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Keep Calm and Carry On: The Importance of Leadership and Crisis Management during a Natural Disaster: A Comparison Between Iceland and New Zealand.

Sigríður Magnea Óskarsdóttir

Icelandic Meteorological Office

Bustadavegur 7-9, IS-108

magnea@vedur.is

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ABSTRACT

The aim of this paper is to apply leadership and crisis management theories to natural hazard respondents and monitoring agencies in Iceland and New Zealand. The emphasis is on leadership role and the crisis challenge and what methods can be applied in order to obtain better communication, mitigation and coordination in future crises. Two case studies are investigated, one from each country. Main findings are that the importance of leadership and psychological aspect during a natural disaster is essential and improved risk assessments for all types of natural hazards are necessary. The case studies fit into the leadership and management theories. They have several things in common, such as both came as surprise to everyone and immediate action had to be taken. However both disasters are common in each country but they had new factors that increased the risk temporarily. The difference is in more structured response in New Zealand whereas the Icelandic ones were more spontaneous. This could be a result of cultural influence. The low population size in Iceland shortens the communication lines but there is not enough man-power to maintain high communication standards if the disaster´s duration is for a long time. New Zealand has a strong emphasis on preparation among the public and responses to a natural disaster are presented widely, in public buildings, shools and all information are gathered in one website. However, despite all the preparation the application the theories of leadership and crisis management can help the DCEM, scientists and stakeholders to better understand the public's response and criticism so they can keep calm and carry on.

1. INTRODUCTION

The two islands, Iceland and New Zealand have beautiful landscapes, volcanoes and geothermal areas in common even though being on the opposite sides of the planet. However these common factors makes both countries prone to natural hazards. A lot of research and investments have been established to monitor and respond to natural disasters, bot hin Iceland and New Zealand. Due to difference in tectonic setting the types of natural disasters are different. Iceland, with its glaciers and subglacial volcanoes is more prone to subglacial eruptions and its concequences whereas in New Zealand, hilly topography and steep slopes in conjunction with complex tectonics make New Zealand prone to landslides and local tsunamis due to large earthquakes. The above mentioned natural disasters have major effects on the local and regional community in each country. Due to global warming weather related hazards such as landslides due to heavy rainfall and increased volcanic activity due to glacial retreatare may become more abundant resulting in increased emphazis on civil defence management today and in the near future (Almannavarnir, 2019). When a natural disaster occurs the world of the people affected is turned upside down and everything has changed. The people experience psychological trauma and it is helpful for the stakeholders involved in the crisis management and plan setting to understand human's psychological responce to trauma and apply that knowledge in the preparation process for the next crisis.

Firstly the framework of geohazard monitoring and civil defence in each country is outlined and the theories of crisis management and models thereof are then introduced. Lastly two case studies, one from each country are outlined, and things they had in common and what was different are listed. This paper focuses on answering the following two research question:

H1: How do Civil protection groups fit to crisis management theories?

H2: Is there any difference between the case studies in terms of crisis management?

1.1 Framework for civil defence and monitoring geohazards

1.1.1 Iceland

The Department of Civil Protection and Emergency Management (DCPEM) in Iceland is a department within the National Commisioner of Police (NCIP) where the head of civil protection in Iceland is the Ministy of Justice. The structure of DCPEM and NCIP is illustrated in Fig. 1. The NCIP makes decisions regarding civil protection alert levels at any given time in consultation with the local police commissioner and informs the Ministry of Justice (Almannavarnir, 2019a).

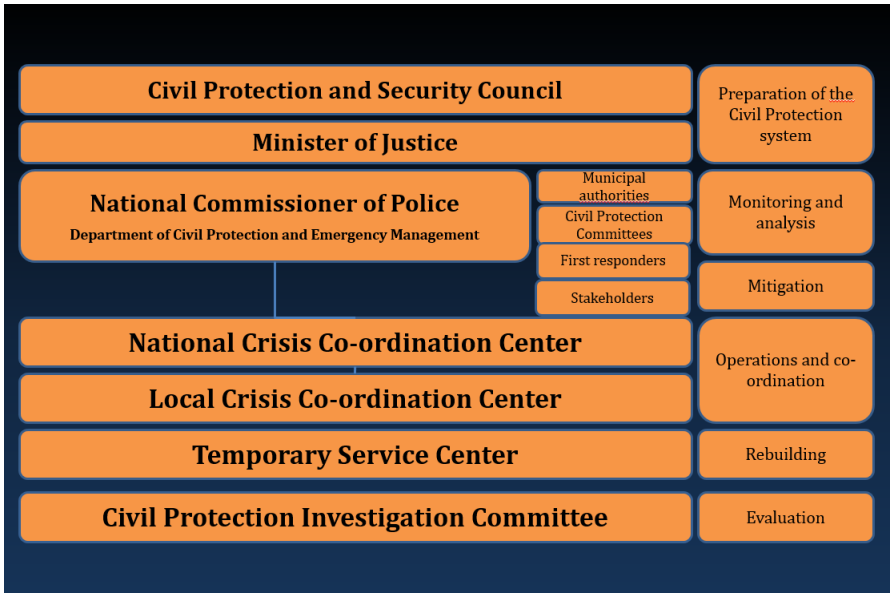

Fig. 1. Structure of the Civil Defence Management in Iceland (Almannavarnir, 2019a).

The Civil Protection Act No. 82/2008 state that NCIP is responsible for assignin alert levels in collaboration with the relevant Chief of Polilce, for all nautral and man-made hazards (Almannavarnir, 2019a).

