IMPACT OF NATURAL DISASTERS IN ECONOMIC AND ENVIRONMENTAL VULNERABILITY OF NEPAL

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By

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DECLARATION

I, DEVENDRA ACHARYA, declare that this thesis proposal entitled IMPACT OF NATURAL DISASTERS IN ECONOMIC AND ENVVIRNMENTAL VULENERABILITY OF NEPAL submitted to Central Department of Economics is my own original work unless otherwise indicated or acknowledged in the thesis. The thesis does not contain materials which has been accepted or submitted for any other degree at the University or other institution. All sources of information have been specifically acknowledged by reference to the author(s) or institution(s).

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LETTER OF RECOMMENDATION

This thesis entitled IMPACT OF NATURAL DISASTERS IN ECONOMIC AND ENVVIRNMENTAL VULENERABILITY OF NEPAL has been prepared by Mr. DEVENDRA ACHARYA under my guidance and supervision. I, hereby, recommend it in partial fulfillment of the requirements for the Degree of MASTER OF ARTS in ECONOMICS for final examination.

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Thesis Supervisor

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LETTER OF APPROVAL

We certify that this thesis entitled IMPACT OF NATURAL DISASTERS IN ECONOMIC AND ENVVIRNMENTAL VULENERABILITY OF NEPAL submitted by DEVENDRA ACHARYA to the Central Department of Economics, Faculty of Humanities and Social Sciences, Tribhuvan University, in partial fulfillment of the requirements for the Degree of MASTER OF ARTS in ECONOMICS has been found satisfactory in scope and quality. Therefore, we accept this thesis as a part of the said degree.

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ABSTRACTS

Introduction and Objectives: The EVI index of Nepal has been persistently achieved since 2015 triennial review of UN CDP. But natural disasters in Nepal especially water induced and other season based natural calamities have been damaged human life and property severely on regular interval. So, thesis set the objectives as to discover the impact of such disasters on EVI index.

Methodology: The research design is descriptive, correlational and explanatory in nature and before only study design has been deployed. Time series data have been taken in between 1971 to 2021 and its analysis is based on both descriptive and inferential-GLS and VAR (1). Private house damaged (PHD) (including cowshed) has been used as a shock of natural disasters on environmental vulnerability index. As such, Affected Families (AF) has been used as a shock of natural disasters on economic vulnerability index.

Results: The GLS shows that when 10 private houses damaged, about 9 families will be affected. This rise an interesting question as why has Nepal been meeting EVI criteria? The granger causality of VAR (1) shows AF does not impact on AffG and ExpG. The impulse response functions show that there is a positive association of AffG and AF in the short run but not such relation in the long term. As such, there is negative relation between AF and ExpG in the short run but not such relation in the long term. Likewise, variance decomposition tests show that AffG is not statistically vulnerable on the basis of AF and its own past values in both short and long run evidence and ExpG is not statistically vulnerable on the basis of AF and its own past values in both short and long run time horizon.

Conclusion: It is inferred that natural disasters significantly affect human beings and property, so, environment of Nepal is vulnerable. However, economic indexes are not vulnerable in terms of season based natural disasters and their own past values.

Keywords: LDC-graduation, Natural-disasters, EVI, GLS, VAR

ABBREVIATIONS

Abbreviation	Full form
AF	Affected family of natural disasters
AffG	Share of agriculture, forestry and fishing to GDP
CEDECON	Central department of economics
CME	Child mortality estimation
COVID-19	Corona virus disease 2019
CRU	Climate research unite
CUNY	City university of New York
DM	Death and missing people of natural disasters
DRR	Disasters risk reduction portal
EVI	Economic and environment vulnerability index
ExpG	Share of export of goods and services to GDP
FDI	Foreign direct investment
FY	Fiscal year
GDP	Gross domestic product
GL	Generalized least square
GNIPC	Gross national income per capita
HAI	Human asset index

IBoA	Istanbul programme of action
IGME	Inter-agency group for child mortality estimation
IJ	Injured people of natural disasters
IMF	International monetary fund
JME	Joint child malnutrition estimation
LDC	Least developed country
LDCs	Least developed countries
LLDC	Landlocked least development country
LLDCs	Landlocked least developed countries
MMEIG	Maternal mortality estimation inter-agency group
MMR	Maternal mortality rate
MOHA	Ministry of home affairs
NPC	National planning commission
OLS	Ordinary least square
PHD	Private house damaged (fully or partially)
STD	Special and deferential treatment
U_5MR	Under 5 mortality rate
UIS	Institutes of statistics
UN	United nation
UN CDP	United nation committee for development policy
UN DESA	United nation development and economic social affair

UN ECOSOC	United nation economic and social council
UNCTAD	United nation committee for trade and development
UNDP	United nation population division
UNESCO	United nation educational, scientific and cultural rganization
UNICEF	United nation children's fund
UNSD	United nation statistics division
USD	United state dollar
VAR	Vector auto regressive
WB	World bank
WHO	World health organization
WTO	World trade organization

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CHAPTER I

INTRODUCTION

1.1 Background of the study

In 1971, the United Nation Committee for Development Planning (UN CDP), a subsidiary body of United Nations Economic and Social Council (ECOSOC), prepared a tentative list of 25 least developed countries (LDCs) based on initial criteria for identification of LDCs endorsed by General Assembly of United Nation (UN) along with recommendation of reviewing and refining the criteria (CDP, 2008).

The Least Developing Country category comprises the most disadvantaged of the developing countries. On the initial list of contained 25 disadvantaged countries, later 28 additional countries were added throughout the period. This is because when countries gained independence then faced sever development challenges; in some cases compounded by the effects of independence, war, and conflicts. By 2021, six countries have been graduated. As of 2021, there are 46 countries in LDC category that comprises approximately 14 percent of the World's population, but accounting for less than 1.3 percent of global gross domestic product (GDP) and 1 percent of global trade (CDP, 2021).

The decisions on inclusion in and graduation from the LDC category are made by General Assembly of UN, based on recommendations by the UN CDP endorsed by ECOSOC. The UN CDP reviews the list of LDCs every three years period called Triennial Review of LDC category to identify any countries that may qualify for inclusion in and graduation from the LDC category. There is provision of three criteria whether or not to graduate the countries from LDC category-gross national per capita (GNI per capita), human asset index (HAI), and economic and environmental vulnerabilities index (EVI). If two out of three criteria have been met as threshold value

or GNI per capita is double of threshold value in two consecutive triennial review, then the countries will be eligible for graduation (CDP, 2018).

The reason behind the establishment of LDC category is not to categories a country as a failure state having no potential of development rather design to allow LDCs to receive development assistance from the developed country and expedite their economic development(Qazi et al., 2019a). The fourth United Nation Conference on LDCs-Istanbul Program of Action (IPoA) took the objective on enabling the number of LDCs to meet criteria for graduation by 2020 (United Nations, 2011).

The progress made for enabling LDCs to move toward graduation has not been successful enough. Fourteen countries have been able to meet the criteria for graduation during 2011-2020. Based on the statistical information on the historical trend, only 20-24 LDC (44-53% of the total) may meet graduation thresholds by 2030, approaching the IPoA target set for 2020. Optimistic hypothetical scenarios predict that 27-36 LDCs (60-80% of the total) may meet the graduation criteria by 2030. To achieve the optimistic scenarios, however, an unprecedented pace of progress in all LDC criteria are required – income growth needs to be at least 7 per cent for all LDCs, or the progress needs to be accelerated two or three times faster than long term trends (Kim, 2018).

Nepal was included in LDC category in 1971 as a least developed country and met the graduation threshold for the first time in 2015 triennial review. Since then Nepal has been meeting the graduation criteria in triennial review of 2018 and 2021. The country should graduated from LDC category in 2018 triennial review but the CDP in its triennial review recommended to defer the graduation on the request of Government of Nepal (GoN) by considering the adverse impact of 2015 earthquake, blockade, and other disasters in the following years the graduation postponed to 2021.

As such, the UN CDP has recommended for Nepal's graduation from LDC category in 2026 with preparatory period of Five years as Nepal has met the criteria for graduation for three consecutive triennial reviews. Due to enormous challenges posed by COVID-19 pandemic along with the request of Government of Nepal, the normal preparatory period of three years has been extended to five for smooth transition during which Nepal would

be enabling per se to offset the loss of support measures exclusive to the LDCs. Nepal will, however, continue to have access to LDC specific support measures until 2026.

The profile of Nepal in 2021 triennial reviews can be analyzed from table 1.1.

Table 1.1: Nepal's profile and threshold in 2021 triennial review

Criteria	**Threshold**	**Triennial Review 2021**	**Remark**
GNI per capita	Graduation Threshold	$1222 or above	Fail
	Nepal's Situation	$1027	
HAI	Graduation Threshold	66.0 or above	Pass
	Nepal's Situation	74.9	
EVI	Graduation Threshold	32.0 or below	Pass
	Nepal's Situation	24.7	

Source: UN CDP, 2021 triennial review

The fact shows that as per UN CDP criteria Nepal is eligible for Graduation owing to Nepal has crossed the threshold value of HAI and EVI criteria that are 74.9 and 24.7 respectively. The GNI per capita is, however, in below the threshold level that is $1027 only. This is, thus, a serious concern about Nepal's graduation from LDC category.

Nepal has performed well in HDI and EVI criteria even though there is a low economic growth, large discrepancy between projected and actual economic growth, lower per capita income, lower capital expenditure of the government, huge trade deficit, delay in the completion of national pride and game changer projects along with increasing cost of the project, political turmoil, unable to create conducive environment for foreign direct investment (FDI), and poor macroeconomic indicators. Remittance and foreign aid have, however, been realized the factors contributing on improving of HAI.

In 2026, Nepal will be graduated from LDC country category and lose LDC specific provisions after graduation to some extent. GNI per capita is, however, still below the threshold level and EVI and HAI criteria also in threat because of economic impact of COVID-19 pandemic and national and international geo-political scenarios and unrest. As such, after graduation, Nepal will lose LDC specific treatment in terms of trade,

contribution on UN, travels at official level, scholarship program, financial and technical assistance, and so forth whereas Nepal has been facing enormous trade deficit year after year. So, more worrisome has been the unprecedented rise in external trade deficit, which, so far funded by remittance inflows.

