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## Dimension of Disaster and Coping Strategy in Nepal (1971 – 2020)

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### Abstract

*The people of Nepal today, are victims to perform disaster events. The combined efforts of the government and non-government sectors are seemed to reduce the impacts of growing and changing disaster patterns. This article provides an overview and results of Nepal disaster vulnerability and achievements of the government and non-government efforts. The impact of efforts has been monitored on the based-on disaster and mortality rate of disaster. This study was carried out based on 42,878 total disaster events and 44,782 deaths that occurred within 50 years period (1971-2020). The information has been pulled from the website of the national planning commission for 15 different periodic plans. And for the disaster detail, statistical data (incidents and death) has been also carried out from the website. Some statistical tools were used for the analysis. Statistical analysis found the number of total deaths is increasing, the event/death ratio is decreasing. The pattern of disaster has been changing in Nepal. The planning and legal efforts seem somehow positive for the case death rate on average.*

**Keywords:** *disaster events, causality, strategy, accident, cost of disaster, climate change*

### Introduction

Extreme weather events that cannot afford by mankind caused several losses (human and property) is called a disaster. Climate change and extreme weather events might cause-effect relationship. Manmade innovation and its hazardous implication could return to painful results, like an airplane crash, road accident and huge dam outburst, etc. are unaffordable by local people is called a disaster. Disaster might explain the interaction between the earth's surface and its troposphere events and vulnerable people. Disaster is a natural phenomenon whither it is sudden or regular happen and it might loss of life and property (Aryal, K. R, 2012).

Most often, we use these words to describe a crisis triggered by a natural hazard such as an earthquake, hurricane, tsunami, or flood. It is a rapid-onset emergency it has been sudden happened and destructive force. Yet “disaster” is also used to refer to slower-moving environmental catastrophes such as droughts, epidemics, and climate change. And some disasters are technological or human in origin: shipwrecks, airplane crashes, nuclear meltdowns, and war. What

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we label “catastrophe,” in other words, encompasses a wide and diverse range of events and states of being none of them good (Irwin and Smith, 2020).

## **Background**

The fragile geology and steep topography have made Nepal more vulnerable and hazard-prone physically. In addition, Due to the poor human development index and economic development, people have been worried, and they invite several incidents like fire, drought, famine, and other health hazards (Diarrhea, malaria, measles, hepatitis, influenza, typhoid, asthma, cholera, sexually transmitted disease, tuberculosis, and leprosy) make them more vulnerable. The fragile geology and steep topography have made Nepal the 20th topmost disaster-prone country in the world. Among 200 countries, Nepal ranks 4th, 11th, and 30th regarding relative vulnerability to climate change, earthquake, and flood hazards respectively (Khanal,2020).

The country has been facing a high risk of damage due to its young geophysical structure, high peaks, steep slopes, complex geology, variable climatic conditions, and active tectonic processes. The United Nations Office for the Coordination of Humanitarian Assistance (OCHA) hazard map displays the metrological and seismic hazards the country is exposed to in aggregate. People believed, most natural disasters in Nepal consist of flooding or landslides. High rainfall intensity deforestation, rapid population growth, and unplanned settlements help the Nepalese vulnerable. An average of 300 people dies each year due to floods and landslides with annual economic damages exceeding USD \$10 million (Pezard, et. al, 2016).

## **Review of Periodic plan**

- First periodic plan (1956-1961) had been incorporated to resettle the flood victim people to the Rapti Valley Multi-purpose plan. The same plan had focused on compulsory vaccination for malaria control measures. A safe drinking water supply was encouraged to reduce water-induced diseases.
- Second (1962-1965): The Royal Constitution of 1959 has been suspended in 1960 and it failed to materialize however road construction, telephone installation and some irrigation sector improvement plan.
- Third periodic plan (1965-1970) put Malaria, Small Fox, and Tuberculosis eradication program with the help of UNICEF and WHO. Re-forestation, Soil conservation, and fire line concept were planned.
- Fourth periodic Plan (1970-1975) focused on forest conservation, collection of hydrological and Metrological data, and started to sewerage system along with drinking water supply.
- Sixth periodic plan (1980-1985), considered to balance between people and environment. Environmental aspects had been considered as a matter of policy while developing plans and implementation.
- Seventh periodic plan (1985-1990) was focused on ecology, land use policy, and weather forecast. River control works was a special program in partnership with local people. A topographical survey and map production plan was kept. The tariff Survey and Research program was kept reducing and controlling traffic accidents. To reduce forest dependency and carbon emission, biogas plants, solar and wind energy were planned.
- Eighth Periodic plan (1991-1996/97): This plan kept forest development, soil conservation, and watershed management plan. In addition, collection data for water-induced hazard control

and river control program was planned. Further, this plan kept plan water quality, water level forecast, air pollution, and Glaciological study.