The Icelandic Meteorological Office (IMO) is a governmental institution under the Ministry of the Environment and Natural Resources. It works according to its act nr. 70/2008. Its main purpose is to contribute to increased safety by:

1. Monitoring, analyzing, interpreting, giving advice and counsel, providing warnings and forecasts, and if possible, predicting natural processes and natural hazards;
2. Issuing public and aviation alerts about impending natural hazards, i.e. volcanic ash, extreme weather and flooding (https://en.vedur.is/about-imo/mission/).

In 2011 Icelandic Meteorological Office became a State Volcano Observatory (SVO) that is it monitors the active volcanoes in Iceland, assesses their hazards, issues warnings and advances scientific understanding to reduce impacts of volcanic eruptions. In addition to IMO´s advisory role to the DCPEM IMO is tasked with monitoring, forecasting and dissemminating natural hazard warnings to the public and aviation service providers (Karlsdóttir et al., 2010).

The Institute for EarthSciences at the University of Iceland has specialists in volcanology and glaciology. It monitors glacier surface surveying and seismic mearsurements by INSAR and land deformation via GPS measurements, the real-time monitoring is on IMO´s responsibility. However, IES advices DCPEM in collaboration with IMO before and during a volcanic eruption (Þorkelsson, 2012). The DCPEM is responsible for all daily matters including crisis communication, emergency coordination efforts and disaster recovery in relation to all hazards affecting the nation (Almannavarnir 2019a). The National Crisis and Coordination Centre (NCCC) also sits under the NCIP but is managed by DCPEM. Its staff comes from NCIP, Emergency Call Centre 112, Icelandic Coast Guard, Icelandic Red Cross, National Health Care System and rescue teams (ICE-SAR), ISAVIA and others (Bird et al, 2017). When a natural hazard/disaster occurs the NCCC is activated but it is based in Reykjavik and is responsible for coordinating a national response when the event affects several civil protection districts accros the country (Bird et al., 2017).

If a seismic activity increases and an unrest is detected in a volcano, based on the real-time monitoring of seismic, hydrologycal and meteorology at IMO the DCPEM in collaboration with IMO and IES, meets to evaluate the risk and make recommendations on how to respond based on the real time monitoring and situation at the time (Þorkelsson, 2012).

The main natural hazards in Iceland are earthquakes, volcanic eruptions, storms and snow/rock avalanches/landslides (Vedurstofa Íslands, 2019).

1.1.2 New Zealand

The Civil Defence Emergency Management in New Zeland works under the Ministry for Civil Defence where the mistry is responsible for administering the Civil Defence Emergency Management Act (CDEM) 2002. The Civil Defence Emergency Management (CDEM) has three main subgroups: National, regional and local groups where 16 CDEM groups have been formed as committees of elected councelors from each council with regional borders (Cvili defence, 2019). In the event of a natural hazard the MCDEM issues a warning via the National Warning system.

The organizational chart of the Civil Defence and Emergency Management is illustrated in Appendix 1 due to its complexity.

The Ministry for Civil Defence Management (MCDM) is responsible for all civil defences and GNS Science is a research institute owned by the New Zealand government and operating as a limited liability company. It has an independent board of directors (GNS

Science, 2019). GNS Science monitories seismic, volcanic and geothermal activity via the GeoNet. Whereas floods, weather hazards and landslides are monitored by NIWA (NIWA, 2019; https://www.niwa.co.nz/; GNS Science, 2019).

2. THEORIES ON LEADERSHIP, CRISIS MANAGEMENT AND CULTURAL INFLUENCES

The field of leadership and management has been greatly researched and many theories have been developed. At the beginning of the 20th centutry theories focusing on the leader as a person born with exceptional talents to lead (i.e. „Great man theory) (Hutchinsky and Buchanan, 2013). After WWII theories on situational leadership (aðstæðubundin forysta) became popular but developed into theories on the leader that supports his followers and encourages them for the benefit of the group as a whole (Kellerman, 2016; Williams, 2005). Barbara Kellerman states that leadership consists of three factors: the leader, the leader´s followers and the environment or context they liv ein. Leaders have existed since begining of mankind but leadership is a relatively new subject (Kellerman, 2016). John Garnder agrees with Kellerman on the fact that leaders can be of all types and they do not have to fit the same form such as the leadership theories from the beginning of the 20th century assumed. Garnder argues that it depends on the individual if one has talents as a manager or a leader, even both (Garnder, 1990).

There are many ways to increase leadership skills but since it is so highly attatched to human interactions and communication it is necessary for a leader to understand and take his follower´s feelings into account.

In their book, Managing transitions, William and Susan Bridges (2016) introduce a model that describes the psychological stituation of people when they are facing abrubt and rapid change and transformation. The model is illustrated in Fig. 2 but it consists of three steps:

1. The Ending - letting go: The most important step is for the followers to let go of the past in order to move on. Accepting the end, the fact that the present situation will transform into a new one. This can be very difficult and take quite a long time to accomplish.
2. Neutral zone: Most difficult step because direction and the atmosphere is dull that can prevent progrecss. Very important for the leader to understand this and show support during this phase.
3. New beginning: When people see and start to enjoy the fruits of their labor and start to realize that crisis come with new possibilities. That gives the leader and the followers the confidence to accept and deal with new challenges.