On the other side, the 25 years vision has been formulated by National Planning Commission (NPC) of Nepal on fifteenth five year plan (2019-2024) to graduate to middle income country by 2030 by integrating Sustainable Development Goals (SDGs) in policies and programs and to reach the level of developed countries by 2043 (NPC, 2019). It is also required to discover that how much supportable government expenditure to grab the track of national plan is.

Under MDGs, performance on reducing poverty and hunger, maternal mortality, child mortality, increasing literacy, enrolment in primary schools, parity between girls and boys in access to education had been commendable and acknowledged internationally. While most of the targets had been achieved, some were partially achieved and there are some unfinished agendas including achievements are unevenly distributed among cast and ethnic groups, geographical region and economic status, and disadvantaged Janajatis, Dalits (Indigenous and minority) and people in remote areas lag behind the national averages (NPC, 2016).

Till this date, Nepal's overall progress in the SDGs is mixed-poverty reduction and some of human development related goals including education, gender qualities, and empowerments, and biodiversity are in track; goals related to water and sanitation, energy and infrastructure are also in the right direction and lags behind in the areas related hunger, industrialization and climate change impacts owing to natural calamities and disasters pose a great challenge further compounding the country's multiple vulnerabilities-earthquake of 2015 had significant impact in the past, and now the COVID-19 pandemic is going to have serious aftermaths across the sectors-especially on vulnerable population (NPC, 2020).

Even though Nepal is in high risk of natural disasters, EVI index have been achieved. Nepal is located in the central of the Himalaya range, Nepal is one of the most disaster

prone countries in the world due to its topography and climatic condition. More than 80% of total population of Nepal is at risk from natural hazards viz. earthquake, flood, landslide, storms, cold wave, thunderbolt, Glacial Lake Outburst Floods (GLOFs) etc. Globally, as per Maple croft 2011, the country is ranked 4^{th}, 11^{th}, 16^{th} and 30^{th} in term of climate change, earthquake, multi hazard risk, and flood respectively. It is notable that Nepal is in a seismically active zone with a high probability for massive earthquake.

About 83 percent of Nepal's area falls within the mountainous region, while the remaining 17 per cent lies in the northern part of the Ganga Basin plain. Nepal can be divided into eight physiographic units that roughly run east to west viz., (1) the Tarai (2) the Chure or Siwalik range, (3) the Dun valleys, (4) the Mahabharat Range, (5) the Midlands, (6) the Fore Himalaya, (7) the Higher Himalaya, and (8) the Inner and trans-himalayan valleys. The Mahabharat and the Higher Himalayan Range are the two physiographic units that control the rainfall and the climate zones of the country (Doinepal, 2022) .Nepal has five climatic condition /zones from subtropical to arctic broadly corresponding to the altitudes. The tropical and subtropical zone lies below 1200 meters, the temperate zone 1200 to 2400 meters, the cold zone 2400 to 3600 meters, the subarctic zone 3600 to 4000 meters, and the arctic zone above 4400 meters. Nepal has four major seasons comprises winter (December-February), spring (March-May), summer (June-August), autumn (September-November). Monsoons become active from June to mid September which brings about 80 per cent of the rainfall during that period. Rest of the seasons usually becomes dry. Spring and autumn are the most pleasant seasons. In winter, temperature drop to freezing with a high level of snow fall in the mountains.

Earthquakes, landslides, floods, fire, thunderbolts are the major causes of disaster events that caused major damaged in the past and weakening the fragile ecosystem of the country. Economic Vulnerability Analysis shows that Nepal exhibits the largest losses due to large exposure at risk and the high level of hazards. As a matter of these phenomena not only cause loss of lives and properties, but also pose severe threats to physical infrastructure, and also disrupt economic development.

Flood is mainly caused by the rainy season-monsoon in Nepal, and has been most frequent, highly damaging and wide spread natural hazards. It is estimated that more than 6,000 rivers and rivulets are in Nepal flowing from north to south. Among these, snow fed rivers, such as the Koshi, Gandaki, Karnali, and Mahakali, are perennial rivers. They originate from the Himalayas and snow capped mountains and pass through the hills to the Terai plains. During the monsoon (June-September), these rivers swell and cause damage to the villages, crops lands, and people and livestock remained within the river basins. The Terai region is more vulnerable to flood. According to DRR portal of Nepal, Historical data has shown that Nepal witnessed major flood in Tinao basin (1978), Koshi River (1980), Tadi River Basin (1985), Sunkoshi Basin (1987) and devastating cloud burst in Kulekhani area (1993) which alone claimed the lives of 1336 people. So, rivers in Nepal have been both boom and bane for Nepali.

Landslide is one of the very common natural hazards in the hilly region of Nepal. It is also caused by rainy season in Nepal. Both natural and human factors such as steep slopes, fragile geology, high intensity of rainfall, deforestation, unplanned human settlements are responsible for landslide. The risk of landslide is further exacerbated by anthropogenic activities like improper land use, encroachment into vulnerable land slopes and unplanned development activities such as construction of roads and irrigation canals without proper protection measures in the vulnerable mountain belt. The hilly districts of Nepal located in the Siwalik, Mahabharat range, Mid-land, and also fore and higher Himalayas are more susceptible to landslide because of steep topography and fragile ecosystem.

DRR (2022) reported that Nepal on a regular interval witnesses earthquake along the major active faults in east-west alignment. Historical data and ongoing seismological studies have clearly indicated that the entire region of Nepal is prone to earthquake and it lies in the active seismic zone V. It is evident that the seismic pattern has geographically divided into three clusters of events; viz. western, central and eastern Nepal. It has also pointed out that Siwalik, lesser Himalaya and frontal part of the Higher Himalaya are the most vulnerable zones. Historical data has shown that the country witnessed three major earthquakes in 20th century namely Bihar-Nepal earthquake (1934), Bajhang earthquake

(1980) and Udayapur earthquake (1988). In 2015, Nepal experienced another catastrophic earthquake of 7.8 rector scale name as Gorkha earthquake which killed 9,845 which was more than 10,000 along with missing.

Glacial lakes are located in the high altitude areas particularly in the foot hill of mountain and constructed due to damming in by moraines. These lakes contained huge volumes of water melting of glacier may lead to outbreak the lakes, called a glacial lake outburst flood (GLOF) with substantial capacity to cause great damage in downstream. DRR have been reported 2,315 glacial lakes have been identified in Nepal and 14 GLOFs were recorded to have occurred between 1935 and 1991 in Nepal. At this background, 15 glacial lakes are found substantially dangerous in Nepal. Wildfire is another cause of natural disaster which usually occurs during dry season, especially in the mid hill and Terai areas. Most of the houses of Nepal are agro-based household made of earthen wire, stone and wood. In Nepal, houses for residential purpose are developed in cluster basis which are more susceptible to catching fire and spreading over immediately due to close connectivity especially in the dry season.

Drought is the frequently happening hazard in Nepal caused by uneven and irregular low monsoon rainfall. Some parts of Terai, mid-land and Trans-Himalayan belts of Nepal are prone to drought. The lack of irrigation facilities further exacerbates the effect of drought causing enormous loss of crops production leading to the shortage and insecurity food. As per DRR, the droughts happened in 1972 and 1979 were the most seriously damaging and harmful to the people, livestock and crops. In 1994 Nepal witnessed the worst drought in its history that affected 35 districts of western hilly and Terai regions. Avalanches are a rapid movement of snow and debris flowing down through the slope or flanks of mountains. It can be triggered by natural factors like slopes, thickness of snow or human activity. They have the capacity to carry massive masses of snow and associated debris that make them one of the most destructive elements of hazards. The high mountainous region having the rugged and steep slopes topographically is susceptible to avalanche. As per DRR, a number of cases of avalanche with destructive nature have been reported in Nepal. Unexpected Seti River Flood of 5th may, 2012 at Kaski district could an example of this type of hazard.

Thus, this study contributes the literature in the following way:

i. It takes consideration on impact of natural disasters in EVI index of Nepal empirically for the first time. So, it becomes one of the milestone research;
ii. The impact of natural disasters has been quantified using empirical model using generalized least square (GLS) model; and
iii. The impact of natural disasters has been discovered on agricultural and export sector of the economy using econometric vector auto regressive) model (VAR.

1.2 Statement of the problem.

The triennial review of UN CDP held from 22 to 26 February 2021 has recommended for Nepal's graduation from LDC category in 2026 with preparatory period of five years as Nepal had met the criteria for graduation for three consecutive triennial reviews. Out of three criteria HAI and EVI index have been met but EVI attainment is questionable because EVI comprises economic and environmental vulnerability index where economic vulnerability includes victims of natural disasters and natural disasters have been imposing strong negative impacts on human life, property and infrastructure damages thereby may impact on economic and environmental vulnerability index as a whole.

Even though Nepal is in high risk of natural disasters, EVI index have been achieved. Nepal is one of the most disaster prone countries in the world due to its topography and climatic condition. Globally, as per Maple croft 2011, the country is ranked 4^{th}, 11^{th}, 16^{th} and 30^{th} in term of climate change, earthquake, multi hazard risk respectively, and flood. It is notable that Nepal is in a seismically active zone with a high probability for massive earthquake. According to DRR portal and based on historical data, Nepal witnessed catastrophic natural disasters including flood, landslides and earthquake. Nepal witnessed major flood in Tinao basin (1978), Koshi River (1980), Tadi River Basin (1985), Sunkoshi Basin (1987) and devastating cloud burst in Kulekhani area (1993) which alone claimed the lives of 1336 people. The hilly districts of Nepal located in the Siwalik, Mahabharat range, Mid-land, and also fore and higher Himalayas are more susceptible to landslide because of steep topography and fragile ecosystem. Historical data has shown that the country witnessed three major earthquakes in 20th century namely Bihar-Nepal

earthquake (1934), Bajhang earthquake (1980) and Udayapur earthquake (1988). In 2015, Nepal experienced another catastrophic earthquake of 7.8 rector scale name as Gorkha earthquake which killed 9,845 which was more than 10,000 along with missing. . DRR have been reported 2,315 glacial lakes have been identified in Nepal and 14 glacial lake outburst flood (GLOFs) were recorded to have occurred between 1935 and 1991 in Nepal. At this background, 15 glacial lakes are found substantially dangerous in Nepal. In the Terai region, fire, including the wildfire occurs mainly in the dry season. Most of the houses of Nepal are agro-based household made of earthen wire, stone and wood. In Nepal, houses for residential purpose are developed in cluster basis which are more susceptible to catching fire and spreading over immediately due to close connectivity especially in the dry season. As such, droughts happened in 1972 and 1979 were the most seriously damaging and harmful to the people, livestock and crops. In 1994 Nepal witnessed the worst drought in its history that affected 35 districts of western hilly and Terai regions.

