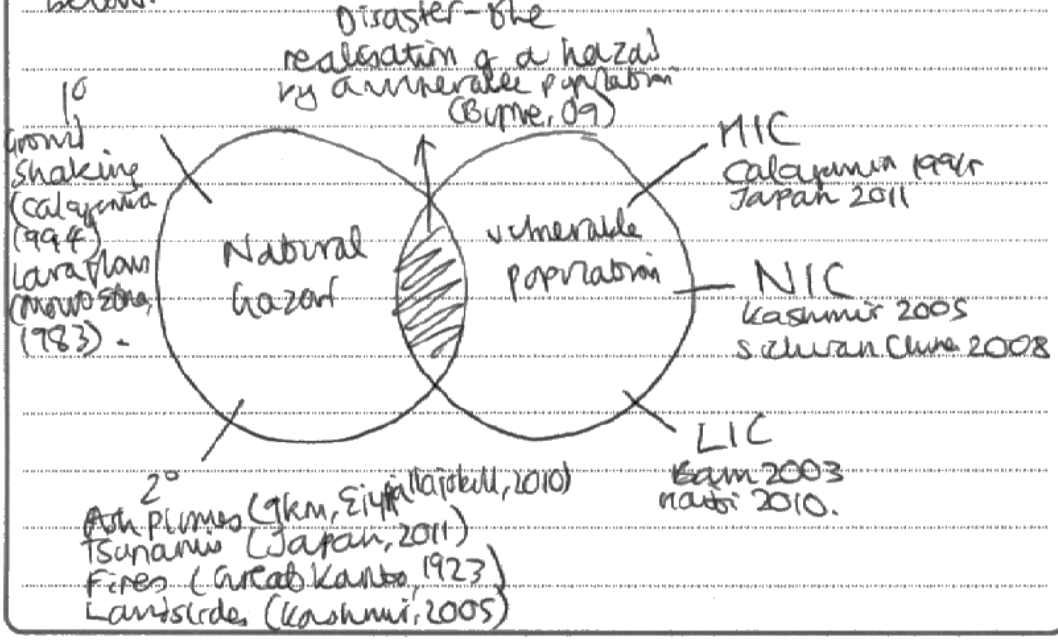
Unit 4 Examples Q1 Tectonic Hazards:
Example 1

1.0 INTRODUCTION

A tectonic hazard is a naturally occurring event which has the potential to cause loss of lives and property (Smithson, 1981). They can broadly be classed as a result of earthquakes - a sudden slip on a fault (USGS) or volcanic eruption/release of gas and lava from below a crust (IFRC). This results in either primary hazards - or secondary hazards - a hazard which occurs after the main event (Nagle, 1998) such as tsunamis - potentially devastating waves caused when earthquakes occur or large volcanic eruptions displace large volumes of rock into the sea - such as Krakatoa in 1883 (Dunn + Degg 2012). This can be shown on Degg's model (1980) - figure 1 below:

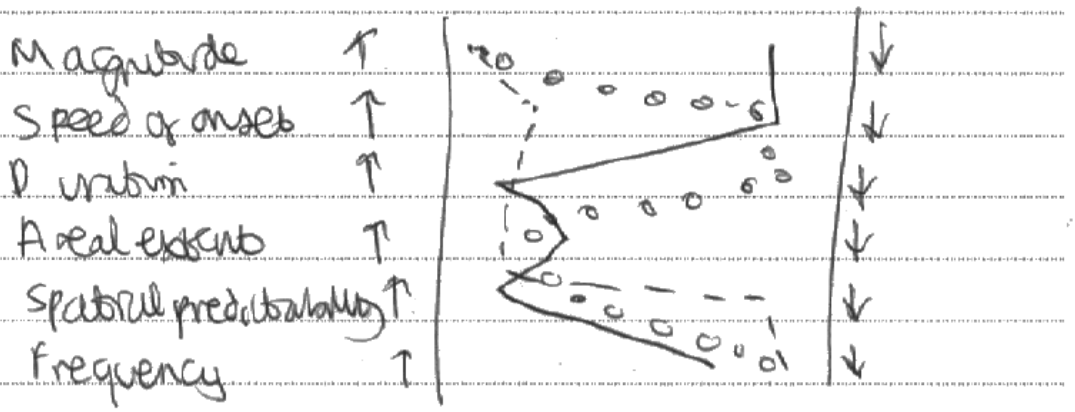


The model shows that the greater the vulnerability, the more the two circles overlap and overcome the greater the disaster. Vulnerability is the social, economic, environmental and physical factors which increase the susceptibility of a community to natural hazards (UNISDR) however, this can also be expanded to include political factors as seen in Haiti 2010. Vulnerability is also shown in the hazard risk equation. (Bypne, 09) pg 2:

$$\text{Risk} = \frac{\text{hazard} \times \text{vulnerability}}{\text{capacity to cope.}}$$