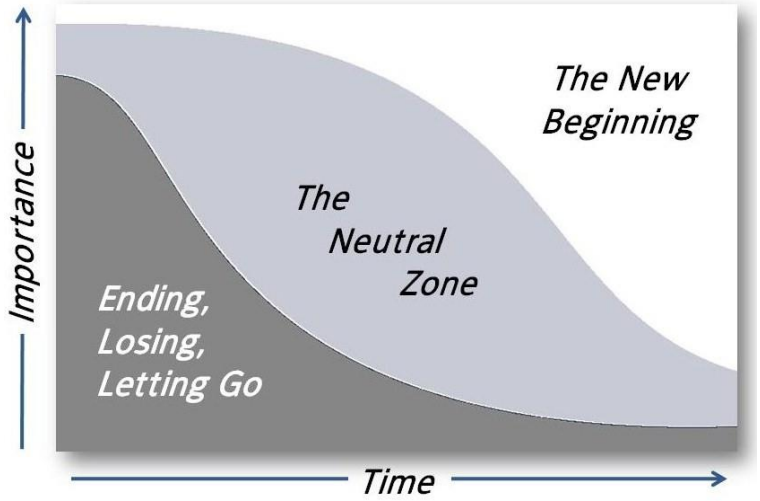

Fig. 2. Bridges' model of transformational process and people´s pshychological state during the transformational process. First step is to let go of the past and accept the ending. Step 2 is the neutral zone where dullness and lack of shared vision make it difficult to overcome. Last but not least stage 3 - The New Beginning that brings hope and courage to accept the past and face new challenges (Bridges, 2016).

Bridges model was first introduced within the transformational leadership and management sector. It describes a psychological process that people undergo during transformational changes in companies and organizations but they can be applied to a nation that is traumatized by a natural disaster.

John Kotter (2012) has prepared a 8 step model for implementing change within corporations and organizations. The model is illustrated in Fig. 3. The first step is for a leader to sell his followers the real problem and the necessity of the change. Next step is to develop a shared plan and vision for the future. Broad based action is empowered and short-term wins are generated in step 4 and 5. It is vital to never let up and constantly re-evaluate the plans with respect to the progress and the milestones in order to incorporate the changes which is in fact the last step of Kotter´s model of change (Kotter, 2012).

Fig. 3. Kotter's eight steps of change (www.staff.napier.ac.uk).

When natural disasters occur the local residents, community even whole nations, depending on the scale of the disaster, are in a state of crisis. But what is a crisis? In its simplest form crisis is an imminent and serious challenge that threatens a group, community, institution or a nation. It is a grave and urgent challenge that threatens a group, community, organization or a nation. (Dean Williams, 2005). The symptoms of a crisis include hostile forces from without or within that threaten the survival of the group. The atmosphere is explosive that fuels fear and anxiety and some immediate action needs to be taken. If not the values (i.e. resources, culture, goods) of the group can be lost or diminished significantly (Williams, 2005). There are two types of crisis: man-made crisis and crisis due to natural disasters. The onset and crisis management in terms of the latter type is the main focus of this paper. Leadership is very important to companies and institutions but it is crucial in times of crisis. According to Williams (2005), the role of leaders during times of crisis, is first and foremost to remain calm and prevent the group from experiencing more trauma and assisting people in channelling their fear, anxiety and anger in a positive and solution-seeking pathway.

In order to avoid chaos when a natural hazard occurs the civil defence along with the geosicentists have come up with several contingency plans to take control of the situation at stake. The leadership work during a natural hazard is to restore calm, protect the people from further hazards and risks and assist them in channeling their fear, anxiety and aggression towards creative and workable solutions (Williams, 2005).

Crisis management is built on the organization's values but as Mitroff and Pearson state (1993, 53): "Not all organizaitons match their actions (what they do) to their formal statements (what they should do). For crisis management, the accurate reflection of values in action is a must." Thus the crisis management plan must be in accordance with the organization's values and mission statements. However the most dangerous crises are the ones that blindside the organization, causing more trouble since no one was preparing for them (Pearson et al, 1997). Successful crisis management is based on two significant keys: communication and coordination (Kline & Smith, 2006).

2.1 Crisis management models

Many articles have been written on crisis and crisis management and several scholars have made crisis management models for leaders and managers to follow, i.e. Fink's model from 1986. According to Moe and Pathranarakul disaster management includes five generic phases: (1) prediction; (2) warning; (3) emergency relief; (4) rehabilitation; and(5)reconstruction (Moe et al, 2006). It is highly consistent with the Mitroff and Pearson's 5 step crisis management model.
One of the models is Mitroff's and Pearsons's 6 step crisis management model (Fig. 5). from 1993.

We choose this model since it is more precise than other models and fits well with the warnings and responses that governments use in times of natural disasters.

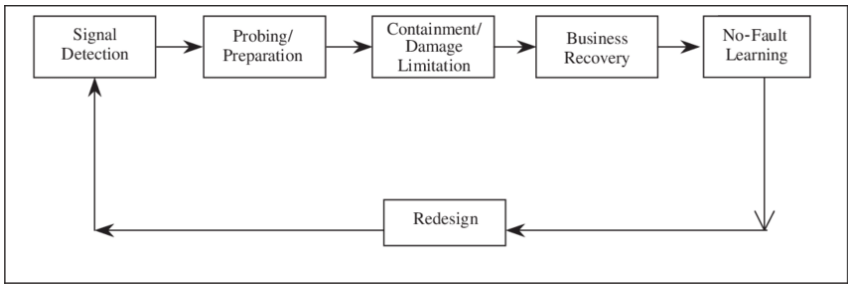

Fig. 5. Mitroff's and Pearson's Crisis management model (1993). Six step model that describes the process managers can apply in times of crisis and event to prevent or decrease the effects of crisis. Firstly the detection of crisis is signalled then the preparation begins. During the crisis state the main focus is on containment and to limit damages. Pos-crisis the recovery begins followed by a learning phase and improvements/redesign are made.