This evidence shows that due to natural disasters, both environment and economy seem like vulnerable. When a natural disaster occurs, it has damaged a lot of human life, private and public property, cultivation- agricultural production, and infrastructure. After such devastating impact of natural disasters, it is a responsibility of government to recover and provide financial assistance and shelter to victims of natural disasters and to reconstruction of damaged properties and infrastructure as per provision of constitution and other federal law of Nepal being a welfare state. This process requires a big amount of fund. It is, therefore, challenge for Nepal to sustain or stabilize EVI index. . It is, thus, rational to conduct research on “Impact of Natural Disasters in Economic and Environmental Vulnerability of Nepal”.

1.3 Research questions

Nepal would be graduated from LDC category to developing nation in 2026. There is, however, natural disasters have been playing an adverse role in economic and environment of Nepal viz. death, missing and injured people, destruction of buildings-private house and government house, damages of cultivation, and infrastructure including

roads, bridges, hydropower sector and so forth. So, on the basis of this statement of problem, research questions are formulated as:

i. How many families or households will be affected as victims of natural disasters due to private house damaged as a shock of natural disasters?
ii. Do affected families or victims of natural disasters affect the share of agriculture, forestry and fishing in GDP?
iii. Do affected families or victims of natural disasters affect on share of export of goods and services in GDP?

1.4 Objective

The general objective of this study is to measure the impact of natural disasters on economic and environmental vulnerability index of Nepal.

Specific objectives

i. To examine the effect of the natural disasters on families or households level;
ii. To assess empirically the effects of natural disasters' affected families on agriculture, forestry and fishing output as share of total GDP; and
iii. To estimate empirically the effect of natural disasters' affected families on exports of goods and services taken as a share of GDP.

1.5 Hypotheses

The study primarily focuses on the following hypothesis that based on the research questions and objectives of the study. The hypotheses have been categorized into alternative hypotheses and null hypothesis. The formal represents the claim of the thesis whereas later represents the falsification of the alternative hypotheses.

H^1_A = private house damaged due to natural disasters affect the families or households

H^1_N = Otherwise

H^2_A =Affected families from natural disasters affects the share of agriculture, forestry and fishing to GDP.

H^2_N = Otherwise

H^3_A =Affected families from natural disasters affects the share of exports of goods and services.

H^3_N = Otherwise

Where, A = Alternative hypothesis and N = Null hypothesis

1.6 Significance of the study

There are some literatures relating impact of natural disasters in social and economic sectors of Nepal most of them are descriptive in nature. Hence, it is the first research in the field of natural disasters and its impact on LDC graduation approach using econometric analysis viz. GLS and VAR model. That is why it may be milestone research which is empirically and descriptively studied in the field of LDC graduation and natural disasters. It will, thus, help to those who are interested in the field of LDC graduation and natural disasters.

As such, it would contribute on policy and planning level of government. The Fifteenth Plan (FY 2019/20-2023/24) of the country has been formulated with the aim of achieving income growth, formation of quality human capital, and reducing economic vulnerabilities. The Fifteenth five year plan envisages graduating to an upper middle income country by 2030 by achieving the SDGs. This research would help to policy level in order to take appropriate decisions in planning and program to achieve stated target within a stated time framework on the basis of findings and conclusion of the research.

1.7 Scope and limitations of the study

The scope of thesis is relating to natural disasters and economic and environmental vulnerability index of Nepal a LDC graduation index. Only meteorological, hydrological and climatological natural disasters have been taken into consideration. Environmental vulnerability index includes victims of disasters as a sub index and economic vulnerability index uses share of agriculture, forestry and fishing to GDP and share of export of goods and services to GDP as sub indexes.

The scope of the study is, however, limited by unavailability of all required data and difficulty to obtain the data. The UN CDP updates the sub indicators of HAI and EVI as

per improvement in data availability and the evolution in development theory and practice. In 2020 CDP include prevalence of stunting index and gender parity index of gross secondary enrolment in HAI criteria and share of population living in dry land index in EVI criteria. As such, share of export of goods and services to GDP has been deployed as proxy variable for instability of export of goods and services. Likewise victims of natural disasters consider affected family of natural disasters as proxy variable. While measuring the impact of natural disasters on EVI index, impact of natural disasters viz. geophysical, biological and extraterrestrial natural disasters have not been taken into consideration as geophysical disasters like earthquake and extraterrestrial occur occasionally and biological disaster more related to awareness of sanitation and diseases than vulnerability of environment. As such, the reliability of the study depends on the reliability of the secondary data and the findings of the study cannot be generalized to all LDC owing to diverse characteristics of the country.

1.8 Organizations of the study

The research has been formatted into five chapters where each chapter comprises different aspect of content on the research topic. Chapter one is introduction that conducts background of the study, statement of problem, research questions, objectives, significance of the study, scope and limitation of the study and organization of the study. As such, chapter two concentrates on available literature related to LDC graduation and natural disasters which comprises theoretical, empirical and methodological review that ranges from national to international level.

Likewise chapter three has detailed methodology of the research that includes research design, conceptual framework, sources of data, and techniques of data analysis. Similarly, chapter four is the results and interpretation of trend analysis and regressions analysis.

Furthermore, the last but not the least chapter is summary, conclusion and recommendations. It presents precisely the whole research in some paragraphs. It is either in disclosure of findings or in recommendation form. Moreover, this chapter indicates the pave what research should be done to contribute in the same research field as well.

CHAPTER II

REVIEW OF LITERATURE

This chapter comprises the review of related literature relating to research topic. There are theoretical review, empirical review and methodological review and research gap and additional contribution.

2.1 Theoretical review

2.1.1 Least developed countries (LDCs) identification

The United Nation defines the least developing countries (LDCs) as the countries that have low levels of incomes and face sever structural impediments to sustainable development (CDP, 2021b). The LDCs are, therefore, weakest members of the international community that have lower income with serious economic and social development issues (Qazi et al., 2019). Such low level of income, economic, and structural handicaps to growth limit resilience to vulnerabilities; structurally transform their economies or build resilience against internal and external shocks and crises (United Nations, 2011).Table (2.1) shows the milestones to create developed country category by UN.

Table 2.1: Milestones in the creation of the developed country category

Years	**Steps to Create LDC Category**
1964	UNCTAD I recommended special support for the less developed among developing countries
1969	General Assembly called for action to provide special measures for the least developed among developing countries
1970	Committee for Development Planning issued report on LDCs
1970	General assembly reiterated urgent need for formal identification of LDCs
1971	Committee for Development Planning established tentative list of 25 LDCs

1971	General Assembly formally endorsed list of 25 LDCs

Source: (CDP, 2021b)

In the beginning there were 25 countries as LDCs later 28 countries added. Six countries have been graduated so far. As of 2021, there are 46 countries have been placed in LDCs list of UN CDP.

Following table (2.2) shows various programs of action for the LDCs adopted by UN.

Table 2.2: Programs of actions for the LDCs

Decades	**Program of Action for LDCs**
1980s	The Substantial New Programme of Action for the 1980s for the Least Developed Countries, adopted in 1981 at the first United Nations Conference on the Least Developed Countries **Aim:** transform LDC economies and enable them to provide minimum standards of nutrition, health, housing and education as well as job opportunities to their citizens, particularly to the rural and urban poor
1990s	The Paris Declaration and Programme of Action of the Second United Nations Conference on the Least Developed Countries **Priority Areas:** macroeconomic policy; human resources development; reversing the trend towards environmental degradation and reinforcing action to address disasters; rural development and food production; and the development of a diversified productive sectors
2001-2010	The Brussels Programme of Action for the Least Developed Countries for the Decade 2001–2010 adopted at the Third United Nations Conference on the Least Developed Countries, shortly after the adoption of the Millennium Declaration **Overarching goal:** substantially reducing the proportion of people living in extreme poverty and suffering from hunger in the LDCs and to promote sustainable development **Priority areas:** developing human and institutional resources; removing supply-side constraints and enhancing productive capacity; accelerating

	growth; and expanding the participation of LDCs in world trade and in global financial and investment flows
2011-2020	The Istanbul Programme of Action for the Least Developed Countries for the Decade 2011–2020, adopted at the Fourth United Nations Conference on the Least Developed Countries **Overarching objective:** enable half of the LDCs to meet the graduation criteria by 2020 **Priority areas:** productive capacity; agriculture, food security and rural development; trade; commodities; human and social development; multiple crises and other emerging challenges; mobilizing financial resources for development and capacity-building; and good governance at all levels
2022	The Doha Programme of Action for the Least Developed Countries, to be adopted at the Fifth United Nations Conference on the Least Developed Countries, scheduled to be held from 23 to 27 January 2022 in Doha

Source: (CDP, 2021c)

2.1.2 Criteria for defining least developed countries (LDC) category

According to CDP (2021d) in 1971, the Committee for Development Planning examined common traits of the economic and social development of LDCs. The criteria have changed over time to reflect improvements in data availability and the evolution in development theory and practice - LDC indicators, methodology and data sources are occasionally updated to reflect changes in the understanding of sustainable development and in the availability of data. From the outset, the Committee for Development Planning and subsequently, the Committee for Development Policy, utilized a multidimensional concept of development. The criteria originally covered social and economic dimensions, and, in 1999, CDP included indicators related to environmental vulnerability. CDP has adopted four principles it adheres to when refining the LDC criteria.