- Ninth Plan (1997-2002): This plan was focused to prepare necessary guidelines and standards to control industrial pollution, preparing Tribhuvan International Airport during natural calamities such as earthquakes and floods, and other emergency situations. Some educational programs were planned. They are environmental science and microbiology. Also, this plan kept diarrhea control and an epidemiological program.
- Tenth periodic plan (2002-2007): The plan widely put conservation of environment. The integrated development of social, economic, and environmental aspects was stressed keeping in line with the inter-relationship between poverty and environmental depletion.
- Eleventh periodic plan (2007/8-2009/10): The plan kept establishing of Himalayan Climate Research Center. The plan kept the study of rivers and lakes and output displayed on the hoarding board with a thematic map. Further, the plan kept the concept of environmental impact assessment, River cleaning program, and environment protection.
- Twelfth periodic plan (2010/11-2012/13); This plan had focused on compulsory use of housing code. It had introduced formally to natural and manmade disasters and put to do Pre-disaster assessment of every development works. The plan had believed to work together with NGOs and Government. Capacity building to Nepal Army, Nepal police establish fire brigade in the municipality, made plan to disaster risk reduction in 75 districts were planned.
- Thirteenth periodic plan 2013/14-2015/16: Climate change adaptation, the concept of carbon gas marketing was focused on this plan. The plan had been kept to jointly work of Government, private sector, and NGO together to combat with disaster as a cross-cutting issue were kept in this plan.
- Fourteenth periodic plan (2016/17-2018/19): This plan adopted the Paris agreement with UNFCC on greenhouse gas emission, finance, and adaptation. It adopted developing weather radar, Glacier Lake outburst study, and other scientific data collection and dissemination.
- Fifteenth periodic plan (2019/20-2023/24): The running 15<sup>th</sup> plan adopted the Sendai framework of 2015-2030. It has a plan to develop three-layer hazard mapping at federal, state, and local levels. This plan introduced a separate chapter of disaster risk reduction and management, environment, climate change, and water and weather science. This plan agreed to the “build back better development” concept.

## **Legitimacy Review**

### ***Constitution of Nepal 2015***

The Constitution of Nepal 2015 provides the people who live in the Nepal territory have the fundamental right to live in a clean environment. And victim people shall have the right to obtain compensation, in accordance with the law, for any injury caused by environmental pollution or degradation. Part three of the constitution clears that to make of necessary legal provisions for a proper balance between the environment and development, in development works of the nation.

### ***Acts and regulation on Disaster Risk Reduction***

The first act on disaster risk reduction was formulated in 1982 in the name of the Natural Disaster Relief Act (NDRA). It is also known as Natural Calamity Act (NCRA). It has four amendments made. They are on 10 Nov 1986, 27 Oct 1989, 30 September 1992, and 21 January

2010. This act is already replaced by the Disaster Risk Reduction and Management Act 2017. Furthermore, some cross-cutting acts of different issues have been made at different times.

### ***Soil and Watershed Conservation Act 1982***

It is one of the major disaster risk management acts which has defined soil and water conservation as a function of controlling and saving landslides, floods, and soil erosion. It is for the central/federal level preparedness and relief act.

### ***Water Resource Act 1992***

It focuses to minimize the adverse effect on the environment by way of soil erosion, flood, landslide, and similar other cases.

### ***Forest Act 1993***

Forest Acts 1993 aims to design a comprehensive structure of forest resources protection through the private, community, and religious sector in Nepal from the perspective of disaster management.

### ***Environment Protection Act 1996***

Environment protection acts, 1996 has made provision of environmental impact assessment of the purposed development activities before it is carried out.

### ***The Building Act 1998***

It has made provisions for the regulation of building construction works to protect buildings from earthquakes and fire. And it is locally implemented.