Both these models show that the most successful way of managing a hazard is by reducing the vulnerability - to enable Resilience. This is the process of becoming more adapted to withstand and recover from shocks such as an earthquake (DFID). The strategies used to manage tectonic hazards include do nothing, adjustment (based on swyth model) - of the losses, vulnerability or events itself and the choice to leave. The strategy employed depends on a complex and interlinked range of physical and human factors (Khan, 08) including the economic development of a country, and the hazard profile (Fig 3) this can affect the response which a community is able to give to a tectonic hazard - possibly making some

more successful than others

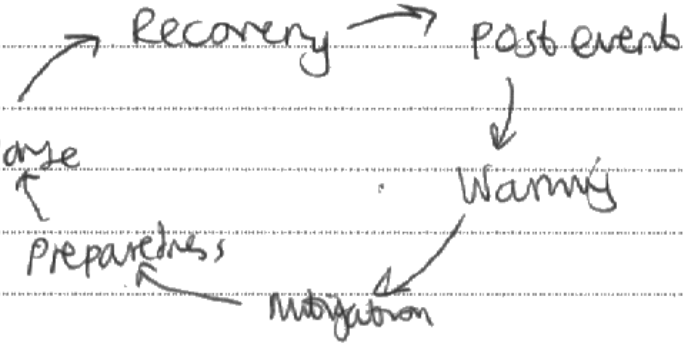


... Great Kanto earthquake

--- 2007 tsunami

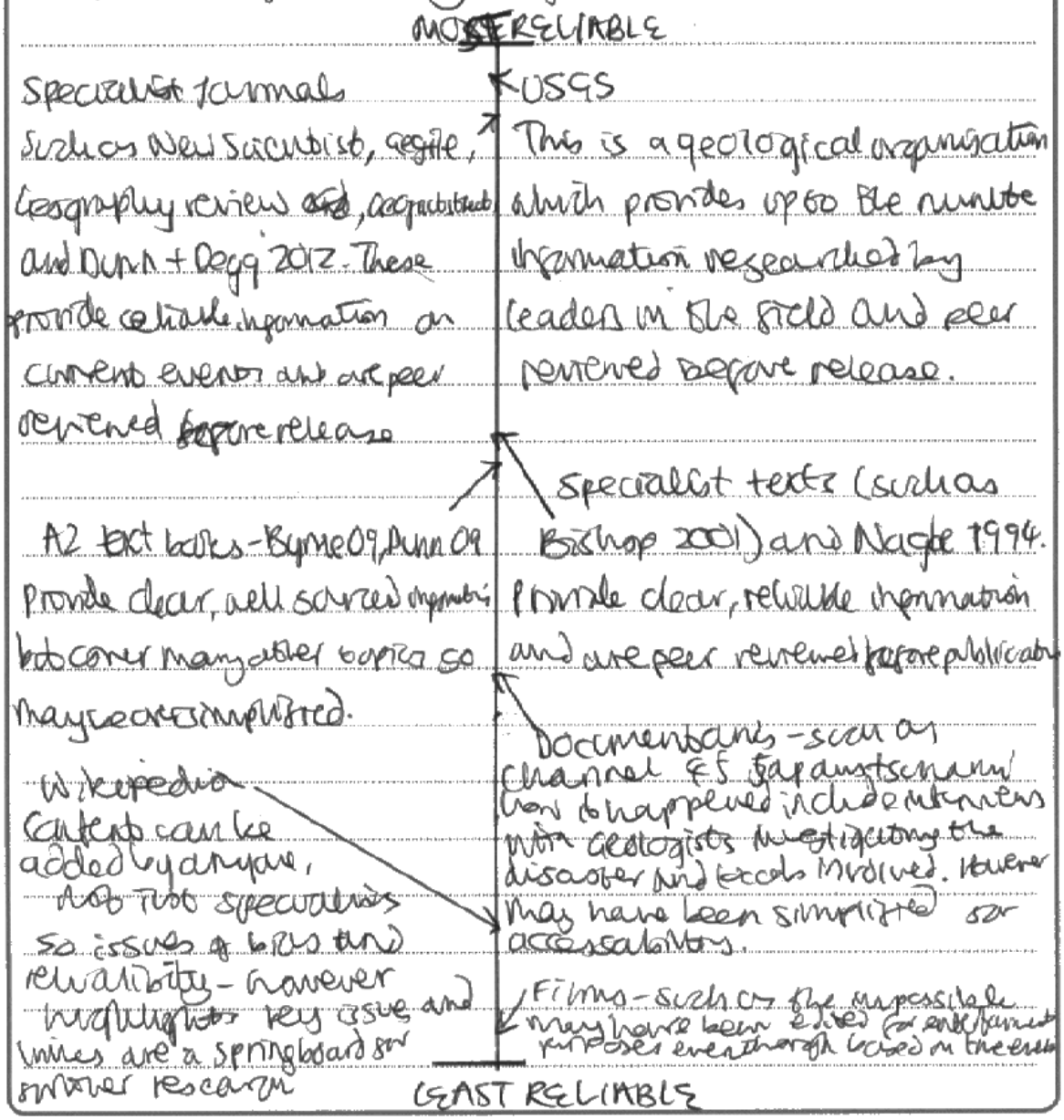
—— Eyjafjallajökull eruption

The strategies employed ~~to~~ before, during and ~~after~~ an event, and the speed of response can affect the success. The timescale over which this occurs can be shown by the hazard management cycle (Warn 08): fig 4:



2.0 METHODOLOGY

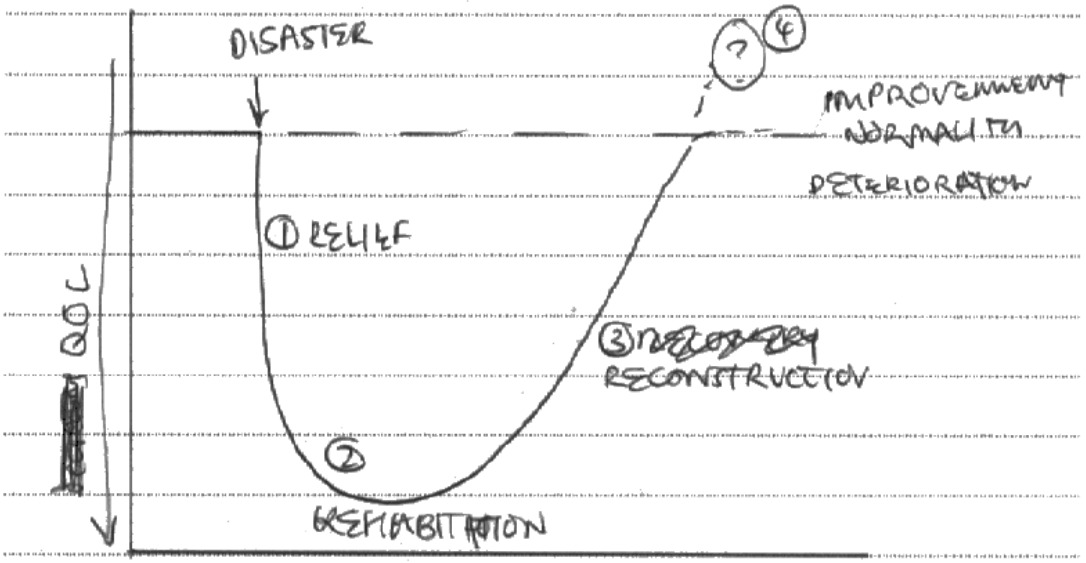
In order to research the success of the management strategies involved in managing tectonic hazards, a range of sources were consulted in order to achieve balance and avoid bias. They were evaluated based on their reliability and relevance and can be shown as a spectrum of reliability - by S.



Simply on their own, these scales are less useful than when used in combination to corroborate each other and highlight any discrepancies.

3-0 RESPONSE

According to Parker's Model (1990) fig 6 - communities pass through various stages following an disaster before the next will occur. The type of management strategies used, will influence the success of the outcome:



At ④ this can be seen as a chance between do nothing - adjust or never leave - and the impact of this choice on whether the quality of life for a community will increase or not.