(i) **Inter-temporal consistency of the list and equitable treatment of countries:** it is required because that refinement to the criteria and their application should not lead to a questioning of recent decisions on graduation and inclusion.

(ii) **Stability of the criteria:** It implies that refinements should only be undertaken if they lead to a significant improvement in identifying LDCs.

(iii) **Flexibility:** It refers to the application rather than the criteria themselves. The principle ensures that the criteria are not applied mechanically. CDP uses additional sources of information before making recommendations for inclusion and graduation.

(iv) **Methodological robustness and complete data availability:** It ensures that only high-quality indicators for which data are available in all developing countries and updated with sufficient frequency are utilized to identify LDCs.

Moreover, as the LDC category aims at addressing the challenges of the "least developed among the developing countries", the criteria and indicators need to allow for a comparison between LDCs and other developing countries. In order to ensure comparability across countries, all indicators are based on internationally available data. The latest version of the criteria for defining LDCs was adopted in 2020 by UN CDP has recognized the LDCs as low-income countries suffering from the most severe structural impediments to sustainable development in terms of following three criteria and their sub indices.

a. Gross national income per capita (GNI per capita)
b. Human asset index (HAI)
c. Economic and environmental vulnerability index (EVI)

Where, GNI per capita serves as a measure of the income and the overall level of resources available to a country, whereas HAI and EVI measure main structural impediments to sustainable development. Both HAI and EVI are indices composed of several indicators.

Gross national per capita (GNI per capita)

GNI per capita gives information on the income status and the overall level of resources available to a country. GNI is equal to the gross domestic product (GDP), less primary incomes payable to nonresident units, plus primary incomes receivable from non-resident units.

(a) Human asset index (HAI)

HAI is a measure of the level of human capital. A higher HAI represents a higher development of human capital. Low levels of human capital are major structural impediments, not only because they are a manifestation of unsustainable development, but also because they limit the possibilities for production and economic growth, prevent poverty eradication, exacerbate inequalities and hamper resilience to external shocks.

The index consists of six indicators, three on health and nutrition and three on education. All six indicators have an equal weight of one sixth in the overall HAI. As HAI indicators are measured in different units, indicator values are first converted into index scores between 0 and 100. The average of these index scores is then the final HAI score of a country.

Under-5 mortality rate (U_5MR)

As per WHO and other relevant organization " it is the probability of dying between birth in a specific year or period before reaching the age of five, if subject to age-specific mortality rates of that period". It is expressed as deaths per 1,000 live births. The under-5 mortality rate (U5MR) provides comprehensive information on the health impacts of social, economic and environmental conditions in a country. Even though the indicator specifically measures child survival, it is seen as suitable and the best available measure for the overall health status of a population, in particular in LDCs.

i. Prevalence of stunting

The indicator is defined as the percentage of children under 5 who fall below minus 2 standard deviations ranges from moderate and severe from the median height-for-age of the WHO Child Growth Standard population. The percentage of children who have a low height for their age or stunting reflects the cumulative effects of undernutrition and infections since even before birth. Stunting is the result of long-term nutritional deprivation and often results in delayed mental development, poor school performance and reduced intellectual capacity. This measure can therefore be interpreted as an

indication of poor environmental conditions or the long-term restriction of a child's growth potential.

ii. Maternal mortality ratio

The indicator is defined by WHO and other relevant organizations as "the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births during a given time period". Maternal mortality is a leading cause of death and disability among women of reproductive age, that is, at an age when death and disability have particularly negative social and economic effects. The maternal mortality ratio (MMR) represents the risk associated with each pregnancy and also captures broader development handicaps such as poorly developed health systems and gender inequality.

iii. Gross secondary school enrolment ratio

The indicator measures the number of pupils enrolled in secondary schools, regardless of age, expressed as a percentage of the population in the country-specific official age group for secondary education. It provides information on the share of population with a level of skills deemed to be necessary for significant developmental progress.

iv. Adult literacy rate

The indicator measures the number of literate persons aged 15 and above, expressed as a percentage of the total population in that age group. The indicator provides information on the size of the base available for enlarging the trained and skilled human resources needed for development.

v. Gender parity index for gross secondary school enrolment

The indicator measures the ratio of girls to boys enrolled at the secondary level in public and private schools. It provides information on gender inequities in education that have long-term negative impacts on sustainable development, in particular discrimination against girls. An index of less than 1 suggests that girls are more disadvantaged than boys with regard to learning opportunities, and an index of greater than 1 suggests the reverse.

(b) Economic and environmental vulnerability index (EVI)

EVI measures the structural vulnerability of countries to economic and environmental shocks. High vulnerability is a major impediment to sustainable development in LDCs in view of their heightened exposure to shocks and the long-lasting negative impacts of those shocks. To an extent, all countries are vulnerable to some specific adverse shocks. Thus, when using vulnerability as an explicit criterion to designate countries as LDCs, there is a need to focus on those sources of vulnerability that (a) accentuate or perpetuate underdevelopment; (b) are not the result of misguided policies but, instead, are such that they limit policymakers' capacity to respond to shocks; and (c) are beyond a country's control.

There is no explicit resilience component in EVI, as some aspects of resilience are policy-related and therefore non-structural. Vulnerability depends on the magnitude and frequency of such shocks, on the structural characteristics of the country concerned—which affect the degree to which it is exposed to such shocks—and the country's capacity to react to shocks. In terms of economic shocks, EVI focuses on trade shocks; with regard to environmental shocks, EVI covers natural hazards, weather shocks and climate change. These shocks potentially affect economic activity, consumption, employment, the well-being of the population and the natural resource base of economic and social development. Moreover, they are mostly exogenous, at least from the perspective of LDCs, even though the frequency and magnitude of trade shocks and environmental shocks (e.g. climate change) are to some extent dependent on policy choices made at the international level.

The refined EVI is composed of eight indicators: four indicators on economic vulnerability and four on environmental vulnerability. All eight indicators have an equal weight of one eighth in the overall index. A lower EVI score indicates lower economic and environmental vulnerability. As these indicators are expressed in different measurement units, indicator values are first converted into an
index score of between 0 and 100, using the max-min procedure.

i. Share of agriculture, forestry and fishing in gross domestic product

The indicator is defined as the percentage share of the agriculture, hunting, forestry and fishing sectors in the gross value added of a country. It provides information on countries' exposure to shocks caused by their economic structure, because agriculture, hunting, forestry and fishing are particularly subject to natural and economic shocks.

ii. Remoteness and Landlockedness

The remoteness and landlockedness indicator is defined as a trade-weighted average of a country's distance from world markets. Location is a factor that has a bearing on exposure and resilience, as countries situated far from major world markets face a series of structural handicaps; such as high transportation costs and isolation—which affect the economy's ability to export and import, and render countries less able to respond to shocks in an effective way. Countries isolated from main markets have difficulty in diversifying their economies, even in the current era of globalization and the Internet. Remoteness and landlockedness are structural obstacles to trade and growth and possible sources of vulnerability when shocks occur. The indicator takes into account the increased transport costs incurred by landlocked countries.

iii. Merchandise export concentration

The indicator measures the product concentration of a country's exports. As currently applied, export concentration excludes services. This is largely due to methodological differences in terms of both data collection and reporting. A more concentrated export structure indicates higher vulnerability to shocks, as a relatively larger part of the export-oriented sectors can be potentially affected by shocks in specific product markets.

iv. Instability in the Export of Goods and Services

The indicator measures the variability of the value of exports around its trend, calculated over a 20-year period. It is defined as the standard deviation of the difference between the value of annual export earnings and its multi-year trend. Highly variable export earnings cause fluctuations in production, employment and the availability of foreign exchange,

with negative consequences for sustainable economic growth and development. High export instability indicates heightened vulnerability to trade shocks.

v. Share of population in low elevated coastal zones

The indicator measure the share of the population of a country who live in low elevated coastal zones, defined as areas contiguous to the coast below a certain elevation threshold. Currently, an elevation threshold of five meters is used. The indicator intends to capture vulnerability to coastal impacts (including sea level rise and storm surges) associated with climate change.

vi. Share of population living in dry-lands

The indicator measures the share of the population of a country who live in dry-lands. Dry-lands and their fragile ecosystems are particularly sensitive to changing rainfall patterns and land degradation induced by climate change. The expansion of dry-lands is expected to continue as a result of continental warming, threatening to aggravate poverty, food and water insecurity in affected areas.

vii. Instability of agricultural production

The indicator measures the variability of agricultural production around its trend, defined as the standard deviation of the differences between production and its trend over a given period of time (20 years). A high variability of agricultural production is indicative of high vulnerability to natural shock; as such variability often reflects the impacts of natural shocks, including droughts and disturbances in rainfall patterns.

viii. Victims of disasters

The indicator measures the share of the population who are victims of disasters. Victims of disasters are defined as people killed or affected (i.e. people requiring immediate food, water, shelter, sanitation or medical assistance). It includes those affected by weather and climate-related disasters (such as floods, landslides, storms, droughts and extreme temperatures) as well as geophysical disasters (such as earthquakes or volcanic

eruptions). The indicator reflects vulnerability to natural shocks, in particular the human impact of natural disasters associated with these shocks.

2.1.3 Natural disasters

As per central for research on epidemiology and disasters (CRED, 2023), natural disasters can be divided into six broad category as follows:

1. **Geophysical**

It is a hazard originating from solid earth. This term is used interchangeably with the term geological hazard viz. earthquake-ground movement and tsunami; mass movement(dry)-rock fall, landslides; volcanic activity-ash fall, lahar, Pyroclastic flow, Lava flow.

2. Meteorologicala

It is a hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that last from minutes to days viz. storm- storm-extra tropical storm, tropical storm, convective storm (derecho, hail, lightning/thunderstorm, rain tornado, sand/dust storm, winter storm/blizzard, storm/surge, sever storm); extreme temperature-cold wave, heat wave, sever winter condition (snow/ice, frost/freeze); and fog.

