, were still lacking. Most agencies, if prepared, still worked in isolation, although the Gonu experience showed the need to coordinate.

Gonu was a mental model for the responding actors participating in both events. They frequently compared the two disasters, as the same areas were affected, and the events were only three years apart. Gonu helped agencies to form awareness of what the situation would look like in Phet. Therefore, days before its impact, there was an overwhelming acceptance among officials of the seriousness of emergencies triggered by cyclones. Many participants described how most officials felt unable to accept the possible magnitude of devastation in cyclone Gonu. This time the spokesperson warned people through the different media, emphasising how serious the event could be. People were told to take action to protect themselves, which involved an important change in awareness and the public’s risk perception. These

factors helped reduce the demand for emergency services. In contrast, a sector coordinator who experienced several storms and was involved in storm data analysis (SC8) described how officials could not accept the possible scenario of Gonu as follows:-

> "There were doubts among them that "this thing cannot happen". I told them trees along the road will fall down. There will be large inundated areas. Most wadies will flow. Things like that. They could not comprehend the picture. … They could not believe. They believed that we can deal with it."

Emergency-related demands only appear during crises. Hence, many of them were unknown to the government agencies before cyclone Gonu, as many participants described. Thus, some tasks were left unassigned to any agency. Existing agencies were given new EM roles, following the general norm that utilising existing resources and organisations is best instead of establishing new agencies. Among the important tasks were managing and distributing relief items, operating shelters assigned to the Ministry of Social Development, and searching and rescuing stranded people assigned to the Police. Despite the importance of ensuring that all emergency-related demands are assigned to an agency, some participants mentioned that these tasks were irrelevant to their regular work and expertise, which created barriers for them in developing the required resources and capacities to fulfil the new roles. It is important to acknowledge that emergencies create roles and tasks, not part of routine activities; hence, they must be accepted and learned in advance.

A presidential order to review the national civil defence system was issued immediately after Gonu. However, none of the participants mentioned a thorough evaluation and analysis of how events unfolded during Gonu. Instead, several participants mentioned forming a working group that visited different countries to learn about the different organisational structures for crisis management. According to them, the idea of dividing the EMS into sectors or functions came from this initiative. Although no formal EM plan existed, two sectors were recognised during Phet: relief, shelter, and search and rescue (EM1, EM2, SC8, ER2). Each one was managed by a lead agency and included several governmental actors. They had worked as they would in a coordinated response. As several participants described, the 'experiment' (working

as sectors) was viewed as a positive change. After that, the idea was formally implemented and broadened to include different functions.

As it did during Gonu, the national multi-agency coordinating committee, the NCCD, convened in the capital city, discussed matters, designated roles and formed a response plan just before the cyclone approached (EM1, EM2, all SCs). The national EOC was also activated and had been relocated to another building that is on higher ground after its collapse and failure during Gonu. As a precautionary measure, a backup location was also prepared in case of the failure of the new EOC for any reason. The strategic committee was still governmental and had no members from the private or voluntary sectors, despite their active participation, informally, in crisis response during Gonu.

At the regional level, a joint coordination committee was formed in Sur, the Eastern Governorate (EM1, SC2), which amounted to a new procedure absent during Gonu. A decentralisation of crisis management had taken place. The regional multi-agency committee set up a temporary EOC to coordinate the response tasks, which enabled the regional agencies, such as Police, civil defence, social care and health authorities, to rapidly share information as they were co-located to the same site. Tasks were designated among them. They had worked jointly towards a shared objective. Shelters, for example, were activated and prepared by several government agencies (SC4, T). The evacuation of Masirah Island was also a great coordinated effort because it was a remote island and more at risk of storm surges. However, disaster response resources were still centralised in Muscat, despite the apparent failures during Gonu. They had to be mobilised to the Eastern Region as regional preparedness was deficient. Furthermore, they were still centralised in the city centre and not distributed across the different Wilayats, the local areas.

Despite the severe conditions in the isolated areas during Gonu, local emergency preparedness did not change. The Wilayats – the lowest administrative level of the government – still did not have a crisis coordinating agency at the local level. The informal EM team that spontaneously formed during Gonu was not institutionalised. However, some individualistic initiatives were taken by Walis for the first time. The local Wali of Masirah, for example, encouraged people to evacuate. Also, private boat

owners collaborated with the emergency agencies and helped to evacuate people. A government charitable society worked collaboratively with a government agency to prepare shelters and provide relief items. Main supermarkets and bakeries also worked with government agencies to provide relief food and drinks. At this stage and time, the roles of non-state actors began to be recognised. Although informal, these initiatives highlight the necessity of collaborating with non-state actors.

As most causalities during Gonu were expatriates whose first language was neither Arabic nor English, warnings and alerts were issued in seven different languages: Urdu, Hindi, German, Malay, Pilipino, English and Arabic (OD4, SC8). A multilingual warning was a major lesson learned from this experience of Gonu. Official warnings began three days earlier (OD4, SC8), giving people ample time to evacuate and seek shelter. There was an early activation of live streaming by the official TV and radio stations. The alerts and notifications included the cyclone's track, forecast rainfall and storm surge. However, instructions on what to do or where to go were lacking, as with Cyclone Gonu.

The importance of early evacuation was also a lesson learned from Cyclone Gonu. Hence, the Police began an early evacuation of Masirah Island and the coastline of the Eastern Region. Joint tasks between a civilian airline, the Omani Air Force and the police air arm were carried out in large-scale air evacuations of Masirah Island. In addition, when Phet struck, it was on the weekend. Most people were in their original hometowns, which meant there was no need to declare a public holiday, particularly for schools, and there was no need to evacuate Muscat, the capital and largest city in the country. There was a wide acceptance of public of the need to evacuate. Schools were activated as shelters in the governorates of Muscat, the East and Al-Wusta (EM1, SC4, ER2). The early evacuation and activation of shelters reduced the number of search and rescue demands. Reduced demands on emergency services were regarded as a measure of the success of the overall operation.

Emergency conditions and impact on the EMS

All participants agreed that Phet did not bring unanticipated challenges to the responding agencies. It was less intense and brought less rainfall than Gonu. In addition, it did not directly impact the capital city, where the vulnerability was much higher. Moreover, this time, critical failures that brought the system to a state of disorder during the response to cyclone Gonu did not occur. Therefore, the operating environment was less disturbed. Main roads connecting the towns and telecom services were available. An emergency manager (EM1), who was actively involved in the management of the crisis, described the smoothness of the operations during Phet in comparison to Gonu as follows:-

> **"**I was at the EOC. The benefit was in the way of managing the crisis and planning. It was a smoother process comparing to Gonu. We didn't face problems such as inundation of the EOC. We met and a statement was issued that included the preparedness of the committee. Command to raise the alert level to the orange level.**"**

Nevertheless, some challenges did emerge, as is the case in all emergencies. Service roads connecting the villages to the town centre in Sur were easily inundated (SC2). Similarly, many service roads in Muscat were also flooded (SC2, EM1, SC8, ER1), a nationwide problem for the drainage system. Flooded roads created a challenge for the responding agencies as they were engaged in clearing the debris from the roads instead of carrying out their own tasks, such as rescue operations and relief distribution. Main roads, however, were not significantly affected. There was no blockage of essential roads. Emergency responders were able to use them to deliver their services as needed. A sector coordinator (SC4) described engaging in tasks that were not part of their roles:-

> "We had major issues with the water pools in the roads. For example, Sultan Qaboos road (the main road in the capital city) when it rains water pools stay there and block the road. These are not Wadis. We had to deal with these issues. We had to suck water out of the roads instead of doing our own work (search and rescue)."

Electricity was also interrupted in many areas in the region due to the collapse of transmission poles (SC5, SC2, ER3, EM1). Many areas became isolated for several hours as a result. The electricity failure was not as extensive as it had been in Gonu. It did not lead to the collapse of the telecom service. Both organisations and the public

were able to communicate. Sustained communication was important, as information could flow easily in both directions. In addition, the situation in the affected areas was not very difficult as people managed to remain at home safely due to lower rainfall totals and wind speeds compared to Gonu.

Due to heavy rainfall, most of the water reservoirs in Muscat and the Eastern region were full (EM1, ER2, SC8). It was a critical moment as several participants mentioned that everyone hoped the dams would not be breached, which was a growing concern among the public, especially those living near them. These structures overflowed but did not collapse. The risk led authorities to warn people to exercise ‘extra caution’. Unfortunately, what that meant for people was ‘to be more concerned’ without knowing what actions to take. As there was no early warning system for the 32 dams distributed nationwide, the authorities were unaware of breaches in the levee system (WMO and ESCAP, 2010).

As several participants agree, one of the critical issues was a conflict over which agency was to lead at the regional level. Some participants attributed it to the absence of an emergency plan which led to a lack of clarity regarding the designation of roles, as they were not institutionalised. Others attributed it to inaccurate situational awareness based on an assumption derived from Gonu that the lead agency would ‘lose control’ of the system. The strange attractors, actors who are not part of the formal response system but whose actions were critical to peoples’ survival, were the armed forces. They played critical roles in re-organising the EMS during Gonu and were also involved in Phet. Following this sensitive issue, institutionalising roles by writing an emergency plan seemed to be an effective tool to avoid problems in the future.

The response to cyclone Phet was viewed as effective by most participants. However, some issues emerged due to inadequate emergency planning. Table 4-2 lists four organisational learning lessons based on Phet’s expereince.

Table 4-2 Phet organisational learning lessons

Failure	**Lesson at the institutional and organisational level**
Organisational conflict over the lead agency at the regional level	The response should be based on planning. Having a written emergency plan can help designate roles and specify the lead agency at different levels and in different disasters.
Duplication of efforts	Agencies should work together (coordinate and collaborate) in the planning phase and plan for efficient use of resources during crises.
Unassigned emergency-related tasks	The response should be based on prior planning, making sure all tasks are assigned to an actor.
The unfamiliarity of emergency-related tasks that are not routine for some actors	Agencies need to conduct exercises, drills and joint training in order to understand their own roles and the roles of others.
Inadequate management of shelter and relief items	Building capacity for shelter and relief items management is recommended. Engaging professional voluntary organisations (local and international NGOs) in this task could assist in developing this sector.

4.2.3 Cyclone Mekunu 2018

On May 25 2018, Cyclone Mekunu struck the Governorate of Dhofar, located in the country's south-eastern corner. This region is affected by a cyclone about once every five years (Kwarteng et al., 2009). According to the NOAA historical database, Mekunu was one of the strongest cyclones to affect this region since 1958 and the third, after Gonu and Phet, to make landfall as a category three cyclone. Parts of the region recorded over 270 mm of rainfall within 24 hours (T5). Recorded wind speeds were over 100 km/h in many places (T5). Salalah, Dhofar's capital city, received double its yearly average rainfall in less than 24 hours. According to the Omani Meteorological Service, wave heights reached 8 to 12 meters off the coasts of Dhofar and Al Wusta regions (T5).

After four days of impact, Mekunu left Oman with seven casualties, including a member of the emergency response services (T3). The economic loss was estimated at around USD 1.5 billion (T7). Fishing and agriculture, the main sources of income in the region, were severely impacted. Over 34 fishing boats were destroyed, and hundreds of coconut and banana trees were uprooted (T7). The storm caused several days of power outages, telecommunications disruptions, and severe flooding. Participants described their Mekunu experience as follows:-

> 'If you ask me whether we worked *positively* and in a *planned* manner, I would say "NO"' male sector coordinator (SC5)
> 'What happened was not expected' male sector coordinator (SC2)
> "What happened reminded us of what happened in Gonu" male emergency manager (EM1)

Given this brief context, the following section analyses the governmental response to Cyclone Mekunu. It first discusses how the system's initial state had changed since cyclone Phet, and then it identifies changes in the preparedness actions that were taken before the cyclone's landfall. Then, an analysis of the emergency conditions and their impact on the formal EMS is provided. It compares whether they differ from those that prevailed in the previous events. The analysis is inspired by chaos theory, as detailed in Chapter 3.

Initial State of the EMS

Emergency resources were mobilised from Muscat to Dhofar as regions have limited capacities (EM1, EM1). They were stationed at a central location in the town centre at the lead agency's premises (SC5, EM1). Mobilising them to any Wilayat in the Governorate was based on the requests received from the public or the organisations. The response was described as proactive from the national viewpoint. However, it was noticeably reactive at the local level. The reason is that disaster response is structured through existing organisations. As noted by several participants, most agencies have an office at the regional level and rarely at the Wilayat level. For example, medical response teams are not likely to be present where no medical centre exists in a Wilayat. Similarly, a search-and-rescue team is not present in a Wilayat that does not have a civil defence authority.

> "The preparedness that we take is at the regional level. And at the same time, we place a support plan for the Wilayats. During Mekunu, resources were stationed in Salalah, the city centre, at the police headquarter in Salalah. It was the main activation point. We provided the support. Salalah obviously needs the support from the organisations in Muscat during emergencies as we understand its capacities are limited." A government official describing preparedness actions to Cyclone Mekunu (EM1).

Dhofar's NCCD was formed at the regional level (EM1, EM1, T3, T2). It included regional government response agencies. The formation of a regional unit enabled rapid information sharing and the formation of response teams, such as an emergency water supply team, a medical response team, a search-and-rescue team, an essential services recovery team, and a relief and shelter team. They activated several call centres for residents' inquiries. Contact numbers were distributed across different media. A regional EOC was also activated. Due to a lack of technical expertise at the regional level, support from the central EOC was required (EM1, EM2, ER3). The regional EOC sent commands to the different areas in the region and managed the crisis by centrally directing resources within the region. It received commands from the central EOC in Muscat and reported updates from the different sites to the national centre. Most of these actions marked a new trend in emergency response centred around addressing the different needs of the affected people. However, they have not

been institutionalised (OD1, OD2, OD3). They were improvised and largely driven by the strong political impetus.

This time, warnings, alerts and notifications included the cyclone's features and instructions about what actions to take (T5, T6). Examples included the need to obtain a battery-powered radio in case of the interruption of electricity supplies, to remain indoors, to avoid crossing a running flood under any circumstances, and to enable the feature of 'automatic transfer between different telecom operators' networks' so that if one network fails during the storm, the mobile phone automatically connects to other available networks. Through its different channels, the official media broadcast several animated videos on how to act in a cyclone event (SC7, T6, T7). Warnings were issued in seven different languages (T6, T7). They were circulated using different means, both traditional and digital. Responding agencies made heavy use of social media. Private media operators were strongly engaged, working collaboratively with government agencies and coordinating with the media and public awareness sectors (SC7). In addition, spokespersons from different sectors and governmental levels addressed the media, which ensured representativeness. However, the risk of sending out conflicting messages arose on several occasions.

Major evacuations took place based on the early warning sector's recommendations. Coastal areas were anticipated to be at higher risk than inland areas (SC8, EM1, T6), similar to what happened in Gonu in 2007. Therefore, the Wilayats of Rakhyut and Dhalkut were evacuated. The Air Force evacuated Al Hallaniyat Island. The coastal line of Salalah was also evacuated. Seaports in Al Wusta and Dhofar Governorates were evacuated. Foreign workers, mainly in the fishing industry, were taken to shelters. Main hospitals were evacuated. The Air Force transferred patients to other hospitals in the country (SC3). The Air Force and Police Air carried out large joint-coordinated evacuations. Mekunu represented the largest evacuation event in recent emergencies. As Dhofar's inland western areas were deemed safer locations, they were not asked by the authorities to evacuate, nor were they provided with shelters or relief items. People were advised to remain indoors and limit their movement.

The authorities opened 23 shelters in the two regions to accommodate the large number of evacuees (T6, SS2, SC4, T7). As always, schools were selected. Despite

it being a subjective evaluation, eleven criteria were considered, this time, when selecting 'safer' schools (SC4, LE1). A joint decision-making process was used between the NCCD and the Ministry of Education (EM1, SC4, LE1). The shelters were opened before landfall, and the authorities used public and private media channels to disseminate their locations (SC4, SS2, T7). Evacuees were supplied with food, water and sleeping materials. However, most local Omanis stayed with their relatives or in private accommodation provided by hotel and flats owners (SS4, SC4, EM1). Communal emergency shelters are unpopular in many parts of the world, particularly North America. Most shelter evacuees were foreign workers who make up a significant share of the local population (SC4).

According to the majority of the participants in the survey, closures of critical facilities became a new norm of preparedness after cyclones Gonu and Phet. They agreed that closing down some of them was necessary to mitigate the cyclone's impact. Consequently, as a precautionary measure, the only airport and the main seaport in Salalah closed for 48 hours (EM2, T1, SS2). The effects of shutting the city's two main arteries were uncalculated and remain unknown. As noted by the coordinator of basic services (SC5), the refinery also terminated its operations to prevent damage. Fuel had to be brought from the refinery in the northern part of the country, a 15-hour journey. Fuel, electricity and water are all produced by private companies, while distribution is by government companies (SC5). The closure of these facilities is a decision the company took following its HSE policies. Electricity has also been cut off as a response to recent cyclones. Electricity supply was interrupted for a few days in several Wilayats (SC5, T4, T6). In addition, some roads were closed down for the duration of the cyclone (T3, T7).

Dams form important elements of protection. The government has built several of them across the country to feed groundwater and protect communities from flooding. Two major dams in the region were emptied, and the authorities cleared debris from the Wadis' paths to allow smooth flash flooding (T4, T6, SC, EM1). Three days were declared a holiday for the administrative government in Dhofar and Al Wusta. The level of preparedness in this event was unprecedented, but it remained highly improvised and continued to ignore some of the most important lessons of the reference event, Cyclone Gonu.

Emergency conditions and impact on the EMS

Despite the storm's severity, crisis management was conducted efficiently by organising and directing resources from the regional EOC. The first hours of the impact were not a time of critical challenges. Communication lines were operating as expected, allowing rapid exchange of information and jointly-formed situational awareness. Response teams were concentrated in the town centre; a few command posts were present across the city (EM1, EM2, T4).

After several hours of impact, many areas in Dhofar had received enough rainfall to cause extensive flooding. Hundreds of houses that were thought to be located in safer locations (and, as a consequence, were not evacuated) were severely impacted (EM1, SS2, T7). As many had unstable roofs, occupants found themselves in risky situations and sought refuge in other houses within the same village community. In addition, the episodes of electricity disruption, telecommunications breakdown and water shortages changed the operation conditions. Responding agencies started to receive substantial numbers of calls from people. The magnitude of the impact was noticed through the large scale of the search and rescue operations (SC2, T2, T7, T4). Joint rescue operations by the Air Force and Civil Defence organisations concentrated on the northern parts of the region and Salalah city.

Until this point, the formal EMS was able to deliver its tasks. It had not faced a '*cosmology episode'*, a situation when things seem out of control from the perspective of responders. In other words, a critical failure that directly impacted the system's functioning had not occurred yet. The heavy rainfall and strong wind gusts started causing widespread landslides and rockslides (SC8, T3, T5). Within several hours of impact, the mountainous road connecting Al Mughsail and the western part of Dhofar to the main city, Salalah, had collapsed (EM1, SC8, EM2, E3). It was the only logistics supply line for the Wilayats of Dhalkut, Rakhyut and the western areas. This eventuality represented an escalation point at this time. Mobilising resources from Salalah was dependent on the availability of that road.

The disruption of the telecommunication services further escalated the situation. Resources were centralised, as well as communication, as notifications and

instructions were centred upon the regional EOC. Unfortunately, the preparedness efforts were only made at the national and regional levels. At the Wilayat level, local preparedness was deficient. As a result, the emergency conditions were similar to those during the response to cyclone Gonu in 2007. Back then, two Wilayats in the governorate of Muscat, Qurayat and Al Amerat, were isolated for several days. This time, the western areas of Dhofar became isolated for several days, and emergency response capacities were very limited, if not absent.

People in these areas found themselves in a very difficult situation. The responding agencies could not utilise the resources they had prepared and deliver them to places they were desperately needed (EM1, SC2, SS2). Most participants described how the situation reminded them of Gonu. The response was based on attempts to answer the requests from different areas. Despite the large evacuations and mobilisation of resources by the central government from Muscat to Salalah, the response at the local level was still very reactive. In this context, this phenomenon was created by the intersection of two elements, the unavailability of critical infrastructure services, most prominently roads and telecommunications, and the absence or severe shortage at the local (Wilayat level) of emergency preparedness.

> ‘During Mekunu, the road was disrupted and we could not reach (the affected areas)...’ An emergency responder describing the response to Mekunu (ER1).
>
> "What happened reminded us of what happened in Gonu." An emergency manager describing how Mekunu reminded them of Gonu despite the difference in time and affected region (EM2).
>
> “The western region of Dhofar was isolated. The roads linking Dhalkut and Rakhyut areas to other parts of Dhofar were destroyed. If we talk about improving the roads. The Mughsail road was cut and damaged. The weather conditions did not allow the air transport to deliver relief items. The marine conditions were also not allowing for ships to pass by. And the only port was there was a fishing port. So for three days, the area was isolated." An emergency responder describing what happened in affected areas during Mekunu (ER2).
>
> " The main reason for services delay is the road interruption. Our resources were in Salalah even before the cyclone approached. But the road was not there.” The coordinator of the basic services sector (SC5) describing the dependency on road availability.

Unfortunately, this scenario was not planned for, although it had occurred recently. No procedures existed to guide the behaviour of the responding agencies in the emergent situation. Existing procedures became irrelevant under such emergency conditions. They remained in abeyance until the storm had weakened. Confronted by a *'cosmology episode'*, defined as a situation when things start to be out of control from the perspective of the emergency responders, they, unfortunately, were engaged in a conflict over mobilising resources in such risky conditions (EM1, EM2, SC3). Members of the Municipal Council and Al Shura Councils, elected officials, requested the government to send rescue teams and relief materials (EM1, EM2, ER2). Personnel at the EOC described how a risky decision was taken by sending a ship to an affected area with no appropriate port or personnel to receive unloaded items.

As the institutionalised system could not reach the affected areas, the plan and the bureaucratic procedures designed for disaster response became useless. Therefore, it is important to understand whether or not the situation in the isolated Wilayats was managed. Moreover, if so, it is important to identify the process that had taken place, the factors that facilitated it and the live actors who managed to move into an organisational mode and respond to people's needs. It would be useful to acknowledge the appropriate lessons and feed them into the EMS policies and procedures.

A resident (SS2) from Dhalkut who lived through the Mekunu experience and was interviewed by the local News channel described how they dealt with the emergency as follows:-

> "Mekunu was hard on the people of Dhalkut as they were the ones who had to deal with the emergency. They did not have complete awareness and warnings were not sufficient. What happened was not expected because the electricity, TV and telecom were disrupted. The situation was very hard for us but we dealt with it with what we had particularly at the shelters. The local municipality worked hard despite its limited resources."

The changing conditions in the isolated areas necessitated a new form of management. Similar to what had previously been observed during Cyclone Gonu in 2007, local leaders formed emergency response teams that largely consisted of local spontaneous volunteers (SS2, EM2, SC5, EM1). Under the local governor's

leadership, they helped restore the situation by evacuating people and providing them with shelter and food supplies. According to chaos theory, this reorganisation process (bringing the situation back to a new form of order) was facilitated by 'strange attractors', actors not part of the formal system but whose actions were critical to peoples' survival. Again, this highlights the importance of localising disaster response and integrating voluntary teams into crisis management systems. However, these were individual initiatives that emerged to fill the gaps in the formal system. In addition to local volunteer groups, the armed forces played their usual supportive role in creating temporary ground access to the affected areas and delivered relief items using specialised heavy vehicles (SS2, EM1, ER4, LE3).

Local volunteer groups formed in the different parts of Dhofar. They represented the largest workforce then, although they were not recognised as legitimate actors in the formal EMS. According to the coordinator of the relief and shelter sector (SC4), they came from three streams: the local committees for social development (LSDC), the local charitable and volunteer societies, and groups spontaneously formed in the affected areas. The LSDC is an *ad hoc* committee charged with carrying out several roles, a few of which relate to crisis management. Besides its consultative and awareness-raising roles at the local level, it has started to organise and support volunteer and charity activities. The local governor heads the committee. Although its legislated roles do not mention participation in emergency management, participants in this research frequently referred to it as the arm of the relief and shelter sector at the local level.

Local charities and volunteer societies were established to provide social care services. They were not expected or trained to participate in emergency-related work, but during Mekunu, they engaged fully and performed different tasks (SS2, SC5, EM1, SC4). For example, in the shelter centres, they helped register evacuees and rescued people. They prepared and cooked food and distributed relief items to the affected households. They even worked to increase awareness of hazards among community members. In addition, female volunteer societies worked with vulnerable female-headed households whose homes were affected and had limited access to financial resources (SS2, T6, T7). On the other hand, the official responders were, in large measure, strangers to the locally affected areas, while volunteers came from local

areas and knew the local people. They knew the characteristics of each community. Local people were more likely to trust and listen to the volunteer groups as they were from their communities. They spoke their language and dialects and understood their norms and rules of interaction. Acknowledging this advantage can further enhance the smoothness of operations.

Spontaneous volunteers also participated in Cyclone Mekunu (SS2, T6, T7, SC4). They worked collaboratively with government officials, which was not a question of choice but a necessity. Confronted with devastation and the absence of governmental resources, they were urged to be actively engaged. The official media positively acknowledged their role. It also recognised the volunteering work as a strong sign of social solidarity. On the other hand, the high surge of spontaneous volunteers from outside the affected areas could create unintended negative consequences for crisis management. Therefore, the Ministry of Social Development had to issue a new procedure requiring volunteers and volunteer groups to obtain permission before engaging in any crisis management task (SC4, EM1, T4). The National Youth Committee, a newly-formed body designed to gear up youth participation in voluntary work, began to register and organise volunteers.

> "Societal and volunteer teams that emerged during Mekunu had a great role to reach out to society and creating sustainable cooperation. They worked as a complete cell and proved their efforts during that critical period. We hope it increases its efforts but always put the public interest before any individual interests. The solidarity is necessary and integration of all stakeholders and local societal volunteer groups is necessary for these circumstances." Al-Shura Council member addressing the role of volunteers in crisis management stated in the media.

The supportive role of the armed forces appeared again in Mekunu to help bring the system back to its stable state. It was done through the activities of marines who shipped relief items to the western areas of the region and the army's role in distributing them to shelter centres (EM2, ER4, LE3, T4, T6). Following existing rules of engagement, the armed forces participate if asked to do so by the civil defence central committee. The responding agencies accept the armed forces' involvement in managing civil contingencies. The positive relationship between civil agencies and military organisations influences this sense of acceptance. Most responders share the

perception that they need the armed forces' resources. On the other hand, this need seems to have created a culture of persistent dependency.

> "In Mekunu, if you look most of them are from the Army. We have soldiers that crawled over the mountains carrying water for people." A retired Army commander (LE3) describing some activities of the army during the Mekunu response.