The model describes how crises follow a five-phase sequence where the first step is to signal detection, i.e. increased seismic activity in a volcano or within a seismic area. This step is important for preparing next step and trying to prevent any harm. Next step is

preparation – what can be done to minimize the odds of crisis? If step 3 happens anyway, like in terms of natural disasters, damage containment is implied to decrease the effects from the crisis and preparing for the next step that is recovery. When the organization or society has recovered the last step learning begins. What can be learned? How can we better prepare ourselves for the next crisis? The final stage is making improvements until the next crisis occurs (Mitroff & Pearson, 1993). The model is a cycle because no one can ever be prepared for every crisis at all times. However if one follows these steps represented in the model the probability and effects of the next crisis can be reduced. However, Mitroff (2005) emphasizes that the model should no be used to blame an individual or individuals for the crisis event.

2.1.1 Kübler-Ross curve

When people experience a trauma or a shock emotional response-processes are activated. This applies to when people experience a natural disaster such as an eruption or an earthquake. Dr. Elizabeth Kübler-Ross made a curve indicating the emotional state of an individual from the time of the trauma until time of acceptance or balance (Kübler-Ross, 1970). It's original purpose was to explain grieving responses but has been adapted to change (Fig. 6).

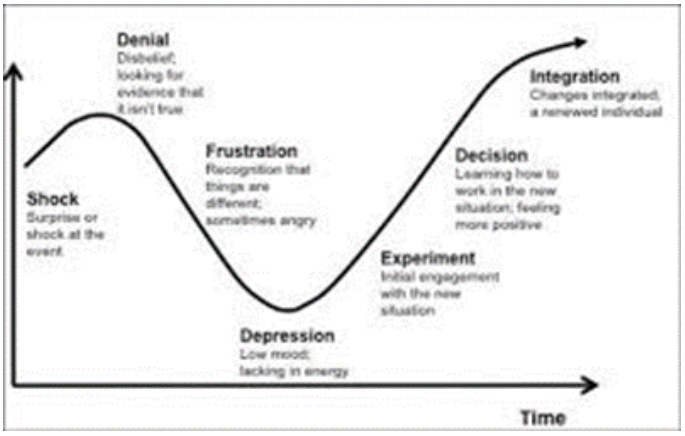

Fig. 6. The Kübler-Ross curve. Describing the 7 stages of grieving but has been applied to other aspects of human response to trauma such as natural disasters.

When crises such as natural disasters occur a transitional process begins as can be seen by the consequences, i.e. buildings collapse due to earthquakes and a thick layer of ash is dispersed over a large area in a subglacial eruption. Thus a some sort of grieving process begins where the former situation is erased and new times are rising. One of the best examples of this is the eruption in Heimaeyj in Vestmannaeyjar islands in January 1973. First response was to ensure the public´s safety and the residents of Heimaey were therefore on stage 1 and 2 of the KR curve. When time passed the residents´s feelings were going from stage to stage on the curve and some of them managed to get to acceptance stage and move back to Heimaey whereas others were stuck in depression and anger and never returned (Vestmannaeyjabær, 2006).

It is important for the monitoring and response parties to understand this process and work with it to make the work easier for their employees to assist the public. In addition the employees are human themselves and by understanding this process can assist one to cope with the situation during a time of crisis. Pearson & Claire (1998) discuss the psychological effects during a crisis as dissillutionment where psychic and shared meaning is lost.

2.2 Influence of cultural types and organizational learning on crisis management

Bernhardsdottir (2015) studied the relationship between crisis management and cultural types using the GGCT typology of cultures and groups to…. The GGCT has two dimensions group and grid and the cultural types are four ranked differently at the dimensions. The GGCT typology is illustrated in Fig 7.

These four cultural types are:

1. Fatalism: Within this culture good luck is valued
2. Hierarchy: Within this culture order and respect to it is valued
3. Individualism: Within this culture liberty of the individual is valued
4. Egalitarianism: Within this culture equality is valued.

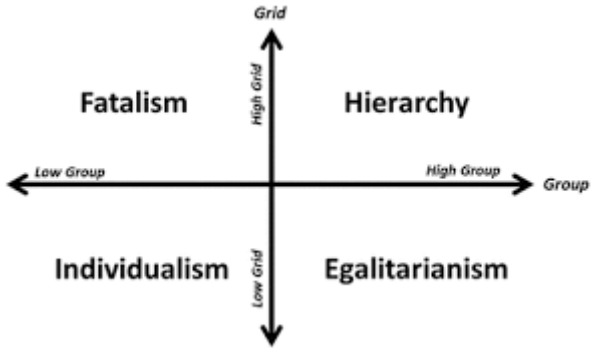

Fig. 7. GGCT typology of sociological cultures and groups.

