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IMPACT ASSESSMENT OF MAJOR EARTHQUAKES IN AFGHANISTAN: A GEOGRAPHICAL STUDY

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Abstract: *The world is always at risk of earthquakes, unpredictable disasters that may cause substantial damage to life and property. Due to its location on several fault lines where the Indian Plate collides with the Eurasian Plate, Afghanistan is at a high risk of experiencing significant and frequent natural disasters, particularly earthquakes. These fault lines are assumed to be the cause of many earthquakes that happen in this area. Also, the country's lack of preparedness and socio-economic vulnerability exacerbate the impact of natural disasters, making it quite difficult for affected communities to recover. Because of years of conflict, Afghanistan is unable to handle emergencies or keep its people safe. Considering this, the following review paper tries to give an overview of the cataclysmic effects of earthquakes in Afghanistan (based on the country's past experiences) and tell the reader about the dangers and precarious situations that the country is now facing. Based on these evaluations, the study then gives some general tips for preventing natural disasters in Afghanistan and making them less tragic when they do occur. These guidelines include analyses of the best ways to respond to and recover from these disasters as well as suggestions for what to do next.*

Key words: Earthquakes, Afghanistan, Mitigation, and Preparedness.

Introduction

Since the dawn of our existence, mankind has been distressed by natural disasters like earthquakes, floods, tsunamis, droughts, hail, forest fires, etc. that overwhelm highly susceptible communities, often resulting in deaths and injuries. Today, natural disasters are often identified with the question of whether global climate change is caused, or at least partially caused, by humanity. In the present day, determining the difference between natural, man-made, and man-accelerated disasters is utterly challenging. During the past decade, over 300 natural disasters have happened every year around the world, adversely impacting the population and costing billions of dollars. (Prasad Abhaya S, et al., 2017). Human choices and activities like inequities, overexploitation of resources, extreme urban sprawls, and even climate change may add to the increased frequency and intensity of these natural catastrophes. However, calamities like earthquakes, storms, floods, etc. have had a vast impact on our planet (Mauch & Pfister, 2009). After an earthquake, children may experience post-traumatic mental health problems (Liu M et al., 2011). According to many studies, there may be a psychological impact on disaster victims who lost loved ones during the earthquake (Guimaro et al., 2011). This impact can be seen in various forms, such as increased anxiety, intrusive thoughts and nightmares, depression, difficulty concentrating or sleeping, and changes in behavior (Fukuchi et al. 2022). The dawning of natural disasters and their outcomes have far-reaching implications for regional migration and international policy-making (Heimann Leiz 2015). As a result, there is an urgent need for targeted interventions that are sensitive to the context of the disaster, as well as long-term strategies and plans to help those who have been affected by the tragedy.

Earthquake

An earthquake is a perceptible seismic event resulting from the displacement of tectonic plates beneath the Earth's surface. Throughout history, earthquakes have been thought to be one of the most dangerous natural disasters that have wrought havoc on our surroundings. The seismic activity of a particular area can be determined by scrutinizing the earthquakes that have occurred there over a specific period, taking qualitative aspects into consideration- its frequency, size, and types. (Choudhury et al., 2016). A major earthquake causes several impacts on the natural environment, as well as casualties and damage to man-made structures. It is invariably accompanied by several aftershocks, making it dangerous for people to move around; people may suffer serious injuries or even die due to falling debris; reaching people to offer aid and assistance becomes difficult and time-consuming.

Measuring an Earthquake

When an earthquake happens, it sends out different kinds of waves that make the ground move. And there are two methods to measure their magnitude and intensity: the Richter scale and the Modified Mercalli Intensity Scale. The Richter scale is a logarithmic scale, which means that each increase of one unit makes the size of the seismic waves ten times bigger. On the other hand, the Modified Mercalli Intensity Scale measures the intensity of shaking and damage induced by an earthquake in each area, considering factors such as building construction and local geology. It ranges from I (not felt) to XII (destruction). (Chung, D.H., et al., 1980); (Dewey, J., et al., 1994); and (Stover, C.W., et al., 1993).

Magnitude Scale

To quantify the magnitude of an earthquake, a complex mathematical equation is employed to convert the recorded motion data obtained from a seismometer into a numerical value. This magnitude number serves as an indicator of the amount of energy that was discharged during the seismic event. Each successive whole number measurement yields an energy release that is approximately 31 times larger than the previous whole number. Hence, it can be observed

that a seismic event with a magnitude of 2 possesses a strength that is 31 times greater than that of a seismic event with a magnitude of 1 (Singh, Deepak, et al., 2019). The Richter scale, which preceded the magnitude scale, is commonly used to refer to it. In the 1930s, Charles F. Richter developed the magnitude scale. The Wood-Anderson torsion pendulum seismograph, a commonly used seismograph, was able to measure the maximum amplitude of seismic waves (expressed in thousandths of a millimeter) at 100 km (equivalent to 60 miles) from the epicenter. The utilization of this magnitude scale enables the quantification of the energy discharged during an earthquake, facilitating comparisons with other earthquakes on the same scale. (The Richter scale for measuring the size of an earthquake is shown in Table 1). The Richter magnitudes (ML) are derived from the concept that, in all seismic events, the proportion between the maximum amplitudes of waves at two specified distances remains constant and is not influenced by the direction of propagation. The initial application of the Richter scale was conducted by Richter himself in the region of Southern California, with the purpose of evaluating earthquakes of shallow-focus nature, specifically those that were reported within a radius of 600 kilometers from the epicenter. Consequently, additional empirical tables were incorporated to facilitate observations at distant stations and on seismographs of non-standard varieties. Subsequent modifications were implemented to the empirical tables to encompass earthquakes of varying focal depths and facilitate the derivation of independent magnitude estimates from the body- and surface-wave observations, respectively. Currently, scientists and engineers employ magnitude scales to assess the comparative magnitude of an earthquake. One such scale is the P-wave magnitude (Mb), which relies on the amplitude of the P wave as detected on a conventional seismograph. The logarithmic surface-wave magnitude (Ms) is utilized to represent the maximum ground motion associated with surface waves having a wave period of 20 seconds (Rafferty, John P., 2020).