Private sector participation in the Mekunu response was also observed. Several participants, however, shared the belief that their participation was random and based on voluntaristic efforts. The participation was largely in donations and loans (EM1, SC4, T6), e.g., flats, houses, equipment, money, relief items and food. Private hotel owners, for example, offered people rooms and flats as temporary shelters (T6, T7). This behaviour became very apparent when the media began to highlight it. Private companies also donated millions of Omani rials. However, several media reports did raise the question of whether these donations were received and, if so, how and where they were distributed (T7). In other words, the process was not transparent. Nevertheless, several companies participated in clearing debris from the streets. The private sector's involvement in crisis management is still unorganised. The government and private media were active during the emergency phase and regularly distributed notifications and press releases (T6, T7, SC7).

Despite large preparedness measures, most participants perceived the response to cyclone Mekunu as ineffective. Table 4-2 shows several organisational learning lessons from the response to cyclone Mekunu that also appeared during cyclone Gonu in 2007. The existing management model heavily relies on the government and the availability of routine essential services. The responses to cyclones Gonu in 2007 and Mekunu in 2018 showed that integrating non-state actors and localising disaster response are among the most important organisational learning lessons that should be learned.

Table 4-3 Mekunu organisational learning lessons

Failure	Lesson at the institutional and organisational level
Large affected areas (western parts of Dhofar) were isolated for several days with no disaster response capacities	Localising disaster response (at the Wilayat level) became a clear need for effective disaster management.
The response based on the assumption that essential services would continue during the crisis has led to an ineffective response.	Emergency planning should include the scenario of a disrupted environment and failures of critical infrastructure.
Centralised EM (resources, communications and decision-making) could not reach mostly affected areas. Local governors informally assumed crisis management with severe response capacities.	The disaster governance model should not only include government agencies; it should be modified to include non-government stakeholders (local volunteers' societies, charitable organisations) and local government agencies (municipalities, women's societies) as active actors in disaster response. The unorganised and spontaneous participation was inefficient and caused chaos in some places. Hence planning for their participation is important.
Not evacuating inland areas (mostly affected areas) based on a subjective analysis of risks.	Evacuation decision-making should be based on a thorough risk assessment that considers physical and social vulnerabilities of the place.

4.2.4 Cyclone Luban 2018

On 13 October 2018, five months after cyclone Mekunu, Cyclone Luban struck the same region, Dhofar. In the recent history of Oman, two cyclones near each other (within the same year) impacting the same region had never happened. People were concerned about whether this would become a new norm (SS2, T6). Luban also coexisted with another cyclone in the North Indian Ocean, but fortunately, it did not approach the Arabian Peninsula. Luban reached category one strength on the Saffir-Simpson scale but made landfall merely as a cyclonic storm (T5). Fortunately, it left no significant injuries and caused little physical damage. There was one recorded death (T4, EM1). The storm continued its path towards Yemen, where damages were significant.

Luban was selected in this analysis because participants frequently made repeated comparisons about preparedness and response between the two cyclones. The memories of Mekunu were still fresh. The general perception among the participants on the response in Luban was 'better', as lessons learned from Mekunu were easily implemented, as many participants mentioned, despite the difference in intensity between the two. Therefore, the objective is to understand how Mekunu's experience relates to the changes in response to Luban if indeed it does. As these events affected the same region, it would be interesting to observe the immediate changes in the preparedness and response actions taken to address the failures identified in the subsequent event, regardless of the storm's intensity.

Initial State of the EMS

Similar to preparedness actions during Mekunu, the *ad hoc* civil defence committee and a temporary EOC were formed to coordinate multi-agency response at the regional level (T4, T6, T3, EM1, ER5). Despite being temporary, these formations have become routine and have decentralised crisis management to a lower governmental level. In addition, the presence of responding agencies in one room has created a platform for establishing collective situational awareness and rapid decision-making. Nevertheless, the regions had limited capacities for disaster response. For example,

operating an EOC required support from the central government. Resources and teams from the different government agencies, such as civil defence, police, medical response and services recovery, were sent from Muscat (SC3, SC1, SC2).

Centralising resources in one location during Mekunu, or as participants referred to it as ‘the central activation point’, turned out to be risky as the emergency conditions made it difficult, and perhaps impossible, to mobilise them to the affected areas. Therefore, some actors took proactive measures, particularly the essential services organisations. They distributed equipment and machines to several locations in the local municipalities rather than centralising them in the city centre. The coordinator of the basic services sector (SC5) described this important lesson from past experience as follows:-

> "the experience we had during Mekunu benefited us in Luban. During Mekunu, the road was disrupted and we could not reach the affected areas. But during Luban, we made sure that the resources are present before the emergency occurs. We considered that the road is no longer there.”

Similarly, as telecom stations failed during Mekunu due to electricity failure, power generators were distributed before the impact to the telecom stations and critical facilities such as shelter centres and hospitals (SC5, SC3, T4, T6). In addition, the telecom regulator and the two private service operators initiated a joint control room for telecom services to ensure service continuity (SC5, T7, T6). The wireless communication team of the national scouts was also called to participate in crisis communication (EM1, SC5). The broad of services has expanded by integrating new actors in the communication sector. For example, a private telecom provider activated two control rooms, distributed recovery teams and repaired equipment across the region (T7). These actions were not observed in previous cyclones.

> "... We also learned how much telecom services were reliant on electricity… They provided generators along grid electricity. So they knew that … electricity interruption will lead to telecom interruption. … they provided alternative sources for power." The coordinator of the basic services sector summarised how they learned from Mekunu's experience in response to Cyclone Luban.

New roles carried out by established agencies were also observed during Luban, which increased the breadth of services provided by the EMS. For example, response teams formed by the Ministry of Trade and Consumer Protection Authority were distributed across the region to monitor and ensure the continuity of commodities and the availability of fuel and cash and to prevent the increase of prices due to manipulation by business owners (SC5, EM1, T6). These were major issues during Cyclone Gonu when the price of a 600-gallon water tank went from 5 OMR to 50 OMR (UK£9.6 to £96). Also, the role of the Tourism Ministry was not noticeable during the previous cyclones, but in Luban, it asked hotels to prepare and activate their emergency plans (T4, T6, SC4).

Similar to Mekunu, several critical facilities were closed as a precautionary measure. The cargo airport was closed for 24 hours, although the international airport operated during the storm (T4, T6). The port of Salalah was also closed down for three days for similar reasons (SC5, T4). The oil refinery terminated its operations (SC5, EM1). Despite critical installations that needed to remain open, the Rakhyut Hospital and Royal Hospital were temporarily closed (T6, SC3). Official authorities did not give explanations. A one-day holiday for the administrative government, including schools, universities and colleges, was declared in the Dhofar region. Similar to the situation in Mekunu and Phet, alerts and warnings were issued in several languages through different communication channels, including social media platforms (T5, SC8).

One lesson learned from Mekunu was that local agencies perceived local preparedness for Luban as a necessity. For the first time, local government agencies were proactive as they engaged in measures prior to the landfall of the cyclone. It was perceived as '*the essential thing to do*' to avoid the failures that had occurred during Mekunu. Local municipalities in the Wilayats formed committees for crisis management (T7), new *ad hoc* formations that were not present in previous emergencies. The Walis headed these committees. They also addressed the public and the media. This new trend gave local administrators unprecedented authority and a sense of ownership. For example, the Wali in Taqah issued an evacuation order for the coastal villages (T7), something that was unprecedented. Managing the crisis at the lowest administrative level created more flexibility and rapid decision-making, as

is required in crises. These new rules were unwritten but largely shared and accepted at that time. However, they are missing in the official plans and policies.

The new structure for managing crisis at the local level, headed by a civilian authority, was not the style of management in the past cyclones when the lead agency had always been paramilitary. The consequences in Dhalkut and Rakhyut during Mekunu dramatically and abruptly impacted the system. Not only was crisis management decentralised, for the first time, by including local societal volunteer groups and private sector members, but it also became more participatory. Their roles were recognised and praised by the official media. Local private companies, for example, collaborated with local municipalities to clear wadis of debris.

> "Mekunu was hard … Now we are more prepared for Luban as we have local volunteer teams that are cooperating with the government to provide food and essential items in the shelters' centres." A resident from Dhalkut who lived through Mekunu and Luban experiences described the difference in preparedness to a local private news agency.

In addition to serving as local joint information centres, the local committees formed response teams to perform emergency-related tasks such as compiling inventories, distributing relief items and making risk assessments of households along the coastline (T7, SS2, ER6). They also distributed resources to the villages, such as water-pumping equipment and tree-cutting machines (T7). In addition, the shelters were prepared by local actors consisting of the social development directorate, medical centres and societal volunteer groups (SC4, EM1, T7). Several schools were prepared as shelters and supplied with relief items. A medical post was prepared in each centre. In Dhalkut and Rakhyut, the main shelters are concentrated in areas mostly affected by the previous cyclone, Mekunu. Several areas and facilities were evacuated, but the scale of the operation was less than it had been during Mekunu. Most evacuations were faced with limited challenges. However, some local farmers refused to evacuate because there was no evacuation procedure for their animals (LE1). They lost many animals in Mekunu. Therefore they remained in their areas to protect their animals which were their main source of income.

Another important task that became a new norm or routine was clearing the paths of the wadis prior to the impact of the cyclone. The municipalities in the different communities worked with private heavy equipment owners to ensure the clearance of wadi channels of debris and the remains of trees and plants (T4, ER3, T7). The major hazard that emerged during Gonu was inland flooding, as flash floods did not find clear paths to the ocean. The debris blocked the bridge openings, and water accumulated, causing large-scale flooding.

Local disaster preparedness marked a fundamental change in crisis management, as it occurred ahead of the cyclone and was supported by the central and regional governments. They were the ones who actively engaged the public and media. A fundamental change was the active participation of voluntary teams and their preparation. Discussion of these phenomena and their relations to the existing literature is further elucidated in CHAPTER 6.

Emergency conditions and impact on EMS

In comparison to Mekunu, Luban brought less rainfall and weaker wind speed. About 145 ml of rainfall was recorded in some areas (T5), which did not cause major challenges for the responding agencies. Its impact on the EMS was minimal, as major failures did not occur. A bifurcation point was not observed in the system.

Like all storm events in Oman, flash floods were immediate consequences, as they are easily formed due to the steep mountains in the West part of Oman and the arid nature of the soil. Six wadies had cut off road transport within the Wilayats, particularly those built on the wadi paths (T6, T7). The main road connecting the western area to the rest of the region, which collapsed during Mekunu, was also cut off but restored within several hours (T7, T4, EM1). Due to the lower intensity of the storm, it was not severely damaged. In addition, other main roads connecting the different Wilayats, which responders relied on to deliver their services, were unaffected. During Luban, areas were accessible by ground transport.

In addition to the availability of roads, telecom services also remained functional throughout the impact period. Information from different areas flowed efficiently; hence, there were limited challenges in establishing situational awareness. Electricity was interrupted for a few hours but restored quickly (SC5, T4). Several search and rescue operations were mainly for those sailing in the sea or people who attempted to cross rivers during flash flooding (SC2, T3). The demand for rescue operations was much less than during Cyclone Mekunu.

Unlike the previous case studies, the regional agencies with local government offices were mostly engaged in clearing debris from the roads and residential areas. Municipalities in local areas were largely engaged in pumping flood water from the roads in the different parts of the region. The local municipalities performed this task through their emergency teams in the local areas.

This case study illustrated that preparedness at the local level occurred but informally and due to a recent disaster experience. Localising disaster response and integrating non-state actors in the EMS were not institutionalised and made formal rules. In addition, there was one organisational learning lesson from this cyclone, listed in Table 4-4.

Table 4-4 Luban organisational learning lessons

Failure	**Lesson at the institutional and organisational level**
Closure of critical facilities such as hospitals, airports, refinery and seaports as precautionary measures	These decisions should be supported by decision support systems that consider the risks of the hazard and the risks of discontinuing essential services. The government should provide alternatives for residents and ensure the continuity of basic services such as healthcare, fuel and electricity.

4.3 Conclusion

The response to the cyclone emergencies was a function of the EMS's initial state and the emergent conditions created by the cyclone agent's interaction with the place's vulnerability, as Figure 4-1 shows. In most case studies, the initial state of the system was not significantly different as it was largely characterised by inadequate emergency planning and a large reliance on improvisation, a lack of local and regional response capacities due to an excessive focus on national preparedness, centralisation of resources instead of distributing them among areas based on prior assessment of needs, hierarchical procedures and lack of inclusion of non-state actors.

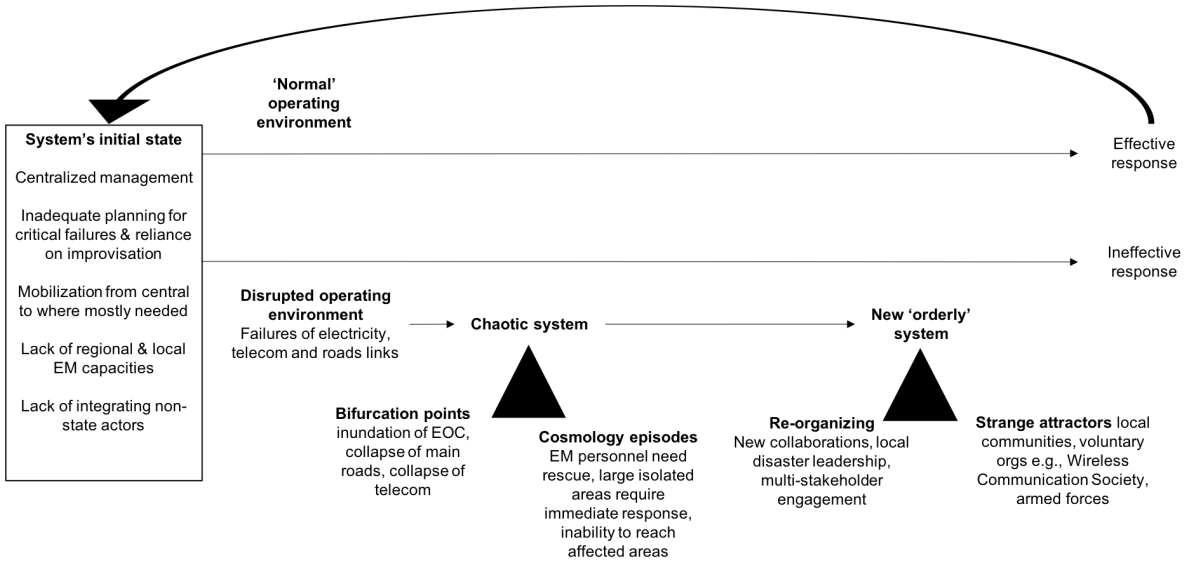

Figure 4-2 Model showing EMS behaviours in normal and disrupted operating environments

While the initial state of the system was not significantly different among the four case studies, this analysis demonstrated two distinguished operating environments and two prominent models of management associated with them, see Figure 4-1. The first operating environment was characterised by the continuity of essential services that the formal EMS largely depended on. The second was characterised by the absence

or unavailability of critical services – largely road transportation, electricity supply and telecommunications. The traditional command-and-control system functioned well under the first operating environment, whereas an emergent informal local management model under the second scenario replaced it. Table 4-1 summarises this analysis's findings, which are elaborated on in the following sections.

Table 4-5 Findings of Analysis of Responses to Cyclone Emergencies

Event	**Conditions before Impact**	**Bifurcation Points**		**State of the formal EMS**	**Type of Response 'System'**
		Cosmology episode	*Self-organisation*	*Collapsed or Functional*	*Formal or informal*
Gonu 2007	Centralised resources and capacities Unprepared regions and local areas	Yes Inundation of EOC Collapse of main CI services Isolated areas, physically and communicationally.	Not self With help of strange attractors	Collapsed in many areas	Informal arrangements Emergence of informal local volunteer-based EM in several areas
Phet 2010	National and regional EM coordinating teams No local EOCs	No Continuity of CI services	NA	Functional in most areas	Formal arrangements
Mekunu 2018	National and regional EOCs Centralised resources and capacities Collapse of CIs services	Yes Isolated local areas	With help of strange attractors	Collapsed in several areas	Informal arrangements Emergence of informal local volunteer-based EM in several areas
Luban 2018	National and regional formal EOCs Informal local EM formations	No Continuity of CI services	NA	Functional in most areas	Formal arrangements

The continuity of essential services characterised the scenario during Phet in 2010 and Luban in 2018. there were no failures of the critical infrastructure. The two cyclones brought less rainfall and weaker storms than the other two. In addition, they did not directly come into contact with urban areas. Under this scenario, the formal EMS, see Figure 4-2, could function effectively as it maintained consistent communication during the storm with no significant disruptions. All participants perceived the response as positive, as they noted that the regional EOC could receive information, issue commands and direct the resources to where they were needed. According to the respondents, the situation remained under control.

Although some of the participants regarded this positive response as an immediate consequence of learning from previous events (Gonu in 2007 and Mekunu in 2018), the conditions that governed the operating environment were, in fact, significantly different. Critical failures that brought the system to a state of disorder during Gonu and Mekunu did not occur in these events. The EMS did not go through bifurcation points during these cyclones. It functioned well under an anticipated scenario in which the demand for emergency services did not exceed the threshold of organisational capacity. The centralised command-and-control system mobilised its resources and delivered its services to the affected areas. The strategy of mobilising resources from a central location to affected places when needed worked well.

The experiences of Phet and Luban, similar in many ways, provided strong reaffirmations that the current command-and-control system, which is highly centralised, functions adequately in disaster response. It reinforced the perception that it works, and therefore there is no need, for example, to involve local agencies or non-state actors in crisis management. However, such a conclusion ignores a fundamental element: the context--i.e., the operating environment. The EMS operated well in these two events, which are associated with the continuity of essential services. These events could hardly meet the characteristics of disasters and large-scale emergencies whose features are dominated by major disruptions and failures. The reinforcement by these events of the perception that the system is effective could lead the lessons recognised during extreme events to be easily ignored.

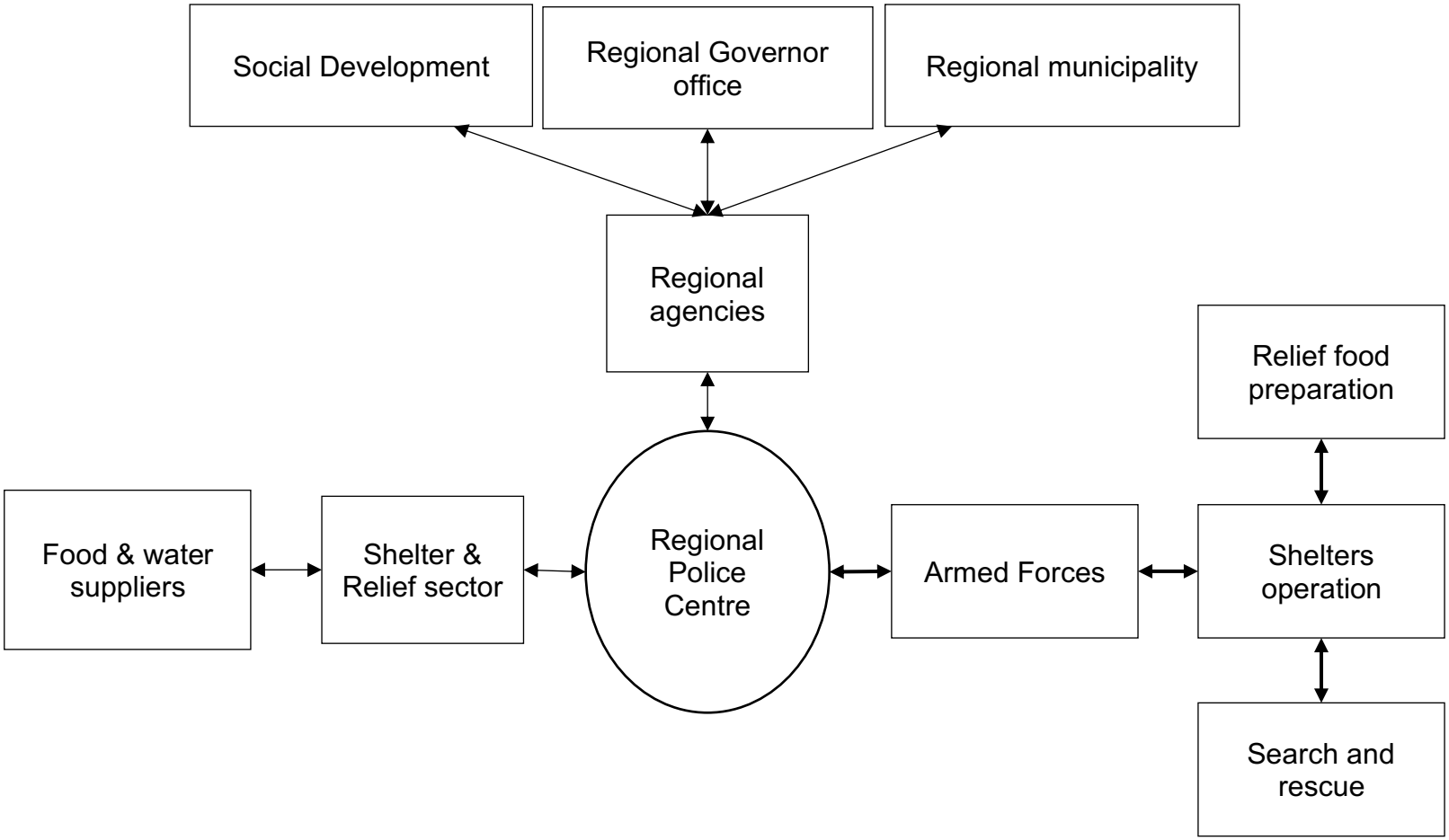

Figure 4-3 EMS managerial model under the scenario of continuity (Cyclones Phet and Luban)

While the highly centralised EMS functioned well in Phet and Luban, it easily bifurcated and entered a state of instability in Gonu in 2007 and Mekunu in 2018. The 'cosmology' episodes of the inundation of the only EOC during Gonu and failures of telecom and roads' availability during both events made the system dysfunctional and its procedures, consequently, irrelevant. Forming situational awareness of what was happening in those areas was almost impossible. The embedded assumption of the availability of essential services during crisis response or after restoration, if damaged, made the EMS very vulnerable to their failures. Mobilising resources from the central location to the affected areas was deemed more efficient, and it worked under the scenario of continuity. However, this reactive approach was inconsistent with the conditions under cyclones Gonu and Mekunu and failed.

Most participants perceived the response to these cyclones as poor and inadequate, regardless of the vast resources' mobilisation, early evacuations and system activation. Therefore, responding agencies' perception of the response is largely associated with their confusion and lack of control over the events during the response. The failures left agencies puzzled about what they could do in such situations. They were confronted by the reality of being unable to deliver their services to the mostly-affected areas. These case studies demonstrate that the centralised command-and-control EMS lacks the flexibility required in a crisis. Its features provided the initial preconditions for the system's dysfunctionality and isolation, which occurred on both occasions. As the institutionalised actors failed to be available, a new form of order was locally self-organised and participatory. In both cases, it largely included non-state stakeholders that replaced the hierarchical command-and-control crisis management model.

Chaos theory calls stability properties, such as actors or agencies, not part of the formal system but detrimental in re-establishing order' strange attractors'. In this case study, local communities were the primary source of resources that formed volunteer teams involved in various emergency-related tasks, such as evacuating people and providing them shelter and relief items. Also, non-state voluntary organisations such as the Wireless Communication Society could re-connect affected areas to the central EOC during Gonu when traditional communication systems collapsed. The local state agencies also facilitated these efforts and took the lead in the emergency response.

Those actors had never been involved in crisis management, but new forms of collaboration and interactions emerged due to the common threat during such critical times (Sellnow et al., 2002).

The emerged self-organised system, see Figure 4-3, had several features different from those of the formal EMS but consistent with the principles of disaster management. First, the lead agency was a local civilian actor who worked closely with local communities instead of a paramilitary agency whose organisational culture is very different. Secondly, the response teams largely consisted of volunteers, whereas the formal system is largely governmental. The close relationship between the emerged lead agency and local communities fostered the formation of volunteer teams. Furthermore, they interacted with each other without hierarchical procedures. Horizontal communication replaced the vertical command structure. A collaborative multi-stakeholder structure replaced the command-and-control model. However, due to a lack of resources, these local formations were unable to meet all the needs.

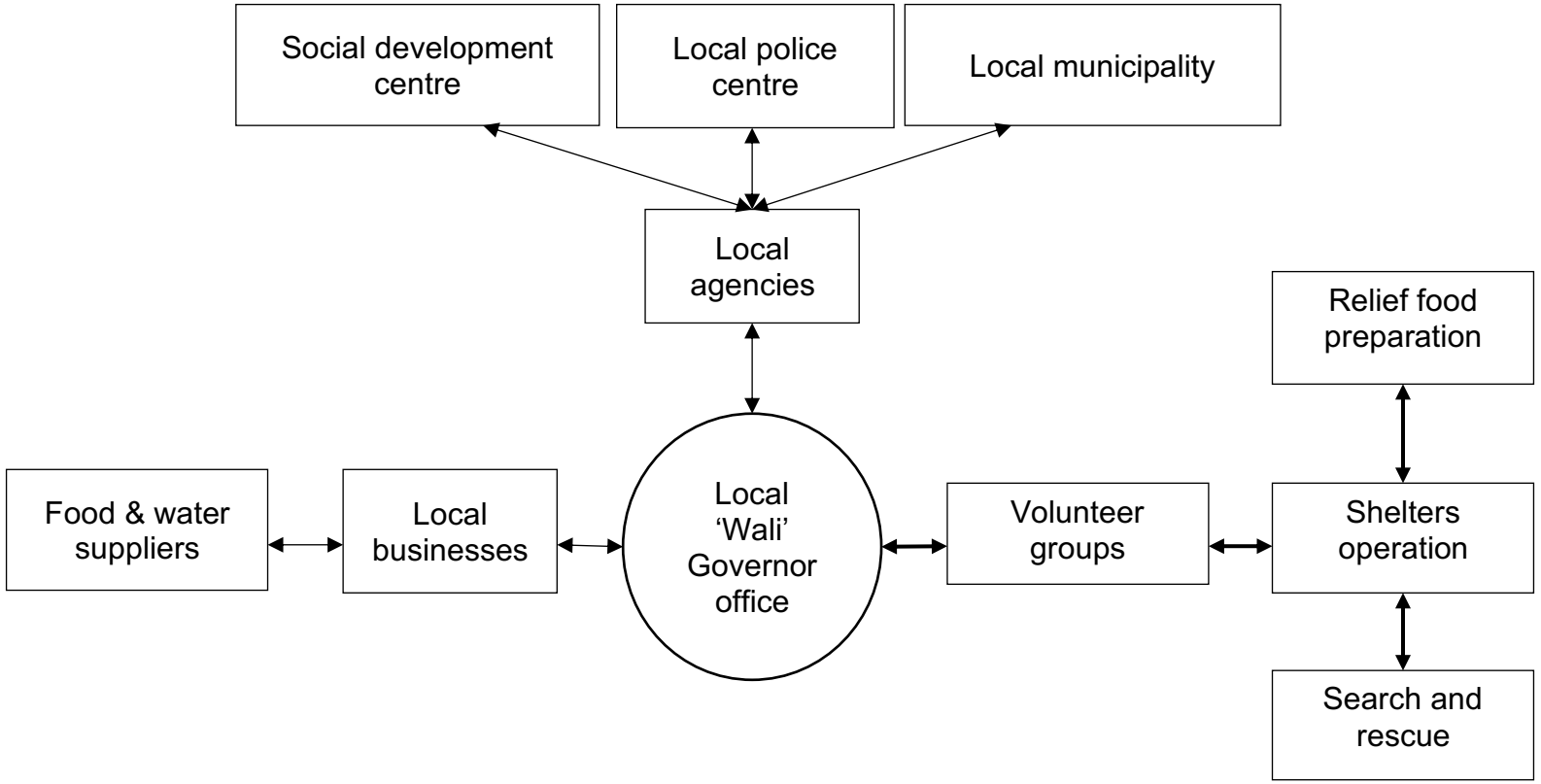

Figure 4-4 EMS managerial model under the scenario of a disrupted environment (Cyclones Gonu and Mekunu)

CHAPTER 5 ORGANISATIONAL LEARNING AND DYNAMICS OF INSTITUTIONAL CHANGE OF THE EMS

5.1 Introduction

As an envelope of complex and uncertain sequences of events, disasters form important opportunities to review the formal arrangements for emergency management, identify failures and suggest new ways to avoid them or at least to minimise their impact. A pattern of change that has been well-documented across a large proportion of literature is that abrupt changes often occur during ‘‘the window of opportunity’’ that follows emergency response (Alexander, 2002a, 2008a). During such periods, necessary modifications may be introduced, greatly driven by responding agencies to show that lessons from the disaster were learned. In this research, participants frequently considered changes to be a consequence of learning from the experience of events. However, there is still a lack of empirical evidence to show whether the identified or implemented lessons were, in fact, relevant. More research is needed in the disaster management field to investigate whether the phenomenon of organisational learning from crisis and institutional change is based on that learning.