3. DO NOTHING

This could be considered to be a result of a conscious choice, due to ignorance of the risks, the 'it would happen to me' attitude, or issues of National pride which prevent a country from accepting international aid (Bishop 2001). This has limited effects, as it affects socially and economically crippling and does not allow a community to increase its resilience. This was seen in the 1985 Nevado del Ruiz eruption, when 28,000 people died, due to the blind faith that they placed in the priest that no harm would come to the village (Nagle, 1998) and due to ignorance of the volcano which had been dormant for 69 years. Another example was when Thai businesses objected by the 2004 Indonesian tsunami (killed 230,000) rejected government plans to move hotels to the edge of seaside shores as they rely on income from beach hut tourism as a major source of income (Geography review, 2007). Another reason why countries may 'do nothing' to manage a natural hazard is due to lack of choice, again seen this in LICs such as Haiti, which cannot afford public spending on education. Shown by low HPI of 0.4 - where literacy rate is a component of HDI. Haiti is the poorest country in the Western hemisphere (USGS) and therefore awareness of what to do in the event of a disaster is low, and great losses are incurred (316,000 died in 2010, 7.0 earthquake).

In addition, Government corruption can force LICs into 'do nothing' as, Haiti is the 4th most corrupt country in the World and the various military coups have prevented the government organising set certain programmes. Therefore 'do nothing' can be a result of several reasons either conscious choice or other issues which force the country into this approach towards tectonic hazards. 'Do nothing' is socially and economically crippling and ensures a country is no better prepared for if the same disaster were to occur, so it of little success.

3.2.1 ADJUST LOSS

Adjustments is most common in larger cities such as San Francisco and Japan as inertia means that they cannot choose to leave, yet to 'do nothing' would be too devastating to the economy. 'Adjust Loss' is most similar to 'do nothing' as it accepts that losses will be incurred and Tob aims to insure them equally (Bishop, 2001) it does not try to actively reduce the risk of hazard itself. Again, the economic development of a country determines which strategy is used within adjust loss. In LICs, such as Haiti 2010, aid is used as people live by a 'hand to mouth' economy so cannot afford regular payments to insurance companies, they also suffer losses mostly of a human nature - not economic like HICs - so the LICs aid is more

effective, plus they back ordered records which insurance companies need when assessing existing insurance. And ~~aid~~ however can be very successful, as seen in Haiti 2010 when neat seeking technology was used to locate survivors and aid volunteers could create a real time map of needs by sending in SMS messages (USHAHIDI). In 2004 the red cross also provided a successful 'cash per work programme' in Indonesia - which meant paying the survivors for ~~work~~ were employed. In HICs, aid is less effective, and insurance is more appropriate as it provides financial support and assistance following a disaster (Dunn, 2012). (vol 1 p 4)
This could have been used in the 2010 Eyjafjallajökull eruption in Southern Iceland as a result ash entered the jet stream closing EU airspace for 6 days at a cost of £600 million to airline companies (Degg, 2012) and 650,000 farmers lost their jobs due to ash pollution on crops. Insurance is also successful as it provides cover for risk events, and since the 1994 Northridge earthquake - in which insurance companies collected less than half of the money they paid out that year (Bishop, 2001) and 20 years later the housing market still hasn't recovered (nbclosangeles.com).
Therefore both aid and insurance can help in the immediate aftermath following a disaster. They are of limited success, depending on which context they are used in. However, they do not help to increase resilience to a hazard, as they accept losses will occur.

3.2.2 ADJUST VULNERABILITY

In order for the aid responses to be effective, early warning is essential for the organisations time to prepare. This is part of adjusting vulnerability. Plus it also gives locals more time to prepare as it can send them early warning - by texts/interrupting parliamentary broadcasts on TV like in Japan 2011. Earthquakes can be difficult to monitor and so are of limited success. The strategies used vary from more proactive forms of managing annual behaviour to discharge of endangered earthquakes (Dunn, 09). They are most successful when set to monitor locations in which the seismic gap theory indicates a major event is likely to occur (Stand and Elv). The effectiveness can be shown in the comparison of Haiti 2010 @ 7.0 in which 316,000 people died (Lori Peek Society) and Christchurch 2011, 6.3 when 185 people died to balanced monitoring. Volcanoes can be monitored over a long period of time using ground and satellite techniques which indicate that a major eruption is likely to occur (CIMSS), satellite techniques include monitoring enhancement level crustal movements which indicate rising magma (Dunn, 08). They are most successful when combined as research stations - such as PHIVOLCS, established in