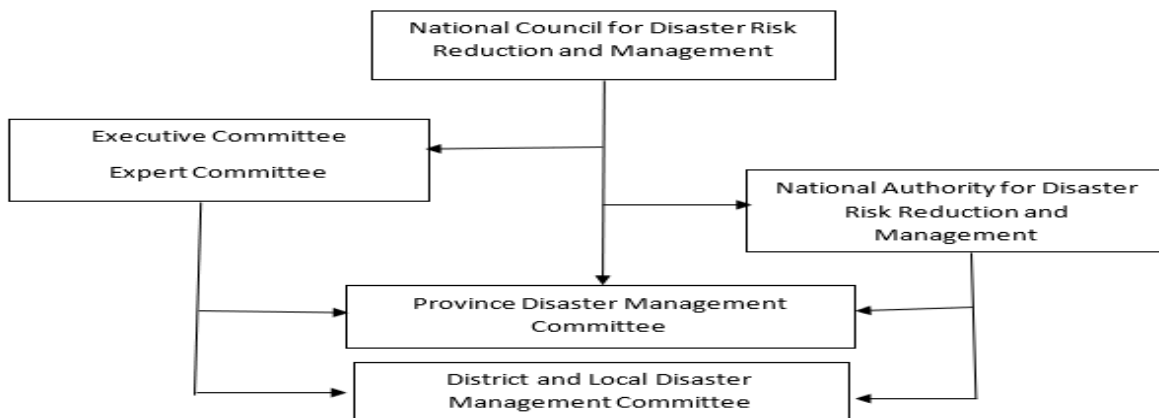
### ***Local Government Operation Act 2017***

Local Government operation acts empower local bodies to govern themselves. It recognizes that local people and local bodies are the most appropriate point of entry to meet the disaster management need at the local level and it replaced to self-governance act 1999.

### ***Prime Minister Relief Fund Regulation 2017***

Prime Minister Relief Fund is mobilized for the relief works to the victim after a disaster. It cannot talk pre-disaster and rehabilitation.

### **Intuitional arrangement for disaster management**



Source: Disaster Risk Reduction and Management Act 2017

## Rationale

At the time of the Rana Regime, Request letters were widely used for relief support those were cash and kind had practiced after the disaster. The first time, in 1982 the natural relief Act (NDRA) also known as the Natural Calamity Relief Act (NCRA) was formulated then disaster management was incorporated at the policy level in development. This is the time to evaluate it regarding disaster risk reduction. There are a lot of works of literature that have been described the total disaster losses, incidents, and painful stories. Efforts, incidents, and losses need to be analyzed in one basket, and it can evaluate the government investment result over time. The spatial distribution of occurrences of disaster events can be visualized, and it gives an idea to cope with disaster. Here, in Nepal, disaster management started from an ad-hoc basis and now the constitution of 2015 ensures safety people is a right

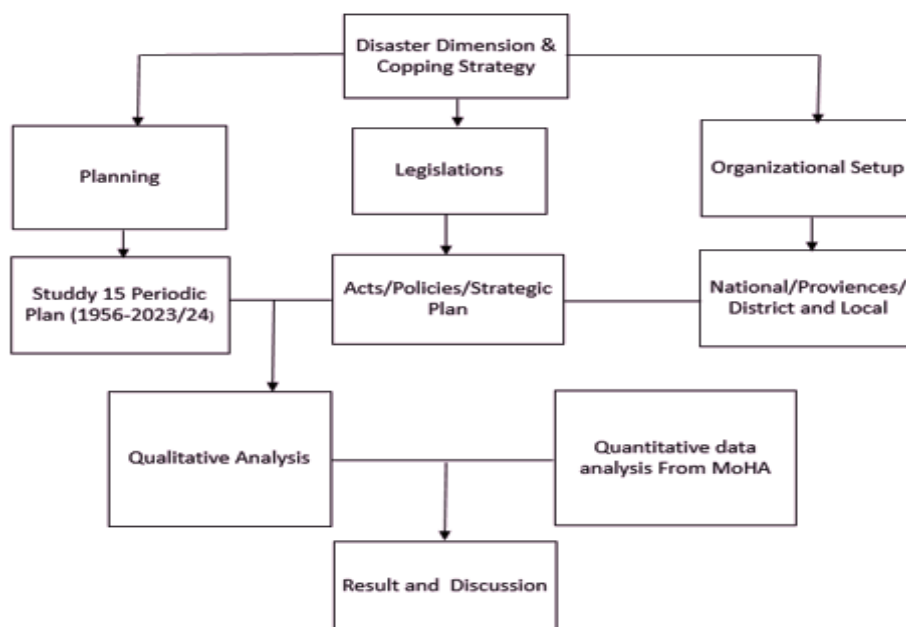
## Objectives

The objective of the study is to analyze disaster acts, policies, and periodic plans special regard to disaster management and other policy-level regulation. In addition, the overview of the disaster dimension, its trend, and losses of human life is analyzed as an outcome.