In this chapter, the aim first is to understand the nature of learning by identifying the formal changes that took place following cyclones Gonu 2007, Phet 2010, Mekunu and Luban 2018, and to compare them with the changes that should have been implemented based on the empirical analysis of these emergencies (see Analysis Findings in Chapter 4). By doing this, the persistent norms and institutions of the system, referred to as ‘‘continuities,’’ are recognised. The findings bring new insights into the ongoing debate about whether organisations learn from the crisis and the forms of change that occur. The forms of continuity that persist are determined in the systematic analysis of the case studies.

The proposition guides this analysis that many changes, which reach the level of institutionalisation, do not challenge the underlying assumptions of the management

approach or the governance model. ‘‘Single-loop learning’’ (Argyris, 1977, 2014) is expected to be found in the prevalent form of learning that occurs after a crisis, but the important lessons, ‘‘double-loop learning’’ (Argyris, 1977; 2014), are expected to be inadequately identified and rarely implemented. This analysis’sanalysis’s theoretical assumptions and analytical framework are explained in detail in Section 3.6.2 of the methodology chapter. Figure 3-4 shows the framework developed to guide the analysis process.

Once the forms of change are identified, based on findings in Chapter 4, the second aim is to identify the forces behind selecting these changes and those behind the persistent norms that continue despite being inefficient. It is hypothesised that the system’ssystem’s evolution was influenced by exogenous and endogenous forces shaping the current system as it is today. However, it is important to identify the factors at work and determine whether they worked as forces that facilitated or resisted organisational learning and institutional change. This analysis combines both perspectives of institutional change – rational choice and historical institutionalism perspectives – in explaining the dynamics of those changes. The analytical framework has already been detailed in section 3.6.2.

This chapter begins by discussing the three stages of development of Oman’sOman’s EMS, identifying the forms of organisational change that took place and their immediate implications regarding its functioning. Then, by comparing those changes with the lessons that should have been implemented, it identifies the main continuities that persisted through these experiences regardless of their efficiency. Once changes and continuities are identified, Section 5.4 presents the role of cyclone emergencies and two other external forces – the emergence and prevalence of social media platforms and the corporatisation of the providers of essential services – that attempted to push the development of the system towards a more inclusive participatory form of management. After that, Section 5.5 discusses the resisting context that has been evolving incrementally due to critical decisions taken in the past. It examines the sociocultural political underpinnings that pushed policymakers and other actors to ‘*‘rationally’’* select or prefer certain organisational and structural changes.

5.2 Organisational Changes and Stages of Development of Oman's Emergency Management System

The organisational structure of the emergency management system in Oman has evolved from an unrecognised form to an *ad hoc* agency-based coordinating committee that forms during emergency response, and then to a function-based structure that aims to bring agencies into several collaborative networks driven by a shared function (see Table 5-1). In the following sections, the development of the system is presented chronologically. The main forms of change are described and their immediate implications are discussed. The focus here is on the changes and their nature while the dynamics and forces behind them are discussed in Sections 0 and 0.

Table 5-1 Stages of EMS development in the case study

Growth phase	**Features of EMS during period**	**Main changes – chronologically listed**
Stage 1: Unrecognised form and fragmented services **1970 – 1988**	Absence of emergency planning EM is the work of one agency EM is emergency response Absence of coordination between agencies	1970 – modern state of Oman established 1970 – Police responsible to manage crises **1977 – Masirah Island cyclone**
Stage 2: Agency-based structure **1988 – 2009**	EM is an inter-agency work; Increased coordination during response EM is largely emergency response and some immediate preparedness measures	1988 – An inter-governmental committee established with 8 rep agencies that forms when a crisis occurs **1990 – Gulf War** **1991 – Gulf Financial Crisis** 1991 – Issuance of the civil defence law 1991 – a new Civil Defence Directorate within the police agency **1996 – cyclone 02A** **1998 – severe storms within same year** 1999 – Members of NCCD increased from 8 to 15 agencies 1999 – Civil Defence became a member of NCCD **2002 – 9/11 Attacks in U.S.A.** **2002 – Salalah tropical storm**

		2003 – A permanently-staffed executive office within the police structure was established to coordinate NCCD inter-governmental efforts **2007 – cyclone Gonu** 2008 – Decentralisation of authority to appoint members of the intergovernmental coordinating committee Issuance of state of emergency law Increasing number of government responding agencies
Stage 3: Function-based structure **2009 – present**	EM is viewed as a forecasting work, more evacuations, a multi-agency works, More inter-agency collaboration through largely information sharing and joint-operations Increased involvement of CIs providers actors in emergency response and preparedness	**2010 – cyclone Phet** 2011 – restructuring from agency-based to function-based 2015 – launch of national multi hazard early warning system 2018 – First written emergency plan **2018 – cyclones Mekunu and Luban**

Stage One: Fragmented Unrecognised EM (1970 – 1988)

When the modern state of Oman was established in 1970, the responsibilities of emergency response were among the terms of reference of the police, as was the case with many countries. At that time, EM was unrecognised, unorganised, unplanned and underdeveloped. Emergencies were managed spontaneously in an improvised manner. Within a few years, due to an increase in the size of the built environment, crises, primarily triggered by storms and cyclones, began to present significant challenges to the young country. The most devastating Arabian Sea cyclone on record 'the Masirah Island cyclone of June 1977', which struck the largest island in the country, located on the east coast off mainland Oman, caused 105 deaths(Office of U.S. Foreign Disaster Assistance, 1993; Watts, 1978), destroyed all dwellings in the island and left 20,000 people homeless (Membery, 2002). It was the first wake-up call for the new government to learn that this scale of emergency requires resources that exceeded and predominantly fell outside the capacity and jurisdiction of the paramilitary agency. With the formal managerial model, the immediate response was to induce more government agencies to collaborate during the response. After that, complacency prevailed for quite a long time as no noticeable emergency planning efforts were observed (Al Shaqsi, 2012).

Stage Two: Agency-based Structure (1988 – 2010)

In 1988, *Royal Decree 32/88* was issued to establish the first national inter-agency emergency coordinating committee. It initially included eight agencies and mandated the police to lead the committee. Formerly called the National Committee for Emergencies, later in the same year, after being struck by several extreme storms and deep depressions, its title was changed to the National Committee for Natural Disasters *(Royal Decree 73/88)*. Despite its new name, the committee was requested to prepare a comprehensive plan for all disasters, assign roles to the different entities and coordinate efforts and operations during all emergencies, whether triggered by natural or manmade hazards. The newly-formed structure seemed simple, but at that time, it was arguably the most developed and unique emergency response system in that region of the world (Al Shaqsi, 2012).

1990 and 1991 also witnessed two remarkable events, the devastating and abrupt Gulf War and the first 'unprecedented' financial crisis for modern Oman, respectively. These two events were critical junctures that unfroze the situation in many countries in the region. In Oman, the government responded in 1991 by issuing its first Civil Defence Law (Appendix A includes the main laws related to EM in Oman) and created its first directorate dedicated to civil defence.

The newly-established civil defence directorate was given control of the fire and ambulance services. Despite an attempt to isolate it from its parent agency, the police, a decision was made to keep the directorate under police authority. Hence it is still staffed with sworn police personnel and predominately has paramilitary norms and values. Initially, it was asked to prepare EM plans, evacuation and relief plans and even develop early warning systems and public awareness campaigns *(Royal Decree 76/91)*. However, soon these tasks were re-distributed to several agencies. Despite the clear connection between this directorate and the National Committee for Natural Disasters, which later became the National Committee for Civil Defence, this directorate was not asked to lead the inter-governmental coordinating committee. The police remained the lead agency, and it was, and still is, involved in specific tasks such as fire suppression, HAZMAT and search and rescue operations.

The *1991 Civil Defence Law* was important and unique at that time and still is today. It was the first piece of disaster management legislation in the country. It defined a *disaster* as 'any natural or human-made event that results in, or has the potential to result in, great loss of life or public or private property so that the capacity required to counter it exceeds the capacity of agencies in the different regions.' The law laid out the key principles for managing emergencies. It emphasised the importance of emergency planning and preparedness. It recognised the role of volunteers and encouraged the police to establish teams of volunteers and train them to participate in crisis management. The new law also requested the authorities to treat volunteers as employees in the case of injury or death. In addition, the law required civil defence to be taught at all educational levels.

Having an accommodating legal instrument is an important foundation and an accelerator of development. However, it remained a piece of paper, and its

implementation lags far behind its prescription. Unfortunately, as there was no serious political will to follow up with the implementation of this law, there has not been any attempt to investigate this deficiency. Participants point to several reasons, as discussed in Section 5.4. However, an immediate cause was that these responsibilities, among many others, were assigned to the NCCD – a temporary coordinating committee with no permanent office. In addition, because it only included senior officials, e.g., ministers and deputy ministers, it was logistically challenging to arrange regular meetings (Al Shaqsi, 2012). Thus, most meetings either preceded or followed an emergency. Therefore, the NCCD engaged in a substantively reactive emergency response.

For at least nine years, there was an apparent gap in any emergency planning activities in the country. A sense of complacency prevailed. The system at that period was inertial (Weick and Quinn, 1999). After all, it was viewed as a response system that only formed during a crisis, so there was an absence of a sense of urgency to do something. Between 1996 and 1998, the country was struck again by severe storms (Padgett, 1999, Membery, 1998), resulting in several causalities and property damage. Immediately following these events, during 'the window of opportunity' (Alexander, 2002a, 2008a), earlier in 1999, a presidential order was issued, making structural modifications to the system. Again, the inter-governmental committee's name was changed from the National Committee for *Natural Disasters* to the National Committee for *Civil Defence* 'NCCD' *(Royal Decree 75/99)*, as it is known today. Perhaps, it was realised that the former name did not reflect all types of hazards the committee was asked to manage. Following the same pattern, the decree also increased the number of participating agencies from eight to 15 government agencies. Thus far, the government has been the only stakeholder in the system. There was no representation from the private sector or civil society in any recognisable form. At that time, an important change was integrating the committee's terms of reference into the Civil Defence Law. The Civil Defence Directorate became a participating member for the first time.

Following the 9/11 terrorist attacks in the USA and the 2002 storms that struck Dhofar Governorate early in 2003, a shift began towards disaster planning and preparedness. The government established a permanently-staffed executive office to perform the

administrative and supportive functions needed for the inter-governmental committee's operations. Since then, some preparedness initiatives have been initiated, but only in the capital city and within single organisations or among a very small number of governmental participants. This office had very few personnel and limited resources. Hence it was not able to fulfil this huge role.

In 2007, the country was struck by cyclone Gonu. It was 'the unprecedented sudden event', as described by most participants, that became a reference point for a disaster at the national level and the lesson that everybody learned from. It was a critical juncture that caught the attention of the whole of society and showed that existing arrangements could not withstand the hazard's impact. Participants agree that all agencies worked alone. They rarely interacted, and there was a clear absence of coordination. Most of them were unaware of the others' roles, information and capacities. The response to cyclone Gonu was discussed in Section 4.2.

Following cyclone Gonu, an important presidential decree *(Royal Decree 27/2008)* was issued to decentralise the authority of selected new members in the system. As it allowed the integration of new members, the institutional change immediately impacted the system. Since establishing the NCCD in 1988, responding agencies have always been appointed by the country's president. It was a very major decision. As emergencies became more frequent and varied, recognition grew that more organisations had to be involved in crisis management. A series of presidential decrees to broaden the types and numbers of participants can be traced to the response to specific emergencies.

Due to this procedural rigidity and the devastating impacts of cyclone Gonu in 2007, which unveiled the extensive range of resources an emergency requires, the Sultan gave the police the authority to appoint new members *(Royal Decree 27/2008)*. This transfer of authority gave the operational arm of the EM more flexibility in choosing the *'right'* members based on the nature of the emergency. As explained in the following section, it also had important implications for the diversity of actors and, consequently, the system's objectives and scope of services. Saving lives and protecting properties were only addressed during the response to cyclones Gonu and

Phet. The continuity of essential services was not addressed by responding agencies and was rarely covered in the media.

Stage Three: Function-based Structure (2010 – present)

Immediately following cyclone Phet in 2010, the president ordered the NCCD to review and improve the national EMS. Accordingly, the lead agency formed an inter-agency committee with senior managers from different agencies. Among them was an influential police officer who had studied EM and was influenced by the modular structure in the USA. He proposed dividing the EM into operational teams or networks (see Figure 1-3). Due to its appealing, functional value, as many participants highlighted, this idea was then approved. An emergency manager who served 18 years in the Police department (EM1) and witnessed this change described this process as follows:-

> '… after Presidant's orders in 2010 following cyclone Phet to… improve the national system, we started to adopt a new system called "sector-based system"… A committee of… entities was formed, and after studying and analysis, it was found that there were eight main functions the committee should undertake to respond to emergencies.'

All participants in the present study agreed that restructuring the EMS from an agency-based to a function-based system was the most fundamental change, as it brought immediate consequences and triggered a cascade of institutional changes. Under the new formation, agencies functioned in a semi-hierarchical structure (Nohrstedt et al., 2018), best described as a group of independent networks in which each one is governed through a centralised mechanism (McGuire, 2006; Moynihan, 2009). Thus, instead of functioning as one large group, similar agencies (or departments within them) were brought under the jurisdiction of one operating team. This restructuring enabled 'parallel working' because several sectors could operate simultaneously. As of 4 August 2020, there were eight independent operational sectors, as Figure 1-3 shows.

The abrupt organisational structure change was pushed forward by the NCCD executive office, whose role was unknown to many participants even though it had been established in 2003. It plays a dual role as an executive office for the NCCD and

the NCEM. Under the new change, all sectors report back to it. This procedure gave it a central role in coordination; hence, its stake in the system has increased. An emergency manager from NCEM (EM2) described some of its most important recent activities as follows:-

> 'The executive office is a 'trust' for the NCCD, as a coordinating office for its different entities and members. … . We do training. We collaborate with abroad organisations for training. We bring experts from abroad. We conduct workshops. We develop guides and plan templates for the sectors. We train them how to make operations command.'

During crises, the role of the executive office switches to the national centre for managing emergency operations. A participant from the EOC explained in detail the process of switching from the administrative role to the emergency coordinating role as follows:-

> 'Right now, we are in the executive office wearing this uniform. During normal daily work, we work in the administrative office. During a crisis, we work in the EOC at the same location. We change the hat from a cap to a beret. Our role turned from an administrative role to an operational role.'

However, the tasks assigned to the executive office were beyond its resources and capacity. Several apparent challenges have prevented this important office from playing its potential role as the country's 'disaster management agency'. It is staffed with undersized personnel and resides in a very small office. Only two of them have academic qualifications in emergency management. In addition, it lacks important resources but is required to manage huge tasks. Furthermore, as it was established within the structure of the police agency, its culture remains dominated by military rules and norms, as will be discussed later.

A qualitative change in the organisational structure was essential to foster collaboration among the various agencies in the system. It places similar departments in a working group, providing them with a platform to share information and resources and make decisions more coordinatedly rapidly. Many participants identified the 'co-location' of senior officials and 'involvement of technical experts' as important changes that helped them build a shared situation awareness. As they began to communicate and get to know each other, reciprocal trust between them began to build. The level

of inter-agency collaboration evolved. Several participants mentioned that new collaborative relationships between civilian, paramilitary and military agencies were formed officially and through informal communications, creating more flexibility in joint tasks. Excerpts from the testimony of two emergency managers (EM1 and EM2) described some advantages of the new modular system:-

> 'The main change, I say, is sectoral management. Now, we manage as a group. … the preparation will be done collectively and not only by one organisation. … the resources I will have access to are not only from my organisation but also resources from other organisations that work with me in the same sector.'

All participants agreed that the network-based structure helped integrate governmental agencies. It brought departments, directorates and sections from civilian, military and paramilitary agencies into one working group to serve one primary function. For example, the search and rescue sector, managed by the Public Authority for Civil Defence and Ambulances, includes members from civil aviation, the Air Force, the Police Air and the Ministry of Education. Interactions among those agencies, particularly at the middle and lower levels of management, were not common. Integrating them into one team was an achievement described by some participants when asked about this integration as follows:-

> '… honestly, based on working with them and going through experiences with them, I think a very successful experience we have in Oman.' A local expert who worked for more than 30 years in the government sector (LE2)

> 'It is not easy to work between the military and civilian sectors. It is not easy for them to trust you with the information. But thank God, we have reached a level of reciprocal trust between us and the military sector, between us and the security sector, between us and the civilian sector, to exchange and pass information.' A sector coordinator who worked in both sectors, military and civil sectors, (SC3) and experienced this integration

Adopting a network-based structure also introduced new important 'administrative' roles that did not exist before. In the EMS, structural changes resulted in new institutions and rules. Before, all agencies had specific technical roles, whereas administrative demands were completely overlooked. Among the most important task was that which assigned a central coordinating agency to each sector that gathers information, pools resources and directs them to serve the function of the sector. Best

described as a ‘network administrative organisation’, abbreviated as ‘NAO’ (McGuire, 2006; Moran, 2013; Moynihan, 2009), it was found to be an important enabler of cross-agency coordination and collaboration. Many participants agreed that it also shortened the chain of decision-making.

Another new role that emerged due to this structural change was the media officer for each sector. According to several participants, this has increased organisational commitment and accountability. During Gonu and Phet, only one spokesperson from the lead agency was allowed to engage with the media. According to many participants, the different services that the EMS provides were not equally covered. The lead agency was not only burdened with this responsibility but was, in most cases, unaware of others’ resources. Other agencies found themselves ‘distanced’ from the attention of the public. Several participants agree that this change ‘forced’ many agencies to engage in crisis management actively. It increased their commitment to the system. The new change, however, created a new need, that is, to ensure the message to the public is unified. A key government informant (EM1) described the importance of this change:-

> “… during Gonu, there was a spokesperson, but among the learned lessons is that … we involve sectors and organisations to participate (in media). This has placed a responsibility upon them that in emergencies, I will stand in front of the camera and talk about what preparedness actions I have done. Therefore, I would not ignore this matter. So, we put them on the spot and tell them, "this is your responsibility". For example, if you are responsible for providing relief, tomorrow a cyclone might strike, come and tell me about your plans in front of the public and live-streaming.”

The modular organisational structure brought many advantages but also created new challenges, as the majority of the participants agreed on a number of them. First, the emergency tasks assigned to the NAOs to coordinate were irrelevant to the agency’s core specialities. Some coordinators mentioned that they were unfamiliar with most of them. This assignment was in the form of enforcement, not normative persuasion, as the higher-level authority imposed the new role to ‘the most fit’ agency in the country. Thus, coordinating unfamiliar tasks was found to be an extra organisational burden, particularly when some of them were already engaged in many daily tasks that were not relevant to EM. Therefore, one can find apparent disparities between sectors as

they became largely linked to the capacity and preparedness of the NAO and the individual coordinators. Several participants mentioned that 'they had no influence on this decision'. A key government official involved in this process (EM1) described how the NAOs were selected as follows:-

> "We gathered the similar tasks of different organisations in one sector. And each sector is managed and coordinated by the main specialisation/jurisdiction entity. For example, what is the responsible organisation providing healthcare services? Many but MOH is the main provider in the country. So all organisations should collaborate with MOH so the function is accomplished."

A female local expert (LE2) who once was a sector coordinator in the national EMS clarified how they were given this task:-

> 'They (higher government level) thought I would be the best candidate to lead that unit. Of course, when I joined in, I had no idea what it was all about. NO IDEA. Nobody even told me anything. We were just like, 'you are going to head the … as part of the whole system. … You know, I just had to start reading. Getting to know what it is. And what has happened in the world about this? It turned out to be a huge, huge, huge unit. It turns out that there is so much to be done within that sector.'

Due to this organisational change, operations became decentralised, bringing relative flexibility to the system. However, hierarchical communications remained the general norm of reporting and receiving commands within each network and between networks. This duality created a hybrid system of both hierarchy and network governance. Despite the mentioned challenges, which would require time and experience to overcome, all participants agreed that the new structure is more effective in crisis management than the agency-based one.

With the change in the organisational structure, the authority for selecting new members was transferred to sectoral managers. It was an important change because it allowed NAOs to select members based on their needs. The influence of the lead agency and the NAOs on the system increased as they began to enjoy a sense of ownership of the system. This policy change allowed them to ask private businesses to participate in crisis management.

This stage of growth also witnessed an increased focus on planning and preparedness (for cyclones), which was evident in developing a national plan for emergency management, written procedures for several operations, investing in monitoring and forecasting technologies, conducting regular multi-agency exercises and drills and undertaking systematic preparedness measures prior to a cyclone impact. Joint training, reciprocal visits between actors, and scenario-based drills and exercises began. As many participants agreed, the responses to Gonu and Phet were highly improvised because there was no emergency planning across all levels. The improvised response resulted in duplication of efforts and failure to meet people's needs and created unnecessary organisational conflicts on several occasions. Among the critical ones was over who should be the lead agency at the regional and local levels. A key government participant who was present at the regional committee described this conflict over leadership during the response to cyclone Phet:-

> "Among the issues was that the army intervened without order or a regional committee (without a request from them). … the director of the regional NCCD committee, … was there, and the armed forces officer was there. However, they (The armed Forces) mobilised their forces, although the rainfall scale was not that much. They mobilised their forces without any request. I was the operations manager here. I contacted the director of the Administration. I received a call from the police headquarters and NCCD executive office asking, "how come the army intervened?". I told them this question should be asked by the director of the regional NCCD and not me. Our role is to provide and support resources and capacities to manage the situation."

Triggered by organisational conflicts during the response to cyclone Phet in 2010, agencies were asked to specify their roles and responsibilities in emergencies. Although the Civil Defence Law was issued in 1991 and included a provision to develop an EM plan, the first official plan was approved and disseminated among responders in 2018. The process had taken a very long time, mirroring the pace of change in the present case study. Several participants attributed this to the absence of a 'specialised' disaster management department. However, establishing a permanent executive office for the NCCD in 2003 was a foundational organisational change. However, it lacked the necessary resources, proper knowledge and funding to accomplish this substantial objective. It gathered information from responding

agencies, developed a proposal, and pushed for an ‘agreed upon’ plan. However, there was a clear absence of political will to invest in a fully-fledged department.

Besides solving inter-organisational conflicts, formalising roles led to creating a new EM culture, that managing emergencies should be planned and require several actors to work together. The shift towards a planning culture was evident in the increased investment in technologies, particularly monitoring and forecasting capabilities. However, although forecasting was channelled through external sources, warnings during Gonu and Phet were poorly disseminated. The process was very hierarchical among responding agencies, and information was given through official channels only in Arabic and English. A National Early Warning Centre (EWC) for multiple hazards was established, and a system of notifications, alerts and warnings became an important preparedness function. Within a few years, its personnel jumped from 100 to 300 employees in different specialisations. It became the scientific arm of the system, and accordingly, the system became heavily reliant on it. Activating emergency response became based on its recommendations. Many organisations experienced large increases in personnel and material resources. The government has generally responded to each emergency by employing specialised personnel and purchasing new equipment. Officials described these events as opportunities for them to ask for more resources. In many agencies, employees jumped from two digits to three and sometimes four-digit numbers. Not only the number of personnel increased but also the type. New specialists and technical graduates were hired in their hundreds.

Despite the importance of all these changes, they largely fall within the single-loop learning category. As will be elaborated in Section 5.5, the main character of the system has persisted through various extreme events. The following sections will discuss the roles of exogenous and endogenous factors in shaping the current EMS. They will show the tension between the forces at play when actors are challenged to select new changes.

5.3 Exogenous Forces of Change: the Role of Cyclone Emergencies and Other External Drivers

The cyclone emergencies played three key roles in triggering organisational learning and institutional change (Figure 5-1). First, all participants who experienced them said that their awareness had increased. As a result, their collaboration increased, but largely during the emergency response phase and at the personal level. Secondly and most importantly, these events ended the complacency period and opened the window for new institutional changes. However, they were somewhat random as to how useful they could have been (Hannan and Freeman, 1984). In other words, they were found to trigger organisational learning, but that does not mean the right lessons were learned. Thirdly, under very specific conditions, they were a significant source for informal bottom-up learning, in the sense that learning took place on the ground, but formalising or institutionalising it into new policies was blocked by several factors.