According to Bernhardsdottir culture is not static and significant surprises can lead to cultural changes from one cultural type to another. Maybe crisis can be defined as this significant surprise triggering cultural change (Bernhardsdottir, 2015). Culture influences the learning phase in the crisis management in the way that the decision makers may not believe that they can learn from past experiences (Bernhardsdottir, 2015). Hood (1998) argues that fatalists are least likely to believe in crisis management because unpredicted failures are part of human aspects and cannot be foreseen. However the other cultural groups differ in believing in managing crisis, i.e. hierarchists depend on expert opinion whereas egalitarians dislike that resulting in more public activation and preparation. Individualists depend on organizations and indivual's household to learn from the past but demand that this knowledge is distributed to those parties. Bernhardsdottir (2015) argues that in order to improve crisis management the ability to learn is crucial to an organization and the learning process should be institutionalized of both organizations and individuals. Other research emphasize that the learning process needs to be mutual among individuals and organizations for it to work properly (March, 1991). According to Berhardsdottir (2015) Argyris and Schön viewed the learning process as a process of negative feedback, i.e. mistakes are discovered and corrected and the organization must adapt to the correction. It can either be a single-looped or double circulation (i.e. single-looped or double-looped process of learning). Single-looped learning describes the learning process of decision makers during a time of crisis whereas double-looped learning describes post-crisis review and focuses on improvements in organizations' response in future crisis, i.e. by establishing new organizational legislations (Bernhardsdottir, 2015).

3.METHODS

In order to compare crisis management during a natural disaster in Iceland and New Zealand the Mitroffs and Person´s (1993) model of crisis management is used because it is rather clear and logical. GGCT typology for sociological groups (Bernhardsdottir, 2015) is used to assess the influence of culture on the crisis management in each case. Two case studies, one from each country are selected and analysed. The natural disasters in each study are not identical and physically different but they are chosen because they are the most disastrous in each country.

4.CASE STUDIES

4.1. 2010 eruptions in Fimmvorduhals and Eyjafjallajokull

Mt. Eyjafjallajökull volcano is a stratovolcano in South Iceland. It's summit is covered by up to 200 m thick glacial ice. The volcano has erupted three times since the Settlement producing fine-grained ash depostis that are found within 10 km radius from the volcano's crater (Larsen et al, 1999). It last erupted in 1821 with glacial outburst floods that destroyed some fams and grassland in the vicinity of the volcano (Gudmundsson et al, 2005).

At the end of 2009 and in the beginning of 2010 seismic activity in Eyjafjallajokull strato volcano increased with events being larger and shallower. Due to this increased seismic activity regular emergency management meetings with scientists, local police and rescue teams were organised by the CDEM (Bird et al, 2017). In March the seismic activity accelerated and volcanic tremor was detected, resulting in an eruption on Fimmvorduhals, Iceland's most popular hiking trail, on March 20th at around 22:30. The eruption was an effusive one with no explosive activity and ash fall. Two cinder cones, Magni and Modi, were formed on top of the volcanic vents and lava flowed down to Hrunagil in Godaland, Thorsmork. The eruption was very popular to visit by Icelanders and tourists and lasted for about three weeks. Last day of any activity was April 12th 2010 (Veðurstofa Íslands, 2019).

The Fimmvorduhals eruption was a precursor to the large eruption in Eyafjallajökull strato volcano. The eruption in Eyjafjallajokull's summit crater began on April 14th 2010 with a basaltinc flank eruption on the northeast flank lasting about three weeks and followed by 39 days of continuous activity in the summit crater with two main explosive phases separeted by a two week long effusive and mildly explosive phase. The eruption is the largest eruption ever recorded in the volcano producing 0.27km^3 of fine grained tephra and 0.023km^3 of lava, as well as several jökulhlaups of a few thousand m/s discharge in the first two days of the summit eruption (Bird er al, 2017; FutureVolc). The role of IMO was to monitor the seismic activity and ash plume and issue warnings at the beginning of the eruption. The fine-grained ash cloud was dispersed over the whole North-Atlantic to UK and Europe for several days grounding thousands of flights and leaving millions of passengers stranded in airports (heimild vantar). The main tool for monitoring the ash cloud was a C-band Doppler weather radar located approximately 150 km west of the volcano, at Keflavik International Airport along with surveillance flights and pilots reports (Vogfjord et al, 2005). The area 8 km from the summit vent of Eyjafjallajökull is sparcely populated, with a few hundred people living within 30 km from the volcano. The greatest hazard is glacier outburst floods and/or lahars, with approx. 30 min response time. Further pyroclastic flows can occur and lighting within the ash plume are common with heavy tephra fallout. Further away from the mountain ash clouds and tephra fallout are the main hazards (FutureVolc).

The eruption was shortlived but had catastrophic results for farmers and inhabitatns near the volcano. Also for the flight passengers who‘s flights were cancelled and all the companies and tourist firms affected due to the ripple effects.

No overall natural hazard assessment did exist prior to the eruption in March 20 and April 14. Only an assessment of possible jokulhlaups from the volcano. Therefore the heavy ash fall came as a surprise to everyone, especially the local residents and the stranded air passengers in Europe (Bird et al, 2017).

Both IMO and IES were not prepared for the event and the massive media attention it got.Eyjafjallajokull´s nearest neighbour is Katla volcano and sometime during the early stages of the eruption media was discussing the possibility of the eruption triggering another one in Katla. This worried the local residents, especially children. Iceland´s president at the time, Olafur Ragnar Grimsson, did not help when he stated on Katla „ You ain‘t seen nothing yet“ in the BBC show Newsnight on April 19th 2010 (http://news.bbc.co.uk/2/hi/programmes/newsnight/8631343.stm). IMO‘s staff went to inform the local residents of the status of the eruption but soon realized that scientific facts and status reports did not meet all of the locals‘ needs. One of the IMO‘s employee said that the IMO‘s staff did not realize that their job is not just about showing real-time data and referring to their website over and over again, it is also a part of a trauma help and that local residents need to talk about their experience and feelings. Real-time monitoring information are good but you cannot drown the public with information since it can become confusing. IMO should have responded earlier about the rumors of a hypothetical Katla eruption (Gunnlaugsdottir et al, 2010).