Table 01: Richter Scale Magnitude, Description, and Impact on Human-made Infrastructure

Ritcher Scale Magnitude	Description	Impact Of Earthquakes on the Man-Made Structures
1.0 - 1.9	Micro	Not felt but monitored by a seismograph
2.0 - 2.9	Minor	Felt slightly and no damage to the infrastructure
3.0 - 3.9	Minor	Often felt by people, Vibration is observable
4.0 - 4.9	Light	Vibration is felt, and no damage to the infrastructure
5.0 - 5.9	Moderate	Felt by everyone, causing damage to fragile structures
6.0 - 6.9	Strong	A strong vibration in buildings is felt by everyone.
7.0 - 7.9	Major	extremely high level of vibration damages most of the structures and is felt across a wider area
8.0 - 8.9	Great	Individuals standing on the ground tremble, as the earth shakes, causing extensive damage to infrastructure, even earthquake-resistant buildings.
Greater than 9.0	Great	complete collapse of the infrastructure.

Source: http://pubs.sciepub.com/jgg/7/2/5/index.html

Modified Mercalli Intensity Scale

A tremendously powerful and active earthquake source, the intensity of a quake is defined as the predominant impact and shock of the quake felt on the Earth's surface. The level of intensity is determined by a series of definite key responses, such as people waking up, furniture being moved, chimneys being damaged, and complete destruction and damage. Numerous seismologists have developed earthquake intensity scales in the last century. We use the term "intensity," which has its own scale, "the Modified Mercalli Intensity Scale," to describe and record how the earthquake felt (its impact) to people in the affected region. The Mercalli Scale measures the effects of an earthquake on people, buildings, and the land itself. This scale,

created by American seismologists Harry Wood and Frank Neumann in 1931, consists of increasing levels of intensity, denoted by roman numerals, ranging from barely perceptible shaking to catastrophic destruction. It lacks a mathematical foundation, instead relying on an arbitrary ranking based on observed effects. For non-scientists, the Modified Mercalli Intensity value assigned to a specific location after an earthquake is a more meaningful measure of severity than the magnitude, because intensity refers to the actual effects experienced at that location. The lower numbers on the intensity scale are frequently associated with how individuals feel during an earthquake. The higher values on the scale are based on structural damage that has been observed. The Modified Mercalli Intensity (MMI) scale uses values ranging from I to XII to represent the intensity of an earthquake based on its impact on humans and the built environment. Near the epicentre of an earthquake, intensity measurements are typically greater than those taken at a distance. It is difficult to estimate the intensity in sparsely populated areas due to the low population density. Despite this, MMI scores can still provide valuable information regarding severity levels. (Singh, Deepak, et al., 2019); (Dewey, J., et al., 1994); (Wood, H.O., Neumann, F., 1931).

Table 02: Modified Mercalli Intensity Scale, the Category of Vibration, and its Impact

Intensity	Effects	Description/Damage
I	Instrumental	Vibration is only felt by a few individuals.
II	feeble	Only sensitive people notice such earthquakes.
III	weak	People on the upper floors of the buildings notice it more. No actual earthquake.
IV	Light	Generally noticeable by people in motion; rocking of loose objects.
V	Moderate	People awakened; Unstable objects tipped over; Pendulum clocks may break.
VI	Strong	Everyone is aware of it, and many get terrified. Some heavy pieces of furniture begin to shift; there is minor damage to the property.
VII	Very Strong	Buildings that are earthquake-resistant are unaffected, whereas poorly-built or poorly designed structures sustain significant damage.
VIII	Destructive	Masonry structures are fissured; chimneys fall, causing much damage to substantial buildings.
IX	Ruinous	Damage to the infrastructures; ground cracked; pipes broken
X	Disastrous	Several buildings destroyed.
XI	Very disastrous	Few structures remain standing; rail lines are bent; pipelines are destroyed.
XII	Catastrophic	Complete devastation; ground rises and falls in waves; objects were thrown into the air;

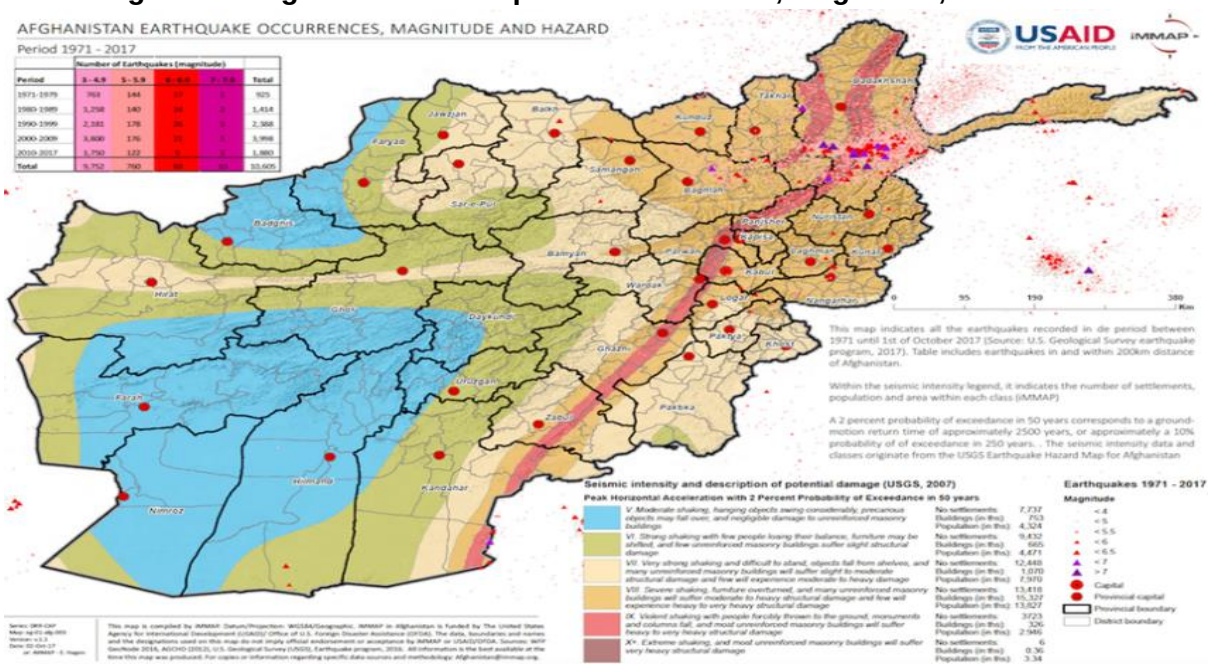
Source: http://pubs.sciepub.com/jgg/7/2/5/index.html