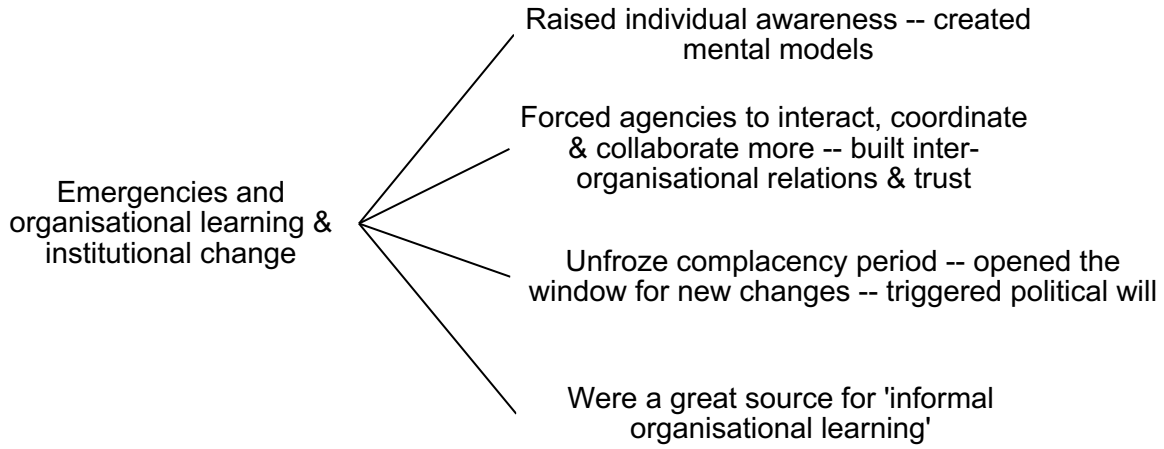

Figure 5-1 Role of emergencies in organisational learning and institutional change of the EMS

Across the dataset, all participants frequently refer to an increase in awareness after undergoing these experiences, but the nature of awareness they largely refer to is at the individual level. They agree that emergencies elucidated their roles, as many of

them agree that they were unaware of what was expected from them and what they expected from others during Gonu. Although regulations and laws such as *(Civil Defence Law 1991 and Royal Decree 32/88)* existed, they were not enough for individuals to recognise their roles. They must have been practised in order to be recognised. However, with inadequate cross-organisational training, drills or exercises, actual emergencies filled this gap, but with large devastations, economic loss and perhaps many fatalities. For example, until 2002, most participants were unaware they were members of the NCCD, even though it was established in 1988. The 2002 storms, which caused significant damage in Dhofar Governorate, made them aware that they had roles to play during crises. A government official who spent more than 30 years working in the committee (SC8) described this as follows:-

> 'As for the national system for civil defence, it was existing. It existed during the 1980s. It is old. The committee existed. But because a major incident didn't occur, it was not very activated. And some did not even know that they were members of such a committee. On May 11th 2002, around 10 am, a major storm struck Dhofar Governorate, 40-47 knots. There were damages. We learned many lessons from the storm.'

Before cyclone Gonu in 2007, there was a lack of emergency planning. Consequently, many of the participants in this study mentioned the absence of a mental model they could refer to, apart from what they had seen on television. Participants described how they could not comprehend and project what would happen. There was a high degree of uncertainty about what heavy rainfall and strong winds would do, particularly in the capital city that had not experienced a cyclone for a long time. The absence of a mental model ultimately delayed establishing accurate situational awareness (Endsley, 1995). Responders who lived through the events of Gonu became more aware of cyclone hazards and what demands they generate. One can observe the increase in preparedness measures before cyclones Phet and Mekunu, such as cleaning wadi channels, evacuating inland areas (not only coastal ones) and evacuating hospitals in vulnerable locations. A key government sector coordinator (SC5) described the mental condition of senior officials from key responding agencies who were convening before cyclone Gonu as follows:-

> 'There was a hesitation. Is there something? Is there a serious cyclone coming? There was a great underestimation.'

As cyclones became recurrent threats, the demands, particularly the agent-generated ones (Quarantelli, 1997), began to be clear. Actors became more aware that many demands are not necessarily met by an emergency-related agency such as the police or the civil defence. Among the critical roles was that of the Ministry of Regional Municipalities and Water, which began taking on routine preparedness tasks, most importantly clearing the paths of the wadis and emptying the dams and catchment areas before the cyclone impact. Similarly, during a crisis, the Ministry of Trade practised its role in monitoring prices and ensuring the continued availability of basic commodities, fuel and cash. The increased awareness meant that all agencies could participate in disaster management. That role could include those agencies that are not regular EM organisations or are even normally involved in the emergency response phase.

In addition to raising awareness, agencies were forced in emergencies to work together in an unanticipated manner, particularly in Gonu. Because disasters cross organisational, sectoral and jurisdictional boundaries (Nohrstedt and Bodin, 2014), agencies operate outside their normative scope (House, Power & Alison, 2014), which forces them to interact and collaborate as they face a common threat. They found themselves dependent on each other in order to survive the situation. Due to that, they began to get to know each other. A sector coordinator who experienced the cyclone emergencies (SC6) described building inter-organisational relationships due to the effect of joint experiences as follows:-

> ‘We started to know each other (after experiencing Gonu together). Then, we attended joint training/exercises. We went to their centres, and they gave us lectures. They came here. I gave them a speech. We worked/trained together as a joint national committee during these years.’

However, most participants agreed that much of this collaboration was based on personal relationships, and it largely occurred during the emergency response phase. Once time passes and a normalcy period is perceived to take over, organisations rarely initiate cross-organisational interactions. There have been several nationwide exercises, but these were very limited and included only HQ agencies. A female local expert (LE2) who was once a sector coordinator described the nature of this collaboration as follows:-

> ‘I will be very honest. I feel if there is collaboration, it is based on a personal relationship. But cooperation in terms of the official organisations and such, we still have a problem there. Giving information is like, “This is mine”. “Why do you want to know about it?” We do not have unified/shared thinking... People (agencies and officials) come together at that time (emergency response phase). And the minute that finishes, the disaster or whatever the situation ends, everybody returns to their shells. As I said, they won’t sit together and learn from that experience.’

Those who lived through a particular disaster, and established personal relationships, may not be able to remember its details for a long time or may eventually leave the organisation, retire, find another career or even get promoted to a different position, so they may not be available when the next one occurs, especially when there is a long interval between such events. For example, most participants were unaware of the 1890 cyclone that struck Muscat and caused many causalities and much damage. With a clear absence of a systematic mechanism to store, share and integrate knowledge generated from disaster experiences within the organisation (Crossan, Lane & White, 1999), the risk of its loss is very high and likely. All participants but one mentioned the absence of an information management system in which incident reports could be stored. Nevertheless, they all agreed that these experiences increased their awareness and forced them to interact more with each other.

The second key role emergencies were found to play was unfreezing the status quo, breaking the cycle of complacency, and opening up the space for new organisational and institutional changes. Thus, most changes occurred in the specific periods that follow emergency response. According to Alexander (2008a), this is due to the catalytic effect of disasters that expedite forming and legislating of new ideas. Solecki and Michaels (1994) attribute this to the political conditions that enable such changes. During these periods, important presidential decrees were issued that transformed emergency management in Oman. *The 1991 Civil Defence Law* was passed following the regional Gulf War in 1990. The overemphasis on radiological hazards indicated the influence of the war crisis at that time which triggered this important change (Al Shaqsi, 2012). Similarly, Cyclone Phet also triggered a change in the organisational structure. Also, following the 2004 Asian tsunami, a committee was set up. It went to visit several countries, which consequently resulted in forming a multi-hazards early warning system. The changes in these periods were abrupt and mostly driven by the

political need to assure the public that improvements and continuous learning were occurring.

The participants emphasised royal decrees, or presidential orders, as the main mechanism for achieving change, largely in the public sector. They send a message to all agencies that they must improve current conditions. However, such decrees only seem to be issued after an emergency that causes a substantial degree of damage, which happens sporadically. For example, after encountering widespread failures in collecting, storing and distributing relief materials during cyclone Gonu, one decree requested agencies to find a mechanism for managing relief aid. Hence, political will is an important driver for new changes but was in most cases triggered by the occurrence of disasters, as mentioned by several participants as follows:-

> '… a Royal order came later (after cyclone Gonu in 2007) to look for mechanisms for distributing relief materials.' A government emergency manager who participated in cyclone Gonu (EM1)
>
> 'Without intervention (from the President), there would not be changes.' A female local expert who conducted several studies about the EMS in Oman (LE2)
>
> 'We do not learn and grow by ourselves. We wait for interventions.' A female sector coordinator who served more than 30 years in the public sector (LE1)
>
> 'Because of Gonu, the whole country was pushed to establish this system, the NCCD.' A male sector coordinator (SC4) explaining the impact of Gonu
>
> 'The most transforming phase was after Guno in reducing risks from cyclones and storms.' An emergency manager (EM2)

The triggered political will to improve the system may entail an embedded positive intention. However, the changes that occurred during those critical periods were, in fact, random to whether they enhanced the performance of the system or not. First, as described in Section 5.2, most have only a trivial connection to the emergencies themselves. As will be explained in the following sections, they have strong connections to other, stronger drivers, such as the socio-cultural political environment and external sources.

In addition to the key roles that emergencies played in this case study (increasing individuals' awareness, forcing agencies to interact and unfreezing the current situation for new changes), they were found to be a great source of a specific type of learning that occurred 'informally' as a bottom-up process, and under specific circumstances. It is referred to here as 'informal organisational learning'. It could be defined as a means of organisational learning that occurred in reality but was not translated into a new policy. It enabled people to adapt to crisis conditions to fill important gaps the formal system could not address.

As illustrated in Chapter 4, during the response to cyclone Mekunu that struck the southern governorate, for several days, the formal EMS was unable to dispatch its resources to most of the affected areas as these areas became physically isolated and emergency resources were centralised in one location, namely the city centre. Therefore, local people found themselves in inconceivable conditions. As described by some participants, people were frustrated with government procedures. The dire consequences during Mekunu led many local agencies, practitioners and individuals to distrust the formalities of the government system. As a result, before cyclone Luban, local disaster management activities took place, a new phenomenon not observed in the previous events.

Led by their Walis, local municipalities (Wilayats) took wide-scale preparedness measures and were in charge of the emergency response. One could observe unprecedented actions by local Walis and village leaders (Sheikhs). Walis gathered the Sheikhs, local agencies, charities and voluntary teams, and local essential services providers. They formed emergency response teams at the local level and directly addressed the media. Their engagement with the media was extraordinary. Table 6-1 shows some of the tasks local administrations took. These preparedness actions were, for the first time, carried out locally.

Table 5-2 Forms of emergency management tasks adopted by local administrations and supportive Tweets by local media

Emergency Task	**Tweet**
Evacuation	"Local emergency committee decides to evacuate houses located on the coast"

Relief supplies	“the special EM committee in Wilayat Mirbat supplies food and basic necessities to shelter centres”
Shelters	“the local EM committee specifies the locations of the shelter centres”
Media engagement	“Wali Mirbat shows preparedness measures to deal with Luban” “Wali Dhalkut explains preparedness measures for Luban”

At the Wilayat level, forming a local coordinating unit for EM meant everything had to be locally available. The demands made by local officials, which were largely driven by people’s calls and needs, made support services available at the local level. As a result, emergency resources were distributed among the Wilayats instead of centralising them in the city centre, as had occurred during Cyclone Mekunu. Despite not having a representation (an office) at the local level, essential service providers also had to decentralise resources. During Mekunu, they could not reach affected areas, and most people were without power and telecom services for several days. Two participants described the proactive approach as follows:-

> “During Mekunu, resources were stationed at the city centre of Salalah. During Luban, some resources were moved to the Western region (the region that suffered the most during Mekunu).” (EM2)

> “During Mekunu, the road was disrupted, and we could not reach the affected areas. But we ensured the resources were present during Luban before the emergency occurred.” (SC5)

In reality, what occurred represented a management model that is proven effective for emergencies. A localised approach to managing an emergency is fundamental for the security of people (Alexander, 2007a; 2008a). As the local area is always the theatre of operations, a localised management approach is the most effective way to manage a crisis (Alexander, 2015). Such a model works with the people and for them. It is not only local but inclusive as it includes members of the local communities and voluntary sectors. However, it did not occur during the crisis as an adaptive mechanism for survival during Gonu 2007. It was adopted in the preparedness phase.

This type of learning was short-lived and based on initiatives taken by local entrepreneurial Walis. It was 'perishable' and stayed in the memories only of local practitioners. Notwithstanding, the appropriate lessons were learned from the disasters in this case study but under specific conditions. First, this phenomenon only occurred in the Dhofar region, a semi-independent administration. Its special administrative status makes it different from the other ten governorates. Its government agencies are administratively under the authority of a regional agency, the Governor's Office. In contrast, in the other regions, local and regional agencies report directly to the central government in Muscat. This privilege allows it to act in a more decentralised manner. Geographical, political and possibly cultural factors are root contributors to this special status. Dhofar is perceived as a 'far-away' region in terms of distance. People must take a two-hour flight or an approximate 12-hour road journey from Muscat to Salalah. Therefore, it requires a 'close by' mode of governance. Politically, it was the last governorate to be brought under the rule of the modern state of Oman after a long period of war and conflict. Dhofar is not only unique in that sense but also unique culturally. It has a sophisticated tribal system, and other languages besides Arabic are widely spoken.

The short interval between the two emergencies and their similarities facilitated learning from past disasters by localising the response and allowing the participation of volunteers and voluntary teams. Carely and Harrald (1997) found that organisations learn category by category. Here, both experiences were not only cyclones, but they had very similar tracks. In addition, Schenk (2015) showed that "Learning occurs when disasters have been recurrent phenomena". In this case, only three months separated cyclone Luban from cyclone Mekunu. It was a very narrow time gap where memories of Mekunu were still fresh, as a village’s Sheikh explained to a local media agency on 11 October 2018 (Al Zawamri, 2018):-

> “People from Dhalkut who suffered the most during Mekunu still remember what happened to them, and now they are more aware and cooperative with the evacuation and shelter requests. … Most families had already left the area to safer locations. … Essential services were interrupted for several days during Mekunu. They do not want to experience the same.”

Roles of Other External Drivers

In addition to the cyclone emergencies that caused a widespread shock among responding agencies and opened a window for policy change, participants mentioned other external factors that influenced the growth of the EMS. They agreed on two important drivers: the emergence and prevalence of social media platforms and the corporatisation of essential services providers, which involved restructuring state assets and transforming them into corporations. , It involves transforming government agencies into companies as part of the privatisation process. These forces made them adopt new strategies for communication and consider new types of actors in the system. Figure 5-3 shows the main ways in which this occurred.

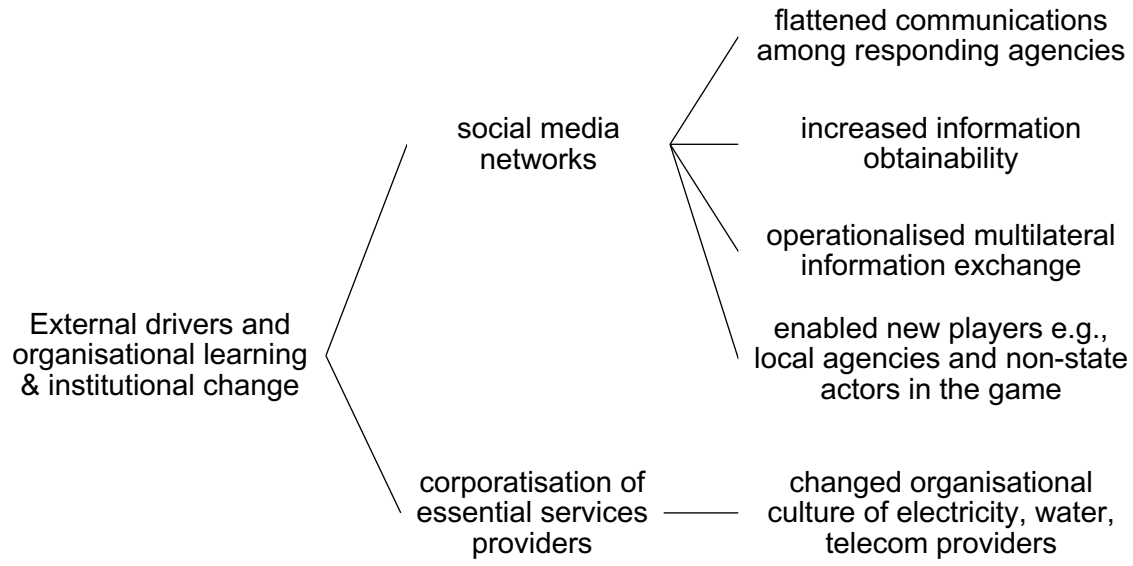

Figure 5-2 Roles of social media networks and corporatisation of essential services providers in organisational learning and institutional change of the EMS

Most participants mentioned that the rise of social media platforms such as Twitter, YouTube and Facebook created new opportunities and brought new pressures upon them. Due to these innovations, they had to make 'unplanned' modifications to adapt to the changing environment. Globally, these tools have become a significant part of disaster response (Cohen, 2013) as they create complex communication patterns

among responding agencies, the general public, and between the two groups. These interactions have not only dramatically increased, but their scope has expanded. First of all, in Oman, following the broadening global trend, responding agencies did not seem to have a choice in rejecting the new *norm* of using social media for official communications. One cannot overlook the speed and scale of this wave that affected the whole world in a very short time.

All governmental agencies in the present case study created official social media accounts and began using these channels to issue notifications, warnings, alerts and updates. Accordingly, they hired new staff specialised in information and communications technology and public relations. Many participants agreed that there was a tendency towards wider public engagement, but how to operationalise this idea was unclear. Social media networks proved to be useful for this purpose, as the coordinator of the media and public awareness (SC7) described:-

> 'It was a request of the committee—direct communication with the public. But we did not know how to do it. Now, we can use social media platforms.'

During cyclones Gonu and Phet, each agency operated its own communication system. For example, the police were using their radio frequencies, and so were the armed forces. Civilian agencies relied on traditional methods such as SMS messages and mobile phones. Furthermore, the information had to pass through several channels linearly and vertically. Hence, most participants agreed that cross-agency communication was a major problem, particularly at the operational level. Some participants even mentioned receiving conflicting messages from several sources, ultimately resulting in an uncoordinated response that lacked uniformity (Simon et al., 2015). Social media offered immediate solutions to this issue, as it flattened the communication system, increased information obtainability and operationalised the multilateral exchange of information.

It cannot be concluded that the prevalent use of social media has fundamentally changed the communication norms in the system or dramatically improved disaster response. However, it has created new information dissemination pathways that did not exist before. The coordinator of the basic services (SC5) mentioned the advantage

of sending one message to several parties simultaneously, informing the public and multiple government agencies of new updates:-

> 'We had to (cut off power)... We informed the people and the concerned agency through the Media and _____, _____ our Twitter account, and other social media etc.'

In addition to sending information, several agencies also used it to gather updates, images and indications of public concerns. During the response to cyclone Mekunu and Luban, the EOC monitored its Twitter account and used the hashtag #Mekunu to check people's concerns and needs. In order to establish situational awareness, it collected information about the situation on the ground. After ensuring its accuracy by contacting local agencies, the centre sent it back as an official message to the public and the involved agencies. This communication pattern was a new one that did not exist before, as (EM1) described:-

> 'We found many mechanisms and channels for information. Today, we even use social media to get information. For example, this Wadi is flowing now. We don't take tweets as facts. We would first, for example, call the _____ to make sure the info is accurate. And obtain more information about the situation, like whether the Wadi is causing an interruption. Then, we may broadcast it (using social media) as accurate info. And by doing so, we reduce our response efforts.'

Social media enabled formal agencies to send and receive information on a wider scale and at a faster rate than was possible with traditional media channels. It also enabled the public to post timely, high-quality eyewitness images and videos from the ground, benefiting from the advancements in smartphones. This bottom-up communication stream was largely absent during Gonu and Phet. Hence, responding agencies missed a comprehensive source of information. As agencies could not have the right equipment and cameras that could withstand strong storms and be distributed across large areas, they found this new informal source very important in establishing better situational awareness of the inundated areas, road closures and interruptions of essential services. Information perception, the first element for accurately understanding the situation (Endsley, 1995), has consequently increased. A sector coordinator (SC7) described how important this was to them as follows:-

> ‘During Luban, we discovered we did not have the equipment to sustain in the “heart of the cyclone”, such as cameras that could be placed somewhere to record. We did not have enough photos of the event itself. So we relied on the images shared on social media more than our people.’

An important advantage of social media networks was that they gave equal opportunity to all agencies and across the different governmental levels. As central ‘national’ agencies had well-established relationships with official media channels that were also centralised, their activities were largely circulating. On the other hand, local and regional agencies severely lacked connections with the centralised media. They had to cut through several procedures to make themselves visible in the local media. With the prevalence of social media networks and the government’s encouragement to use them to demonstrate preparedness, regional and local agencies found themselves with direct access to the public.

The centrality and linearity of how information was exchanged under the traditional command-and-control system limited the flow of information between participants and the general public. As these online platforms began to gain further popularity, they allowed multilateral participation, most noticeably in the present case study concerning Twitter, which was frequently mentioned and treated as synonymous with social media. The vertical chain of command was relatively flat across the responding agencies, as demanded by the emergence of new technologies (Alexander, 2015). (SC4) described a feature of the horizontal communication pattern as follows:-

> ‘Information exchange is very fast because there are now many communication means. Social media contributed to this as _____ would tweet, and we would immediately get the updates. Also, there are WhatsApp groups. The info is now shared quickly. During Gonu, this was not available.’

Agencies used social media networks to send and receive information. However, several participants mentioned a more critical role that these networks played in relation to institutional change in the EM domain. They brought new players to the game whose voices were largely absent in the past. Two groups of stakeholders became very visible during the response to Cyclones Mekunu and Luban in 2018: the general public and specialists such as amateur meteorologists, EM professionals, experts and academics not part of the formal system. The traditional local media has

been dominated and controlled by conventional government media agencies. What is covered by the media is highly controlled by the central government, as is the case in most countries of the region. As a consequence, the voices of non-state actors were largely underrepresented. This important feedback was largely blocked. In this case study, social media networks were found to provide new pathways for them to express their voices which brought new rules and caused unprecedented pressures on governmental institutions.

During crises, the public created 'hashtags' (labels or tags created by users to mark their posts – Simon et al., 2015) on social media platforms such as Twitter. It formed a public opinion concerning the quality of the disaster response. At the same time, public agencies were found to use more neutral hashtags such as #Luban, #Mekunu, #OmanReady or #ArabianSea, while ordinary people created and used more 'criticising' or 'evaluating' ones such as #_____Drowning. In addition, social media enabled them to use several hashtags and tag relevant agencies and influential individuals. This new phenomenon demanded that agencies make immediate changes to keep up with people's expectations, as the sector coordinator (SC5) mentioned:-

'You need to keep up and improve as the public pushes for more.'

Social media also enabled professionals, experts, academics, and amateur meteorologists not affiliated with formal institutions to share their knowledge. Some were very courageous in criticising the government's response plans and actions. The platforms provided people with more detailed forecasts, relevant information from the sites, and high-quality images using advanced techniques such as drones, modelling software and heavy equipment that could withstand strong winds. As a result, people began to follow them and look up to these informal accounts. Their popularity increased among the general public, making public agencies function more competitively than in the previously 'relaxed' atmosphere. On numerous occasions, participants mentioned how they had to implement new changes as they felt the presence of competitors or rivals. The sense of losing legitimacy was very clear from the participants' accounts. The need to sustain the public's trust by meeting their expectations placed pressure on them to purchase and use more advanced

technologies such as coastal radar and weather radar in aeroplanes. Furthermore, one agency allowed its members to engage directly with the public. The process of decentralised engagement with the public was completely forbidden.

In addition to the emergence and prevalence of social media networks, some participants identified the government's vision to privatise essential services providers as an important driver influencing important aspects of the governmental EMS. Privatisation was not a sudden change, as there had been a long-term plan to implement this 'capitalist' economic policy. As a result, telecoms, electricity, fuel and water providers became corporate and regulated through government authorities, in other words standards-setting entities. As corporatisation involved transferring public agencies to companies and entailed several policy changes, their organisational culture has positively improved, as perceived by several participants.

As a result of this institutional change, the sub-fields of the utility sector are now coordinated by government companies that must abide by new policies. The coordinator of the basic services sector (SC5), who worked more than 30 years in this domain, described this process and its impact on a change of organisational culture as follows:-

> "Government policies are the main driver for changes in the EMS, and its vision drives them… now all entities (sub-sectors coordinating organisations and private businesses within them) must have evacuation plans. Therefore, this was a new change for us. Before, we would not know how to respond in case of an alarm. There was no assembly point. No training. Now, we have the HSE manager, assembly point, emergency tests, etc. ... For example, before, we did not have a call centre for the water sector when it was under the government. But when the authority (public authority for electricity and water) was established, we developed a customer service department and a call centre among its pillars. All organisations that are members of the sub-sectors have a call centre, except the transport."

Privatisation of public services is a recent policy in Oman. Its implications have been appearing gradually and presenting challenges to policymakers. In the EM domain, recent cyclones demonstrated that most recovery efforts are directly related to services provided by the government and private companies, e.g., electricity, water and telecommunications. Participants stated that nothing could be done without the

participation of the private sector, which had become the second wing of society. This factor may increasingly influence the opportunities to create pluralistic management.

In conclusion, the widespread use of social media networks was a primary trigger in flattening the vertical communication pattern of the system and in enabling local agencies and some non-state actors to increase their stake and participation in crisis management. Additionally, corporatising essential services providers impacted the organisational culture of these former government agencies. However, the impacts of social media and privatisation have not yet materialised, and the experience has certainly not revealed its details. For traditional EM agencies, the over-reliance on social media may create a dependency that could result in more catastrophic consequences in case of an IT failure. For the general public and non-state experts and academics, governments have begun finding new ways to control and monitor these platforms. Similarly, privatisation has shifted some agencies towards more professionalism, but in many countries, it has created unwanted, unintended consequences in the larger context of disaster risk reduction.

5.4 Endogenous Processes: History, Contextual Socio-Cultural Factors and Actors' Perceptions

The cyclone emergencies opened the window for new institutional changes, and social media prevalence and corporatisation of essential service providers helped flatten the chains of command and communication. They also emphasised the need to integrate non-state actors into emergency management. However, selecting new changes, usually, after a crisis, did not occur in a vacuum. As shown in Figure 5-4, three main internal sources were found to have greatly influenced the rationale behind the selection process: historical decisions that influenced the character of the EM in the case study, actors' shared perceptions about disasters and how they should be managed, and norms that have been created and enforced by society or culture of the place. These sources supported and favoured the continuation of some older norms in emergency management, or they formed strong resisting forces that blocked important lessons from being identified and implemented. While actors seemed to be

constrained by these forces, they preferred to select changes that did not challenge the status quo, as explained later. These sources were found to be greatly intertwined. Hence, they are discussed simultaneously throughout this section.