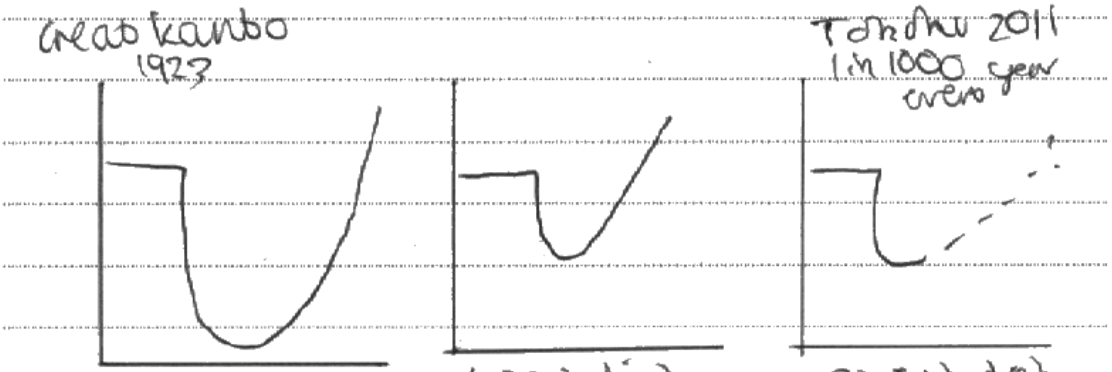
1982. In the 1977 emptions in the cesser antilles it sent an effective warning meaning only 19 died, compared to Mount Pelée in 1902 in which only 2 survived and 30,000 died as this was before PHILVOLCS was established (Nagle, 1998). 20% of the world's volcanoes are monitored in this way. Tsunamis can be monitored by the Japanese-Hawaii pacific warning station built in 1949. However, in the 2011 earthquake this did not give elderly and disabled people enough time to prepare for tsunami - so the IEWP are encouraging community preparedness scheme to increase the success of measures to adjust vulnerability. Plus: some hazards may go undetected so it is essential the community is aware how to respond - 80% of those that survive a natural hazard are rescued by other survivors (geography review 2007). This can be by community drills such as 1st September Japanese disaster preparedness day in memory of Great Kanto Earthquake, 1923, so effective in 2011 teachers in Kamaishi evacuated 3000 children to high ground (USGS) or Red schemes to teach teachers how to evacuate school children to safety from landslide cap. 19,000 died in Kashmir in 2005 plus Lalgamma school + workplace preparedness programme. Therefore there are various schemes to reduce vulnerability. This is the most successful form of management as both Deggs model and disaster risk equation show if you reduce vulnerability, you reduce risk of disaster

3.2.3 ADJUST EVENT

This is a strategy which aims to reduce the impacts of an event itself - even though it is impossible for humans to prevent natural hazards from occurring (Dunn, 09). It includes land use planning (Bishop, 2001) as high death toll of 69,000 in Sichuan, 8.0 in 2008 was thought to be due to weight of water in 700 dams lubricating the faults. However, this can also be used to lubricate the San Andreas fault. Radical technologies such as cooling lava with sea water (Heimaey, 1973) and using explosives to divert course of slow moving lava away from regions of high density (Mount Etna, 1983) plus degassing columns to prevent build up of CO_2 following the 1986 Lake Nyos disaster - (1700 people died). These are arguably of little success as they are experimental and we do not know how effective they will be.

However, building design is another important aspect of adjusting the event, which has been very successful. The development of building code, such as TMG manual systems design for earthquake resistant tests of buildings for structural resistance to earthquakes and fires (secondary hazard). The Trans-America tower was built using this code in 1972, after the 1906

San Francisco earthquake (7.7). It was unaffected in 1989 Loma Prieta as further foundations provided support. Plus cisterns/reservoirs have been built to control rising fires after water mains fractured in 1906 and 3000 died in fire. Buildings can be made resistant to volcanoes by steep sloping roofs to prevent ash build up, and against tsunamis by building at right angles to coast (Bolton, 2001) and providing Station/mobile shelters for elderly/disabled who lack mobility access to high ground (New Scientist). The effectiveness of these measures can be shown in the case of the various Park's models for Japan (pg 7):



130,000 died
Fires burnt for 3 days in Tokyo due to wooden buildings, so improved building design.