Seismicity of Afghanistan

The country of Afghanistan is situated within a geologically dynamic area characterised by significant seismic activity. This can be attributed to its location along the Alpine-Himalayan orogenic belt, where the Indian, Eurasian, and Arabian tectonic plates converge and frequently undergo collision, resulting in the occurrence of earthquakes. (Ruleman et al. 2007). The active plate boundary formed by the collision of the Indian-Eurasian and Arabian plates is in Pakistan and Iran to the east and south of Afghanistan. This boundary encompasses Afghanistan to the east, south, and southwest. The convergence of tectonic boundaries has resulted in the development of a dynamic subduction zone referred to as the "Makran subduction zone." Situated in the Arabian Sea, this region is recognized for its high level of seismic activity, having

been responsible for significant earthquakes and tsunamis in previous occurrences. The convergence of the Arabian and Eurasian plates has led to the geological processes that have given rise to the Zagros Mountains located in Iran. One of the most notable tectonic phenomena is the 'Chaman fault system', which originated from the convergence of the Indian and Eurasian plates. The geographical expanse in question spans a distance exceeding 1000 kilometres, situated within the southeastern region of Afghanistan and Pakistan. This geological feature facilitates the movement of the Indian and Eurasian plates in response to distinct forces. The occurrence of rupture has been documented on two occasions in history: firstly, in the year 1505, and subsequently in 1892. (Quittmeyer and Jacob 1979). The Chaman fault is a part of the larger Chaman-Sistan tectonic zone and is a moderately active fault with a slip rate that ranges from 19 to 24 mm/year (Ambraseys and Bilham 2003). As a result, the possibility of a seismic gap in the Chaman fault between 31° and 33.5° N, near Pakistan and Afghanistan, poses an imminent threat to the country's infrastructure and people's lives. (Ambraseys and Bilham 2003). The Hindukush and Pamir Mountain ranges in northeastern Afghanistan serve as a significant and dynamic epicenter of seismic activity, resulting from the complex interplay between the Indian and Eurasian tectonic plates. This area is characterized by a high frequency of earthquakes with shallow and intermediate focal depths. The sensation is experienced in remote locations within the proximate neighboring nations. The risk of ground motion in Afghanistan is elevated due to the ongoing activity of the Hindukush-Pamir seismic source within the region. Afghanistan experiences moderate earthquakes every year. On average, every 10 to 20 years, it encounters a strong earthquake that may cause significant damage and even the loss of life. A recent example is the Mw 7.6 earthquake of 2005 in Kashmir, Pakistan, which resulted in over 80,000 fatalities and displaced 4 million people. The earthquake also triggered landslides and avalanches, further exacerbating the damage and hampering rescue efforts. (USGS, 2007).

Figure 01: Afghanistan Earthquake Occurrences, Magnitude, and Hazard



Source: https://immap.org/

Major Earthquakes in Afghanistan

Afghanistan has had quakes for a long time, and some of the worst ones have happened in the last few years, owing primarily to its topography in the Hindu Kush area bordering Pakistan. It is in a seismically active area and frequently experiences earthquakes (of varying seismic

potentials), which result in widespread damage and a high number of casualties. Since 1990, Afghanistan has experienced a total of 355 recorded earthquakes with a magnitude greater than 5 (USGS, 2019). The densely populated northern and eastern regions are susceptible to severe earthquake activity, while much of central Afghanistan is seismically inert. The seismic hyperactivity in the former regions could lead to enormous damage, particularly in Kabul, the country's capital and largest city. The situation is accentuated further by the fact that most of the buildings in these regions are not earthquake resistant due to a lack of funds and weak regulation of construction standards. (The table below shows the major earthquakes that happened in Afghanistan.)

Table 03: Major Earthquakes in Afghanistan

Date	Place	Magnitude	Deaths	Injuries
1990-07-13	Hindu Kush	6.4 M_w	43	2
1991-01-31	Hindu Kush	6.9 M_w	848	200
1997-05-10	Qayen	7.3 M_w	1,567	2,300
1998-05-30	Takhar	6.5 M_w	4,000-4,500	10,001
2002-03-03	Hindu Kush	7.4 M_w	166	-
2002-03-25	Nahrin	6.1 M_w	2,000	3000
2015-10-26	Badakhshan	7.5 M_w	399	2,536
2022-06-21	Khost and Paktika	6.2 M_w	1,163	6,027+