3. Hydrological

It is a hazard caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater viz. flood- coastal flood, riverrine flood flash flood, ice jam flood; landslide-avalanch(snow, debris, mudflow, rockdfall); and wave action-rogue wave, seiche.

4. Climatological

It is a hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability viz. drought and wildfire-forest fire and land fire (brush, bush and pasture).

5. Biological

A hazard caused by the exposure to living organisms and their toxic substances (e.g. venom, mold) or vector-borne diseases that they may carry viz. epidemic- viral, bacterial parasitic, fungal, prion; insect infection- grasshopper, locust; and animal accident.

6. Extraterrestrial

A hazard caused by asteroids, meteoroids, and comets as they pass near-earth, enter the Earth's atmosphere, and/or strike the Earth, and by changes in interplanetary conditions that effect the Earth's magnetosphere, ionosphere, and thermosphere. It comprises airburst and space weather- energetic particales, geomagnetic storm and shock wave.

2.2 Empirical review

The study is related to the stands of literature on evaluation of LDC graduation and its related aspects as well as natural disasters. There are few studies are carried out empirically in the field of LDC graduation and about its related aspects in Nepal. So, I have tried to link with the literature in international communities.

Bose and Bose (2011) found that economic growth in Botswana has been supported by the nationwide deployment of information and communication technology and implementation of performance management system including wise economic policy and prudence in almost all facets of public activities and in the private sector thereby has graduated to an upper middle income country. In 1994, Botswana formally graduated from the LDC status to a developing country-one of the first country to do so. The results for the impact of LDC graduation are mixed. For instance, Fialho (2015) investigated on 'Slicing Up the Development World: Differentiation in the Special Treatment of Developing Countries" and derived the conclusion that depth of Cape Verde's foreign dependence nurtured LDC graduation and LDC categorization has been only bureaucratic process not for developing.

However, most of these studies are based on time trend analysis using before only research design and before – after research design in some cases. Rai (2017) used regression and correlation analysis applying before only research design and concluded

that the trend of HAI and EVI of Nepal are on track but GNI per capita is not in better situation due to gap between actual and expected growth and lower volume of export in the study of "A Status Analysis of Nepal's Graduation to Developing country". Kim (2018) discovered that Income growth rate needs at least 7 percent for all LDCs or the progress needs to be accelerated two or three time faster than long term trend to achieve LDC graduation criteria by 2030. He adopted retrospective-perspective study design and further figured out that only 20-24 LDC (44-53% of the total) may meet graduation thresholds by 2030, approaching the IPoA target set for 2020 and Optimistic hypothetical scenarios predict that 27-36 LDCs (60-80% of the total) may meet the graduation criteria by 2030 on the basis of descriptive data analysis.

Some researchers have been used before only study design and descriptive data analysis to derive the conclusion in the domain of LDC graduation. Qazi et al. (2019b), studied on "Graduation Form LDC Status: Lesson That Could Be Learned From Best Practices" and derived the conclusion which is consistent with the conclusion of Bose & Bose (2011) that as Maldives experienced a smooth transition since graduation from LDC status due to promotion activities led by the government and the private sectors thereby enhanced its productive capacity and heavily invested in its infrastructure. As such, (Rashid et al., 2018) concluded that if graduated, Bangladesh will face some major challenges for getting preferential benefit or concessional opportunity in case of export, foreign aid and grants via the sutdy of "development transition from least developed country (LDC) to developing country: current progress and challenges of bangladesh". Unlike (Rashid et al., 2018), Ziaur Rahman et al. (2020) reported that if Bangladesh divert a huge potential for economic growth into a right direction then Bangladesh can surely sustain almost 7 percent economic growth even after graduation in the study of "Steps toward Smooth Graduation of Bangladesh from Least Development Countries".

Klasen et al. (2021), used the 'augmented gravity model of trade' using control research design then found that LDC status granted a large advantage in total and agricultural exports. When compare the export effect of trade preferences for LDCs and off LDC list; other developing countries, there was a substantial export advantages ranging from 30 percent for total export and to more than 159 percent for food and agricultural export for

LDC was noticeable in the study of research question as Does Designation of Least Developed Country Status Promote exports? Baniya and Giurco (2021) figured out Due to economic downturn including remittances, FDI, ODA, and contraction in economic output has increased poverty and raised pressure on biomass resources in the rural areas thereby emerged threaten on to both short and long term feasibility of further investment in renewable energy generation and low GHG emissions technology on the basis of before-after study design and descriptive data analysis of five Asian countries including Bangladesh, Combodia, Lao PDR, Myanmar and Nepal.

Ghimire (2008) studied "Environmental Concern in Nepalese Agriculture" using exploratory and descriptive methodology thereby explored that Natural disasters and human induced environmental degradation viz. small land holding lead to the alternative way of cultivation with improved farming systems. Nepal has preferential ways of producing niche agricultural products by exploiting its inherent diversified climate. Competitive agribusinesses along with the adoption of environmental protection measures keeping the strategy of import substitution and export promotion are the ways for sustainable agriculture development in the country.

There are some research articles which are done using empirical model. (Samir, 2013) concluded the effects of education on reducing disaster vulnerability tended to be more pervasive than those of income or wealth in the case of floods and landslides in Nepal that is reported on "Community Vulnerability to Floods and Landslides in Nepal". At all levels and under all models, the results showed consistently significant effects of more education on lowering the number of human and animal deaths as well as the number of households otherwise affected where the analysis is based on Poisson regression model and descriptive data analysis. Unlike the Ghimire (2008), Jaquet et al., (2016) explored, on the basis of survey and focus group discussion for their research project entitled "The Effects of Migration on Livelihoods, Land Management, and Vulnerability to Natural Disasters in the Harpan Watershed in Western Nepal", found that almost three quarters of the households have at least 1 migrant member receiving on average US$ 206 per month in remittances in the Harpan watershed, Kaski District, western Nepal. Remittances have been used mainly for food and goods and to a much lesser extent for agriculture. Then,

this tendency has been led to migrate to market areas, from uphill to downhill communities. This, in turn, has led to land abandonment and an increase in forest cover in the upper part of the watershed and has also increased pressure on the land and exposure to flooding in the lower part.

Panwar and Sen (2019) conducted the research viz. " Economic Impact of Natural Disasters: An Empirical Re-examination" and reported that natural disasters have diverse economic impacts across economic sectors depending on disaster types and their intensity and the economic impacts of natural disasters are statistically stronger in developing countries. The results is based on panel data consisting of 102 (29 developed and 73 developing) countries over the period 1981–2015. It looks at the growth effects of four types of natural disasters, namely, floods, droughts, storms and earthquakes that were explored using the system generalized method of moments (GMM) approach. Aksha et al. (2019) remarked the conclusion of their research project entitled " An Analysis of Social Vulnerability to Natural Hazards in Nepal Using a Modified Social Vulnerability Index" as due to the natural hazards, highest levels of social vulnerability are concentrated in the central and western Mountain, western Hill, and central and eastern Terai regions of Nepal, while the least vulnerable areas are in the central and eastern Hill regions.

2.3 Research gap and value added

This study contributes the literature in the following way

i. It takes consideration on impact of natural disasters in EVI index of Nepal empirically for the first time. So, it becomes one of the milestone research.
ii. The impact of natural disasters has been quantified using empirical model using generalized least square (GLS) model.
iii. The impact of natural disasters has been discovered on agricultural and export sector of the economy using econometric vector auto regressive model (VAR)

Table 2.3: Research matrix

SN	Author (s), title of the articles, years	Objectives of the articles	Methodology used in the articles	Model specification / Variables/ Issues	Strength/ Innovation of the articles	Limitation of the articles
1	Bose & Bose, Botswana Case Study Role of ICT in Graduation from a Least Developed Country to Developed Country, 2011	To analyze the role of ICT in graduation from LDC category	Descriptive in nature, Quantitative-before and after only study design and descriptive data analysis	ICT connectivity and performance management system	Economic growth has been supported by nationwide deployment of ICT and performance management system	Based only on descriptive analysis of data
2	Djalita Fialho, Slicing up the Development World: Differentiation in the Special Treatment of Development Country, 2015	To discover the Cape Verde's case of LDC graduation and to seek the reason behind LDC categorization	Qualitative: case study, semi structured interviews and Quantitative :before-after study design	LDC categorization, Cape Verde's LDC graduation	Depth of Cape Verde's foreign dependence nurtured LDC graduation and LDC categorization has been only bureaucratic process not for developing	Limitation to collect responses via email and audio recorded was not allowed in some cases

					instrument	
3	Tirtha Rai, A Status Analysis of Nepal's Graduation to Developing country,2017	To analyze the GNI per capita of Nepal	Qualitative- and Quantitative-before only study design, Descriptive in nature	LDC graduation, GNI per capita, growth rate	Nepal could not meet GNI per capita in 2018 triennial review.	Based on Secondary sources for secondary data
4	Namsuk Kim, Prospect of Least Developed Countries Meeting in the Graduation Critria by 2030, 2018	To analyze the needs to accelerate the development progress of LDCs	Quantitative: retrospective-perspective study design; descriptive data analysis and secondary data source	LDC, graduation, growth rate	Income growth rate needs at least 7 percent for all LDCs or the progress needs to be accelerated two or three time faster than long term trend to achieve LDC graduation criteria by 2030.	Lack of empirical data analysis
5	Sebghatullah Qazi Zada, Mohd Ziaolhaq Qazi Zada, Nasir Ahmad Yousofi; Graduation Form LDC Status: Lesson	To analyze the challenges of graduation and to investigate the status of Maldives LDC graduation	Quantitative-before only study design and Descriptive in nature	LDC, LDC graduation, WTO, impact	Loss of preferential treatments subsequent to graduation	Lack of empirical data analysis