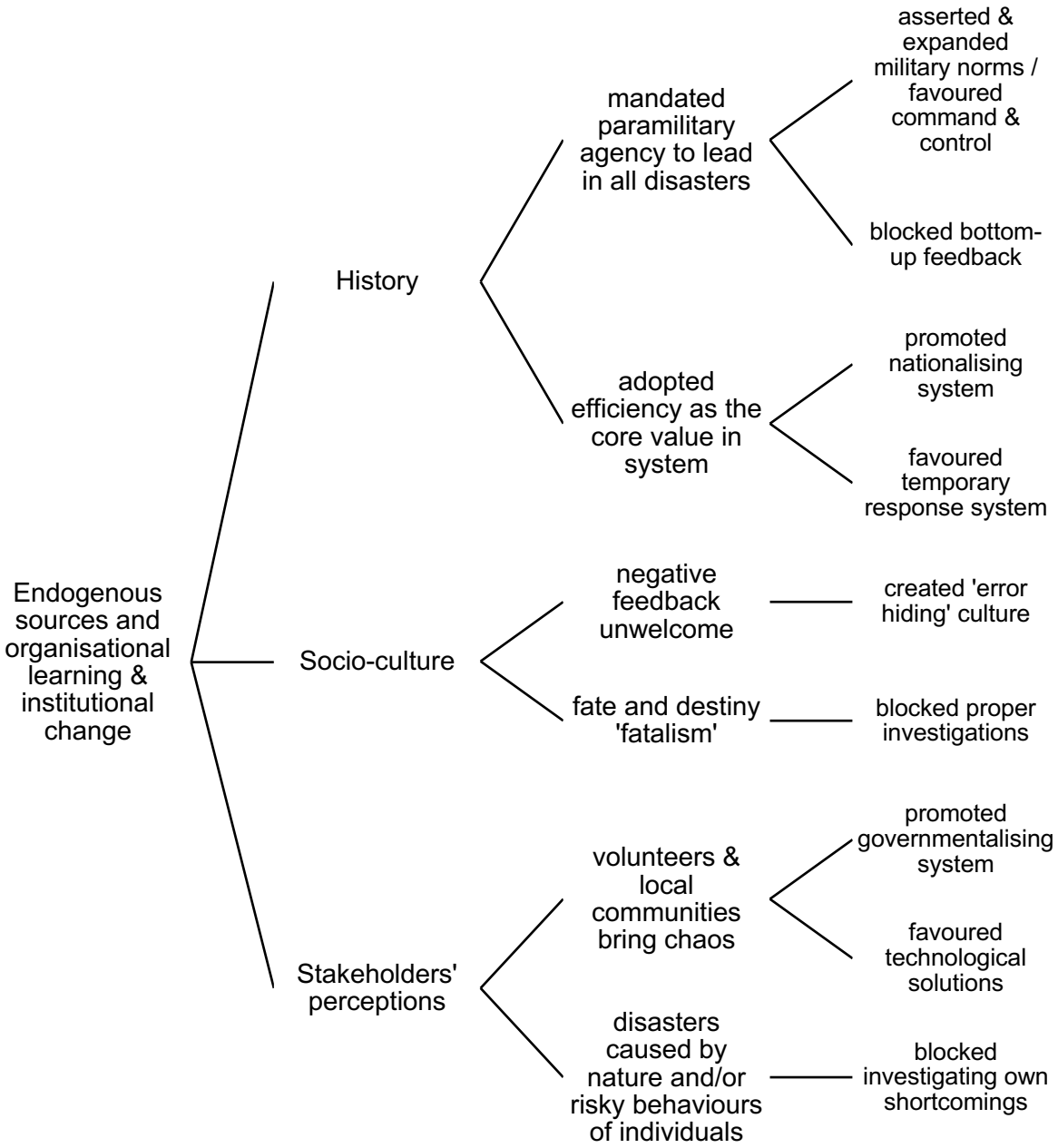

Figure 5-3 Roles of endogenous processes in organisational learning and institutional change of the EMS

The genesis and continuation of a nationally-focused centralised command-and-control response system for managing disasters have been supported by two key historical decisions: the assignment of a military-paramilitary agency as the lead agency in all emergencies and the adoption of efficiency as the core value in the system. Since the establishment of the modern state, these elements have created the underlying institutions and norms for the prevailing culture of emergency response in Oman (Alexander, 2007a, p.138).

As is the case in many countries, the police agency in Oman has been mandated to lead emergency management regardless of the trigger's nature. As it became the focus for coordination activities of the entire response system (Alexander, 2008a), its values and norms greatly influenced the preferred management model and the communication patterns among the responders. The organisational culture of the police organisation is largely dominated by military norms and values, e.g., strict order and discipline, a clear hierarchical chain of command, rigid procedures and authority to control. Command-and-control associated with centralised decision-making and procedural bureaucracy was not only found to be practised but was also praised as an effective approach for sustaining order and managing crises. All participants, including civilian actors, mentioned command-and-control as an effective means for managing crises.

Despite this, the literature emphasises the importance of demilitarising EM (Alexander, 2007a) as such models complicate communications across the different levels of personnel (Waugh and Streib, 2006). It remains the norm in many countries. Not only participants from the police agency were found to view disasters as out-of-control situations that require strict command and control, but also civilian actors held similar views. Sidani and Thornberry (2010) found out that workers in the Arabic culture emphasise and value authority. A female expert who conducted several studies about cyclones in Oman (LE1) expressed the need to militarise the system further to make it more effective:-

> P: 'Crisis management of the military is better than the civilian system in Oman.'
> I: you think?

> P: 'I am sure of this. I will give you an example. They have plan A, plan B and plan C. Their procedures are *very clear*. But the other organisations, the decision is made at the moment, improvised.'

While historical circumstances favoured a paramilitary lead agency in emergency management over other civilian counterparts such as the Health Ministry or the Interior Ministry, the lead agency has used this power to sustain its leadership in this hierarchy and further made its rules and norms more dominant in the system. Hence, a dynamic relationship between institutions and actors exists, as the former created the latter. At the same time, the latter could also use its power further to create new institutions in their favour. This decision placed emergency management in Oman on a particular path of growth. Alternative management models involving the public and local communities in crisis management were found to be inconsistent with the existing culture (Carely and Harrald, 1997) and, consequently, were hard to implement. The proposal to split the newly established Civil Defence and Ambulance Authority, PACDA, from its parent agency (the Police), civilianise it and make it the lead agency was blocked by the police agency. A female retired sector coordinator who served more than 30 years in the government (LE2) described the failure to separate it from the Police as follows:-

> 'it is supposed to be an entity by itself… That was the plan. Just like what happened with _____ . So I think it was supposed to be like that. I don't know why it is not (independent). I cannot say why. I think you know "personalisation" at the end [The intervention of a powerful person].'

Similar to military and paramilitary organisations, the police favour a command-and-control style of management for many reasons, but mainly due to its clear line of hierarchical authority (Moynihan, 2009) and its effective control over personnel, engendering a high degree of compliance with commands. Such a model elevates its authoritarian role, which is more consistent with its organisational objectives, mainly focusing on controlling the 'scene' through strict rules. The objective of any policing operation, including emergency management, was described by an emergency manager directly involved in managing disasters at the national level (EM1) as follows:-

> ‘As the saying goes, communication plus information means control. So you need the appropriate communication strategies and the right information to deliver to the location you want to go. This would lead to controlling the situation.’

Despite the few advantages of a militarised management model, its implications were detrimental to cross-organisational collaboration among responders. Such an approach effectively clarifies roles and authorities within a single organisation, but it is inadequate to foster a culture of cooperation and collaboration among a diverse range of responders. First, the secrecy of data, a characteristic of military culture, was identified by many participants. Despite changing the organisational structure to a network-based form to encourage cross-organisational collaboration through information sharing and resource exchange, most participants still view individual plans as confidential and "sacred" documents consistent with the norm that forbids sharing information, particularly that which is related to operations. For example, emergency plans are viewed as owned by the state and not to be publicised. On several occasions, the researcher was refused access to the operating procedures of some sectors, even civilian ones. Two participants answered whether they should be made available to the public as follows:-

> ‘… these emergency plans are top secrets; only top officials know them.’. (SC2)

> ‘No, why would people need them? They are limited to us, the involved participants, and those working in the field. They include organising procedures, a framework ‘operational plan’, and it is a legislative document. They are given to certain people who need them, so they do their work. They are provided to the people who need them. To organise the work.’ (SC3)

In addition, the culture of communication follows military and paramilitary norms. First of all, the command pattern was found to be very vertical, and it maintains clear and large power distances between the different ranks, positions and levels of management. Those power distances are not created by different levels of qualification. They are created by the number of years served, as promotion is largely based on seniority, which was found to be a learning barrier vis-a-vis crises (Carely and Harrald, 1997). It is expected that lower ranks will not ‘criticise’ higher ranks. Also, it is not unusual for the director of an administration to go to his or her employees and

ask them to say ‘Everything is OK’ when visited by a minister or a deputy minister in order to preserve pride and show that the manager is effective (Sidani and Thornberry, 2010). Similarly, it is usually expected that employees would do so. Therefore, authoritative norms characterise the management style in the workplace (Bakhtari, 1995).

Consistent with this paramilitary organisational culture, top-down feedback was found to be enabled, whereas bottom-up feedback was found to be greatly lacking. For example, the team assembled after a crisis to identify its lessons and suggest new ways to improve the system only included ministers or deputy ministers of key government agencies under the supervision of the lead agency. On the other hand, regional or local governmental agencies that were heavily involved in the response operation were underrepresented. Hence, failing to identify the problem is common in such systems as feedback is only enabled to those who are not on the ground, and therefore it is highly fragmented and subjective (Carely & Harrald, 1997).

Some more candid participants mentioned not listening to those who participated on the ground. The feedback from the lower levels of the hierarchy can easily be overlooked, particularly when it is negative and viewed as a threat to the existing power system. As the committee responsible for reviewing the system is made up of the highest level of the hierarchy, they can select which feedback is important and which is not. A female retired government official (LE2) explained the problem of blocking negative feedback in detail as follows:-

> ‘What I noticed is that the people who are at the top of the hierarchy or whatever who is at the top of the board of the organisation, they would not listen or even not open the door for the people, you know, on the field to set and tell them exactly what they think of the whole operation. Even if you give them feedback, they would always ignore the negative feedback or the ones that are very important for us to take as a case study. We tend not to accept our mistakes which are disastrous sometimes. And from those mistakes, we are supposed to come up with them, and we say we did this time. Next time, we are going to do it this way. But you need to recognise the mistakes first. And I think we tend to block it when it comes to that. That is how I felt in many circumstances from my past experiences.’

Negative feedback could easily be viewed as a lack of appreciation of efforts, negative criticism and even a threat to professional or organisational survival (Carely and Harrald, 1997). A culture of hiding errors (Argyris, 1977) is common in such working contexts, as no mechanism exists to report them. Also, the customs in such a society favour the over-appreciation of efforts over constructive negative feedback. That is why many participants asked the researcher: 'Don't look at Guno, things are different now'. On the other hand, amplifying the perception of improved performance, such as after Phet and Luban, was found to be common practice. One could find top officials honoured and awarded medals, honorary decorations and physical gifts following emergencies. A local expert (LE2) who spent more than 30 years in the government sector answered why officials do not listen to negative feedback as follows:-

> P: 'I think it is also cultural. Think about our culture. We are not brought up to accept our mistakes and learn from them.
> I: criticism?
> P: 'We don't accept criticism. You know, we find it very difficult. We take it very personally, which is not the case. It should not be personal, you know. Even if it is personal to you, you should stop and think that what he/she is telling me is right, and you need to look into it and re-program yourself, and next time, you do not do it again. I think part of it is in our culture. I think.'

When she (LE2) was asked about how this problem can be solved, _____ answered as follows:-

> '[laughing]…You know, we need to be more realistic. We need to accept that one day we are gonna be criticised, especially if you are taking onboard leadership, you know. If you are a leader and you accept that, then believe me all those who are under you are gonna be the same. They will accept that because you are gonna start accepting criticism from them so they are gonna learn that criticism is 'normal', you need to take it and turn that into a better 'you' better 'system'.
> [laughing] I do not know whether the younger generations are gonna be much open to it. If we manage to do that, believe me, a lot of things are gonna change. Not only the EMS. The whole thing is gonna change. The whole perception is gonna change.
> I do not know how it can be done but I think also through 'training'. You need first the decision makers to accept that idea. And then, you start rolling it into the different departments.

When paramilitary norms became dominant, the armed forces' participation in civilian emergencies was expected and largely accepted. As explained earlier, its role in Gonu and Mekunu helped to bring stability and order. However, its engagement has gone

beyond its prescribed supportive role even though the *State of Emergency Law 2008* clearly states that the armed forces are not to be involved in emergencies unless ordered by the President to participate. Even during the recent Covid-19 pandemic, the military was heavily engaged in the command-and-control posts. Its participation could be attributed to the lack of civilian emergency response structures (Alexander, 2008a). However, it was consistent with the lead agency's dominant command-and-control rules in this case.

Along the same lines, implementing the right lessons from Gonu and Mekunu also means recognition, authorisation and crediting new types of actors who are either not at the highest level of the hierarchy or are totally outside the government domain. Therefore, such initiatives could potentially be viewed as threats to existing organisations or even individuals. The phrase 'personalisation' was mentioned on several occasions by different participants. There is a shared agreement among them that this plays a role in organisational learning. *Personalisation*, according to them, entails a general belief that the job position, agency and resources are *somehow* personal *belongings* to the individual. Therefore, some may consider new ideas as direct threats to them and their achievements rather than viewed as new opportunities for growth. A local female expert (LE1) who holds a PhD degree and worked with several responding agencies summarised it as follows:-

> '… the personal interest dominates over the interest of the public; positions are very personalised here.'
>
> 'I did a focus group about _____… After this workshop, one person came to me and told me "don't intervene in our jurisdictions".

In addition, several participants mentioned that collaborative or participatory decision-making, which shares responsibilities with non-state segments of society, is a new and perhaps unfamiliar idea, as the government of Oman has always been the sole policy maker and the largest service provider. A retired government official (LE2) described this common societal norm as follows:-

> ‘The government still thinks that “We should be doing it” and because they are saying that, the public of course also thinks that way. I mean we (people) always think “Why do not the government do that?”. It is not supposed to be like that. Now, we are in a time of our life that the total dependence on the government is *over*. But unfortunately, the government still believes in this… Until now they are… unable to try to deliver this *idea* to other segments of the society.’

The second critical decision that was taken in the past and has greatly influenced emergency management in Oman was the adoption of ‘efficiency’ as the core value for managing disasters. Many participants frequently justify engaging in action because “it was more efficient”. Although efficiency has a positive appeal, overemphasising it has led to several problems. *Royal Decree 32/88* was issued in 1988 to establish an interagency coordinating committee that only convened during a crisis. It was based on the principle of using existing structures and resources. This arrangement was based upon the idea that agencies can switch roles and form new working networks by utilising routine organisational structures and resources for crises. Some participants described why this management model was adopted instead of a permanent disaster management agency:-

> ‘this model of management was selected because it is less expensive, less resources needed, financially and personnel.’ (SC3)

> ‘The current organisation does not incur financial implications. You do your daily work and at the same time, you are ready, if God wills, any natural hazards that might occur.’ (SC8)

Participants defined *efficiency* as delivering their EM responsibilities at the lowest cost using routine resources. It was found to be a strong underlying driver behind the selection of critical choices. For example, operating the system at the national level sounded more efficient to policymakers than localising it. When participants were asked about localising EM, they all agreed on its importance, but many stressed that "it is more efficient to build a national system than local systems". In addition, as many organisations do not have representation at the local Wilayat level during normal times, a local response from them cannot be the norm. The coordinator of basic services (SC5) explained clearly why a local response from their sector is not possible:-

> '… response from our sector is at the regional level, not at the local (Wilayat level) as we don't have organisations (from our sector) that have a presence at the Wilayats.'

Consequently, the mobilisation of resources became the dominant *modus operandi* in delivering emergency services. National strategic emergency management is important but cannot substitute for regional and local levels of crisis management. In fact, at the operational level, the response must be based on local disaster management, as the local areas are always the theatres of operations (Alexander, 2008a). In the four case studies, the demands of response, such as coordinating operations, rescuing people, providing relief, sheltering and recovering essential services, largely emerged at the local level. Agencies attempted to deliver them by mobilising their resources from the capital city to the main city in the affected region and then to affected villages once required. This management model, based on efficiency, as illustrated in Sections 4.2 and 4.4, failed to deliver the system's objective where and when it was most needed. Human losses, economic damage and social consequences in one disaster were evident enough to demonstrate that a nationally-focused approach was inefficient. In addition, over-emphasising efficiency played an important role in strengthening the approach to disaster management in the country as a system that forms to respond to disaster in the aftermath of impacts. This view has blocked the realisation that disaster management is largely about reducing risks and vulnerabilities in society. Consequently, there has not been a proper focus on mitigation and preparedness.

Two important decisions were taken in the past that had a wide and long-lasting impact on the EMS in Oman: selecting a paramilitary lead agency and adopting efficiency as the core value. Today, the set of norms, rules and beliefs that has been created has become a strong source of justification for all responders. On several occasions, participants provided justifications to support the continuation of norms instead of seriously questioning the *system's status quo*. For example, some justified making the system national instead of local by the claims that Wilayats lack sufficient size of development and urbanisation, that disasters are occasional, or that the perception of EM is 'about expensive high-technology measures' (Al Shaqsi, 2015) that cannot be arranged for all local areas. The government's definition of efficiency does not apparently produce true efficiency as defined rigorously.

On many occasions, officials were found to choose not to properly investigate or 'dig deeper' to find the causes of a disaster, including why people died or areas were flooded, or why the EMS could not function. Instead, they gave justifications for disaster damages. One justification seems to originate from the religious conception of fatalism, which meant that 'things have already been destined to happen'. Fatalism, claimed to be an inherent custom in Islamic culture (Acevedo, 2008), can be misused by many officials to attribute failures to external factors instead of taking full responsibility. As some events are believed to be predetermined and therefore inevitable, this, unfortunately, has also been used to justify damage, deaths and inefficiency. Several participants pointed out this cultural factor:-

> 'I think once it happens we would say 'destiny' or 'predestined'. Though we know it is his mistake. We would not go back and study it and make it a lesson for others. We will just leave it as 'destined to happen'. Which also I think it is a misinterpretation of the concept of "al-Qada Wa Al Qadar".' (LE2)

> 'one reason is peoples' culture. Their awareness of natural hazards and they say "whatever is written will happen". (LE1)

Many incidents went without comprehensive inquiries and somehow closed further enquiries with the expression, "God has destined this to happen". Hence, some participants attributed the deaths of casualties during emergencies as follows:-

> 'If you notice, the victims… their cause of death is due to… and of course, the fate and destiny. We cannot ignore that.' (SC2)

In addition to history and contextual sociocultural factors, the perception of stakeholders was found to constitute the third important source behind the selection or rejection of new ideas, as it could form a significant barrier to learning from disasters. A prevalent negative perception among the research participants was that engaging volunteers and local community leaders in crisis management would bring more chaos than the perceived stability at that moment. They agreed that the 'system-as-it-is' is very stable since roles among government agencies are clearly specified, and therefore no conflicts could arise. The fear that new, unfamiliar types of actors would be 'too much' to organise was mentioned several times. Some participants explained why volunteers should not be integrated into the formal system:-

> ‘They (volunteers) would bring more chaos and they themselves need management.’ (SC3)

> ‘From a meeting, they (members of a sector) said they (volunteers) will be a burden for the core tasks of the sectors. However, for other tasks such as cleaning, moving stuff, helping in something maybe.’ (SC8)

> ‘some of them (volunteers) are specialists; some of them are PhD holders in electricity, water etc. I discussed this with the guys in our meeting; they rejected the idea. The reason, which I also believe is valid, is that they said we have licensed people in the sectors and I trust their work. And they said these people instead of helping us they could destroy us.’ (SC5)

Some participants supported this claim by saying that individuals are confused during emergencies. For instance, several said that ‘People would not know what to do in a case of an emergency’ or ‘They would even risk their own lives’. As the common view is that people are helpless, many agree they should be helped rather than asked for help. Alexander (2007b) attributed the prevalence and persistence of such misconceptions to mass media that greatly propagate them. Unfortunately, these beliefs were found to be further manifested in the norm of ‘blaming the public’ for disaster damages. Statements such as ‘people take risky actions’, ‘do not follow the instructions’, or ‘they underestimate the hazards by driving their cars in the middle of running water’ were quite common across the dataset. On the other hand, there was no instance in which a systemic cause was identified for causalities. While such claims could be true on some separate occasions, they negatively amplify the idea of the passive role of people and create an institutional barrier against identifying the root causes of failures. Participants explained why some causalities and damages occurred during the response to Cyclone Gonu:-

> ‘If you notice, the victims, … their cause of death is always either crossing a running wadi or not listening to the instructions.’ (SC7)

> ‘But the circumstances for the people, maybe they did not listen to the radio or did not believe or underestimated the impact of the cyclone.’ (SC8)

> ‘… the main reason for the damages is that some violated the wadies and built in the flood plain.’ (SC2)

Viewing people as part of the problem reinforces the belief that solutions to disasters remain within the government, that they are manifested in structural or technical

modifications rather than in challenging the status quo of the governance or management model, in line with Kenneth Hewitt's statement that 'The natural science-technological fix approach is itself, essentially, a sociocultural construct reflecting a distinct, institution-centred and ethnocentric view of man and nature' (Hewitt, 1983, p. 71). In addition, policymaking and delivery of public goods and services have been historically assumed to be a governmental responsibility. Sharing these roles with non-state segments of society has not been common. An all-stakeholders norm of governance is inconsistent with "how things are run in the country", as the predominant 'governmentality mode' has always been unicentric (Sørensen and Torfing, 2016); in other words, state-based governance. Accordingly, people and private businesses have been viewed as 'beneficiaries' or 'recipients' rather than active stakeholders.

Taking people and non-state actors out of the 'solution equation' explains why many participants suggested building better roads or more dams to solve the failure when they could not reach affected areas that became physically isolated. None mentioned localising emergency response despite the reality that informal local disaster leadership occurred on the ground, as explained in section 4.3. Participants view these as rare individual initiatives that only occurred in exceptional circumstances. In reality, they occur in disasters, but they become key to survival and more relevant to the situation than bureaucratic procedures. The important lessons of localising emergency management and integrating voluntary and non-state actors seem to conflict with these negative perceptions among key stakeholders. Therefore, this issue must be addressed at the grassroots level by raising awareness of the importance of the roles local disaster management and non-state actors can play during crises.

When different options are discussed, stakeholders tend to prefer technical solutions or restructuring inter-governmental organisations instead of changes in the governance model. It was found that a large proportion of them believe that the mechanisms for improving EM are still largely a matter of adopting advanced technologies and building more dams, roads and bridges. Senior officials repeatedly mentioned that very advanced early warning systems are the best way to increase capacity. Some of them even mentioned the idea that the system can be improved by importing ready-made quick fixes from the so-called developed world, though failures of crisis management in the global north can be easily identified (e.g., the Grenfell

Tower disaster in the U.K. in 2017, Hurricane Katerina disaster in the U.S. in 2005, Chornobyl disaster in Ukraine in 1986).

The second important perception that was found to be shared by the majority of the participants was the view of disasters as exceptional events, outliers of normality or rare occurrences that external agents cause (e.g., God or natural hazards). This perception could form a strong barrier to learning, as it prevents responders from identifying their shortcomings, which might have had a greater influence on the response. While participants shared the need for increased awareness, as described in Section 6.2.1, that awareness largely related to the agent's hazards, not their plans and procedures. 'Looking in the wrong place' through trying to understand the dynamic of the external aggressors hinders proper identification of other drivers that could have created the right conditions for an emergency to be managed.

Before cyclone Gonu made an impact in 2007, there was a common perception that a disaster of this scale could happen in Oman. Once it occurred, the devastation was described as unprecedented. Several participants further argued, "why should we prepare for a rare event that caused by an external factor, particularly when there are many current issues that require our attention". These beliefs, among other factors, created a culture of procrastination. All participants mentioned that 'they will do it' or 'they plan to do it' whenever asked about something missing. For example, the intention to develop an EM plan existed in 1988 when the first national emergency committee was issued. However, the first draft was developed in 2003, and a complete formal plan was enacted in 2018. An emergency manager (EM1) discussed the importance of local EM but stated the following when asked whether it is implemented:-

> I: Is it written that… the responsibility… of crisis management at the local/Wilayat level? Is this applied now?
> P: 'Insha'Allah'.
> I: you think it would be applied?
> P: 'Insha'Allah. Right now, we are developing a plan.'

5.5 Conclusion

Similar to the notion that social transformation is an effect of an intervention (Castles, 2001), such as wars and conflicts, the evolution of EMS in this case study was also found to be an outcome of recurring emergencies that opened the window for new changes to take place (Alexander, 2015). Major changes in the EMS occurred in such periods in a pattern better described as a leaps-pattern (Carely and Harrald, 1997). Since 1970 (the establishment of the modern state of Oman), three recognised stages of development can be observed: fragmented unorganised management, an *ad hoc* agency-based structure and a function-based structure. The first stage was characterised by a lack of multi-agency coordinated response as one agency was responsible for managing crises. EM was an emergency response at this stage, with an evident lack of emergency planning and preparedness. The second stage of development began by establishing a national multi-agency committee for disaster management that can be viewed as the first formation of a 'system'. The focus on preparedness and the multi-governmental response was manifested in issuing the first civil defence law, establishing a civil defence entity and an executive office that works as a Network Administration Organisation 'NAO' (McGuire, 2006; Moran, 2013; Moynihan, 2009) to facilitate collaboration and coordinate and direct the national multi-agency resources during crises. The third stage witnessed the restructuring of the national system from an agency-based to a function-based structure (Alexander, 2008a). This change brought more flexibility and direction towards achieving more specific objectives. An increased focus on planning and preparedness manifested in conducting multi-agency exercises and establishing an early warning system were important developments in this growth stage.

These changes were important. They show that the EMS has become more integrated. Government agencies have begun working as a system towards one common objective. However, this integration only occurred horizontally between government agencies. The system remains a civil defence command-and-control model. Despite experiencing large-scale emergencies, it has not evolved into a civil protection collaborative, participatory model. It has neither evolved as a consequence of learning from the experienced emergencies that necessitated the need to focus on

local disaster management and to build a multi-actor system that effectively engages non-state actors. Hence, single-loop learning was the dominant form, which did not change the management style and underlying assumptions. In other words, the management style remains a paramilitary governmental reactive response system. The National Committee for Civil Defence (NCCD) forms during a crisis. The government remains the sole policymaker and largest emergency service provider. Regional and local administrations severely lack emergency response capacities. Support from the national government remains a prevailing norm. Therefore, it was important to identify the forces behind the implemented changes and the learning impediments that blocked the identification/implementation of the proper lessons, as identified in Chapter 4.

Opposing forces originating from external and internal sources played a role in this selective learning. Cyclone emergencies can be seen as unfreezing events, playing a positive role in allowing new organisational changes. Besides, the emergence and prevalence of social media and the corporatisation of essential services providers facilitated changing the status quo by flattening communication patterns and introducing new actors, such as semi-government companies. The corporatisation process of electricity, water, telecom and fuel providers means they became regulated and governed by a standards-setting authority. It appeared as an effective mechanism for change. The essential services providers must adhere to the new rules, such as having an emergency and business continuity plan, a call centre and emergency response units. These forces pushed for a new management style, but much stronger internal forces largely influenced the nature of growth. In other words, the relationship between the implemented changes and the emergencies can hardly be established. Rather, learning resulted from intertwined categories of [largely] internal drivers.

The history of emergency management in Oman was found to be a key element in understanding the current EMS. Crisis management was assigned in 1970 to a paramilitary organisation that still favours centralised management and a clear hierarchical chain of command. In such organisations, enforcement by the higher authority was a common mechanism for making changes. Many agencies were assigned new roles in crisis management by this method regardless of whether or not

they were relevant to the agency's scope. Unfortunately, it was found that rejecting an assignment is very difficult in such organisational culture.