Description of Some Devastating Earthquakes

The 1991 Hindu Kush earthquake: On February 01, a tragedy occurred in the northeast of Kabul, Afghanistan. The 6.9 magnitude earthquake was felt in neighboring Pakistan and the USSR. About 848 civilians were killed in both countries, with an average loss of over $26 million USD. The quake quivered the nation before dawn at 4:03 PST (January 31, 23:04 GMT). While people were still asleep at the time inside their houses. Therefore, they became easy victims when their adobe structures collapsed due to severe jolts and vibrations. (Maliha, F., et al., 1991). In the provinces of Konar, Nangarhar, and Badakhshan in Afghanistan, an estimated 545 people died, destroying several homes and causing significant damage. In the Malakand-Chitral-Peshawar region of Pakistan, there were at least 300 deaths, hundreds more were injured, and several houses were damaged. (NOAA). A lot of people died when millions of homes in Malakand, Chitral, and Peshawar collapsed due to poor construction. According to the Associated Press, the earthquake occurred near the Afghan border in a lawless tribal region of Pakistan. This is the same area that was destroyed 12 years ago by the civil war. Furthermore, a significant number of residences, totalling a minimum of 300, were severely damaged in the hilly locality of Arandu. Additionally, several adjacent villages were engulfed by landslides, primarily due to the prevalent construction of dwellings using straw and mud materials, rendering them highly susceptible to being carried away by natural forces. The rattling of the windows in the city of Islamabad for a minute became a source of panic among residents. According to TASS, a news agency owned by the Soviet Union, the tremors were felt strongly in Uzbekistan and Tajikistan. In Tajikistan, the tremors caused landslides that caused a lot of damage to the power, transportation, communications, and housing systems.

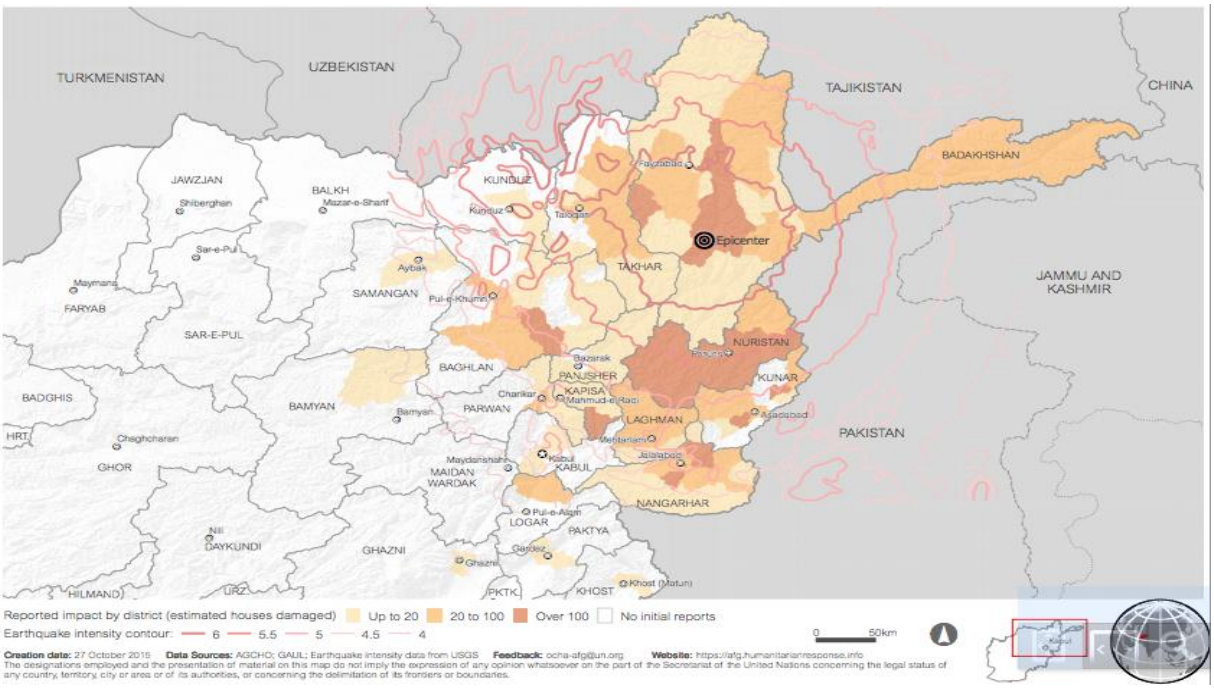
The 1998 Takhar Earthquake: On May 30, 1998, a 6.5 magnitude earthquake hit northeastern Afghanistan, about 70 kilometers west-northwest of the town of Faizabad. This was the second major earthquake to strike the region. Earlier in the year, a similar-sized tremor occurred on February 4, which called for a major international relief effort. The May earthquake was extremely deadly. A total of 4,000 to 4,500 individuals lost their lives in the provinces of Takhar and Badakhshan, while approximately 7,000 families were impacted. Furthermore, the calamity resulted in the destruction of approximately 16,000 residential dwellings. The resultant

aftershocks caused damage up to a month after the initial tremor (Barr Joe, 1998) due to the Afghan Civil War and the control of 'the Northern Alliance' officially known as the United Islamic Front for the Salvation of Afghanistan. Therefore, Afghanistan, like many other poorer developing countries, was unprepared to deal with this type of natural disaster (Peter Webber et al., 1998). The country did not have any form of protection or hazard microzonation, which caused several problems during the relief efforts (Glade Thomas et al., 2005). The remote area had no modern telecommunications network. Local customs prohibit male doctors from examining or talking to women. Roadblocks, harsh weather, and political unrest also hindered relief efforts. Because of this, there was no accurate map of the area (Funnell, D.C., et al., 2001). Many organizations had learned from previous experiences not to deploy resources in any Afghan city, so relief efforts by several organizations were directed from the neighboring countries of Pakistan in Afghanistan. Despite the lack of airfields, Rostaq in Takhar Province, which is close to the border between Afghanistan and Tajikistan, was chosen as a sub-base for relief operations. This is since it had open areas for heli operations and a road leading to Tajikistan. To launch a relief effort in the affected area, the International Committee of the Red Cross (ICRC), the International Federation of Red Cross and Red Crescent Societies (IFRC), and several other NGOs collaborated. (Bar Joe, 1998).