## Methods and Materials

The study is carried out based on published and unpublished literature. Descriptive type information is pulled out from the National planning commission's website (<https://www.npc.gov.np/en>). They are 15 periodical plan documents. Statistical and numerical data has been pulled out from the website of the Government of Nepal, Ministry of home affairs. This website is [www.drrportal.gov.np](http://www.drrportal.gov.np). There are two sources as Desinventar and MoHA (Ministry of Home and Affairs). The data of 01/01/1971 to 04/13/2011 (20,527 numerical data) was pulled out from the Desinventar source and further data of 04/14/2011 to 01//1/2020 (24,255) pull out from the MoHA. There are different 23 types of disaster events listed on the website. After pulling out the data, Microsoft excel has been widely used for trend and losses analysis. Linear equation and regression analysis have been used for the loss trend and disaster case death ratio.

## Conceptual Framework



## Results and Discussion

### Disaster losses and Dimension

Nepal has been facing different types of disasters incidents in different periods to various geographical territories. Disaster share significant losses of total GDP and it seems one of the vital subjects of implementation to reduce poverty in Nepal. The annual average losses were calculated to 165215 million NRS (Khanal B.N. 2020). In the case of life, there were 44782 people who had lost their lives in the study fifty years period with 42878 total events listed. There are 23 different types of disasters listed.

Table No. 1: Total disaster events, total death, and case death ratio (1971-2020)

Events	Total case	Events	Total Death	Case	Case/death Ratio
<b>Fire</b>	18269	Epidemic	16699	Earthquake	1/31.7
<b>Landslide</b>	5015	Earthquake	9845	Epidemic	1/4.5
<b>Flood</b>	4981	Landslide	5579	Boat Collapse	1/2.2
<b>Epidemic</b>	3708	Flood	4067	Avalanche	1/2.2
<b>Thunderbolt</b>	3122	Thunderbolt	1980	Cold wave	1/1.3
<b>Heavy Rainfall</b>	1203	Fire	1945	Landslide	1/1.1
<b>Hailstorm</b>	776	Cold wave	870	Animal Accident	1/1.0
<b>Cold Wave</b>	695	Boat Collapse	369	High Altitude	1/0.8

Source: Derived from [www.drrportal.gov.np/](http://www.drrportal.gov.np/)

Fire disaster is predominant in Nepal every year. The property losses are high, but the case death ratio is calculated to 1:0.1. The forest fire in Nepal occurs in the dry season of April to June. Fire takes place mostly in the rural area of Terai and middle hill. The houses of that area are close and made of straw, reeds, and timber. The total fire incidents have been recorded to be 18269 (42.6 percent) of total disaster incidents. There were 1945 people had got death (Table 1).

Landslide and Flood seem common disasters in Nepal. They seemed 2nd and 3rd position in the case and shared 3rd and 4th position for death. The northern hill area has more frizzle topography caused more landslides and the southern plain is worried by floods every year. Epidemic seemed in the fourth position in terms of the case. It took death to 16699 in the first 48 years (1971-2018) and after 2011 the death rapidly came down and the recent past two years (2019 and 2020) found zero death (op. cit).

Thunderbolts ranked in the fifth position. Every year more than 62 events have been recorded and it has been taken around 40 lives annually. Road accidents have come a greater

worrying subject in the late recent period. It has been taking a lot of lives and property. Climate change and global warming have been helping to sudden weather events like heavy rainfall, cold wave, and hailstone in a short period of time in local territories.

Earthquake is known as a natural phenomenon, and it has been taking a lot of life and property for a long time. On 25 April 2015, a 7.8 magnitude earthquake was recorded in Nepal. The epicenter of this strike was in Barpak (28.230° North and 84.731° East) of Gorkha district. It is 60 kilometers northwest of Kathmandu. This strike had taken 8891 life and it had injured 22303 seriously. Around 600,000 households were damaged. The 14 surrounding districts were severely affected, and the government announced international assistance.