Similarly, feedback from lower ranks in the management/command chain is discouraged, and a culture of 'error hiding' is common. The culture was also found to be a strong element that encourages an over-appreciation of government efforts and discourages criticism. Perceptions of government stakeholders were also found to discourage the non-state actors' engagement in crises, and several participants viewed volunteers as helpless beneficiaries. The context of the place – culture, history and perceptions – were much stronger forces that blocked identifying or implementing the rights lessons. Instead, single-loop learning was much favoured as long as it did not threaten the existing governance model.

CHAPTER 6 DISCUSSION

6.1 Introduction

There is increasing evidence that countries undergo dramatic disaster risk reduction (DRR) policy changes after experiencing extreme events, for example, emergency management in China (Zhang, 2012), Malaysia (Aini et al., 2001) and South Korea (Ha and Park, 2014), civil protection in Italy (Alexander, 2008b), and emergency preparedness in the USA (Waugh, 2000). At the same time, there is substantial evidence that learning which involves interpreting 'the right lessons' from disasters, is a very hard process (Lampel et al., 2009; Desai, 2010; Madsen, 2009). This research used Oman's EMS as a case study to understand whether this phenomenon – organisational learning and institutional change – occurred. In other words, in light of several cyclone emergencies the country has encountered, this thesis examined what the system has learned from them, whether it has evolved and, if so, how it has evolved. The work addressed the ongoing need to understand the nature of organisational learning that occurs following disasters. Therefore, before answering this question, it was important: (a) to identify the essential principles for an effective emergency management system that represents an 'ideal' EMS and (b) to identify the lessons that should be implemented based on the events experienced by the system itself.

Chapter 4 analysed disaster response in the four events. Its findings were found to be consistent with the existing state of the art (see Sections 2.2.1 and 2.2.2 of the literature review chapter), which discussed the main ingredients of an effective emergency management system. Chapter 4 results showed that several fundamental organisational learning lessons should be acknowledged and implemented for effective disaster response. First, disasters must be managed at the local level. Secondly, crisis management must be based on collaboration and integration between state and non-state actors, volunteer organisations, local state agencies and private essential services providers. Thirdly, planning for emergencies should be based on the scenario of discontinuity of essential services such as telecoms and main road

links. Section 6.2 of this chapter discusses the importance of these findings in light of existing relevant knowledge.

Chapter 5 presented the different forms of organisational change following these emergencies. An important finding was that single-loop learning (Argyris, 1977) was the predominant form of change. It included engaging more governmental actors, restructuring the system and obtaining more material and human resources. On the other hand, double-loop learning, which involves changing the values and underlying assumptions of the system, rarely occurs. Localising response, integrating non-state actors in the formal EMS and focusing on DRR rather than response had not been adequately identified, mentioned or implemented as lessons learned from these events. In other words, changing the governance model or the dominant management norms was significantly underrated. The important 'right' lessons have not been absorbed into organisational learning. Several learning impediments were found to have blocked either the identification of the right lessons or their implementation. Section 6.3 discusses how decisions made in the past, social and cultural norms and perceptions of stakeholders play important roles in the process of selective organisational learning from crises by favouring and encouraging centralised, governmentalised emergency response.

6.2 Disaster Response and Command-and-Control Emergency Management Model

The civil defence approach or management style, including the command-and-control model, are widely used in different parts of the world to manage emergencies at different scales (Alexander, 2002b; Neal and Philips, 1995). They have been found to perform well in some emergencies (Bigley and Roberts, 2001; Moynihan, 2009), which usually involve one or two jurisdictions, as long as organisational relationships are relatively clear and operational concerns are relatively narrow (Waugh, 2000). In the present case study, this managerial model, which was found to be centralised, managed by a paramilitary agency and highly vested in governmental procedures, was inefficient in tackling large-scale emergencies triggered by tropical cyclones.

Simply put, it could not meet the needs of the most affected communities during Cyclones Gonu and Mekunu in 2007 and 2018, respectively. Comfort (2007) and Schneider (2005) also mentioned that the hierarchical command structure performed poorly in responding to the Hurricane Katerina disaster of 2005. A similar finding by Jung et al. (2018) was discussed as a key element in the poor response to the Seoul ferry disaster of 2014.

A knowledge gap highlighted in the literature review is to identify when a command-and-control EMS enters into a state of disorder or when bifurcation points occur (Koehler, Kress and Miller, 2014). Identifying when, how and why the system fails to function in certain conditions is important knowledge that should point to areas of improvement. In other words, organisational learning should be about 'what emergencies tell us regarding the characteristics of the system that make it ineffective in some situations' rather than 'what responders have learned from the events themselves' (Christianson et al., 2009; Zhou et al., 2018). Findings, guided by chaos theory, which was adopted to identify systemic failures and lessons, showed that the centralised command-and-control model could collapse or be severely impacted when a critical infrastructure failure occurs or when the affected areas are widely dispersed. It was found highly vulnerable to the failures of roads, telecom networks and electricity services.

The EMS bifurcated into a state of chaos following failures of critical infrastructure, such as the inundation of the central emergency operations room, the collapse of mountainous roads connecting the town centres to the affected areas and the interruptions of electricity and telecom services. When these new conditions occurred, concurrently or separately, the centralised system could not deliver its services where they were most needed, and therefore it failed to achieve its intended objective. These findings support the hypothesis (1. a) that the formal command-and-control model would fail to deliver needed aid and manage the crisis under a highly disrupted operating environment. In reality, emergency responders could not follow their normative guidelines (Neal and Philips, 1995) because these were irrelevant to the crisis conditions. The occurrence of a bifurcation point can be easily linked to the conditions of the operating environment due to the impacts of the natural hazard.

However, it is rooted in the underlying interrelated assumptions of centralised command-and-control systems that provide the initial conditions for failure.

The first assumption is that the crisis 'will occur in relatively limited geographic areas' (Schneider, 1995), and consequently, a limited number of people will require help. Thus, the needs generated will not exceed governmental capacities and resources. In reality, there were severe shortages in both human and material resources. While people and volunteers emerged to help and provide a wide range of materials, there was a noticeable challenge in managing and integrating emergent groups within formal structures. Buck et al. (2006) and Koehler et al. (2014) found that the command-and-control model lacks the flexibility to accommodate informal resources. Alexander (2007a) and McGuire et al. (2010) also mentioned that such a system does not welcome *ad hoc* emergence. Earlier, Quarantelli (1998) mentioned that it does not have the proper mechanisms to manage emergent groups. In this study, the command-and-control system had great challenges building and maintaining cross-sectoral collaborative networks. Responders had great difficulty adapting the command structure to cope with the incoming resources, information and skills required for managing disasters.

The second underlying assumption of the centralised command-and-control emergency management model is that the operating environment will be relatively stable. Normal operating conditions will characterise the scene. And if an essential service is damaged, it will be quickly restored. Therefore, a 'national-to-local' resources' mobilisation strategy or a centralised reactive system would be able to manage and deliver aid whenever and wherever requested. The four case studies showed that disruptions of essential services are inherent in extreme events' nature.

Furthermore, when a main road or a major telecom service is disrupted, it could take several days and sometimes weeks to be restored. These failures will likely occur in future cyclone emergencies, possibly triggered by other hazards such as tsunamis and earthquakes and exacerbated by the increased interdependence of critical infrastructure webs (e.g., telecom networks, power grids and water plants) that characterise modern societies (Boin, 2009). The *isolation phenomenon (*when entire areas become isolated islands) has also been observed in less-intense events with

heavy rainfall, such as tropical depressions and localised troughs. It has become a recurrent phenomenon whose impact is devastating. Therefore, the operating environment is highly likely to be characterised by unanticipated disruptions. In order to be effective, the management model should consider this reality.

Lastly, the third assumption is that coordinating a multi-agency action would be straightforward, and the chain of command would be upheld. Therefore, coordinating and directing resources can be accomplished by a remote centralised mechanism (normally located in the central agency's premises or at the region's centre). In reality, coordination is easily disrupted when communication lines collapse. During Cyclones Gonu and Mekunu, the main central control room could not establish what was happening on the ground in the mostly-affected areas. A coordinated response requiring accurate situational awareness (Comfort and Kapucu, 2006; Alexander, 2016) could not be established.

Furthermore, managing a large network requires flexibility and 'breaking procedures' (Boin, 2009), which command-and-control models lack. The culture of 'secrecy' among responders and the disabled bottom-up communications further complicated multi-agency coordination (Nohrstedt et al., 2018), as these factors did not help the authorities to establish a complete and accurate sense of situational awareness (Endsley, 1995). The formal system was found to function as a detached 'foreign' organisation directed by the central agencies. In contrast, local agencies, volunteers, volunteer societies and private businesses had to improvise with severely limited response capacities.

While these emergencies revealed critical failures associated with the current command-and-control EMS, they also demonstrated how crisis control was reinstituted on the ground. One needs to look no further than the local area to identify the proper mechanisms to avoid or at least minimise the impact of these failures and reduce disaster risks (save lives and protect properties). First of all, when the formal planned system failed to reach the mostly-affected areas, a bottom-up process at the local level (Schneider, 2005) took place, which involved forming 'informal' response teams from local communities, local state agencies and several private businesses such as food and water suppliers. A locally self-organising structure emerged

(Koehler, Kress & Miller, 2014), functioning adequately on the ground. These findings support the hypothesis (1. b) that an adaptive form of management emerges when the formal EMS fails to meet people's needs. In other words, the bifurcation points that caused systemic failures and resulted in a chaotic state were followed by a self-organising process, as suggested earlier by many scholars and researchers (e.g., Kiel,1995; Alexander, 2002b; Sellnow et al. 2002). However, the self-organising process was rather a re-organising process with the help of external actors.

The concept of 'self-organisation', described by Comfort (1994, p.403) as 'a spontaneous emergence of a new order in the dynamic, rapidly-changing contexts', can be understood as the system using its resources to re-correct itself but what occurred, in reality, was that external actors helped the formal system to get back to an orderly state through new mechanisms of collaborations that did not exist before. In other words, without the help of those informal actors, a re-organisation of the system would hardly be established. Due to its rigid procedures, the system lacked the organisational flexibility required to maintain its form under duress (Alexander, 2002b) and lacked the right conditions to self-organise. Hence, self-organisation should be understood in this context as the whole of society, or various independent segments of society, organising itself instead of the system re-correcting itself. This connotation is important because how the society as a whole was able to self-organise in such extreme events demonstrates a management model more consistent with disaster reality. This important knowledge should feed into updating the emergency management model and its underlying assumptions.

Local disaster management, or community-based disaster management, is an effective approach to disaster risk reduction (Alexander, 2007a; 2015; Twigg, 2007). In the present case, it emerged in an improvised manner with a severe lack of capacities, resources and limited technical know-how. The informal system, as identified earlier, involved collaborative engagements between local state agencies and volunteer groups from affected communities. These findings confirm that, for an EMS to be effective, it must be locally oriented and based on collaborations with emergent groups. The role of voluntary organisations (as found by Comfort 1995) is an important element of a self-organising response. Therefore, the catastrophic scenarios in Gonu and Mekunu in 2007 and 2018, respectively, can be prevented or

significantly reduced by implementing local disaster management, which means that the roles of local actors must be identified; they must be trained to work with regional, national and international organisations (Kapucu, 2015). They should be empowered with resources, and capacity building should focus on local authorities (Kapucu, 2015). It also means that the organisation must have plans and be integrated well with existing structures.

Waugh and Streib (2006) added that disaster leadership should be practised at the local level. It should not focus entirely on traditional top-down leadership, such as the presidential variety. Kapucu (2015) found that the failure of leadership at the local level was a key factor in response to Hurricane Katerina. The need for local disaster management cannot be overemphasised. It must be effective in managing a crisis and sustainable because it relies on a larger pool of resources from multiple actors. In addition, when local communities feel a sense of ownership of such systems, they are more willing to participate and cooperate, which is essential for the success of the emergency response. The self-organisation phenomenon informs us that for a society to overcome a crisis, it should be supported and its capacity developed instead of being questioned or viewed as counterproductive (Dynes, 1994, Neal and Phillips, 1995). The findings show that mechanisms to support this process largely exist at the local level, but they require the decentralisation of crisis management to the lowest administrative level.

In conclusion, when the affected area is multiple, and essential critical services are severely interrupted, this crisis scenario is not uncommon. While it is important to increase infrastructure resilience by reducing interdependencies and increasing redundancy, emergency planning and management models should be designed based on the fundamental reality that the theatre of operations might be multiple and that electricity, telecom and roads might be unavailable. Reducing risks in such chaotic conditions requires a managerial model whose operations are decentralised and whose procedures are flexible in facilitating incoming emergent resources. Local disaster management must also be the basis, but the regional and national response should be activated whenever necessary. Failures to request resources and supplies from federal agencies in the early days of Hurricane Katerina played a major role in the catastrophic consequences in New Orleans (Treaster & Sontag, 2005, cited by

Schneider, 2005). Similarly, as FEMA relied heavily on scarce local resources and underestimated the role of federal authorities when Hurricane Maria struck Puerto Rico, this strategy resulted in devastating consequences (Calma, 2018). Thus, an integrated collaborative inter-governmental approach effectively manages crises (Kapucu, 2015; Waugh and Streib, 2006).

Despite being found to be inefficient in managing large-scale emergencies, the centralised command-and-control model is remarkably persistent. Based on this case study, several reasons were found for this state of affairs. First, it worked relatively well during routine emergencies when demands did not cross-jurisdictional and sectoral boundaries (Nohrstedt and Bodin, 2014). Buck et al. (2006) added that this structure works well when demands are routine and social emergence is minimal. Under the continuity scenario, in Cyclones Phet 2010 and Luban 2018, formal emergency responders did not experience failures of essential services. Communication lines among them were sustained during the storm. Also, they were able to mobilise resources and deliver aid to affected areas. Hence, a 'perceived' positive response to these events was created, asserting that such a system is effective. Similarly, the Department of Homeland Security in the U.S.A. mandated using the Incident Command System (ICS) for all crises (Moynihan, 2009) after effectively tackling wildfires in California. This sort of enforcement has driven the prevalence of ICS in the U.S.A. and other countries. However, these events (Phet and Luban) can hardly meet the criteria for large-scale emergencies or disasters as social life was not significantly disrupted, and they did not exceed the capacity of normal 'government' resources (Alexander, 2005).

The second important reason for the bureaucratic command-and-control system's persistence is its clarity and formality. Objectives are defined, and there is a clear formal hierarchical chain of command (Schneider, 1995). It also provides structural mechanisms for forming teams with new roles and authorities (Bigley and Roberts, 2001). However, these studies examined its effectiveness by studying the response of a single agency. Thus, they viewed it from the standpoint of a single agency's organisational reliability and not the whole network's effectiveness. In other words, they did not study whether or not the emergency needs of affected communities were met or whether or not delivering aid and rescuing people were effectively carried out.

Therefore, it is highly doubtful that conclusions from an analysis of one organisation can be generalised to how a multi-agency formation functions in large-scale emergency environments.

Thirdly, this centralised model was consistent with the lead agency's organisational culture, and norms that favour and praise the state's role (Schneider, 1992). The central government advocates its usage. The EMS structure in Oman identifies the government as the sole stakeholder that makes policies and delivers most public services. Hence, engaging non-state actors such as civil society volunteer organisations, private businesses, and NGOs in public service delivery is not the norm. A positive relationship exists between the common norms of governance and the nature of the civil protection system. Additionally, as a paramilitary organisation, the lead agency prefers centralised power and hierarchical decision-making and communication (Alexander, 2008a). Thus, particularly before a crisis, cross-sectoral collaborations can hardly be observed. In conclusion, coordination needs to be centralised in that resources are directed, but the resources and response teams need to be decentralised. In crises, governmental resources can easily be depleted. Resources from private and voluntary sectors are greatly needed but do not need to be demanded. Hence, there is an ongoing need to balance command and control with collaboration.

6.3 Organisational Learning from Disasters and Forces for Persistence and Change

The evolution of the EMS has been influenced by three main forces or drivers of change in constant interaction or competition, as shown in Figure 6-1. The exogenous forces (the cyclone emergencies, the emergence and prevalence of social media platforms and the corporatisation of essential services providers) were found to be facilitating forces that have been driving change in the status quo towards a more inclusive devolved form of management. They have created new norms of interaction, helped flatten the chain of command and integrated new actors. However, this was balanced by a stronger resisting context created by critical decisions taken in the past and reinforced by socio-cultural norms and perceptions that pushed actors to '*rationally'* prefer organisational fixes and structural changes, which resulted in the continuation of centralised management norms regardless of their efficiency.

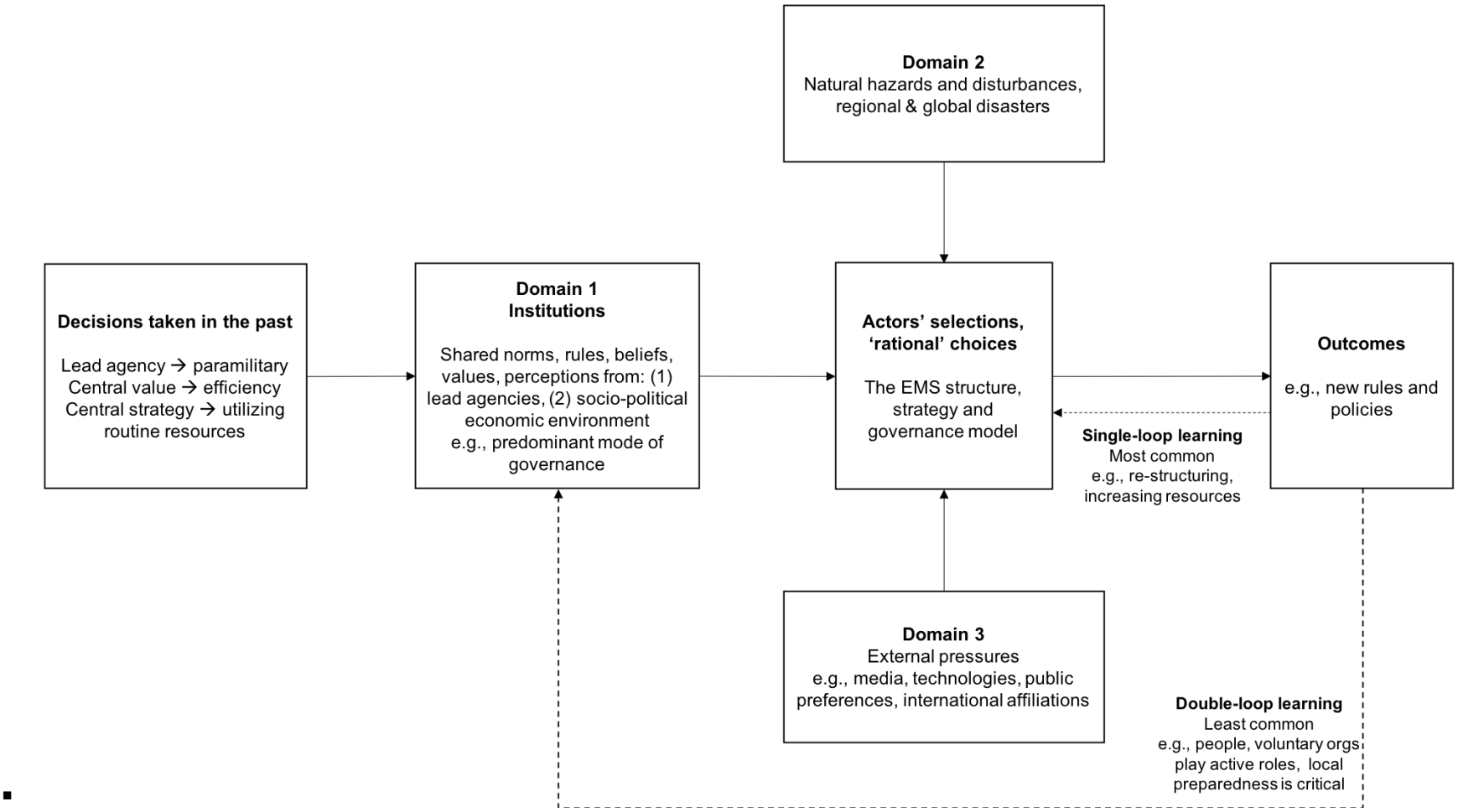

Figure 6-1 Forces of Change and Organisational Learning Loops (combining Ostrom's (2005) model of institutional change and Argyris's (1977) model of organisational learning)

In relation to organisational learning and institutional change, the cyclone emergencies were found to play three key roles. First, they were unfreezing events that allowed the introduction of new changes regardless of whether they benefited the system. Presidential requests (to improve the EMS) were usually issued following an emergency, showing strong political will in such periods. The findings of this research support hypothesis (2. a) that most institutional changes occur following large-scale emergencies during the so-called 'window of opportunity' (Alexander, 2015). Similarly, in a comparative study, Erramilli (2009) found that Indian states that experienced disasters exhibited major policy reforms in such periods. In states that have not experienced disasters, the DRR policy remained unchanged.

Besides opening the window for new changes, the emergencies also enabled responders who experienced them to develop better mental models of a cyclone emergency, particularly in the absence of counter-disaster training and exercises. The increased awareness helped them make better and more timely decisions in the subsequent emergencies, with earlier system activation and deployment of resources, multilingual warnings and large-scale evacuations. However, there was found to be a severe failure to document and share this knowledge at the organisational level. Therefore, loss of knowledge and institutional memory occurred due to the departure of experienced individuals. Finally, the cyclone emergencies that had a short interval between them (Mekunu and Luban) and whose tracks were similar were found to be a direct source of informal learning that took place on the ground through localising disaster preparedness and response and integrating local volunteer teams in a more organised manner. However, no policy change formalised this informal learning, and thus, whether this will be practised in other governorates or other emergencies remains quite unclear.

In addition to the cyclone emergencies, several other exogenous drivers were identified that pressured agencies to make new, unplanned changes to adapt to them. The two prominent ones found in this case study were the emergence and prevalent use of social media and the corporatisation of the providers of essential services. First, all agencies officially utilised social media networks to send and receive information, creating new information dissemination pathways. Secondly and most importantly, this has enabled engagement with the grassroots (Cohen, 2013) as it provided new

opportunities for people to engage in crisis response (Simon et al., 2015). New groups of actors emerged due to social media. The first group was the ordinary people, particularly in the locally affected areas, who formed public opinion through eyewitness videos and images. The second group that emerged was professionals and amateurs with different expertise in aspects of E.M. but who were not part of the formal system. As social media made their voices more visible and widely shared, they have gained increasing popularity and trust among the general public, a phenomenon that was completely absent in the past. The sense of 'feeling pressured' pushed agencies to change their public engagement policies, hire specialised staff in ICT and purchase more advanced technologies.

Similarly, following the global trend of privatising state assets to 'modernise' the country, improve service quality and reduce government costs, essential service providers recently became corporatised. Participants mention several changes in their organisational culture as they became regulated and standardised. They say they became more professional as they had to follow new policies set by the regulator, such as establishing a customer call centre and drawing up emergency and evacuation plans. Sub-sectors (electricity, water, telecom, waste disposal and fuel supply) became coordinated by government companies, different from public agencies in issues such as organisational structure, values, degree of professionalism and, most importantly, a closer relationship with the private sector. These changes bring new opportunities for building cooperative alliances between the state and the non-state sectors. However, the impact of this economic decision requires a longer period of time to reveal its wider influence on DRR. In this case study, privatisation was initially found to be an important exogenous driver of change in the EMS.

The exogenous forces pushed the EMS towards a more participatory collaborative system. By utilising new pathways for information exchange, they demanded the flattening of the vertical pattern of communication and command. They also emphasised the importance of other actors who played important roles, such as local agencies, essential service providers, ordinary people and non-state E.M. professionals. These drivers were found to be facilitating the change of the status quo. However, their impact on the selection process was sudden, sporadic and less

conducive to enforcement. They collided with a stronger resisting tendency, whose norms have been incrementally established by the intersection of complex dynamics.

In the first place, history was found to be a key element in understanding why some forms of learning can hardly be identified or implemented. In the present case study, decisions taken in the past were found to be critical in placing the system on a particular path of growth that became hard to reverse. They favoured a militarised approach to managing emergencies similar to the U.S. civil defence model that emerged after the Cold War with the Soviet Union as the chosen approach to defending people against external threats (Neal and Phillips, 1995). Similarly, the first U.S. civil defence law, *Decree 76/91*, overemphasised protection against radiological hazards. The first American Civil Defence Act was mainly related to preparation for war. However, it was later amended to allow using its assets and resources for preparedness against natural hazard impacts (Canton, 2007). Hence, one can see that the fathers of E.M. originated from backgrounds in the armed forces (Drabek and McEntire, 2003), which had implications for the evolution of emergency management, not only in the USA but also in many countries around the world, including Oman.

In this case study, the two important historical decisions were the assignment of a military or paramilitary agency to lead in all emergencies regardless of their nature and the adoption of ‘efficiency’ measures by forming a temporary coordinating team to manage the crisis at the national level. However, the government’s definition of efficiency does not apparently produce true efficiency as defined rigorously. It created a host of norms and institutions that regulated and constrained what actors could do and think. As a result of military norms, command-and-control culture has dominated the system. Top-down feedback, which is largely positive, was enabled, whereas bottom-up feedback, which is largely negative, was severely disabled. Similarly, an excessive focus on efficiency created a reactive system, resulting in resource mobilisation as its central strategy in delivering aid. These factors supported and enabled ‘centralising’ instead of the kind of ‘localising’ and ‘devolving’ of emergency management that this case study found to be more consistent with the realities of emergencies.

In addition, the misconceptions among participants regarding disasters and how they should be managed were found to be the second most important source in sustaining the system's status quo. Most view disasters as rare events caused by external natural agents such as cyclones and earthquakes; therefore, they only require management once they materialise. Some of these misconceptions were also found to be widespread among E.M. trainees, even though such ideas have been refuted by scientific evidence (Alexander, 2007a). Most participants also viewed volunteers and non-state actors as 'beneficiaries' and 'recipients' and believed engaging them in active E.M. roles would bring chaos to the system. These perceptions reinforce the notion that the 'rational actor' should manage the crisis in such conditions, namely, the government. Similarly, the place's culture was found to over-value appreciation of efforts rather than encouraging constructive criticism, which helped block important feedback from crises.

While exogenous forces pushed towards a change in the status quo, endogenous processes built strong structural inertia (Hannan and Freeman, 1984), rejecting new ideas that could disrupt the unicentric governance norms. Hence, actors operating in such an 'action area' (Ostrom, 2005) could find themselves in a complex context influenced by realities or logic from various sources. While a strong yet dynamic tension existed between those forces, norms of the context were found to be more constraining as they could imply explicit or implicit sanctions such as discomfort or marginalisation (Hodgson, 2006; Tuomela, 1995). As a result, abiding by them could be safer than attempting to change the status quo. It has materialised in either using those norms in the interest of influential actors or suggesting changes that sustain the system's dominant form. These findings support the hypothesis (2. b) that most changes are consistent with the socio-cultural political norms of the existing management model. Hence, 'single-loop learning' was more dominant, and 'double-loop learning' was rare.