Nahrin Earthquake: A 6.1 magnitude earthquake occurred in Nahrin city and nearby villages in the Baghlan province of northeastern Afghanistan at 7:26 p.m. local time. Although the death toll from the earthquake was uncertain due to Afghanistan's unstable political situation, the United Nations concluded that the earthquake had claimed the lives of over 1,200 people, with many homes and buildings destroyed or severely damaged. (Ambraseys and Bilham, 2003). Based on assessments conducted by the United Nations (UN) and the Afghan government, it has been determined that approximately 20,000 families were impacted by the earthquake. This encompasses individuals residing in diminutive communities, situated on the floodplain, adjacent to the range front within the loess hills, and within the mountainous regions to the east of Nahrin. The seismic event occurred to the east of Nahrin, along a southeast-dipping reverse fault that is aligned parallel to the linear range front of the Hindu Kush Mountains, which trends in a northeast direction. It showed that the ground was not broken, liquefied, or spreading sideways. It also showed no signs of land sliding or rocks falling. The collapse of the buildings and the resulting loss of lives can be attributed to the influence of local construction practices. These practices were influenced by the buildings' proximity to the water table and their location on narrow crests of hills that experienced erosion into loess. Additionally, the residences constructed on low fluvial terraces along the Nahrin River suffered significant damage. Nevertheless, the buildings constructed on alluvial fans and metamorphic bedrocks (such as those along the Nahrin River's high terraces or along the Hindu Kush Mountains' range front) sustained significantly less damage. The occurrence of significant building failures in Afghanistan and its neighbouring countries can be attributed to several factors. One prominent factor is the utilisation of mud-block construction, which typically contains a relatively low percentage of clay. Additionally, these structures often lack adequate bracing to withstand lateral shear forces. Moreover, the failure to properly tie together wall corners further exacerbates the structural vulnerabilities, ultimately resulting in corner failures and subsequent roof collapses. Even though many of the mosques in some villages had concrete foundations and structural supports, if houses had been constructed to the same standards as most mosques, the death toll would have been significantly lower. The Nahrin earthquake was moderately small, of a size to be expected every few decades in northeastern Afghanistan and adjacent northern Pakistan, as well as Tajikistan, Uzbekistan, and Iran (Ambraseys and Bilham, 2003; Madden, C.L. et al., 2002).

2015 Hindu Kush Earthquake: On October 26, 2015, a seismic event of magnitude 7.5 occurred in the northern regions of Afghanistan and Pakistan. The epicenter of this earthquake was located approximately 45 kilometers southwest of Jarm, within Afghanistan's Hindu Kush (HK) region. Reverse faulting was the root of it. (Khalil, U. et al., 2021). The earthquake had a significant impact on various regions of Afghanistan, particularly Badakhshan, Takhar, Kunduz, Baghlan, Nuristan, Laghman, Kunar, Nangarhar, and Kabul, which experienced the most severe consequences. Consequently, a total of 399 fatalities and 7679 instances of building disruption were recorded. The center of the earthquake was 45 kilometers southwest of Jarm in the Badakhshan district and 150 kilometers northwest of Chitral in Pakistan. It caused a lot of damage to buildings, infrastructure, and people's lives. After the main earthquake, Ismail Najif et al. (2015) carried out a reconnaissance survey to evaluate the performance of buildings. The survey was done in most of the earthquake-affected areas of KPK and FATA. KPK, which was once known as the North West Frontier Province, is in the northwest of Pakistan, near the Afghan border. The most affected areas, Shangla, Lower Dir, Upper Dir, Swat, and Chitral, were among the Khyber Pakhtunkhwa regions that were hit hardest because they were so close to the epicenter. Land sliding caused the Karakoram Highway to be closed. The study showed that, in comparison to other areas of central Pakistan, the KPK districts closer to the Afghan border were relatively underdeveloped and did not enjoy particularly favorable economic conditions. Nearly, 90% of the buildings in KPK were built without any thought of how they would hold up in an earthquake.

Figure 02: Districts and Provinces with Reported Impact by Badakhshan Earthquake



Source: OCHA

Most of these structures were inadequately constructed, utilising mud or a substandard cement-based mortar, while a small number of government and exceptional buildings exhibited superior quality. However, rural buildings in the earthquake-affected region of KPK, are vulnerable to earthquake damage because their single-story high dwellings are built by unskilled house owners. Most of the damage that was seen was caused by the collapse of unreinforced, single-story houses in rural areas that were built with readily available materials like stone, adobe, mud bricks, and concrete slabs. A lot of the rural houses in Pakistan that have been damaged were built with rubble stone masonry laid in mud mortar. The provincial and national disaster management authorities have been proactive in responding to the

challenges, but a campaign needs to be initiated to examine the houses of low-income families, especially those who live in mountainous areas. The occurrence of shallow earthquakes in each area is expected to decrease if an educational programme is implemented to enhance awareness among local building owners and unskilled builders regarding cost-effective strategies for fortifying vulnerable houses and implementing basic safety measures for simple, locally-built structures.

June 2022 Afghanistan earthquake: On 22nd June 2022, a powerful earthquake with a magnitude of 6.2 in Afghanistan hit the provinces of Khost and Paktika, and as a result, many people died. (Wikipedia, 2022). The earthquake in the south-eastern region of Afghanistan caused over 1000 deaths and injured over 1500, highlighting the challenges faced by the region due to its geographic location. The place also has a history of recurrent earthquakes and other natural disasters. Furthermore, the region's population lacks access to healthcare facilities like medical personnel, beds, and medical appliances in hospitals because the people in this area are illiterate and poor. As a result, the deaths caused by the earthquake added up to make the country face a humanitarian crisis (HealthNet TPO, 2022). The occurrence of a catastrophic earthquake in Afghanistan, which took place amidst the ongoing humanitarian crisis, resulted in the loss of approximately one thousand lives, inflicted three times as many injuries, and caused extensive destruction of residential structures, particularly in the districts of Spera, Giyan, and Barmal (Hussaini S.J. et al., 2022). The Afghan people are already facing hurdles due to the withdrawal of the US and other international organizations, which has worsened the situation. Following the withdrawal, the economy experienced a severe downturn, as well as an increase in poverty, food insecurity, and malnutrition. The political transition further greatly affected the healthcare system in the country; hospitals ran out of medical supplies, and healthcare workers did not get paid for months. Even months after the earthquake, the healthcare system was in disarray and on the verge of failure. This was especially true in rural areas where people have even less access to the facilities. (Essar M.Y. et al., 2022), Yet, Care International staff, on the other hand, said that most of the victims had fractured skulls, broken bones, and multiple wounds, and pregnant women were at risk of miscarriages.