## Dimension

The disaster rank and its pattern is shown in table 2. Since past, disaster pattern has been changing in Nepal. Some scholars believed; the Nepal area has been struck several seismic waves for the mountain building process. We have found some data of the 1934 great earthquake and further. Due to fragile topography landslide and flood has been common here. It is defined as an interaction between human activities, topographical and an atmospheric event that is related to local people's capacity. So physical events itself is not a disaster unless it is not a local people hazard.

**Table No. 2:** Disaster rank and ranking pattern (1971-2020)

Incidents	Ranked Based on Total Events					Ranked Based on Total Death				
	1971-1980	1981-1990	1991-2000	2001-2010	2011-2020	1971-1980	1981-1990	1991-2000	2001-2010	2011-2020
Fire	1	1	1	1	1	6	6	4	5	4
Landslide	4	4	4	4	2	2	2	3	2	2
Thunderbolt	7	6	5	6	3	3	5	5	7	7
Flood	3	3	2	2	4	4	4	2	4	3
Heavy Rainfall	8	9	11	12	5	11	12	11	14	10
Road Accident	20	20	21	5	6	5	3	19	17	17
Animal Accident	19	19	20	21	7	7	20	18	16	16
Windstorm	23	23	23	23	8	10	23	23	23	23
Cold wave	18	17	17	8	9	8	7	9	13	15
Earthquake	13	8	14	20	10	1	19	17	3	6
Epidemic	2	2	3	3	11	9	1	1	1	1

Source: *Derived from [www.drrportal.gov.np/](http://www.drrportal.gov.np/)*

The data mentioned in the table 2 indicate that, there is only one fire disaster that is continuously predominant in all 50 years. It is calculated fire disaster ranked in number one in all year. In terms of fatality, fire disasters have been improved in recent past years. Fire disaster has been calculated 6th position in recent past decade whereas it was ranked to 4th position in 1971-1980. Landslide disaster has been increasing. It comes up the second position from 4th position. And in fatality landslide is calculated the second position in almost all year. Thunderbolt comes up to the third position from the seventh position in both cases of incident and death. Flood is commonly occurring in southern Terai. It's has been ranked down to the fourth position from the third position in both parameters. An epidemic had been continuously dominated for the last forty years (1971 – 2010). It was calculated second and third position in last forty years and it comes down in eleven positions in last decade of 2011 – 2020.

Extreme weather events like heavy rainfall are rising issues and it rises to the fifth position from eighth. Development issue like road accident is coming burning issues. It has been ranked up

to the sixth position in 2011 - 2020 and whereas it was ranked twenty in 1971 - 1980. In the case of fatality, it comes up to a fifth from seventeen. An ecological issue like wild animal accident comes up to the seventh rank from nineteen. And fatality rise to seven from the sixteenth. Wildlife attacks are very severe (Maharjan et. al 2017) in most places especially close to the forest and national park throughout the year. Since the valley is surrounded by national parks and forests, farmers have faced the impacts from wildlife all year round.