6,000 died due to poor structural resistance - lead to Hyogo framework

20,000 died as sea walls in town of Miyako sank by 1m and waves were 15m - lead to improving building design by Tohoku Recovery Village Proposal (Geographical 2011) will this lead to increasing resilience?

However building regulations are less successful in LEDCs, as in the case of Bam 2003, 100,000 were left homeless as famous popular Iranian citadel was destroyed as mud-brick buildings did not comply with regulations set in 1989.

3.3 LEAVE

This can be either short term (evacuation from an area) such as on 25th June 1997 Soufriere hills eruption of VEI 4.0, only 19 died as evacuation so effective. However, long term can also be an option, as when locals returned to the island, ~~[illegible]~~ 8,000 chose to leave ~~[illegible]~~ as 2/3rds of the island was covered in 4-5 million m³ of lava, including plymouth, capital city (Byrne 07) and excavation was not economically viable. Plus other issues includes silicosis, a lung disease caused by the quartz in the lava (Digby, 2009). Another effective evacuation was in Pinatubo 1991 (VEI of 6.0, Ultra-Plinian eruption). ~~This~~ This may not be so effective in LEDCs as emergency services are less organised they may be over-reliant on NGOs such as map action. However, it was shown when the ~~[illegible]~~ prime minister of Iran considered moving the capital, Tehran in fear of a repeat of Bam, 2003 that long term leave is ~~[illegible]~~ potentially successful in LEDCs. Plus, in the Haiti 2010 Post Disaster needs assessment, the world bank suggested decentralisation of the economy, as 60% occurs in Port-au-Prince (UN). This would be effective in reducing loss of lives and property - therefore the risk of natural hazards. However, due to financial issues, people may leave permanently and migrate to another marginal area, where they may be just as vulnerable, so without 'adapt' policies in resettlement, this management may not be entirely successful.

4-0 CONCLUSION

Therefore, it can be seen that there are a range of ~~retreat~~ strategies that can be used to manage tectonic hazards, which fall under the category of do nothing, adjust or leave. For various reasons, including the particular threats and the level of economic development of the country, one particular management strategy may be employed instead of alternatives and each will have ~~different~~ varying levels of success with the management of hazards.

Do nothing is the least successful strategy in the management of hazards, and is either a conscious choice or forced on a country due to lack of economic development (Haiti 2010). Due to lack of awareness or education, people are not in a ~~better~~ position to respond to ~~an event~~ the same hazard if it were to occur again, plus in the case of Haiti, the earthquake was made worse by mass deforestation by locals for fuel wood, and the impact of tsunamis is made worse by removal of mangroves, therefore without adequate education people may be placing themselves in a more vulnerable situation.

Adjustment is the best strategy in the management of tectonic hazards as it allows countries to increase resilience by either adjusting loss, vulnerability or event, ~~and~~ and in stage 4 of Parks model an increase in quality of life.

Leaving either short-term or long-term can have varying

degrees of success, as a whole this reduces loss of life in a disaster but in long term people may move to emerge into as marginal, therefore the success of this strategy is limited as they are just as vulnerable.
Overall addressing vulnerability is the most successful strategy, as with the Bogs model and the hazard risk equation shows if you reduce the vulnerability, you reduce the risk of disaster.

Example 2:

Indicate which question you are answering by marking a cross in the box ☒. If you change your mind, put a line through the box ☒ and then indicate your new question with a cross ☒.

Chosen Question Number:

Question 1	☒	**Question 2**	☐	**Question 3**	☐
Question 4	☐	**Question 5**	☐	**Question 6**	☐

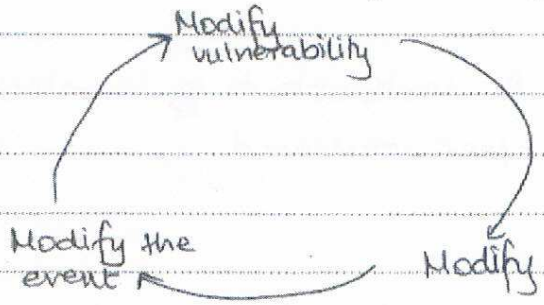
You are advised to use this page to plan your answer and then begin your answer on page 4.

Assess the reasons why the management of some tectonic hazards is more successful than others.