Although the injured individuals were taken to the hospital, however, the displaced survivors were not given any kind of shelter, food, or water. Due to a shortage of resources, even hospitals in the area turned away patients, and the remains of the dead were left on the streets overnight (Juanola, M.P. 2022). To prevent more losses the Afghan government launched rescue operations in the affected area, and the rescue teams arrived via helicopters supplied by the Ministry of Defense (Farrer, Martin 2022). Survivors were rescued without special equipment, and many residents were buried beneath the rubble (AFP). Supreme Leader Hibatullah Akhundzada issued an authoritative declaration, urging the Ministry of Disaster Management and regional governors to promptly mobilize towards the afflicted region. Furthermore, the Supreme Leader appealed to the global community to provide humanitarian assistance, citing an escalating death toll resulting from the ongoing relief endeavors. The interim Prime Minister of Afghanistan, Hasan Akhund, had set aside one billion Afghanis (about $11.3 million) to meet the needs of the afflicted population. He also gave permission for relief supplies to be sent to the respective areas. The Afghan Red Crescent Society provided blankets, tents, and other necessities to affected people (Faizi, F.R. 2022), but poor roadways and unfavorable weather made transportation difficult. Moreover, Poor internet access and communication tools made it hard for the government to share up-to-date information (Mangal, Farooq, January 2022).

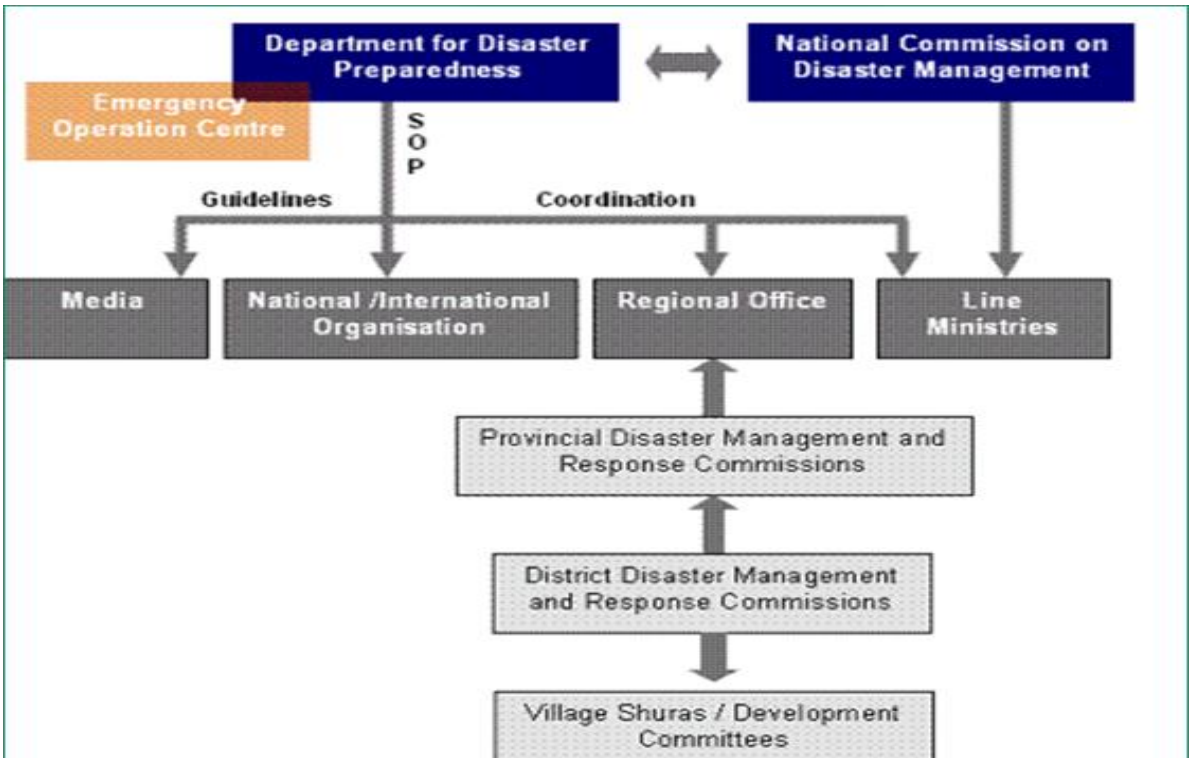
Managing Natural Disasters in Afghanistan

Afghanistan exhibits a notable susceptibility to recurrent natural calamities owing to its geographical characteristics and deteriorating environmental conditions, factors that significantly contribute to the pervasive poverty levels observed throughout the nation. Afghanistan's institutional capacity to address the adverse consequences of natural disasters has remained relatively limited despite enduring years of conflict and neglect. This deficiency in institutional capacity has contributed to the exacerbation of poverty among the Afghan population. To make Afghan communities more resilient, it is important to build up the government's capacity to better plan for and respond to crises. This could include things like making disaster risk reduction strategies stronger, making it easier to get resources and services, and teaching people how to respond to emergencies.