Indeed, actors can be influenced by the pre-existing socio-cultural rules of the place, but on many occasions, their actions are merely preferences that accord with their interests. Therefore, actors have an active role in selecting the nature of changes. They can even use norms and beliefs from the identified sources in their favour. For example, some of them were found to use 'fatalism' to divert responsibility or

intentionally block critical feedback from lower ranks and positions or attribute damages to external drivers and the general public. Therefore, there is a strong ongoing interaction between actors and the rules of the place. North (1990, 1994) stated that actors are, in the first place, created due to institutions' incentives. At the same time, their interactions carry along, dissolve or create new rules to reinforce their power and agency. These findings support the hypothesis (2. c) that important lessons from crises are poorly identified and inadequately institutionalised due to internal resisting forces. In other words, most changes that occur following an emergency are greatly influenced by endogenous stronger dynamics. Accordingly, their relationship with the experienced emergencies is very slight.

Internal forces are more influential in selecting the changes that can take place and those that cannot. Technical solutions and organisational fixes – single-loop learning (Argyris, 1977) – were frequently mentioned by participants as the means used to solve the failures (errors) that occurred during the response to cyclones Gonu and Mekunu, while ideas suggesting changing the underlying assumptions or beliefs of the management approach – double-loop learning (Argyris, 1977) – were hardly found. For example, the organisational structure change was based on the preferences of powerful actors that fall within the 'technocratic fix' approach to disasters (Hewitt, 1983), and that does not present any threats to the existing system of powers. In fact, it was not based on studying disaster response in this specific case. It was an isomorphic institutional choice due to imitation (Powell and DiMaggio, 2012), similar to many changes imported from so-called 'developed nations'.

The Omani EMS has been shaped by the selections and preferences of the most powerful actors, largely within its lead agency. Reinforced by the identified group of endogenous forces, single-loop learning was more recurrent than double-loop learning (Argyris, 1977, see Table 6-1). Increasing the number of the government's responding agencies was found to be the most important form of single-loop learning. Due to the increased frequency of cyclone emergencies, there has been an 'episodic' rise in the number of government agencies participating in crisis management, from one agency in 1970 to over 20 agencies in the 2020s. Furthermore, following cyclone Gonu, the authority for selecting new members was transferred to the NCCD's director and, consequently, to the sector's managers, which allowed them to engage more actors

based on their specific needs. Thus, the increased frequency of emergencies pushed the political agency to engage more actors and to decentralise this power to lower administrative levels. Despite the importance of this institutional change, the system largely remains governmental and highly centralised in the capital city. It profoundly lacks active representation of non-state and local actors, as will be elaborated on later in this section.

Table 6-1 Main Changes and Continuities in the EMS

Main changes		**Main Continuities 'unlearned lessons'**
Single-loop learning	**Double-loop learning**	
New/wide needs emerge during emergencies → engage more government responders Agencies not collaborating → change organisational structure Change titles of EM coordinating committee Emergencies require heavy equipment → Purchase more equipment Agencies lack resources → Hire more personnel	EM is a collaborative work between agencies not a work of single agency → NCCD established with participation of several government agencies EM requires central coordination → permanent executive office established and NAOs within each sector to steer coordination	EM is a multi-stakeholder collaboration → the need to integrate and collaborate with voluntary organisations, private businesses and locally-based groups and societies EM requires local disaster management → the need to enable and empower local actors EM requires planning → the need to implement disaster-counter training Emergencies come in different sizes and types → the need for a multitiered system

The organisational restructuring was found to be the second most important form of single-loop learning. Following cyclone Phet in 2010, the EMS was restructured from an agency-based structure to a function-based one. This change reflected an

important shift in disaster management. Decentralising operations to more agencies brought some needed flexibility to the command-and-control system. It provided a new formative context containing resources and a platform-based organisation for a temporary restructuring (Bigley and Roberts, 2001, citing Ciborra, 1996). Working as networks directed by a shared objective (e.g., search and rescue), a central lead agency operationalised and administrated cross-agency collaboration. Information sharing and exchange of resources have increased between government agencies. Hence, a situational awareness shared among responders has materialised. Despite the coordination challenges upon the NAOs and the emergent developmental disparities between the system's operational sectors, this qualitative change has immediate positive implications for the system's functioning, as agreed by all participants. Hence, multi-agency collaboration is better facilitated under this organisational structure than an agency-based one (Alexander, 2008a).

Other forms of single-loop learning that were not within the scope of this thesis included changing the name of the EM coordinating committee, adopting new technologies, hiring new personnel and purchasing more resources. Most participants mentioned them as important changes at the organisational level. The most fundamental was establishing an early warning system following the 2004 Indian Ocean tsunami. While these forms of single-loop learning were the most prevalent, forms of double-loop learning (changing the underlying values and norms of the EM model) rarely occurred. First of all, the establishment of the NCCD that came after the Masirah Island cyclone in 1977 showed that crises require inter-agency collaborative work instead of the efforts of a single organisation. With the participation of multiple agencies, the number of available resources increased. However, it was also evident that increasing the number of participating agencies was insufficient and challenging, particularly without clear coordination mechanisms. Because coordination requires a central mechanism to govern it and administer its processes (Thomson and Perry, 2006) and to ensure participation and commitment from all member organisations, a permanent office to coordinate NCCD's activities was established after the 2002 storms. Centralising EM coordination was a key factor in administering collaboration between multiple organisations.

An interesting finding was that some forms of single-loop learning could result in double-loop learning. While organisational changes such as organisational restructuring can be viewed as single-loop learning, assigning a centralised mechanism for coordinating multi-agency work (within each network), which was one of its consequences, established an underlying assumption that collaboration must be coordinated and governed. Network administration organisation (NAO) is a critical element in collaboration in the multi-actor network (Thomson and Perry, 2006). Therefore, single-loop learning can influence double-loop learning. A clear distinction between the two forms of learning is sometimes hard to make. In addition, it is unclear how individual learning in emergencies increased awareness among government stakeholders that disasters require specific reduction measures.

Notwithstanding the importance of the forms of single-loop learning identified here and the few examples of double-loop learning, it was found that the main underlying assumptions and beliefs upon which the emergency management model was based were hardly challenged and had improved very little. They persisted, and some were preferred despite being found to be inefficient based on the findings presented in Chapter 4. The first and the most fundamental continuity is the persistence of the classical nationally-focused, largely governmental, top-down approach as the central model for managing emergencies despite the fact that these emergencies largely affected local areas and, in reality, required local management from multiple stakeholders who were in many cases non-state sectors.

Not only is the emergency still planned to be managed by a far-away EOC located in the central government premises, but this model is also manifested in disaster preparedness and planning, perpetuating the marginalisation of both regional and local municipalities, as well as non-state actors, particularly voluntary organisations and local communities. Accordingly, most drills, exercises and training sessions were found to take place in the capital city with the participation of government HQ agencies. Also, the central government's authority can only take critical decisions that require a swift response, such as issuing evacuation orders, activating shelter centres, and engaging with the public and the media. Likewise, EM resources are largely located in Muscat, the capital city. As a result, this has created a culture of dependency on the direct intervention of the central government.

This management model has persisted despite its lack of consistency with the findings of this research. The analysis of responses to cyclones Gonu and Mekunu illustrated two closely-related and largely coexisting phenomena: the leading role of local state agencies on the ground and the critical participation of local communities and volunteers in emergency response. Consistent with Quarantelli (1977) that 'disasters affect local communities, and in line with Alexander's (2015) call that managing an emergency by local administrations must become the general norm, Chapter 4 showed that local administrations and volunteers not only participated but led the response, and it occurred in the two occasions when formal institutions failed. It was informal, self-initiated and self-organised, and helped to re-establish order, save lives and reduce damages. Forms of participation included evacuating, rescuing and sheltering people, supplying food and relief necessities for only a few hours but several days. However, with inadequate resources and capacities, local disaster management could not meet the substantial needs of the local communities. In addition, they lacked the proper training and knowledge to manage the crisis using an organised and smooth process.

Similar to the marginalisation of local leadership in crisis management, the engagement of volunteers and voluntary organisations was also kept to a minimum. People interviewed for this study noted some forms of participation of the non-state organisations at the operational level, but they were completely absent at the tactical and strategic levels. They agreed that it has become expected that some forms of labour-work participation would occur, such as clearing debris or donating relief items. However, professional and organised voluntary work has rarely happened. A positive but very 'shy' integration mentioned by several participants is that some local charities are represented in Social Development Committees' SDCs'. The SDC is a member of the shelter and relief sector. As an *ad hoc* local committee (led by the local Wali and including the Sheikhs of villages) that oversees the social welfare of citizens in the Wilayat, the SDCs lack emergency training and resources and are preoccupied with large, non-emergency-related responsibilities.

Contrary to the increasing trend in which NGOs and for-profit organisations replace governments as direct providers for EM services (Brower et al. 2009), the central government remains the sole policy maker and the largest service provider in the

present case. The participatory (or all-stakeholders) approach that integrates the different segments of society into a collective network responsible for addressing the different needs generated before and during times of crisis is not replacing the classical governmental system. Public institutions are important, but local agencies and communities should be 'first responders' for protecting lives and livelihoods.

A nationally-focused approach was found to be unachievable as the ultimate objective of emergency response during large-scale emergencies due to its characteristics that directly influenced its functioning and performance. First, it was highly centralised and directed by the nation-state (Alexander, 2008a). Mobilising resources from the central government (in Muscat) to the affected regions became its only strategy for delivering emergency aid and services. This reactive response only worked under the scenario of continuity, whereas it was a complete failure when the areas most seriously affected became physically and communicationally isolated (see Section 4.6). With the underlying embedded assumption that essential services will largely continue during an emergency or, if disrupted, would be quickly restored, the central reactive approach made the system highly vulnerable to partial or complete failure.

Under such a strategy, two recognised response levels can be expected: either a large mobilisation of resources that is a national response or requiring regional and local agencies to deal with the situation but with a clear shortage of resources and EM capabilities. One could assume that a national response with large mobilisation of resources would be more effective than a regional one with limited resources. However, systemic failures still occurred even with the early activation of a national response during Gonu 2007 and Mekunu 2018. The inadequate response was simply due to a lack of regional and local emergency management capacities. On top of that, many participants considered mobilising resources to be "a very large decision" that must only be initiated when there is a 'large emergency'. Interviews data suggest an implicit agreement among the participants that a major cyclone should represent a large 'weather-related' emergency as it can result in widespread damages, with which the decision makers are familiar. As is the case in many countries, in Oman classification of storms follows the Saffir-Simpson hurricane scale, which relies on sustained wind speed (not on rainfall, storm surge or other criteria). Reluctance to activate the national system occurred several times, delaying the response. In addition

to a lack of emergency management capacities, regional and local administrations are not authorised to make critical decisions, such as issuing evacuation orders, setting up shelters and declaring a state of emergency at the regional or local levels.

The implications of this strategy were clearly illustrated in response to cyclones Hikka and Kyarr that impacted Oman in 2019. Though alerts were issued before Hikka made an impact, there was no activation of any preparedness as “it was only a storm” at that time. Unexpectedly, as described by some, during the early morning hours of 24 September, Hikka intensified from a tropical storm to a category two tropical cyclone. A state of emergency was declared late that morning, the same day the cyclone began to strike the Eastern Region.

Similarly, cyclone Kyarr, a category three cyclone, was not forecast to strike the country, a coordinated response was not activated, and resources were not mobilised. However, the cyclone caused a significant coastal storm surge, a new hazard not experienced in recent cyclones. Many households were severely inundated with seawater. They were surprised by the scale of such an inexperienced hazard. Then the agencies began a spontaneous response operation in a very improvised manner. The effect of this strategy was also illustrated in response to the heavy rainfall caused by the deep depression named ‘Haya’. As it was only heavy rainfall, there appeared to be no need to activate the national system. Seven people died, and large areas were completely flooded as a result. Warnings and alerts were not issued. Only reports and notifications were circulated across the different media in Arabic and English. Most of the fatalities, however, were people who were not literate in both languages. The lesson learned from Cyclone Gonu that warning must be multilingual did not take effect this time, which indicates that learning from disasters is very categorical (Carely and Harrald, 1997). Broadening learning from one type of hazard to another seems to be challenging.

In conclusion, it was clear that the political will increased immediately following an emergency, but this correlation did not allow several recognised lessons to be learned. The identified types of change demonstrated that most changes are technocratic, structural or organisational. There was a relative increase in emergency planning and preparedness, but EM is still largely viewed and practised as multiple government

agencies carrying out emergency response operations. Mitigation, long-term planning and recovery are still overlooked and receive little attention. The formal EM is only embodied in the temporary structure that forms in order to react once a crisis occurs. As there is still no disaster management agency such as the Federal Emergency Management Agency in the U.S.A. or the Civil Protection Department in Italy (McGuire et al., 2010), the role of the national emergency planner and manager is largely absent.

These findings support this research's hypothesis (2a) that most organisational learning in this case study has resulted from single-loop learning – organisational restructuring, changing techniques and strategies – whereas double-loop learning has been inadequate. Changing the underlying conceptual or governance model and the system's culture, such as integrating non-state actors, localising EM or shifting the focus on mitigation and planning, has not occurred, although these lessons surfaced during the emergency response. While single-loop learning was dominant and double-loop learning was rare, several critical lessons were not learned. Some norms persisted despite being inefficient during the response to those emergencies. Learning impediments originated from various sources, notably history, culture and stakeholders' perceptions. Historical circumstances favoured a paramilitary agency whose norms became dominant in the system due to this centralised command-and-control was always perceived effective despite its apparent failures in delivering aid when and where most needed. The norm of unwelcoming criticism and over-appreciating efforts blocked some important lessons from being learned and implemented. Stakeholders' perceptions of disasters and why they occur, and who should be in charge of managing them were also found to form an important category of elements that facilitated the continuation of an inefficient governance model.

CHAPTER 7 CONCLUSION

7.1 Introduction

This chapter will begin by summarising the main conclusions of this thesis. Failures of the centralised command-and-control system in responding to the crises that occurred during Cyclones Gonu and Mekunu in 2007 and 2018 will first be discussed. A main conclusion is that the features of this system can contribute to those failures. Then, the roles of local agencies and communities in reinstituting the situation and bringing a new form of stability will be addressed when formal arrangements fail in the mostly-affected areas. The second part of this chapter will summarise the main forms and dynamics of institutionalised changes, the unlearned lessons and learning impediments and barriers. Policy-related recommendations are suggested alongside relevant findings. This section will discuss the limitations of this work and recommendations for future research. Throughout this chapter, the author reflects on what has been found.

7.2 Disaster Response of the Centralised Governmental Emergency Management and Organisational Learning from Disasters

Many governments have developed or adopted a model or a system to manage large-scale emergencies. A widely used one is the command-and-control system. It has some good qualities, such as a clear command structure and a centralised mechanism for directing resources. However, in this case, it was associated with various features that can negatively influence its functioning and performance. First of all, resources and decision-making were found to be highly centralised. The central government controls most response capacities and enjoys the most power and authority over critical EM tasks and operations. On the other hand, regions and local administrations severely lack EM capacities and are largely marginalised and replaced by foreign assistance. Secondly, at the policy-making level, the system was strongly dominated by government agencies, with a few government companies at the service-delivery

level. Thirdly, the processes of communication and decision-making were found to be hierarchical. A top-down sequence of sending commands and instructions exists, while a bottom-up feedback loop is largely absent. The crisis is planned to be managed by a distanced agency rather than on-site. Lastly, the system was found to be dominated by paramilitary rules and norms, manifested in strictly following procedures, loyalty to the government and clear sanctions if rules were violated.

A system with those features performs relatively well in events characterised by relative stability and continuity of essential services. In conditions where hazards are not severe and interruptions are limited, responders could sustain communication links, rescue people and deliver aid. However, it easily bifurcates into disorder and chaos when affected areas are multiple and critical infrastructure is impacted. In such emergency conditions, responders experience 'cosmology episodes', an overwhelming shared sense that the world is no longer in order. The situation evolves beyond the capacity of centralised management. The responders cannot form an accurate situational awareness and carry out emergency tasks. Unfortunately, emergency environments are not associated with stability and normal conditions. They are characterised by failures and interruptions of the critical services that normally emergency workers rely on during peace times. These failures have become an inherent feature of extreme events. A managerial model that adopts a national-to-local delivery strategy is incompatible with those disaster realities. Hence, it should be updated and redesigned to operate under extreme conditions. This finding was discussed at length in Section 6.2.

While it is always important to increase infrastructure resilience, the case study illustrated the evolution of a management model that is more stable in disaster situations. In the devastating conditions and the failure of formal arrangements, a new adaptive management model emerged, characterised by local disaster leadership and active and large-scale participation of volunteers and voluntary organisations. A self-organisation phenomenon emerges when planned systems fail. These critical periods in crisis response should form significant learning opportunities. They show how society comes together to face a shared existential threat. New forms of organising emerge to adapt to a changing environment. They should be encouraged rather than suppressed, and self-organising responses should be sped up rather than slowed

down. In contrast, the lack of local response capacities exacerbates emergency conditions. Enhancing local capacities is a lesson that must be learned. A learning and evolving EMS should learn from its failures. In this case study, implementing this lesson was a central indication of the system's growth rate, and failure to learn shows the existence of learning barriers, which will be discussed later in this chapter.

Disaster risk can be reduced by recognising, enabling, empowering and building local and inclusive disaster management. Local actors, namely state agencies, utility providers, voluntary and charitable organisations, communities and private businesses, should be recognised as active first responders in disaster management. A national governance framework for disaster management should be developed to encourage the participation of all stakeholders, particularly local and non-governmental organisations. A more inclusive system can pool resources from various sources. As the number and types of NGOs in the country are increasing, in the forms of charitable teams, voluntary organisations, specialised associations, women's societies and faith-based organisations, opportunities for partnerships already exist. These actors should have important roles in disaster management, particularly at the local level.

Local disaster management should not only mean recognising roles, but also planning must be focussed on this level. Emergency plans must be applicable at the local (Wilayat) level. The roles of local actors should be clarified. Wilayat administrators can take a leading role at the local level as they are more engaged in local affairs and are familiar with the social status of the communities. The Gonu and Mekunu experiences also showed how local Walis played their leading natural role when formal institutions failed to be available. Hence, they should be trained to gain basic scientific knowledge of possible disasters that can take place in their region. They should be sufficiently able to implement preparedness and response measures. Localising disaster response also means that resources should be made available locally. Mobilising response teams and equipment from the central government to the affected regions should not be the norm. This case study illustrates the catastrophic consequences that could result from this strategy. Crises must be managed locally. Building local capacities can effectively enhance disaster response (saving lives and protecting properties).

The second phenomenon that existed when formal systems failed was social emergence. Local communities played important roles in the affected areas. They were not beneficiaries and helpless victims. They were important active participants on the ground. Besides providing resources and rescuing people, they possess local knowledge essential to DRR policies. They are more aware of the local hazards, vulnerable areas, and people in their communities. Active engagement of local communities in disaster risk reduction is essential. It can be utilised through the local social development committees, which include villages' sheikhs and representatives of local agencies and the ministerial council. These committees already exist for social affairs, and there is great potential for engaging them in crisis management. Though a new emergency management plan was recently issued, the roles of local communities and volunteers were overlooked. There has not been substantial growth in this theme—the reasons are discussed in the next section.

This case study illustrated that the initial state of the EMS influences disaster response and that it can be improved by focusing on emergency planning. However, disaster management in Oman, as in many parts of the world, focuses on responding to crises largely through a relief-oriented approach. Once a crisis has occurred, government agencies come together to provide relief and 'return to normal' or the pre-disaster state. This improvisation approach resulted in catastrophic consequences, as discussed in Chapter 4. On the other hand, planning can effectively reduce disaster risks. Disasters necessitate a culture of cooperation, collaboration among different actors, and a structure that can hold such partnerships. Collaborative networks need to be built beforehand so that resources are efficiently used. Through jointly acknowledging possible scenarios, needs generated can be anticipated, and resources to meet them can be identified in advance. Hence, this thesis recommends developing national disaster risk reduction 'DRR' policies that address the different phases of the disaster: mitigation, planning, preparedness, response and recovery. Setting specific guidelines and objectives for each stage is important, ultimately reducing disaster risks.

These DRR objectives cannot be achieved without being assigned to a dedicated central agency for EM. Therefore, in many parts of the world, there is a dedicated entity for disaster management whose main role is to encourage collaboration and

promotion of civil protection, such as the Ministry of Disaster Management and Relief in Bangladesh, the Federal Emergency Management Authority in the U.S.A. and the Department of Civil Protection in Italy. Developing a manual for emergency planning, ensuring active participation from all stakeholders under the national objectives, and moving towards integrating efforts among different organisations should be facilitated and accelerated by the DRR agency. It is recommended that such an agency enjoys high authority and reports to the council of ministers (the National Cabinet) instead of being an existing 'regular' government agency.

In conclusion, the findings showed three fundamental criteria for an effective emergency management system. First, management must be local and carried out by local emergency management units. Localising disaster management is needed in places where the focus has been on centralised preparedness. Secondly, it is concluded that the government alone cannot meet the needs of people in large-scale emergencies. Not only do needs exceed governmental resources but other societal segments are more acutely aware of local communities' needs than the government. Local sheikhs are more aware of the social status of local people. Integrating non-state civilian actors and de-militarising the system are important principles that must be implemented. Moving from the government to the governance model is needed to manage disasters. Thirdly, management should emphasise improving the system's initial state through investing in emergency planning. This thesis revealed that disruptions of critical infrastructure and unavailability of some essential services must be a central assumption when designing disaster management models. The critical failures that led to catastrophic conditions in Cyclones Gonu and Mekunu can be avoided, or at least dramatically limited, by institutionalising these lessons.

The findings illustrated several interrelated phenomena. In the crisis period, local management emerged as the natural mechanism for leading disaster response. Informally, it pooled and directed resources, built and organised response teams and delivered emergency aid. Although it was not planned, a local lead agency emerged on the ground. A learning and evolving system should recognise and implement this lesson. How localised a management system in any country should be is an important criterion for its robustness and an indication of its evolution. Secondly, social emergence and active participation of voluntary teams became the largest force on

the ground when disaster struck. They existed because they 'fit' better with the realities of the disaster. Governmental response alone was found to be 'unfit' in extreme conditions. A learning system should acknowledge this fact. Non-governmental actors, voluntary organisations and private businesses should be viewed as active participants in crisis management. Their level of engagement and integration was found to be the second essential component when assessing the system's growth and observing its evolution. Recognising and implementing those lessons demonstrates the existence of organisational double-loop learning while neglecting them shows impediments to learning from disasters.

The findings of this case study show that the most dominant form of learning after a crisis is single-loop learning, which is typically introduced to solve a problem while not significantly challenging or changing the style or norms of management. Examples included adopting new technologies, hiring more personnel, changing the organisation's structure and bringing in more government agencies. Double-loop learning, which involves making substantial changes in the management model, was found to be much less common. The important 'right' lessons or institutional changes that should be implemented after the experienced disasters – localising response, integrating non-state actors in crisis management and focusing on emergency planning – all fall in this learning category as they eliminate old norms and introduce new norms of management. In some cases, drawing a clear distinction between the two types of learning is not easy to do as they may overlap and interact. For example, the organisational structure change from an agency-based to a relatively function-based one was implemented to solve the coordination problem. This change can be seen as single-loop learning. However, it resulted in decentralising operations and decision-making, which can be viewed as double-loop learning. It created a relatively flexible structure and introduced new rules and relationships between actors. Therefore, entry points for double-loop learning can be through single-loop learning forms. However, more research is required to establish the relationship between the two.

This case study showed a deficiency in organisational double-loop learning from extreme events. The main reason is an ongoing tension or conflict between exogenous forces supporting OL and endogenous processes resisting it. In this context, tension

exists between forces that support devolution and polycentric EM and those that support centralism and unicentric emergency management. In this thesis, the latter was more influential than the former in continuing the status quo.

First, exogenous forces that originate from outside sources were found to push towards integrating new types of stakeholders, supporting local disaster management, and calling for a collaborative pattern of interaction and communication instead of control-and-command relationships. The cyclone emergencies, the first external source of change, were found to play their recognised role as ‘unfreezing’ events. They opened the window for new changes. They are best described as opportunities for actors to make new changes and acquire more resources and agency. In other words, they are taken advantage of rather than thoroughly analysed to identify failures and suggest new ways to avoid them. Hence, the relationship between experienced emergencies and the changes afterwards is loosely-coupled or separated. The analysis of disaster response in Section 4.3 discussed the important managerial changes needed based on the four case studies. They necessitated a localising response, integrating voluntary organisations and shifting the focus towards emergency planning.

Social media was another force that encouraged flattening the chain of command and integrating new actors. While creating new information pathways, they allowed the public to form opinions about the response. They also enabled non-state EM specialists and academics to share data and information relevant to crisis management. As these actors are more judicious and critical concerning the response’s quality, responding agencies have experienced unprecedented pressure. Hence, new feedback loops came into existence, which was generally positive as agencies had to make new changes and acquire new advanced equipment, as discussed in Section 5.3. However, it is unclear how governments will react to the increased pressure emanating from social media. New laws could likely emerge to prevent people and non-state specialists from posting specific information. Based on the results of this case study, governments are advised to allow the participation of informal actors in crisis management via social media.

The corporatisation process, which involves transforming government agencies into government companies as part of the privatisation process, has also been identified as an important driver for organisational change. Essential service providers (electricity, water, telecoms, fuel, transport and sewerage) have had to conform to new standards defined by the regulators. As a result, a new organisational culture appeared for those previously governmental agencies. This process has created new norms and values centred around quality and customer satisfaction. Emergency and business continuity plans, 24-hour call centres, and evacuation drills are relevant crisis management changes in this new organisational culture. These three main forces were found to push towards changing the status quo of emergency management in Oman. However, this was met by intertwined socio-cultural and political factors that resisted changing the character or style of management. Endogenous processes – history, culture and stakeholders' perceptions – were more influential in sustaining the status quo by favouring changes that do not threaten existing power structures and discouraging changes that do.

The history of emergency management in Oman, as in many parts of the world, has placed EM on a particular path of growth. It has been assigned to the police agency, whose culture is dominated by military norms and values. Such an organisation would expectedly support models of management whose objectives are consistent with its objectives. Hence, there is a strong, widely-shared belief that a para-militarised centralised model is effective in disaster management. The second important historic decision was forming an *ad hoc* committee for crisis response instead of a disaster management agency, which has materialised into a reactive approach rather than a comprehensive one, which assumes that disaster risks can be reduced before they occur. Those norms have been incrementally built in a gradual but enduring process and transferred from generation to generation. They became resilient in the face of sporadic and short-living events such as cyclone emergencies. In addition, confidence and trust in it are reinforced when the command-and-control system functions fairly well under normal conditions. A self-reinforcing loop supports its continuation. On the other hand, when large-scale emergencies associated with large disruptions and extreme conditions cause catastrophic consequences and breakdowns of the system, there is a quick return to normalcy. Systemic failures can easily be forgotten and classified as exceptions and rare events.