	That Could Be Learned From Best Practices; 2019					
6	Ziaur Rahman et al, Steps toward Smooth Graduation of Bangladesh from Least Development Countries, 2020	To analyze the position of Bangladesh on LDC graduation	Quantitative: before study design, secondary data, descriptive in nature	Economic development, LDC and graduation	Bangladesh can sustain almost 7 percent economic growth even after graduation if resources divert into right direction.	Small data sets
7	Stephan Klasen, Inmaculada Martínez-Zarzoso, Felicitas Nowak-Lehmanna and Matthias Brucknerc, Does Designation of Least Developed Country Status Promote exports?, 2021	To investigate the effectivenss of LDC designation on exports	Quantitative: before only study design ; gravity model; secondary data	LDCs, trade preference, gravity model, generalizes system of preferences (GSP)	Designation of LDCs has been associated with higher aggregate exports and positive effect of LDC status has been significant and sizable even when controlling doe specific trade preferences	The findings may not valid all the LDCs

					system.	
8	Bishal Baniya and Damien Giurco, Resource-efficient and renewable energy transition in the Five Least Developed Countries of Asia: A Post Covid-19 Assessment, 2021	To discover the impact of COVID-19 on renewable energy transition and efficacy of resources	Quantitative: before-after study design; descriptive data analysis and secondary data	LDCs, COVID-19, resources productivity, GHG emissions, climate finance and economic output	Due to economic downturn and contraction in economic output has increased poverty and raised pressure on biomass resources in the rural areas	Based only on descriptive data analysis
9	Shree Ram Ghimire, environmental Concern in Nepalese Agriculture, 2008	To show the environmental impact on agriculture.	Exploratory ,descriptive	Competitive agri-business, evironmental depletion, open-global market, sustainable development	Due natural hazards in environment, it has induced the alternative and improving way of agriculture	Lack of detail
10	Samir K. C., Community Vulnerability to Floods and Landslides in Nepal, 2013	To explain the effectiveness of education to reduce community vulnerability due to Floods	Descriptive, explanatory, Poisson regression model	education; Floods, landslide, and natural disaster;	significant effects of more education on lowering the number of human	

		and Landslides			and animal deaths as well as the number of households	
11	Jaquet et al ,The Effects of Migration on Livelihoods, Land Management , and Vulnerability to Natural Disasters in the Harpan Watershed in Western Nepal, 2016	To show the impact of migration on threat of natural hazards.	Survey study design and focus group discussion, Sustainable Livelihoods Framework (DFID	Migration; land management; livelihoods; left-behind population; land use; flood	Increasing the pressure on the land and exposure to flooding in the lower part.	
12	Panwar & Sen ,Economic Impact of Natural Disasters: An Empirical Re-examination, 2019	To discover the economic impact of natural disasters	Panal data, Generalized method of moments (GMM)	Natural Disasters, Economic Growth, Loss and Damages, Economic Development	natural disasters have diverse economic impacts across economic sectors depending	

					on disaster types and their intensity and	
13	Aksha et al., An Analysis of Social Vulnerability to Natural Hazards in Nepal Using a Modified Social Vulnerability Index ,2019	To show the risk of natural disasters in the society level	Modified Social Vulnerability Index	Disaster risk reduction , natural hazards Nepal , Principal component analysis , Social Vulnerability Index	highest levels of social vulnerability are concentrated in the central and western Mountain, western Hill, and central and eastern Tarai regions	

CHAPTER III

RESEARCH METHODOLOGY

This chapter details the research methodology used in the study. Research is combination of various steps to be undertaken in the processes of carrying out the research work. It ranges from the very beginning steps like research design to the final step of research - the report writing. This is, therefore, a set of various instrumental approaches used in achieving the predetermined objectives (Ranjit, 2014). This chapter describes the research design, conceptual framework, sources of data, and techniques of data analysis used in the study.

3.1 Research design

The research design is quantitative on the basis of enquiry mode of research and applied in terms of application mode. On the other hand, on the basis of objective mode of research, explanatory, descriptive and co-relational research designs have been used and study design is before only in nature.

To show the impact of natural disaster on EVI index, only meteorological, hydrological and climatological natural disasters have been taken into consideration since these disasters have direct link to environment and economy of the nation and other natural disasters viz. geophysical, biological and extraterrestrial natural disasters have not been taken into consideration as geophysical disasters like earthquake and extraterrestrial occur occasionally and biological disaster more related to awareness of sanitation and diseases than vulnerability of environment. In the study, landslide, flood, thunderbolt, cold wave, storms, hailstone, drought, heavy rainfall, forest fire, avalanche, heat wave, flash flood, high altitude and frost have been taken into consideration as natural disasters in Nepal. However, earthquake has been also considered in description of natural disasters section as it is a major natural calamity of Nepal.

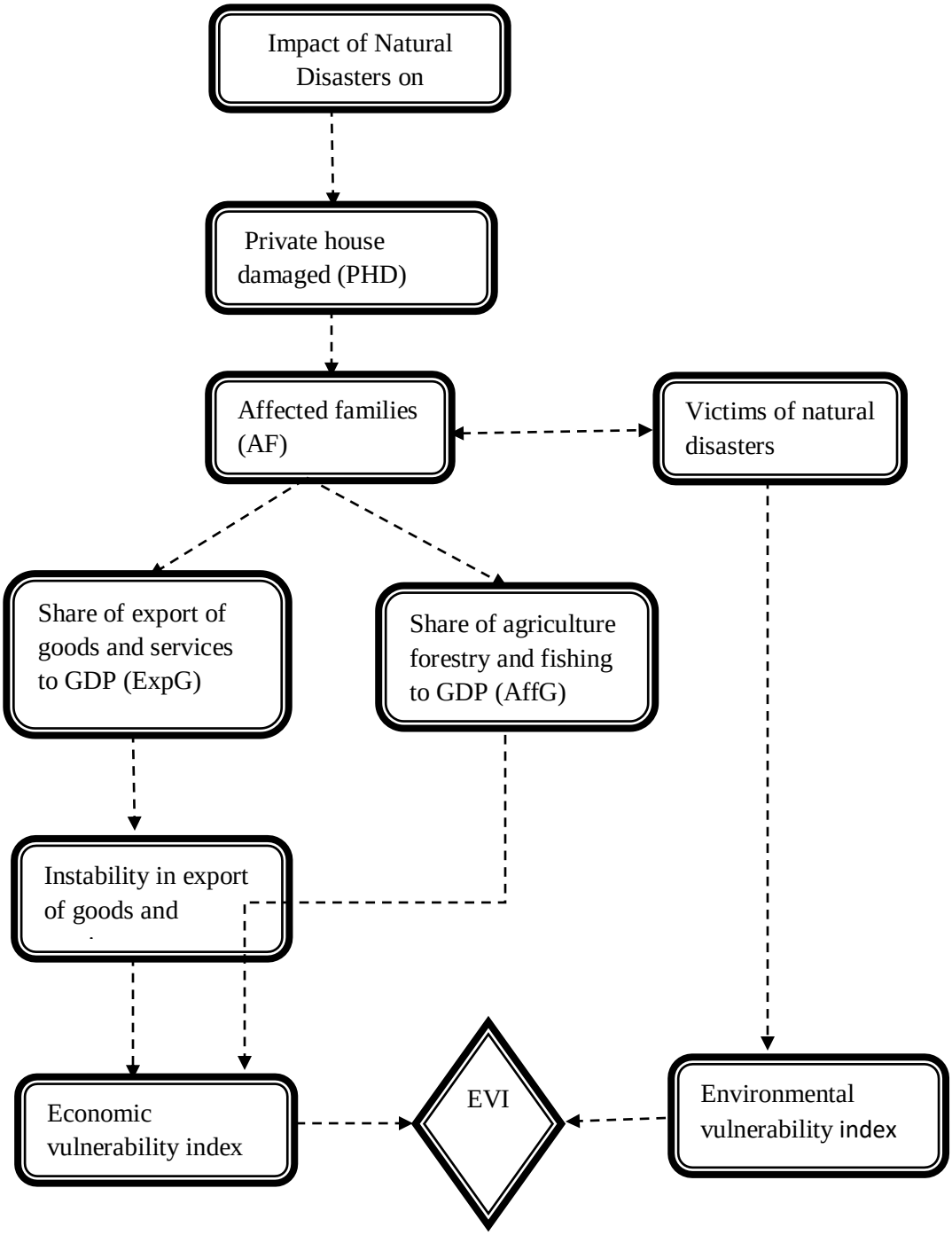
Data analysis is both descriptive-charts and line graph and inferential in nature- GLS and VAR. Generalized least square (GLS) regression model has been used to analyse the impact of natural disasters i.e. private house damaged as a shock in environmental vulnerability index i.e. affected family as victims of disasters and vector auto regressive (VAR) model has been adapted to analyse the effect of natural disasters i.e. affected family as a shock of disasters in economic vulnerability index i.e. share of agriculture, forestry and and fishing to GDP and share of export goods and services to GDP of Nepal.

The data and information pertaining to research topic and its relevant aspects are collected up to the time of study from the existing records to get the objectives of the study. Thus, before only study design has been adapted to collect, describe, analyse the required data.

3.2 Conceptual framework

The conceptual Framework of the research has been depicted in the following flowchart.

Figure 3.1: Conceptual framework



Source: Author's construction

3.3 Sources of data

This research has been based on the secondary data collected from different reliable sources including UN DESA, World Bank, disaster risk reduction portal (DRR) which have two sources namely Ministry of Home affaire (MOHA) and disinventer to accomplish the thesis. The secondary data are time series in nature.

3.3.1 Secondary data

The secondary data on variables of interest including GNI per capita, HAI , EVI, share of agriculture, forestry and fishing to GDP, share of export of goods and services to GDP , victims of natural disasters-total affected families, death and missing people, injured people, public and private house damaged due to natural disasters have been taken in between 1971 to FY 2021.The data on variable of interest have been adopted in between 1971 to 2021 as in 1971 United Nation Committee for Development Planning included Nepal in LDC list and endorsed by General Assembly of UN. So, it has been rational to take data and information from 1971 to 2021 for studying the impact of natural disasters in EVI index of Nepal.