Legal and Institutional Framework for Disaster Management

Article 143 of Afghanistan's constitution (2004) addresses disasters and the state of emergency. The Disaster Management Act of 2012, outlines the activities associated with emergency response, readiness, and alleviating risk. (ANDMA 2017). The Afghanistan government first established a committee for disaster management in 1971, and it has operated under the same guidelines and with the same organization ever since. However, the Afghan National Disaster Management Agency (ANDMA) was restructured after the Taliban regime's collapse in 2001, leading to the adoption of several documents to lay down the conceptual and institutional framework for disaster management. This includes the Disaster Management Framework (2003), the Afghanistan Disaster Management Plan (2003), the National Disaster Management Plan (2010), and the Disaster Management Law (2012) (ANDMA 2017).

Figure 03: Institutional Structure of Disaster Management of Afghanistan



Source: https://www.researchgate.net/figure/Afghanistan-Disaster-Management Framework_fig1_318796020

The establishment of the National Disaster Management Commission (NDMC) was undertaken under the direct oversight of Afghanistan's President or Vice President, with the primary responsibility of coordinating and overseeing disaster risk reduction efforts. The NDMC

designates the Afghanistan National Disaster Management Authority (ANDMA) as its secretariat.

Main Challenges in DRR in Afghanistan

In Afghanistan, issues like security, unemployment, and poverty have often been more important than how to deal with disasters. Even though the international community has spent a lot on state-building, economic development, good governance, and other things, but there has not been much emphasis on disaster mitigation and resilience building. Afghanistan has consented to the adoption and execution of the Sendai Framework for Disaster Risk Reduction (SFDRR). The strategy under consideration was formulated in March 2015 in Sendai, Japan, with the aim of mitigating disaster risk and enhancing global resilience. To achieve this goal, the SFDRR identifies seven global targets and four priority areas of action. Due to its continuous war and urgent requirements in other sectors, the country suffers a pang of convulsions when faced with the disturbing after-effects of a natural calamity. In his 1999 speech, the former Secretary-General of the United Nations, Kofi Annan, talked about this "cycle of vulnerability" that the country's population is subjected to and asked all countries to take disaster prevention more sincerely. He elucidated that "the vulnerability of persons living in risk-prone areas is perhaps the main cause for disaster casualties and damage. The Afghanistan National Development Strategy (ANDS) was finalized in 2008 as a blueprint for eradicating poverty in Afghanistan. The plan called for the Social Protection Sector to incorporate disaster management, with a specific goal indicating that "by 2010, an effective strategy for emergency readiness and a response would be in place." According to the United Nations Office for Project Services (UNOPS), the Afghan government and the rest of the international community have not done enough to build long-term capabilities for reducing risk and vulnerability.

The Afghan National Disaster Management Authority (ANDMA), which focuses on managing natural disaster prevention, preparedness, and emergency response, is one of the existing government agencies that need a lot of determination to become strong. Also, natural disasters keep causing terrible problems in Afghanistan that affect, on average, more than 200,000 people every year. Since 1980, around 20,000 people have died in Afghanistan, making it the world's second-highest disaster-related death rate. Social conflict and crisis have been going on for a long time in Afghanistan, which is one of the main reasons why the country is in such bad shape. After more than 30 years of conflict and war, the nation-state is not far ahead in terms of social and economic development. In addition, factors like weaker coping mechanisms, less effort on disaster risk management, and lower levels of governance (like a fragile system of governance with high levels of corruption and low levels of human development) have hampered the country's potential to recover and become more resilient. Afghanistan has several policies referring to disasters and has even recognized the "Sendai Framework for Disaster Risk Reduction". Although the ineffectiveness of policy management has been a big problem for agencies, DRR activities on the ground have not changed because of the way institutions are set up. The Afghan government decided that it would be too hard to impose these rules because a large portion of the country is not under state control. However, national and international NGOs and UN agencies are the main groups that carry out DRR plans and initiatives. One of the stellar reasons why the government has limited participation in disaster risk and response activities is that it emphasizes its "peace-building agenda".

Strengthening of DRR in Afghanistan

Afghanistan must adopt a comprehensive strategy that includes disaster mitigation, preparedness, response, and recovery to minimize disaster-related human and developmental losses. This includes managing risks and making people less vulnerable, educating the public,

encouraging participation and social protection, sharing information and knowledge, building capacity, and giving money for quick responses.

Risk Governance

Powerful risk governance is crucial for identifying disaster risks in a timely manner. Implementing schemes to reduce vulnerabilities and risks from impending hazards requires developing national and local policies, supported by an adequate legal framework, and headed by institutional mechanisms that prioritize mitigation. The existing policies in Afghanistan vitalize a "response-oriented approach," in which the government responds when a disaster happens. A shift in policy from response to mitigation is a primary condition for an effective system of risk governance. A change in policy, the allocation of resources, and the resetting of institutional objectives and mandates will lead to the formation of a "culture of prevention". Another important prerequisite for a more comprehensive framework for disaster management is "disaster law." It is necessary to plan the stages involved in policy implementation, including the allocation of departmental responsibilities, as well as to support relevant legislation or policy documents. Such documents may give information regarding the risk context, outline the priorities for disaster mitigation, and specify the roles and responsibilities of all involved parties. In this situation, the goal of making a national disaster management plan for Afghanistan is to streamline disaster management systems in the country. This includes figuring out the roles and responsibilities of the National Disaster Management Commission and ANDMA, provincial offices, the Provincial Disaster Management Committee, and related line ministries, NGOs, and international organizations. The plan also outlines the concepts of principles, structures, and procedures for mitigation, preparedness, impact assessment, rescue and relief, and recovery activities, which are important for effective disaster risk management.