The second determinant for organisational ‘double-loop’ learning capacity is the culture of the place (both organisational and societal). What can be learned from a crisis is subject to the dominant cultural norms, beliefs and shared perceptions. Disasters generate knowledge, but its meaning and interpretation are subject to pre-existing established cultural framings. Several beliefs were found to contribute to blocking the identification of root causes for failures. While they can be easily unnoticed, their impact can be substantial. Actors can also use (and have used) them to justify damages and even deaths. For example, fatalism, a strong Islamic cultural tenet, was widely shared among participants. It can divert attention from responsible agencies towards external causes such as God or nature. Some cultural beliefs can easily block lessons from disasters.

Perceptions about why disasters occur and who should be in charge of managing them can also hinder organisational learning at the individual level. Most believe disasters are sudden events caused by natural phenomena such as cyclones and earthquakes. Holding such misperception about the social causes makes investing in forecasting and understanding the dynamics of the agent more appealing and relevant than building social resilience or updating the governance model. Hence, the view that disasters require sophisticated advanced technical solutions is dominant. Similarly, holding the misperception that chaos occurs in all ‘natural’ disasters makes authoritarian approaches seem reasonable, while involving non-governmental actors seems irrational. There is attitudinal resistance to a polycentric style of management. The impact of those strong negative attitudes can be reduced by increasing awareness among practitioners about disasters and who should be involved. This issue can be tackled by knowledge transfer by inviting local and international disaster management experts to share expertise. Understanding emergency management principles is key to organisational learning in this field.

In conclusion, several levels of organisational learning impediments exist: impediments to identifying and interpreting the root causes for systemic failures and impediments to identifying and implementing proper solutions. Disasters open a window for new changes, but learning from them is greatly influenced by other factors created by historical conditions, cultural norms and beliefs shared in society. As a result, what is learned can be irrelevant to the lessons unveiled by the crisis event.

Actors, who identify and interpret failures, might be imprisoned by their thoughts, perceptions and beliefs. In such a context, single-loop learning (or solutions) is easier and safer to suggest and implement than double-loop learning, which comes with the risk of challenging power relations and threatening established norms. Localising disaster management and integrating more actors means sharing authorities and resources, decreasing dependency on central government interventions.

Organisational 'double-loop' learning requires the right conditions for it to occur. The first is an organisational culture that encourages and enables feedback from all levels, particularly from people who participated on the ground. 'Learning to accept failures' is key to improvement. An initial condition for creating such a culture is informing everyone they can report failures. A unified evaluation sheet in electronic format is recommended as a reporting mechanism to record failures and gain important knowledge on the system's functioning during crises. Stakeholders should recognise that knowledge must be stored and processed to be analysed, and organisational learning can hardly occur without information storing and processing mechanisms. Mandating participating actors to evaluate their response can be beneficial, but it should not be the only mechanism, as own errors can be hidden. External parties free from pressures, such as local and international academic institutions, should be encouraged to analyse and evaluate disaster response.

7.3 Limitations of This Research and Recommendations for Future Work

This section will discuss the limitations of this thesis and suggest recommendations for future research in disaster response and organisational learning.

Case studies produce detailed knowledge about specific events. Initially, there was the intention to conduct several case studies (several emergency management systems from different countries). It was, however, realised that such an aim is beyond the capacity of one thesis. Time, resources, financial funding and travel restrictions did not favour such an ambition. This thesis discovered that using a case study strategy is very helpful, and it, therefore, encourages future work within this line of research. Organisational learning has been widely discussed in theory but greatly

lacks empirical evidence to demonstrate whether it occurs or how it occurs. There is a need to investigate the impediments that block organisations and nations from learning from disasters, particularly through double-loop learning. Therefore, case studies are required to generate novel knowledge on the required conditions and the factors that have enabled some nations to succeed in developing a participatory comprehensive emergency management system.

As with all qualitative research, it is limited by the amount of data that could be collected and analysed. The sample size has to be small but representative. In-depth interviewing generates tremendous amounts of data that require significant time to transcribe, translate (if conducted in another language) and analyse. This thesis focused on studying the experiences of senior and mid-level managers and coordinators. However, more data may also be required from the local administrators and community leaders to understand the ground realities further. Disaster response, as demonstrated, can be largely informal when the planned system cannot reach affected areas. By necessity, crisis management becomes a responsibility of local organisations. The perspectives of central and regional responders were obtained in this thesis, but future research could focus on gaining the perspectives of local administrators.

This thesis was qualitative research that aimed at identifying key themes concerning organisational learning and institutional change of the EMS in Oman. These themes suggest a relationship between them and organisational and institutional changes after a crisis. For example, one important source for organisational learning impediments was the shared misperceptions about disasters and how they should be managed. This finding generates the need to confirm this relationship using quantitative methods to measure stakeholders' perceptions and organisational learning in different cultures.

This thesis also found social media and privatising government agencies to be important drivers for change. Social media exposed the performance of formal institutions to a wider audience. International agencies, other governments, EM professionals and people from other countries were provided direct access to what was happening on the ground during the response. Corporatising agencies resulted

in new rules and standards for some EM participants. The implications of these two factors in this case study were positive, but their wider impact requires more research as they unveil their unintended consequences. For example, social media can significantly spread rumours, conspiracy theories, and misinformation, creating serious challenges to containing an emergency. Privatisation also greatly impacts society and DRR, opening a new research area.

An important line of research within this area that was found but not addressed in detail is the danger of learning solely from experience. Several findings illustrate this point. The current EMS has been institutionally arranged against the background of cyclone emergencies, manifested in the selection of NAOs and the sequence of procedures to activate the system. Early warning, for example, is managed by the Meteorology Department, which only specialises in three hazards, while the remaining nine are within the mandate of other agencies. The warning process is also based on the classification of weather events. Hence, it is irrelevant to other types of hazards. Furthermore, procedures are designed so there is a window of time to act, form teams, and conduct meetings. Therefore, when faced with other hazards, the system may find it difficult to apply its procedures. For example, when the Convid-19 pandemic began to impact Oman, there was great confusion about the role of the EMS in the pandemic crises. Instead of activating it, a totally-new committee was formed. Hence, it is important to understand how experience can sometimes modify established norms.

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APPENDICES

Appendix A – Main emergency management regulations in Oman

Royal Decree No. 32/1988
Establishment of an emergency management committee
National Committee for *Emergencies* established, included members from 8 government entities; the committee was mandated to develop an emergency plan at the national level, designate responsibilities among the different actors and coordinate emergency response operations. Members to be appointed by the Sultan himself.

Royal Decree No. 73/1988
The title of the committee was changed to the National Committee for *Natural Disasters.*

Royal Decree No. 76/1991
Issuance of Civil Defence Law
The first civil defence law was issued; Civil Defence General Directorate established within the police overall structure. The law recognised the importance of emergency planning and the value of volunteers.

Royal Decree No. 75/1999
Integration of Legislations: EMC's terms of reference with the Civil Defence Law
The title of the committee was changed again to the National Committee for *Civil Defence*. The NCCD terms of reference were integrated within the civil defence law; its members expanded to 15 governmental representatives. Civil Defence was appointed to coordinate the NCCD operations.

Royal Decree No. 51/2003
A permanently-staffed executive office for the NCCD was established to perform all administrative and support functions needed for its operations;
NCCD subcommittees in the Governorates and Regions across Oman to be established

Royal Decree 27/2008
Decentralisation of decision-making
The Sultan does not appoint the members of the NCCD; they are selected by the Police based on the nature of emergencies.

Royal Decree 75/2008
State of Emergency Law
Outlined the process of declaring a state of emergency
National Security Council given the power to make decisions on evacuations
Operational arm of emergency response is the Police

Armed Forces not to operate during emergency response unless ordered by the Sultan **Royal Decrees No. 3/2013 & No. 68/2014** Public Authority for Civil Defence and Ambulance (PACDA) Law *Organisational Restructuring* Creation of PACDA as an independent entity with financial and administrative independence but still under the umbrella of ROP

Appendix B – Guide for interviewing emergency management government stakeholders

Heading	Question
Background information	Invite interviewee to briefly introduce him/herself Prompts: role in the organisation and length of service in his/her career. Can you tell me about your sector's role as a sector of the National Committee of Civil Defence?
Tasks and activities performed by the actor	The tasks/functions your organisation did in response to the incident? Were these tasks planned? Objectives of those tasks Prioritising those tasks, given that resources, personnel and equipment were limited and shared. *Gonu – Phet – Mekunu – Luban what have changed?*
Resources and services used to achieve those tasks	What resources, technical infrastructures and other actors you relied on to perform the tasks? *Gonu – Phet – Mekunu – Luban what have changed?*
Challenges and issues during performing your tasks	What challenges, problems you faced during performing your tasks? Damages due to cyclone impact Damages on critical infrastructures and lifeline services *Gonu – Phet – Mekunu – Luban what have changed?*

Command and instructions channels	How did you receive instructions? What were the challenges and difficulties? *Gonu – Phet – Mekunu – Luban what have changed?*
Coordination, collaboration, and exchange of information and resources	Agencies you interacted with? To do what functions? What were the challenges and difficulties? *Gonu – Phet – Mekunu – Luban what have changed?*
Perceptions of operations	What is your thought about the response in general (Gonu, Phet, Mekunu and Luban)? What is your thought about the incident command structure during the cyclone? Have I missed anything?
Perceptions of involving the private sector companies	What is your thought about integrating companies from the private sector in your sector? What are the challenges?
Perceptions of involving the non-profit sector	What is your thought about integrating non-profit organisations in your sector? What are the issues?
Perceptions of involving the local people 'individuals'	What is your thought about integrating members of the public in your sector? What are the issues and barriers?

Appendix D – Themes and Codes

Objective	Theme	Sub-theme	Selected Codes	Example Extracts
Building detailed descriptions of the events	**Cyclone characteristics and impact (for each cyclone)**	Cyclone Data	Rainfall	'rainfall totals reaching 610 mm (24 inches) near the coast.' SS1 '450mm on the eastern' SS2
			Windspeed	'winds reached 100 km/h (62 mph)' SS1 Phet 2010 (max wind: 125kt) T5
			Impact/damages	'uprooted electrical poles, leaving the capital city without power' SS1 'In June 2010, tropical cyclone Phet occurred, which killed 24 persons and injured 10,000 others' SS4
			Track	'the tropical cyclone is expected to impact Al Sharqiyah region and it will gradually extend to cover all the coastal areas of the Gulf Oman' SS2 'system remained unpredicted by most of the Numerical Weather Prediction (NWP) Models' SS1
		Descriptions	First experience	'first ever super cyclone over the Arabian Sea as per the recorded history' SS1 'It is an experience. And I think it is full of learned lessons. After Guno, we did a symposium; we came out with more than 30 lessons.' LE3
			Disaster	'first of all what happened was the city of Muscat became a 'disaster' city.' LE3

	Initial state of the EMS (for each cyclone)	Emergency planning	Written EM plan	‘plan which was signed in 2003 and practically we applied in 2007... Decree 28/2018 to approve the national plan’ EM1 ‘This is all written now. These plans, the sequence of documents...’ SC5
			Coordination	‘no prior coordination that I would open this shelter’ SC4 ‘In this plan, many entities/organizations participate but each entity/organization worked alone (by itself).... The coordination occurred after the emergency. We needed resources. We asked them after the event (impact). This has delayed the response.’ SC5
			Training	‘We have trained more than 350 individuals on it from the different organizations from military and civilian organizations.’ EM1 ‘we attended joint training/exercises. We went to their centres and they gave us lectures. They came here I gave them a lecture.’ SC8
		Preparedness measures	Warnings	‘NCCD warns “Don’t go out, stay indoors!” T6 ‘For your safety! Keep always away from the damaged places, not to put yourself at risk or hinder the work of emergency personnel.’ T2
			Evacuation	‘Most people living in the eastern part on the coast used their own vehicles. They voluntarily evacuated to places away from the coast and low land areas to safer regions.’ EM1 ‘Phet mostly affected the Eastern region. The situation was different than the capital. An evacuation operation occurred.’ EM1
			Sheltering	‘We activated schools as shelters here in Muscat and in Al-Wusta governorate.’ EM1 ‘volunteers participated in managing shelters’ T6

Analysing emergency response (identifying operating environments)	**Type of emergency operating environment**	**Normal operating environment**	No major unanticipated challenges	‘During Phet, we did not face great challenges.’ EM2 ‘We didn’t face problems (Phet) such as the inundation of the EOC (Gonu).’ EM1 ‘there were no main problems. Problems were with the distribution networks. And coordination and resources were not provided.’ SC5 ‘During Phet, the system was activated but the task/operation was easy and simple.’ SC4
			Less physical vulnerability	‘Phet mostly affected the Eastern region. The situation was different than the capital (during Gonu).’ EM1 ‘The less damage caused by the tropical cyclone Phet, in the study area, compared to that caused by Gonu is due to the fact that Phet affected severely the eastern coastal region and Muscat was affected slightly.’ (Al Hatrushi & Al Alwai, 2011)
			Continuity of essential services	‘main roads were available but some roads (service roads) were disrupted.’ SC4 ‘due to safety concerns electricity has to be off, not because electricity was affected but provisional.’ SC5
		Disruptive operating environment	Inability to establish situational awareness	‘They (responding agencies) were not able to know what happened and what was happening.’ LA ‘when the communication was cut off, we couldn’t communicate.’ SC5
			Isolated villages	‘Several villages were completely isolated as service roads connecting them to the town centre were completely destroyed.’ LE2 ‘the areas that became isolated as its leading roads were destroyed. Refuelling trucks could not reach them.’ LE3
			Failures of essential services	‘we were not able to go to Qurayat due to roads collapses.’ EM1 ‘During the three following days, life was similar to a primitive life; no services, no communication with external world.’ LA

				‘What happened was unexpected. And when electricity, TV and communications cut off, situation became very difficult.’ EM1 ‘There were no alternative solutions of roads interruptions. How could you deliver relief materials to the areas that you can’t reach?’ SC4
			Cosmology episodes	‘Roads interrupted. Heavy rainfall. People were staying indoor. Wadies flooded heavily. You could not imagine.’ SC8 ‘we were unable to know the conditions in the affected areas for several days.’ EM1
			Bifurcation points	‘During Guno... the main... headquarter and the inundation of the EOC... We were trying to survive.’ EM1 ‘...when communication is out, here it is not clear who should do what or who should take the management.’ LE3
Identifying management models	**Form of management model**	**Formal centralised command-and-control model** (Phet and Luban)	Centralisation	“Resources were stationed at the city centre of Salalah. It was the main (central) activation point.” EM2 ‘If one governorate is affected. Resources would be transferred there’ SC8 ‘we hoped that during Ashobaa, each organization mobilized its forces by itself.’ SC8 ‘The SAR team is present here in Muscat. The regions have first responders. The Hazmat sector is also present in Muscat. This is a problem. They have to reach 200 people so it can be distributed in the different regions. PACDA still faces the shortage of staff.’ SC1
			Hierarchical Top-down communication	‘The information flow goes through us, from the operational sectors and regional subcommittees through us to NCCD for direction.’ ‘from NCCD to the operational sectors and regional subcommittees.’ EM1
			Governmental system	‘most of the responders are governmental.’ LE3 ‘we still largely a governmental response.’ LE2

			‘The national system is governmental.’ SC5 ‘All are 23 governmental entities.’ EM1
	Emergent model (Gonu and Mekunu)	Participatory	‘They (volunteers) came spontaneously in large numbers from the affected areas.’ EM2 ‘Volunteers cleaned the roads, contributed food to the point it was abundant.’ EM1 ‘Military continues to provide support to people in cyclone affected areas’ LE3
		Local crisis management	‘the Wali took the responsibility of crisis management.’ LE2 ‘Walies want to take this responsibility. And in reality, they do take the lead. The police director at the region is there. This is natural. During emergencies, he gathers the villages sheikhs and local organizations. He manages the crisis.’EM2
		Informal communications	‘were able to connect them by signals (the Wireless communication society). They were in the shelter centres. For example, if someone is looking for their relatives. They connected Qurayat with Muscat. They helped a lot’ EM1
		Self-organisation	‘When the track changed, We started to bring the forces and resources back to Muscat.’ SC8 ‘We also benefited from the police trainees from the police academy to preserve security in the evacuated areas.’ EM1 ‘the Wali took the responsibility of crisis management. He took charge, formed teams. Each time was assigned a number of tasks
		Strange attractors	‘The entity that managed the crisis during that time was the Armed Forces.’ LE3 ‘They (Wireless Communications Society) approached us and they told us that they were able to connect Qurayat and Muscat when all communications broke down.’ EM1

Analysing organisational learning	**Type of learning**	**Single-loop learning**	Awareness of individuals	'We also learned how much telecom services are reliant on electricity.' SC5 'We entered Phet and we were ready. The operation/process was easy. Everyone knew their role.' SC8
			Organisational structure	'… after the orders from the Sultan in 2010 following cyclone Phet to… improve the national system, we started to adopt a new system called sector-based system… A committee of… entities was formed and after studying and analysis, it was found that there were eight main functions, the committee should undertake, to respond to emergencies.' EM1
			More personnel	'The number of employees jumped from 150 employees to around 270 now.' SC8 'Now there is the rescue team, an international team that participates in international operations.' SC1
			New equipment	'... purchasing equipment such as weather radars (#5).' SC8 'Now we use dogs, specialized cameras, cutting equipment.' SC1 'we feel the resources are much better. ...the improvement in fire engines and water tanks.' SC1
			New organisations	'But the problem was with the ways and mechanisms of distributing them. Therefore, a Royal order came later to find mechanisms of distributing relief materials. Therefore, a relief and shelter sector was started. This includes the spread of food stores and reserves across the country.' EM1 'also among the lessons that we learned is establishing stores for food; to have more than one store; known; shown in a GIS map.' SC8
			Critical infrastructure & Backups	'now we have large bridges on that street' SC8

			‘Communications, now, we’ve got backups; in the shape of a circle; if this side/area is interrupted, the other side/area will function.’ SC8 ‘now we have got satellite communications; if an aerial tower is affected, we could rely on satellite communications.’ SC8
	Double-loop learning	Emergency planning	‘Now, everything is written. What we have written in 2004, we have applied in 2007, the operational procedures.’ SC8 ‘we attended joint training/exercises.’ SC8 ‘_____ conducts training and operations exercises. And they involve all the organizations....’ EM1 ‘we have plans [now] not only one plan.’ SC4
		Authority transfer	‘the response and its speed has changed; the formation of teams, ‘tuning the system’; comparing Gonu response to now, the executive office initiating the response, this has changed dramatically. Before the inspector initiated the ‘call’ the response. Now, if the MET says a cyclone and there are possible damages, the executive office can initiate the response. They were given the authority. This is a fundamental ‘root’ change.’ LE3
		Cross-organisational relationships	‘we have cooperation agreements between the different regions. In case one region is affected, the neighbouring regions would support and fill the gaps.’ SC5 ‘We brought here all the organizations that we believed we would need during an emergency.’ SC4
		Regional disaster management	‘we have representatives at the regional level. This is important so you can manage the work. Sometimes, some events are within one governorate and not general.’ SC4 ‘these events are more dealt with by the regional committees rather than us. we deliver the info to the regional committee, the civil defense and the NCCD. Now the regional committees have their own operational procedures and do their own work.’ EM1

		Decentralising operations	‘Before 2007, the EM was based on collective work... [now] It includes 8 sectors that represents the functional jurisdiction.’ SC7
	Informal learning	Planning for failures	‘We already mobilized resources to the area before the cyclone struck.’ SC5 ‘they provided backup generators for telecom stations instead of only relying on grid electricity.’ SC5
		Awareness of roles	‘We have been through Gonu. We entered Phet and we were ready. The operation/process was easy. Everyone knew their role.’ EM2
	Persistent norms	Response system	‘it is a system but you cannot visualize it. It is there but during the event it functions’ SC8
		Governmental system	‘We are a mixed system, military, paramilitary and civilian’ EM1
		Centralised system	‘..., the regional subcommittee is activated... a recommendation from us (central government)’ SC8 ‘we do not have a permanent one (operations centre) [at the regional level] right now.’ SC4
		Paramilitaried lead agency	‘under the command/lead of ‘military, para-military’ leadership’ LE1 ‘we are against the idea that the police is always the lead agency’ LE3
		Inadequate emergency planning	‘Actually, we do not have a risk register. and based on it, I would anticipate the needs and the logistic needs, the resources that I will need and the communication lines that I would use.’ SC5 ‘they are aware of their roles but not really aware of the roles of others’ LE1 ‘Each participant should understand their role and what is expected from him. It must be written.’ SC4

				‘now even we want to know the resources and capacities of government organizations. Very difficult.’ SC1
			No local disaster management	‘Now, you need to do ‘response’; the response from our sector is at the regional level and not at the local ‘Wilayat level’. This is because we don’t have organizations (from our sector) that have a presence at Wilayats.’ SC5
			Poor integration of private businesses	‘the private sector did not participate’ LE3 ‘individual initiatives’ LE3 ‘Who represents the private sector. Ministries are known but private sector?’ SC4
	Drivers of change	**Disasters**	Increased awareness	‘as for the national system for civil defence, it was existing. It was existing during the 1980s. It is old. The committee was existing. But because a major incident didn’t take place, it was not very activated. And some did not even know that they were members of such a committee. On May 11th 2002 around 10am, there was a major storm struck Dhofar Governorate, 40-47 knots. There were damages. We learned many lessons from the storm.’ SC8
			Forced organisations to interact	‘We started to know each other (after experiencing Gonu together). Then, we attended joint training/exercises. We went to their centres and they gave us lectures. They came here I gave them a lecture. During these years, we worked/trained together as a joint national committee.’ SC8
			Opened window for new changes	‘It is because of Gonu that the whole country was pushed to establish this system, the NCCD.’ SC4 ‘after the orders from the Sultan in 2010 following cyclone Phet to restructure and improve the national (emergency management) system’ EM1
			Source for informal learning	“During Mekunu, the road was disrupted and we could not reach the affected areas. But during Luban we made sure

			the resources are present before the emergency occurs." SC5
	Social media	Created pressures on government	'you need to keep up and improve as the public was pushing for more.' EM1 'It was a request of the committee. The direct communication with the public. But we did not know how to do it. Now, we can use social media platforms.' SC7
		Increased horizontal communication	'now, information exchange is very fast because now there are many communication means. The social media contributed to this as _____ would tweet and we would immediately get the updates. During Gonu, this was not available. Also, there are WhatsApp groups. The info is now shared quickly. This was not present during Gonu.' SC7
	Privatisation	Created new organisational culture	'The government policies are the main drive for changes in the EMS, and they are driven by its vision… now all entities (sub-sectors' coordinating organisations and private businesses within them) must have evacuation plans. Therefore, this was a new change for us. Before, we would not know how to respond in case there is an alarm.' SC5
		Mandated new standards	'There was no assembly point. No training. Now, we have HSE manager, assembly point, emergency tests, etc.… For example, before we did not have a call centre for water sector when it was under the government. But when the authority (public authority for electricity and water) was established, we developed a customer service department and among its pillars is a call centre. All organisations that are members of the sub-sectors except the transport has a call centre.' SC5
Barriers of learning	Cultural and religious factors	Fatalism / destiny	"If you notice, the victims… their cause of death is due to… and of course, the fate and destiny. We cannot ignore that." EM1 'destined to happen' 'it was written for it' LE2

		Procrastination	“Inshallah, we will write it.” SC3 “We are developing a plan.” EM2
		Rejecting criticism	“they would always ignore the negative feedback...” LE3 “they would not listen” LE2
	Historical circumstances	Selecting paramilitary lead agency/approach	1988 NCCD Formation Decree
		Adopting *ad hoc* structure / using existing resources	1988 NCCD Formation Decree

Appendix E – Definitions of Codes

Code	Definition / Explanation
Ad hoc structure	A temporary formation such as a committee that was formed for a specific task or purpose.
Bifurcation point	A sudden qualitative change that leads to a new state of the system such as the collapse of the emergency control room.
Centralisation	The concertation of resources and decision-making powers within the capital city rather that decentralised in different governates.
Continuity of essential services	The continuity of main services such as electricity, telecom and water services during the response phase.
Coordination	Integrating EM functions and operations from different organisations and making sure that someone is responsible for them.
Cosmology episode	A situation that takes place when things start to be out of control from the perspective of the responding agents.
Cyclone features and impact	All facts and scientific information about the cyclone such as recorded rainfall and wind speed, affected areas and reported damages
Decentralising resources	Distributing resources in multiple locations rather than centralising them in one central location.
Emergency plan	A written plan for managing emergencies that specify the roles of response agencies and overall governance structure of the EMS in Oman.
Failures of essential services	A major failure of critical infrastructure that greatly influenced the functioning of the emergency responders such as interruption of electricity, unavailability of main roads and disruptions of telecom services.
Fatalism	The belief that events were predetermined to happen or meant to happen.
Governmental system	The emergency management system is made of governmental entities. Private and NGOs are not active actors.
Hierarchical top-down communication	The pattern of communication in which information is sent from the highest level of the management chain to lower ranks or positions.
Horizontal communication	A pattern of exchanging information across organisations within the same managerial or hierarchical level.
Inability to establish situational awareness	Responding agencies are not able to know what was happening in the affected areas, and accordingly unable to project the scenario.

Informal learning	Changes that occurred on the ground due to learning from a recent disaster experience but were never institutionalised.
Isolated villages	Villages that lost connecting roads to town's centre when supplies are stationed.
Localising response	Recognising, enabling and empowering the local authorities to manage the crisis which also includes providing them with necessary resources
Multigovernmental	The EMS is made of several government agencies that work together to manage the crisis.
Organisational culture	The set of rules and values whether hidden or visible but shared and followed by the members of the organisation.
Paramilitary lead agency	The overall agency that leads disaster response is a paramilitary organisation (police).
Participatory	A system that involves or engages people, private businesses and NGOs in developing and/or delivering EM-related policies and tasks.
Relies on routine resources	The resources used during a crisis are the regular or routine resources of the agency that are used in day-to-day operations.
Response-based	The EMS mainly functions in the response phase of the disaster whereas mitigation and planning receive minimal attention.
Strange attractors	Agencies, actors or any sources of stability that are from outside the system and brings or re-establish order in the system
Self-organisation	The process taken by the system to establish a new form of re-organisation to adapt with the new demands that were not met by the formal 'planned' procedures.
Sustained communications	Maintaining consistent communications among different agencies during crises.
Training	All forms of drills, exercises, trainings, simulations that produce knowledge which can be utilised by response actors during crises.
Unanticipated challenges	Challenges and disruptions mentioned by participants as not being expected that influenced their performance.
Unavailability of essential services	Loss of main services such as ground transport links, electricity, telecom and water that emergency responders rely on
Warnings	All alerts, notifications and warnings issued by the response agencies.