For natural disasters related data viz. affected family, death, missing and injured people, public and private house damaged due to natural disasters have been taken from disaster risk reduction portal (DRR)- an official portal of government of Nepal established with the aim of providing information related to natural disasters and other disasters of Nepal. Disaster risk reduction portal have been taking the data related to disasters from two sources viz. disinventer which comprised the data from 1971 to 2013 and MOHA that provide the data of disaster to DRR since 2011. So, the data from 2011 to 2013 have been overlapped. To avoid such difficulty of data collection the data from 1971 to 2013 have been taken from disinventer source then remaining data have been taken from MOHA since 2014. The data sources of variables of interest have been explained in techniques of data analysis section.

3.4 Techniques of data analysis

The data analysis techniques have been based on descriptive viz. tables, graphs, histograms, bar carts, pie chart, ring charts, correlation and maps and analytical or

inferential in nature including regression analysis viz. generalized least square (GLS) and vector auto regressive (VAR) model which are analytical in nature. GNI per capita, HAI , EVI, share of agriculture, forestry and fishing, share of export of goods and services to GDP , victims of natural disasters-total affected family, death and missing people, injured people and private house damaged due to natural disasters will be deployed as main variables in the study.

All the variables that will be deployed in the study are in continuous that can be measured in the ratio scale owing to these all have a fixed starting point at zero thereby using for mathematical operation. The operationalisation of the concepts has been presented in the table 3.1.

Table 3.1: Operationalisation of concepts

Concepts	**Variables**
Natural disasters	Water induced and season based natural disasters
Shock of natural disasters for environmental vulnerability index	Private house damaged
Shock of natural disasters for economic vulnerability index	Total affected families
Environmental vulnerability index	Total affected families as victims of natural disasters
Economic vulnerability index	i. Share of agriculture, forestry and fishing to GDP ii. Share of export of goods and services to GDP

Source: Author's construction

The variables of interest, their unit of measurements, types and data sources in the study have been shown in the table 3.2.

Table 3.2: Variables used in the study and their units of measurement

SN	Variables of interest	Units of measurement	Types of data	Sources
1	Total affected families of natural disasters (AF)	Number	Continuous	MOHA and Disinventer
2	Private house damaged either fully or partially due to natural disasters measured in numbers (PHD)			
3	Total death and missing of people owing to natural disasters in numbers (DM)			
4	Injured people due to natural disasters measured in number (IJ)			
5	Share of agriculture, forest and fishing to GDP (AffG)	Percent		World bank
6	Share of export of goods and services to GDP (ExpG)			
7	GNI per capita (GNIPC)	Number		
8	Economic and environmental vulnerability index (EVI)	Ratio		UN CDP
9	Human asset index (HAI)			

Source: Author's construction

To investigate the impact of natural disaster on environmental vulnerability, private house damaged either fully, partially (PHD) or both has been considered as exogenous variable as a shock of natural disasters and total affected household of natural disasters (AF) considered as endogenous variable. As such, to discover the impact of natural disaster on economic vulnerability, AF is considered as exogenous variable and AffG and ExpG are taken as endogenous variables.

3.5 Model specification

To get the objectives of the thesis the employed model can be categorized into two parts viz. generalized least square (GLS) for first objective and vector auto regressive (VAR)

for second and third objectives. The reason behind employing the formal is that the presence of serial autocorrelation when using only simple ordinary least square (OLS). So, to avoid the difficulty of serial autocorrelation of residual term (stochastic or error term) GLS has been run thereby getting the robust result of regression analysis. As such, to get the both second and third objective at the same time, VAR has been used as VAR is able to embed two or more than two OLS regression models.

3.5.1 Empirical model I: Generalized Least Square method (GLS)

Generalized least squares (GLS) was first described by Alexander Aitken in 1936. It is a technique for estimating the unknown parameters in a linear regression model when there is a certain degree of correlation between the residuals in a regression model (Berrington and Cox, 2003). In such cases, ordinary least square and weighted least squares can be statistically inefficient, or even give misleading inferences. To avoid such problem, the GLS method has been adapted to the answer of the first research question which is the extended version of OLS.

Here, the ordinary least square (OLS) is

$LAF_t = \alpha + \beta LPHD_t + e_t$ [1.1]

Where, LAF = Log of affected families from natural disasters

LPHD = Log of private house damaged from natural disasters

In this empirical model, log transformation of the variables has been adopted to minimize the outliers in the model to get smooth results as well as robustness of the model.

Lagging one period behind and multiply by ρ both sides

$\rho\, LAF_{t-1} = \rho\, \alpha + \rho\, \beta LPHD_{t-1} + \rho\, e_{t-1}$ [1.2]

$e_t = \rho e_{t-1} + \varepsilon_t$ [1.3]

Where ρ is estimated from OLS residual

Autoregressive of first lag scheme AR (1) and $-1 < \rho < 1$

Subtracting Equation [1.2] from [1.1]

$LAF_t - \rho\, LAF_{t-1} = \alpha - \rho\,\alpha + \beta LPHD_t - \rho\,\beta LPHD_{t-1} + e_t - \rho\, e_{t-1}$

Or, $LAF_t - \rho\, LAF_{t-1} = \alpha\,(1-\rho) + \beta(LPHD_t - \rho\, LPHD_{t-1}) + e_t - \rho\, e_{t-1}$

$\therefore LAF_t^* = \alpha^* + LPHD_t^* + \varepsilon_t$ [1]

This is a generalized least square regression model.

Where,

LAF_t^* $= LAF_t - \rho\, LAF_{t-1}$

α^* $= \alpha\,(1-\rho)$

$LPHD_t^*$ $= \beta(LPHD_t - \rho\, LPHD_{t-1})$

ε_t $= e_t - \rho e_{t-1}$

3.5.2 Empirical model II: Vector auto regression (VAR)

Christopher Sims (Sims, 1980) provided a new macro econometric framework as vector auto regressions (VARs). A VAR is an n-equation, n-variable linear model in which each variable is explained by its own lagged values, plus current and past values of the remaining n - 1 variables. It provides dynamic analyses as employed variables become both endogenous and exogenous. To get the impact of AF on AffG and ExpG simultaneously, VAR model is appropriate econometric tool for getting the objectives second and third.

The VAR model in the thesis can be derived trough following simultaneous regression model as:

$$LAF_t = \alpha_1 + \sum_{i=1}^{n} \beta_{1i} LAF_{t-i} + \sum_{i=1}^{n} \gamma_{1i} AffG_{t-i} + \sum_{i=1}^{n} \theta_{1i} ExpG_{t-i} + U_{1t} \quad [2.1]$$

$$AffG_t = \alpha_2 + \sum_{i=1}^{n} \beta_{2i} LAF_{t-i} + \sum_{i=1}^{n} \gamma_{2i} AffG_{t-i} + \sum_{i=1}^{n} \theta_{2i} ExpG_{t-i} + U_{2t} \quad [2.2]$$

$$ExpG_t = \alpha_3 + \sum_{i=1}^{n} \beta_{3i} LAF_{t-i} + \sum_{i=1}^{n} \gamma_{3i} AffG_{t-i} + \sum_{i=1}^{n} \theta_{3i} ExpG_{t-i} + U_{3t} \quad [2.3]$$

Matrix representation is

$$\begin{bmatrix} LAF_t \\ AffG_t \\ ExpG_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \begin{bmatrix} \sum_{i=1}^{n} \beta_{1i} & \sum_{i=1}^{n} \gamma_i & \sum_{i=1}^{n} \theta_i \\ \sum_{i=1}^{n} \beta_{2i} & \sum_{i=1}^{n} \gamma_i & \sum_{i=1}^{n} \theta_i \\ \sum_{i=1}^{n} \beta_{3i} & \sum_{i=1}^{n} \gamma_i & \sum_{i=1}^{n} \theta_i \end{bmatrix} \begin{bmatrix} LAF_{t-i} \\ AffG_{t-i} \\ ExpG_{t-i} \end{bmatrix} + \begin{bmatrix} U_{1t} \\ U_{2t} \\ U_{3t} \end{bmatrix}$$

$X_t = \alpha + \sum_{i=1}^{n} A_i X_{t-i} + U_t$ [2]

Where,

X_t = 3×1 endogenous variable matrix in particular time 't',

A_i = 3×3 matrix for coefficient in particular time 't' when i^{th} lag order exists,

X_{t-i} = 3×3 matrx of i^{th} lag exogenous or predetermined variables in particular time 't',

U_i = Error

3.6 Operational definition of the variables

In the regression analysis of empirical model 1 and 2, there consist endogenous and exogenous variables.

(a) Exogenous variable: An exogenous variable is the cause supposed to be responsible for getting about change in phenomenon. In empirical model I, PHD and in empirical model II, AF is exogenous variables.

(b) Endogenous variable: An endogenous variable is the change or outcome brought about by introduction of an independent or exogenous variable. In empirical model I, AF is the outcome when exogenous variable PHD is introduced. Likewise, in empirical model II, AffG and ExpG are the endogenous variables.

(c) Extraneous variable: Additional factors operating in an economy may affect change in the dependent variables which are not measured in the study that may increase or decrease the magnitude or strength of the relationship between endogenous and exogenous variables are the extraneous variables. For instances, injured people, death and missing people, injured people due to natural disasters.