4.2. The 2016 earthquake in Kaikoura

On November 14th 2016 at 0002NZDT an earthquake of M7,8 occured northeast of Culverden. The earthquake was felt throughout New Zealand with 15840 felt reports submitted to GeoNet. At first the size of the earthquake was calculated to be less than the final M7.8. Resulting in „Tsunami - No threat“ messages being released. Shortly after that the geohazard analysts were alerted by a 1.0 m drawndown observed on the Kaikoura tide auge indicating a tsunami was imminent. Thirteen minutes later the size of the event was updated to M7.9 and a tsunami warning messages were sent via the National Warning System (GeoNet, 2017).

In the months after the event significant aftershocks occured with some >M6,0. The earthquake chracteristics were significantly complex with ruptures of 21 faults and generating a local tsunami. The wave run-up on shore reached as high as 6.9 m.a.s.l. at Goose Bay area and several other locations experienced 3-4 m run-up. The tsunami was detected in Wellington Harbour, Castlepoint, Christchurch and the Chatham Islands. Since the tsunami occurred at a low tide and as the land was simultaneously lifted, the impact was reduced. The impact from the earthquake included: two fatalaties, damage to properties, roads an utilities in the Kaikoura and Hunurui districts and building and infrastructure damage as far away as Wellington. Approximately 150 landslide dams were created by the earthquake across multiple South Island catchments (MCDEM, 2017).

Tsunamis generated by a large local earthquake or undersea landslide may not provide sufficient time to implement official warning procedures, therefore there are agencies for local source tsunamis the Civil Defence Emergency Management groups (CDEM groups). Comprehensive puplic education regarding acting immediately on natural warnings is therefore the principal preparedness measure for local source tsunami. When a local tsunami is detected the Ministry of Civil Defence Emergency Management (MCDEM) will issue warning messages for New Zealand via the National Warning System.

In this event the Duty Team was awoken by the severe shaking from the earthquake and they responded immediately and sent a National Advisory based on the initial magnitude and location given by GNS followed by four other warnings. The tsunami warning was cancelled at 1500NZDT on 14th November. The NCMC operated on a 24/7 basis to support responding CDEM Group Emergency Coordination Centres (ECC‘s) and Local Emergency Centres (EOC‘s). On December 5th the NCMC activation status was downgraded from Mode 3 (Assist to Mode 2 (Engage) reducing the staffing and hours of NCMC. In December MCDEM commenced an enhanced puplic education campaign that centred on the correct action to take when an earthquake is felt (drop, cover & hold) as well as the action to take from a tsunami risk perspective (long or strong, get gone, don‘t wait for official warnings). This was in reaction to the public‘s perceived reliance on official warnings rather than taking action after natural warnings were felt (MCDEM, 2017).

Three new pieces of legislation passed within two weeks of the earthquake:

- Civil Defence Emergency Management 2016 Amendment Act
- Hurunui/Kaikoura Earthquake Emergency Relief Act 2016
- Hurunui/Kaikoura Earthquake Recovery Act 2016

A national transision period was given notice for the three affected South Island districts. It enabled the government to manage certain aspects of the recovery centrally via a National Recovery Manager due to the extent of national infrastructure affected. The National Recovery Manager was subsequently appointed and National Recovery Office was established within the MCDEM (MCDEM, 2017).

A number of advisories about the earthquake and tsunami were issued, based on the information available at the time. The information and adviced received changed significantly during the first hours after the earthquake that lead to decisions also changing in accorance with the procedures. This resulted in the puplic perceiving to be a delay with issuing a tsunami warning, while inconsistent response to the warning at the local level further caused criticism. The tsunami monitoring and assessment rests with GNS Science, while the responsibility for warnings rests with MCDEM. This practice is unnecessary comlicated and can cause delay, which is further impaired by the fact that neither MCDEM nor GNS Science conduct their responsibilities from a dedicated 24/7 monitoring and

warning centre (MCDEM, 2017). Thus an enhanced public education campaign centred on local-source tsunami warning signs was launched in December 2016. MCDEM also initiated work with the GNS Science and CDEM Groups to enable more effective warnings for local-source tsunami.

5.RESULTS

Both eruptions in Iceland were unforeseen events that could not have been anticipated in the same scale as they came to be. Therefore crisis management was crucial under these circumstances. If we apply the Mitroff and Pearsons‘s model to the precursor and responce of the eruptions we see the results as follows:

Eyjafjallajokull 2010:

1. **Signal detection** - Increased seismic activity in the volcano, the rescue teams, scientists, police and CDEM start regular emergency meetings. Discussing possible scenarios.
2. **Preparation** – Risk assessments only for jökuhlaups had been made in the area before the 2010 eruption. Therefore there was no risk or hazard assessment for ash fall and how to respond pre 2010 (Bird and Gisladottir, 2012). The seismic activity had been on going for about 15 years prior to the eruption. When the seismic activity increased rapidly in 2009/2010 a stage of uncertainty was put up for the public in feb 2010 (heimild). If the seismic activity increases stage of danger is put on and locals are evacutated.
3. **Containment / damage limitation** – When IMO had issued a warning that an eruption had started in Fimmvörðuháls, local residents were immediately evacuated by the assistance of local rescue teams. A temporary Service Centre was established at Heimaland in Fljótshlíð where the locals were encouraged to drop by and get some information. There the status reports from scientists, DCEM and the police were presented to the locals, but also in closed meetings with the Icelandic Government in Reykjavík The heavy ash fall highly influenced both the local residents that watched their homes fade into a grey/black fog with tons of ash covering their homes and surrounding areas. (Bird et al., 2017).