1.0 Introduction

Tectonic hazard refers to an event that is caused by the movement of earth's crust which threatens human life or settlement (ref. 1). The management of tectonic hazards refers to the ~~action~~ strategies that is takes place in order to reduce the impact of a tectonic hazard before, during and after the event (ref. 2). ~~The~~ ~~The management strategies of a of For the purpose of this report a hazard~~ A succesful management ~~strateg~~ depends on the strategy that has been put in place. Generally ~~the~~ better strategies are more succesful. This report will assess the different ~~strategies~~ management strategies and their success effectiveness. In order to this, a hazard management cycle will be used, (Figure 1).

Figure 1: Hazard Management Cycle



The hazard management cycle ~~concex~~ covers all the strategies that can be put in place. ~~lay~~ in ~~It covers modifying the event (before), modifying~~ It includes modification of the event (before), modification of vulnerability (during) and modification of loss (after).

In addition, Park's model will also be used in this report. The Park's model covers all the aspects of a ~~tectonic~~ hazard, pre and post tectonic hazard and helps to ~~des~~ decide how ~~country~~ countries have managed a hazard and if they have been successful.

2.0 Methodology

For the purpose of this report, various resources has been used for accurate data to ~~increase~~ the reliability and reduce bias opinions.

Source	Evaluation
Natural Hazards – S. Ross	A textbook so is reliable, peer-reviewed.
Oppenheimer	peer-reviewed journal ↳ reliable
DEC Disaster Emergency Committe	considers UK agencies for ~~Relief~~ humanitarian aid. ↳ reliable
JMA ↳Japanese Modification Agency	~~reliable~~ unless reliable as Japanese gov is biase

(For the references, look at the end of the report, page 12).

Analysis 3.0 Analysis.

3.1. Modify the event

Modification of the event ~~once~~ the relates to the strategies that takes place before an event, ~~Modification can take p~~ which can be both for volcanic and seismic hazards. For example, ~~in~~ in 1991 Mt Pinatubo eruption killed 800 people (ref 3) whereas Nevado del Ruiz, in 1985 killed 23 080 people (ref 5). The ~~main~~ reason why Mt Pinatubo ~~was~~ experienced less death toll compared to Nevado del Ruiz ~~in 1985~~ is due the management ~~strategies~~ strategy that was in place. Mt Pinatubo had implemented hazard mapping which meant that high risk areas were identified. ~~The hazard~~ However Nevado del Ruiz did not have any management strategy in place which resulted in high death toll. Similarly the prediction of a tectonic hazard with the use of seismometers makes management strategies successful. For example, ~~the~~ in ~~1988~~ 1975, ~~China~~ China evacuated 90 000 people when there was an earthquake of 7.3 magnitude, (ref 4) The reason why this management strategy was successful was because of the technology to monitor the tectonic activity and ~~the~~ swift response. ~~In the same way~~, however, Japan's preparedness for a tsunami was not enough. ~~to~~ ~~win~~ Even

with 40% of Japan's coastline with 10meters high sea wall, it still experienced the worst effects of the tsunami. This is because Japan's management was for 1 in a 10000 event however the 2011 tsunami was 1 in a 100000 event. So the magnitude of the hazard made this particular management strategy unsuccessful.

In conclusion, if a country has implemented management strategies, then they are likely to be successful and this depends on the development of the country. However the magnitude of the tectonic hazard can result in a management strategy being unsuccessful.

3.2. Modify the vulnerability

Modifying vulnerability is carried out during the tectonic hazard. Reducing vulnerability is possible due to technology advancement. For example, in Japan, straight after a 9.0 magnitude of Tohoku earthquake (ref 4), an automatic alert system sends text messages and warning on TV for public to be prepared for possible tsunami. Similarly the bombing at Mt Etna to divert the flow of lava (ref 5)

during the event ~~is successful~~ reduced the vulnerability of the people living in that area. In conclusion, ~~the~~ ~~was~~ modifying vulnerability depends on the strategies that ~~the~~ ~~took~~ is used. The alert ~~syst~~ and warning system made Japanese prepared for a tsunami. ~~However~~ ~~the~~ In addition the public awareness through ~~of~~ earthquake drills (1st September every year), and education helped this ~~manag~~ management strategy to be ~~successful~~ successful.