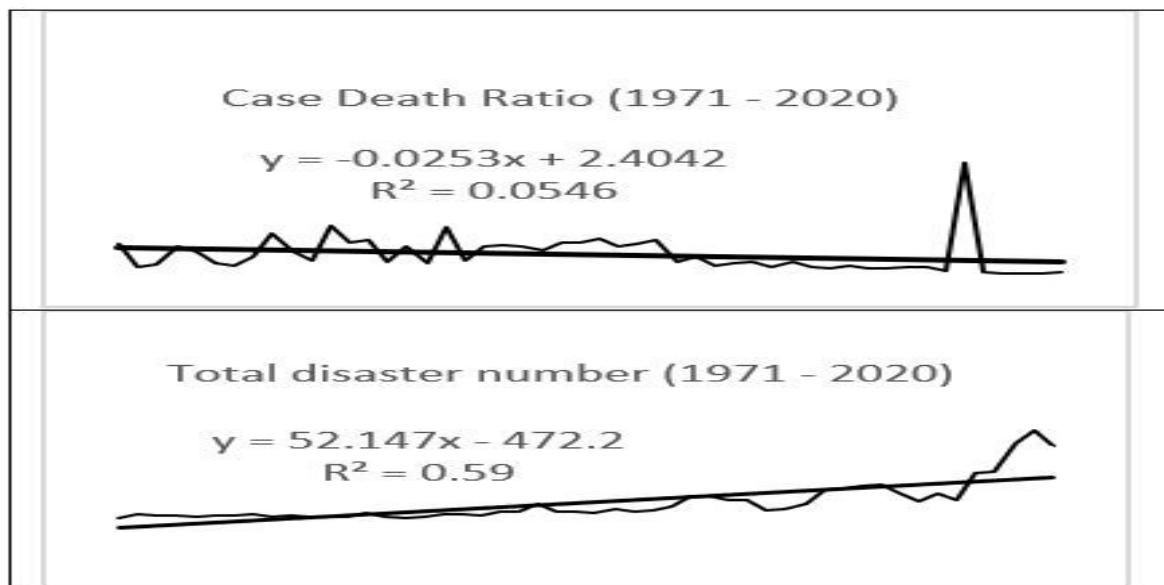
### Losses trends result in general

In Nepal, it was calculated to 896 people have been lost their lives each year from the average incident of 858. The major disasters are recorded as earthquakes, landslides, thunderbolts, floods, Accidents, fires, Animal Accident, and extreme weather events like cold waves, heavy rainfall, and storm. Despite the increasing population and disaster events, the death number is coming to decrease apart 2015 in Nepal. In 2015, the horrible earthquake took 8972 lives in Nepal, whereas the total number of deaths was 22861 in the world. This number comes to 39 percent. From the second half of the 20th century, the death rate is continuously declined in the world too.

Case death ratio of the disaster of Nepal has been continuously decreasing with up and down in a different year. Total case recorded to 42878 in fifty years. And 44792 people got death. So, the Case death ratio was calculated to 1:1.04. The case death ratio was 1: 2.7 in the base year of 1971 and it dropped down to 1: 0.1 in 2020. In between the ratio seemed up and down. The maximum ratio was in 2015, which was due to a terrible earthquake.

The disaster incident has been continuously increasing. The lowest case was record in 1986. It was recorded to 109 events in 1986 and the maximum case recorded in 2019 of 4483. The maximum death happened in 2015. Total death has been recorded to 9307. A horrible earthquake took 8972 lives. It is calculated to be 97.5 percent of the total death over the country that happened from different disasters. Minimum death happened in 1977 that was 150. Both sides (death and case) have been increasing in total, but incidents death ratio seemed to decrease. This is the positive result of our interventions.

**Figure 1.** Incident number and case death ratio trend (1971 – 2020)



Source: Derived from MoHA (Ministry of Home and Afire)



Although, there is decreasing incident death ratio on average there are some disasters that have an increasing ratio. They are cold waves, earthquakes, heatwave snowstorms, and windstorms. It seems the extreme weather type disaster is coming to increasing challenges. Storm looks like no change, and it is the same line throughout the period. Rest events are decreasing the death ratio. Epidemic, landslide, flood, and boat collapse are in the steep slope towards decreasing. So, we can say the government and non-government effort looks effective effect to reduce the death ratio and need to furthermore focus on new increasing type disaster.

## **Major casualties in Nepal**

### ***Earthquake 2015***

According to a global report on disaster rank, Nepal ranked 11th position of earthquake risk. In this period (1971 – 2020), Nepal has faced two major earthquake disasters. On April 25, 2015, the terrible earthquake struck the north middle part of Nepal located at Barpak of Gorkha District (28.230 North, 84.730 East) It was recorded to 7.8 magnitudes. It was the second horrible event after the 1934 earthquake (8 Magnitude) in Nepal. It had taken to 8972 human lives and 22 thousand injured suffer. Half a million houses collapsed, and another 250,000 were partly or wholly damaged. More than seven hundred nine billion rupees worth of economic loss was recorded during the review period (2015 to 2017), out of which about 99.5 percent of loss was due to earthquake alone (GoN,2017). It also caused a lot of dry landslides to the new mountain range of Nepal. The nation was busy that period making a constitution from the constitutional assembly.