   The days after the April 14 eruption started all airports in Europe were closed due to the finegrained ash and aerosols that where dispersed by jetstreams from Iceland to Central Europe. Millions of passengers got stuck in airports in Central Europe causing discontent towards Iceland among passengers and media.
4. **Recovery** – after the natural disaster has subsided and is finished the locals can move back to their homes, if there are any left. In 2010 the tephra fall from the volcano was the major disaster and many people arrived to assist locals in shovelling the tephra off the roofs to prevent them from collapsing. The tephra was blown by the wind and distributed widely accross S and W Iceland during the summer of 2010 and until the next spring (Heimild vantar). Since Iceland and the infamous name of Eyjafjallajökull had hit the headlines in the springmonths of 2010 a new advertising campaign for toursits was started, called Ispire by Iceland (Bird et al., 2017).
5. **Learning and improvements** – The grain size of tephra is vital for aviation and it was further researched in the the following years. As a result the IMO bought two more Doppler Radars to assist meteorologists and other scientists in detecting and analysing the grain size of tephra in the next eruptions.
   Bird et al (2017) surveyed the local residents that claimed that they felt disturbed by the live broadcasts from their evacuated homes and how the media victimized them and dramatized the summit eruption. This reveals that in a state of crisis the leader, in this case IMO and DCEM should take the locals´feelings and psychological situation into account and apply the theories of Kübler-Ross and even forbid reporters to show live broadcasts from evacuated homes since that has no added value to the news and only seems to over-dramatize the event.
   An overall hazard assessment for natural hazards in all Iceland is underway but has not yet been finished, despite the 2010 eruptions, the eruption in Grímsvötn in 2011 and the 2014-2015 eruption in Holuhraun. The IMO, however established a Geohazard monitoring centre at the Department of Monitoring and Forecasting, where geohazard specialists work alongside meteorologists.

Kaikoura 2016:

1. **Signal detection** – Seismic activity is common in New Zealand and residents are well aware of that. However there are no strong precursors to a large earthquake and little for tsunamis. Therefore the local CDEM groups are the lead agency for local tsunamis since a tsunami generated by a large local earthquake or landslide my not provide sufficient time to implement official warning procedures (CDEM, 2017). Public is educated of the ever looming threat of a large earthquake and that it cannot be stopped from happenening and that preparation is the best way to survive (GeoNet, 2017).
2. **Preparation** - While general supplementary staff were put in place quickly, the process for requesting and matching the need for specialist support staff with available skills was ineffective. It took time to get specified requests from the Group, while the offers of assistance from other CDEM Groups and external agencies were not aligned with the NCMC’s requests for assistance. Subsequently some support staff did not represent the skills required or were unfamiliar with processes and/or systems. It should be noted steps were taken to address this matter during the response. MCDEM commissioned an external logistician to review the resource request and matching process used during the response.MCDEM has made instrucions on how to respond during an eathquake that is visible to the public in elevators, in public buildings, schools and even in public areas.

3. **Damage containment** – All routes in and out of Kaikoura were damaged, leaving the town in isolation. There were two fatalities and approx. 16000 reports of people detecting the earthquake all over New Zealand causing very challenging work for the responents. Local residents and tourists were evacuated from the area by sea and helicopters (NZ Hearald, 2016).
4. **Recovery** – Around NZ$ 2 billion insurance claims were reported, two third of them from Wellington and 25% from South Island (NZ Herald, 2016).To understand the processes and systems involved in a coordinated response the specialists involved require specific training. In the Kaikoura erthquake the process for requesting and matching the need for specialist support was ineffective. Getting a specified request from the CDEM Group took time and other CDEM Groupss offers of assistance were not alinged with NCMC´s request for assistance, Resulting in some of the support staff did not represent the skills required. Therefore the MCDEM commissioned an external logistician to review the resource request (CDEM, 2017).
5. **Learning and improvements** - Large earthquakes can produce underwater landslides resulting in a tsunami like what hap pened in Kaikoura in 2016. Therefore the MCDEM started a public adverticement campaign with a videos and information leaflets on how to respond to large earthquakes and expect a tsunami: Long or strong – GET GONE. Encouraging the public to run to higher ground. Road signs with heigh level and expected heigh level of tsunami have been installed all over the country also known as tsunami evacuation zones (https://getready.govt.nz/) . In addition warning flutes have been installed in areas prone to local tsunamis. As was in the case of Kaikoura. In December 2018 a National Geohazards monitoring centre was established at GNS in Wellington. Its main purpose is to locate earthquakes 24/7 and tsunamis (gns.govt.nz). After the 2010/2011 earthquakes in Canterbury GNS Science started to focus on earthquake forecasting where Kaikoura event was the refinement of these forecasts in a wide range of practical applications (GeoNet, 2017). In July 2019 all information on how to prepare for a natural disaster in NZ and how to respond are gathered in one website run by MDCEM: https://getready.govt.nz/.