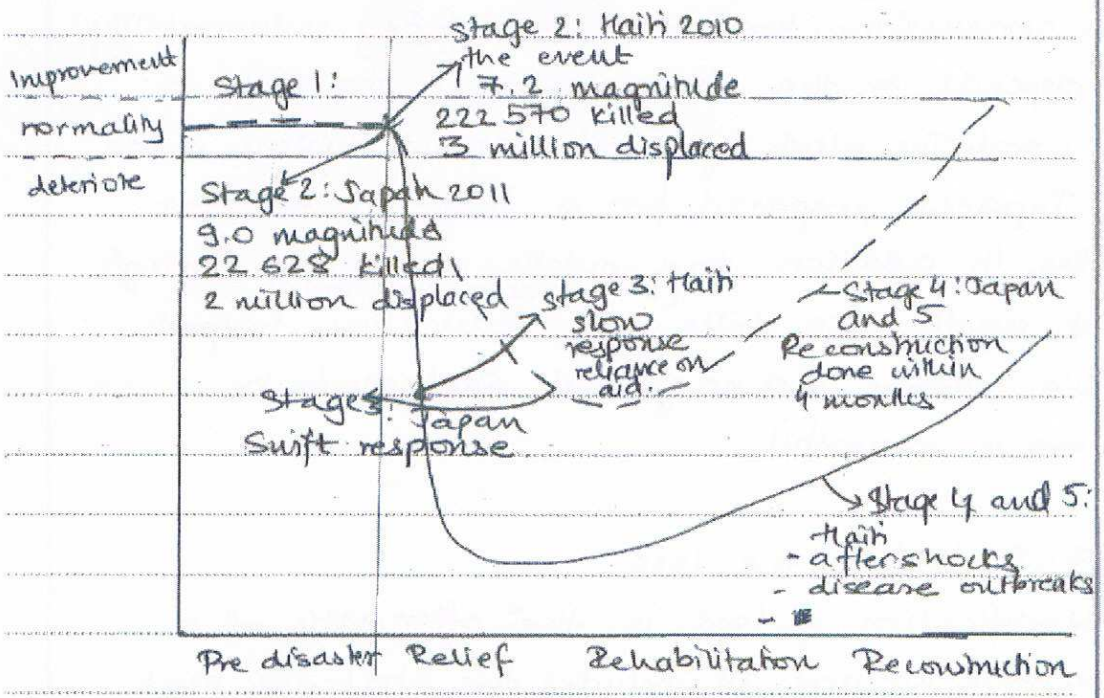
3.3 Modify the loss

Modification of loss is the aftermath of a tectonic hazard. It includes the strategies that ~~to~~ is used after the event, ~~to prev~~ such as aid. This can be best expressed through Park's Model (see Fig 2). The Park's model will compare Haiti with Japan and how each country has managed tectonic hazard.

The Park's model shows that Japan has been able to manage the hazard successfully even though it experienced a larger magnitude earthquake. Japan had a swift response to the event. It has readily trained and army that are in action straight after the event (ref 7)

▼ Figure 2 : Park's Model. Key : —— Haiti

: - - - Japan



~~(reference years and 4 and 6 7~~

(reference 4, 6 and 7)

which reduced their reliance on foreign aid. Whereas Haiti had to wait for 4 days in order to start rescuing and searching people as it relied on ~~for~~ international aid. Japan ~~has~~ finished its reconstruction within ~~NOFA~~ 4 months of the event (ref. 8) whereas in Haiti still approximately 800000 people are in need of humanitarian aid.

Another example to reduce loss burden is by leaving the tectonic hazard area:

Relocation: Chaitén

- after 1 May 2008 earthquake
- abandoned.
- reduced its loss burden. } (ref. 9)

In conclusion, the managements are successful if a country is developed as it allows the relief to be quick. ~~and return to normality.~~ It enables a country's ability to successfully ~~ref~~ ~~return~~ return to normality.

4.0 Conclusion.

The management of hazards depend on the type of tectonic hazard itself, ~~if the~~ whether a volcanic or seismic. The hazard mapping in Mt Pinatubo ~~attained~~ resulted in low death toll compared to Nevado Del Ruiz which had no management strategy before the event. The technical feasibility of a country allowed advanced methods of alerting the public through SMS texts and warning on TV like in Japan. And also the Sabo dam in Japan prevents the mudflow by trapping the large rocks and debris. In addition, bombings ~~at~~ to divert Mt Etna

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