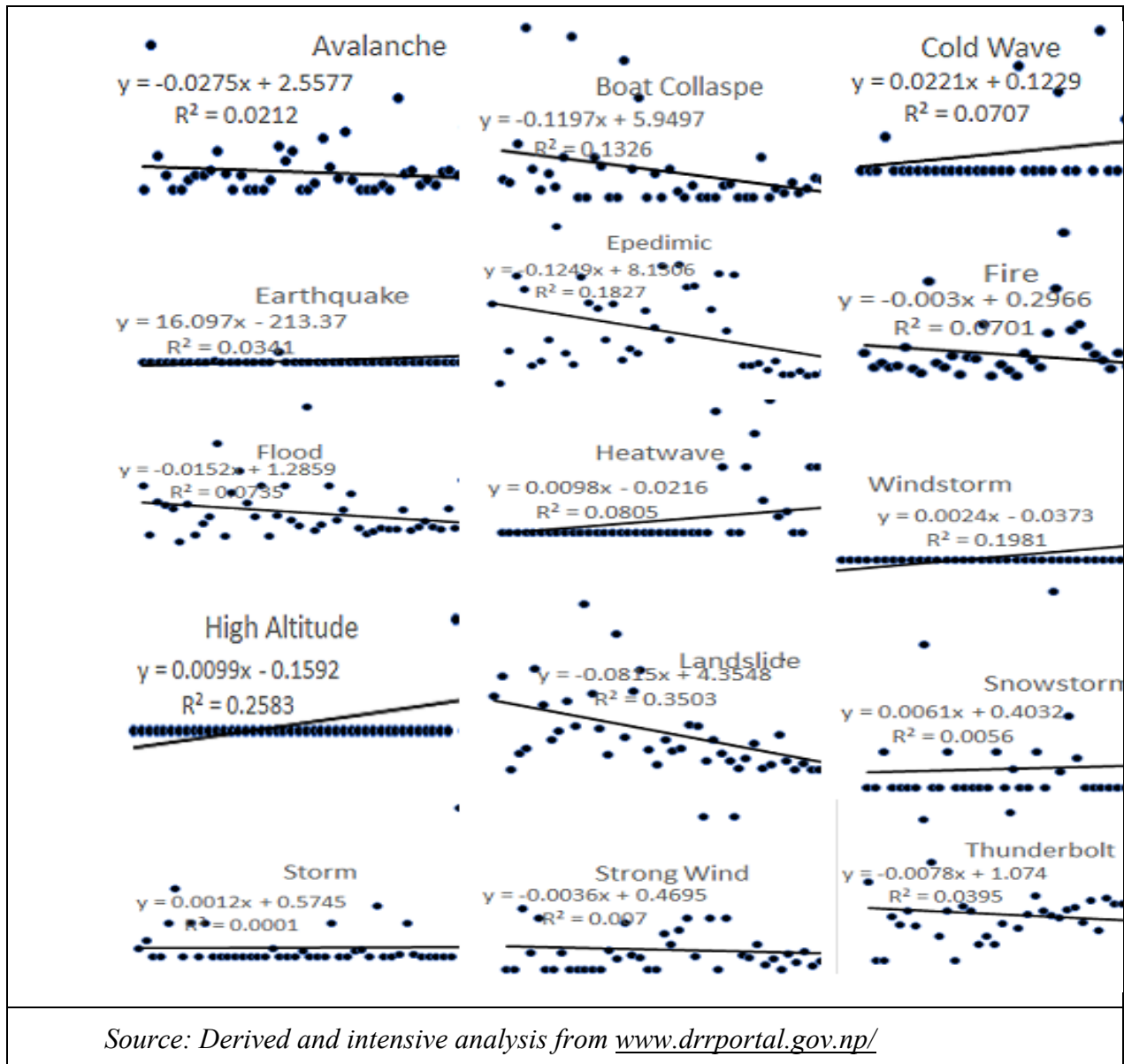
So, it made slow to rehabilitation. But the horrible earthquake brought along the opportunity to come together all parties to cope with the disaster. The government declared an emergency and all parties came together for disaster management. This understanding also brought an opportunity to make a constitution. Another horrible earthquake was recorded on Aug 21, 1988, and it affected eastern Nepal lost 744 lives, and was cracked 50 thousand houses. Some parts of the east-west highway were broken, and it stopped transportation for a few days.