Both cases have some things in common: they surprised both the locals and the respondents that were not fully prepared for catastrophes like these. The 2010 eruption in Iceland was, in terms of influence on society, the largest since the Akja eruption in 1875. Eathquakes are common in New Zealand and they are well prepared for tsunamis originated far away in the Pacific Ocean. Local-tsunamis are not common and the public campaign on that threat was issued right after the Kaikoura earthquake. In both countries the civil defence is efficient and well structured. There is a difference between the two cases, especially in the learning and improvements phase. Research indicate that cultures influence the crisis management (Berndardsdottir, 2015). Thus cultrual difference between New Zealand and Iceland can explain to some extent the dirfference in crisis management in both countries. If we fit both nations in the GGCT diagram one would expect Iceland to value individualism, egalitarianism and to some extent fatalism. The spontaneous nature of Icelanders has helped in not giving up against natural disasters and harsh weather over the centuries. Where everything that one has built is ruined. There is a phrase among the public that describes their culture to the point: „Þetta reddast“ (eng: „It will fix“). Icelanders do not like too much structure and regulations. New Zealand however, being a part of the British Commonwealth and its population consists of the natives Maori and colonists from England has a longer history of city culture than Iceland where the farming community was dominant up to the middle of the 20th century.Therefore , in terms of the GGCT diagram, it could be argued that New Zealand values hierarchy and individualism; since the three legislation Acts passed within two weeks after the earthquake and a large advertisment campaign on earthquake and tsunami response was launched short after the event.

At the beginning of this paper two reasearch questions were proposed:

Do CDEM response during natural disasters in each country fit into crisis leadership and management theories? Yes in terms of both countries crisis management theories can be applied. The focus has been on the damage containment but should be more shifted towards the preparing stage by making national all geohazard risk assessments and by using Kotter´s 8 step og change management to implement the human relations aspect into the preparing and damage control steps. That is to educate the employees of Civil Defence and the scientists on leadership role and crisis management during and before next crisis occurs. Both countries have in common is a well established civil protection and monitoring of natural hazards. The Eyjafjallajokull case study seems to fit quite well in the Mitroffs and Pearsons model for crisis management. The system seems to be built around communication and coordination and the stakeholders work well together. However some aspects can be improved such as making the over-all risk assessments on natural hazards in Iceland and implement the change management and leadershio theory of Bridges

The other research question is there a difference in crisis managament between the two case studies? As Bernardsdottir (2015) has argued, culture does influence the crisis management of dicision makers. If the GGCT typology is applied one can argue that the structuralized response of New Zealand and that the public is aware of how to respond during a natural disaster indicates that New Zealand dicision makers value hierarchy and individualism. Puplics education on responses to natural hazards, new Acts are passed shortly after the event, and adverticement campaigns on responses in the whole country (www.getready.govt.nz). Whereas Icelandic dicision seem to value egutaliarism, individualism and up to some extent fatalism (i.e. despite the 2010 eruption there is still no overall hazard assessment available for Iceland). This might even argue that New Zelanders have a more double-looped learning than Icelanders since there is so little focus on educating the public on response to natural disasters. Prior to the 2010 eruption there were no risk assessments on ash fall or any other natural hazard from Eyjafjallajökull, except glacier outburts floods (Bird et al, 2017).

6.DISCUSSION

Both case studies were a great learning experience for the Civil defence Authorities and monitoring institutions in both countries and it can be a guidiline procedure for future natural disasters. However it seems that New Zelanad dicision makers have come further than Icelanders in the learning process. Kotter´s 8 steps of change could explain this difference. Maybe New Zealand´s dicision makers´value of hierarchy makes them more prone to acknowledge the problem. The need for order and vlaue of expert´s opinion

assist the dicision makers to follow Kotter´s steps. The individual, egalitarian, and up to some extent fatalic, nature of Icelandic dicision makers makes them more spontaneous and following the single-loop learning circulation. However, Icelandic decision makers can learn from their colleagues downunder and could implement Kotter´s theory into their learning and improvement phase to structuralize the crisis management and in terms of the human factor of the crisis management. The experience from IMO´s employees and local residents in the 2010 eruption supports this since both said that human relations aspects were lacking in the reponse, damage containment and recovery phase of the disaster. It is good have real time monitoring but it does not help the public to feel better and therefore an understanding of the Kübler-Ross curve and transitional changes is necessary for employees in this sector (Bird et al, 2017; Gunnlaugsdottir et al., 2010).

7.CONCLUSION

At the beginning of this paper two research questions were proposed:

Do CDEM response during natural disasters in each country fit into crisis leadership and management theories?

Is there a difference in crisis management between the two case studies?

For each country the Civil protection response fitted quite well into Mitroff and Pearsons crisis management model and leadership theores can be applied. The main difference between the two case studies is that the response in Iceland was a bit more chaotic but more structured in New Zealand. This could be as a result of cultural influence. The group cultrue in each country is different. Value of hierarchy and indvidualism is higher in New Zealand than in Iceland that has a higher value of individualism and egalitarianism, even a bit of fatalism. Resulting in a more spontaneous nature of the culture.

However, during a time of crisis, such as a natural disaster, a strong leadership is cruscial to prevent the society from chaos and unrational disisions to be made. By restoring calm and reassuring the public that this all shall pass and new times are about to begin, a firm leader uses the Mitroff and Pearson´s model to obtain these goals. The human factor has been neglected as has been discussed above but should be of more emphasize. Applying Mitroffs and Pearsons´s model is one way to implement it but other methods could be interesting to research for comparison. Despite the methods of leadership and crisis managment natural disasters will occur and the only thing we can do is be prepared as best as we can but the leadership theories and crisis management can help us keep calm and carry on.

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