Risk Assessment

To reduce disaster risks in the country due to insufficient policies and organizations, Afghanistan should try to come up with ways to mitigate the effects of a natural disaster. One way to do this is to develop disaster mitigation policies through disaster risk assessment, which includes creating disaster risk maps. Knowing that assessing the risk of a disaster is expensive and takes a lot of time, it is important to decide on the purpose, scale, and scope of the assessment. For example, hazard maps can be made to show where the general hazard zones are. A database of past disasters, along with hazard mapping and an analysis of the social, economic, and environmental conditions of different parts of the country, could be useful tools for learning about the factors that make a different segment of society more exposed and vulnerable to disasters. This would help researchers figure out how disasters have happened in different parts of the region in the past and what their aftereffects were. The major gaps in national capacities for disaster risk assessment revolve around the lack of adequate infrastructure for monitoring hazards and the lack of technical expertise in various ICT technologies. However, more comprehensive assessments are advisable at the local level. By conducting such assessments, communities can better understand their risk levels and take measures to reduce the risks that are identified. Therefore, it is important to prioritize the use of microscale hazard zonation, exposure mapping, and vulnerability analysis. It is also important that disaster risk assessment should be conducted on a regular basis to stay abreast of changing risk scenarios. To conduct a disaster risk assessment, Afghanistan needs to improve the technical skills of its national institutions before it can do a risk assessment of possible disasters.

Promoting Public Awareness and Participation

For disaster management to be successful, public participation and awareness are essential at every stage of the process. This is because all disasters ultimately have indirect effects, and all mitigation work is done at the local level. Along with disaster mitigation, raising awareness among individuals and organizations can be achieved through various means, such as regular training and drills for community members, the sharing of appropriate information, and the establishment of communication channels. By engaging communities and ensuring their active participation, authorities can enhance their ability to respond to disasters and minimize their impact. Additionally, coordination among various stakeholders is crucial for effective disaster response. This includes collaborating with government agencies, non-governmental groups, and actors from the private sector to ensure efficient use of resources and avoid duplication of efforts. Building partnerships and networks at all levels can strengthen the overall response capacity and increase the resilience of communities in the face of disasters.

Social Protection

Since poverty and disaster risks reinforce each other, different studies have shown that households that experience many disasters have worsening economic conditions because they lose money or have their property damaged. The least amount of government-funded facilities is available to poor families, which makes it hard for them to get back on their feet after a disaster. Often, poor families have a low chance of spending money on disaster mitigation due to the cycle of poverty and disaster losses, which leads to increased poverty and disheveled living conditions. Therefore, the reduction of structural poverty is necessary to make poor communities less vulnerable to disaster risks. To reduce the poverty of families in Afghanistan, various microfinance programs can be developed. These programs would provide small loans to individuals and groups that lack access to traditional financial institutions. Through these loans, individuals can start or expand small businesses, which can help them become more financially stable and less at risk during natural catastrophes. Furthermore, raising the awareness of community members to actively participate in disaster preparedness and response efforts can enhance the effectiveness of risk reduction strategies.

Knowledge Dissemination and Capacity Building for Preparedness and Response

Information plays an insistent role in the efficient management of disasters and orderly transitions from response to recovery. A good analysis of the risks of disasters, supported by formal institutional, legal, and financial capacities, is needed to make sure that the community is ready to deal with the problems that come with any kind of major disaster on all levels. In addition to this, it is important to do a thorough analysis of what is needed, set up early warning systems and backup plans, stockpile equipment and supplies, make plans for coordination and evacuation, share important information, and do training and field exercises, etc. Information management and analysis are important tasks that need to be done. Even before taking any action in the aftermath of a disaster, it is important to gather reliable information about the affected populations and their needs. However, people living at the periphery are often overlooked because most needs assessments generally do not scrutinize gender-specific and age-based analyses. In many cases, the countries do not have access to collect the necessary data to track and examine the entire process. A lack of capacity to collect and utilize data and information on disasters leads to ineffective disaster management. And Restoring data on hazards and vulnerabilities, developing risk assessments, and using these as the foundation for disaster mitigation plans, emergency responses, and post-disaster recovery are all critical steps in disaster management that can even prove successful in dealing with a post-disaster scenario in a country like Afghanistan. Moreover, Afghanistan's Ministry of Education should teach disaster risk management in schools and universities so that students have the skills

they need to deal with natural disasters. Adding training programs for officers already on the job, new recruits, and the public would help them deal with emergencies more effectively. It will not only increase public confidence in the government's ability but also assist in the prevention of panic and chaos during disasters.

Financing Response

A well-managed funding mechanism is indispensable for emergency relief and early recovery activities since state agencies do not have the money to meet people is needs and fix basic infrastructure and services. Disasters have a significant effect on the social and economic well-being of a country. This is especially relevant in a post-apocalyptic country like Afghanistan, where the government does not have the money to renovate and rebuild the most critical infrastructure or help the private sector with its assets. The vulnerable segments of society further suffer post-disaster poverty due to a lack of national funds. Financial and monetary aids are needed to provide ex-post resources and inducement for lowering risk and adapting to climate change and post-conflict situations.

Approach

This review paper took a qualitative approach and was based on empirical data from secondary sources like reports from the government of Afghanistan, the UN, and other organizations, research articles, review articles, and other internet-based sources.

Conclusion

While it is impossible to prevent earthquakes from happening, there are several mitigation measures and actions that can substantially lessen their impacts. This may include building with earthquake-resistant materials, instituting early warning systems, and developing emergency response plans. It is necessary to understand that this process is not a one-time event but rather a continuous effort on everyone's part. Regular monitoring and evaluation of the effectiveness of the mitigation measures should be conducted to ensure that they are achieving the desired outcomes. However, in the case of Afghanistan, a more cost-effective course of action would be to construct new roads and keep money aside for damage repairs rather than reconstruct or resurface existing roads. This approach will not only reduce costs but also ensure that roads are able to withstand extreme weather conditions. After a natural disaster, it may take many years for a community to grow, and the main question lies in the rebuilding efforts that must focus on both short-term and long-term objectives, considering the needs of the community as well as the resources available. To ensure effective recovery, a collaboration between government and non-governmental organizations is essential. Additionally, the creation of a comprehensive disaster recovery plan should be a priority for all communities at risk of future disasters.

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