### ***Flood***

Nepal falls 30th rank in flood disaster among 200 countries in the world. Due to the fragile topography, the northern highland is vulnerable to landslides, and it pushes to flood vulnerable to southern lowland. International authorities of the disaster management forum agreed, Nepal is identified as a rapid climatic change region. On 19-21 July 1993 monsoon laid directly over central and eastern Nepal. It resulted in a very heavy downpour of 540mm during 24 hrs. The intensity was measured as high as 65 mm/hr. at Tistung of Kulekhani catchment (a sub-catchment of Bagmati basin). This year eastern and central Nepal had severely affected and had swept to 1168 people and 25425 livestock were lost. Other major flood disasters have been recorded to 1999 (139 Death), 2009 (119 Death), and 2001 (49 Death). MOHA Consolidated data

### ***Landslide***

Landslide usually occurs as an effect of heavy rainfall, weak topography, and earthquake. In addition, land gradient, type of soil, a composite of vegetation cover, and other human development activities play a role. There were 5579 deaths recorded within 50 years period from landslides. On average, every year 111 people had been death life by a landslide. In 2002 there are more than 400 people died due to landslides. On August 21, 2002, Damti village of Ramechhap district 200 kilometers east from Kathmandu valley got death more than 70 people from 40 houses from a landslide. In September 2020 massive landslide took place in the Ramechhap district. It had taken 75 people's life the early morning of 3:30 A.M.(MOHA)

**Figure 2.** Total Case/Death trends on various Disaster sectors (1971 – 2020)

### **Epidemic**

The epidemic is predominated disaster in Nepal from the very beginning and continued to 2010. Due to the weak health facilities and lack of good public health education, epidemic terrior continued for the last 45 years and took 16,699 lives. In the recent past of 5 years, it was slowed down and its rate almost zeroes after 2017. (Derive from MOHA)

### **Fire**

Fire is a recurrent disaster in Nepal. When people lose their houses and properties, they often fall into poverty. Nepalese largest fires occurred at Singha Darbar in 1971, The Bhirkuti paper factory in Nawalparasi district in 1984, Tehrathum and Ramechhap in 2008 and 2009 respectively and the Bhutanese camp of Jhapa and Siraha in 2001 and 2012 respectively were remarkable fire disasters. Fire disaster shared 42 percent (18269 cases) in terms of the incident within 50 years and it shared 4 percent of death. (Derive from MOHA)

### ***Thunderbolt***

Thunderbolt is a natural phenomenon occurring with decreasing frequency and increasing intensity. Scientists said that it is due to global warming. Robbing cloud develops the charge as positive and negative. Positive charge aligns upward, and negative charge aligns downward within the cloud. Upper earth surface aligns positive charge underneath of the negative charge of cloud. The negative electron of cloud and positive electron of earth surface develop a magnetic attraction. This situation creates a way to transfer an electron from a cloud to earth. At the time of transferring, it gives a big sound and light with huge electric power is called a thunderbolt. It gives electric shock and has been taken lives. A thunderstorm was considered as God gifted evils in Nepal. Annually, it has taken several lives and domestic animals. At the beginning of the study base decade (1971-1980) total case was recorded to 56 and it took 60 lives. Its number goes up to 2071 in the last decade of the study (2011 – 2020) and had been taken 1000 lives. Although the total case and human death go up, the case death ratio drops down to 0.5. The maximum case was recorded in 2019. The case was recorded to 383 and human death was 94 people. The maximum incident death ratio recorded to 1978. There were 17 people who had lost their lives on a single day of 7/12/1978 in karsiya Bazar of Morang district.

### **Conclusion**

The first periodic plan of 1956-1960 put rehabilitation plan of flood victim people of the country on the name of Rapti Dun project in Chitwan. Later plans have been focused on disaster mitigation, rescue, relief, and rehabilitation. And it has been forward up to adaptation now. Nepal started its first legal acts in 1982 focusing on rehabilitation. Nepal has been involved in the international panel for disaster reduction and adopting the strategies. It has an active institutional arrangement from the central to the local level to fight the disaster. The disaster events are continuously increasing. The total disaster events were recorded to 42878 and these events had taken 44782 human lives in the study period of 1971-2020. Some extreme weather-related incidents have an increasing death ratio. They are thunderstorm, cold wave, heat wave, snowstorm, and windstorm. Although, total disasters incidents and total death has been increasing the case death ratio has been coming down in total.

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