The summary of research objectives, sources, specified variables, tools and specified models have been shown methodological matrix in table 3.3:

Table 3.3: Methodological matrix

SN	**Objectives**	**Specified variables related to objectives**	**Tools of Analysis**	**Specified model**	**Sources of data**
1	To discover the impact of PHD on AF	AF and PHD	Graphical, correlation and GLS	$LAF_t^* = \alpha^* + LPHD_t^* + \varepsilon_t$	DRR-disinventer and MOHA
2	To show the effects of AF in AffG.	AF and AffG	Graphical and VAR	$X_t = \alpha + \sum_{i=1}^{n} A_i X_{t-i} + U_t$	DRR-disinventer, MOHA and WB
3	To show the effects of AF in ExpG	AF and ExpG			

CHAPTER IV

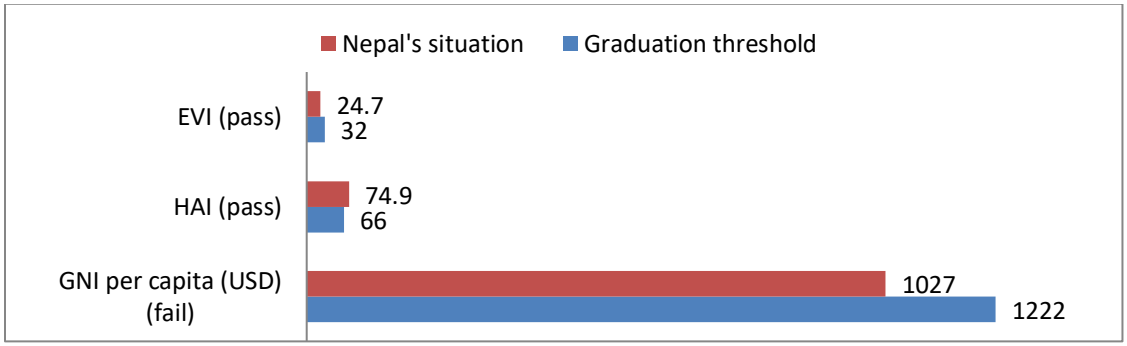
RESULTS AND DISCUSSIIONS

This chapter comprises presentation and analysis of data that are descriptive and analytical (inferential or econometric or empirical) in nature. The descriptive data analysis describes the data in terms data summarization, correlation, tables, graphs and charts- bar charts, pie charts, box plot and maps. As such, analytical data analysis analyses the data on the basis of econometric or regression analysis viz. generalized least square (GLS) and vector auto regressive (VAR). So, this section contains an explanation and description of the data, and highlights of findings, patterns, trends and relationships observed and implication of findings.

4.1 Profile of Nepal on triennial reviews of UN-CDP

4.1.1 Profile of Nepal on 2021 triennial review

Figure 4.1: Profile of Nepal on 2021 triennial review



Source: UN CDP

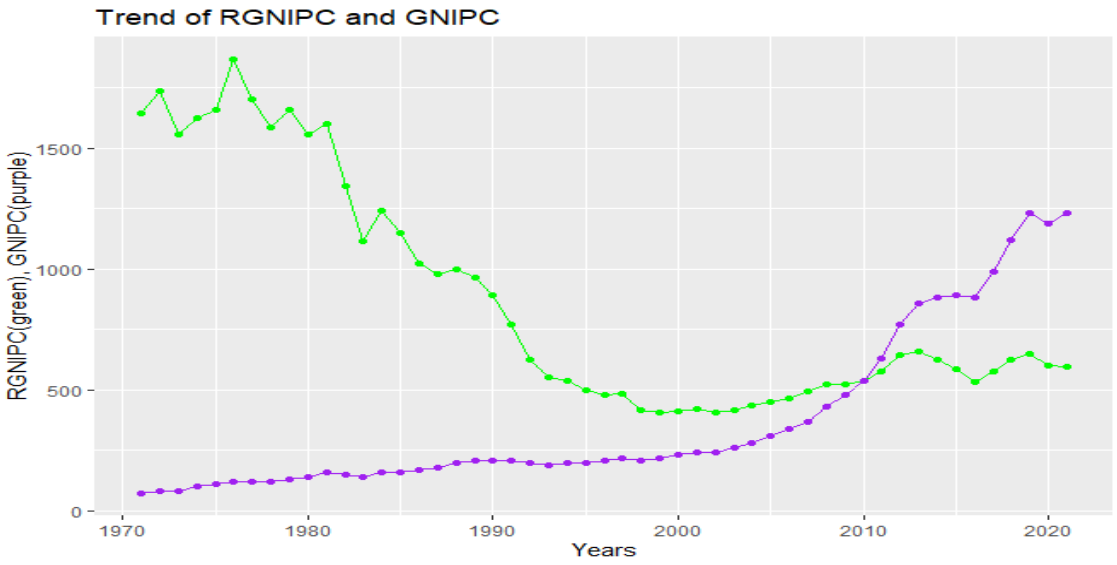
Figure 4.1 demonstrates, out of three index of LDC graduation, in 2021 triennial review, Nepal met two of them viz. HAI and EVI. In the context of HAI, Nepal marked 74.9 whereas graduation threshold for the triennial review was 66, which shows Nepal scored 8.9 points more than threshold level. This signifies health and education status of her in

better position. As such, her EVI index is 7.3 points less than threshold level that is 32 where her situation was in 24.7. This fact shows that Nepal is in better position with reference to HAI and EVI index in 2021 triennial review. This implies environmental and economic risk is low.

However, GNI per-capita was far less than threshold level. In 2021 triennial review, her GNI per-capita index score was only 1027 $ only while threshold level was 1222$ which shows Nepal is 195$ behind the threshold level for 2021. This fact signifies financial status of the citizen of Nepal is poor.

4.1.2 GNI-per-capita

Figure 4.2: Real and nominal GNI per capita of Nepal



Source: Author's construction

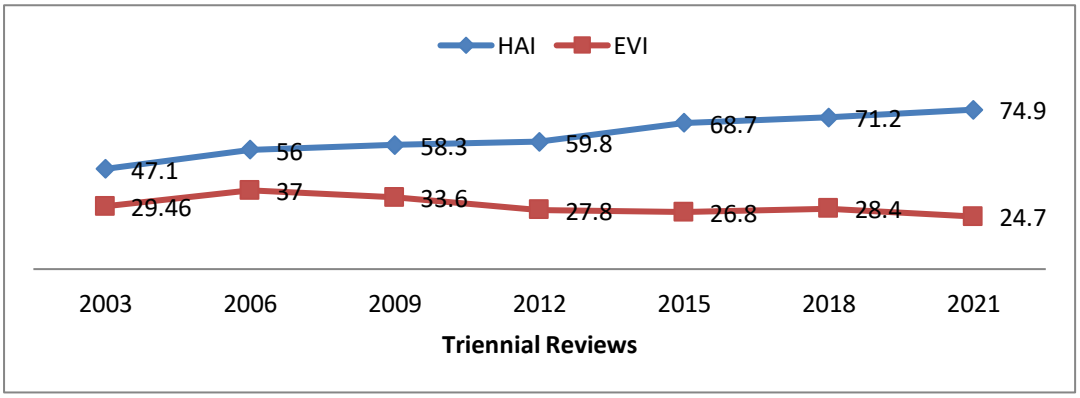
Figure 4.2 displays the GNI per capita index of Nepal. The nominal GNI per capita of Nepal (below up to2010) has been slowly increased. In 2071, it was 70$ and even after a long period it remained only $ 1230 in 2021. It is noted that in the triennial review of UN CDP in 2021, it was $1027, which is based on average of previous three year i.e. 2018, 2019 and 2020. In 2016, GNI per capita of Nepal was declined to $ 880 from $ 890 in 2015 owing to catastrophic earthquake of 2015 and informal blockade of India at the same year disturbed the economy of Nepal. As such, in 2020, it was again reduced to $

1190 from $ 1230 of previous year which was same as 2021 as the brutal impact of COVID-19 pandemic on national macroeconomic and microeconomic sector. This facts show that overall performance of Nepal on GNI per capita is too poor and fragile.

On the other hand, real GNI per capital (based on 2010 CPI index, taken from World Bank) of Nepal has been decreasing. From the outset of 1980s to the edge of 1990s, GNI per capita has been dramatically reduced. Then, since 2003 to 2013, it has been slowly rose up. In 1972, the GNI per capita of Nepal was about $ 1733 whereas in 2021 it was about $ 596 only. This shows that the real sector of the economy is too poor that is production of goods and service has been reduced and inflation has been increased more often demand side. Likewise, share of industrial sector to GDP is very low and the economy has been evolved only as consumption based and import based economy thereby Nepal yet to meet GNI per capita.

4.1.3 Trends of HAI and EVI

Figure 4.3: Trend of HAI and EVI index of Nepal



Source: Author's construction

For the first time of history Nepal meet both criteria of LDC graduation in 2015 shown in figure 4.3. The human asset index (HAI) of Nepal has been continuously is in the path of progression in the 2003 triennial review of Nepal, HAI was 56 and in 2021 triennial review that was 74.9. It is noted that the increasing tendency of HAI curve is desirable for HAI criteria.

HAI index comprises six sub indexes. According to World Bank data, adult literacy rate has been persistently increased. In 1981, adult (15 to 49) literacy rate was 20.57 percent of them 9.15 percent is female and 31.67 percent is male adult literacy rate and in 2018, it was that was 67.91 percent of them 59.72 is female and 78.72 percent is male adult literacy rate. On the other hand youth (15 – 24) literacy rate in 1981 was 30.04 of them 14.97 is female and 45.10 is male while in 2018 that was 92.39 of them 90.88 percent is female and 94.03 is male. Maternal mortality rate has been reduced significantly to 28.2 in 2020 from 260.2 in 1971 in per 10000 live births. In 1996 maternal mortality rate was 750 (national estimation in 100000) but in 2017 it was 250 only. It shows maternal mortality of Nepal has been decreased persistently and significantly. As such, prevalence of stunting has been drastically reduced to 32.9 in 2019 from 62.6 in 1998. Gross secondary school enrollment has been increased from 18.55 in 1981 to 85.52 in 2020 whereas gender parity index has been rose up to 1.03 in 2020 from 0.25 in 1981.

On the other hand, economic and environment vulnerability (EVI) index of Nepal also in relaxes position. It is notes that, the decreasing trending of EVI is desirable. However in the triennial reviews of 2003 and 2018, EVI was increased as compare to previous triennial reviews, which show that EVI is less stable as compare to HAI index.

EVI comprises economic vulnerability index and environmental vulnerability index each includes four sub-indexes. Share of agriculture, forestry and fishing is significant to GDP but has been continuously decreasing trend. In1971, it was 66.83 whereas in 2021 it became 21.31 percent only. However, it is not oscillation in nature so, it is not vulnerable. After 1997, share of export of goods and services to GDP has been drastically or significantly reduced especially after the membership of WTO owing to lower quality of goods and services, exporting goods and services which is lower valued and higher volume in nature, inability of country's mechanism to utilize specialized and differential treatments (SDTs) of WTO, poor economic diplomacy, insufficient infrastructure, unimplemented economic policy of nation and so forth. Nepal got 26.33 percent of export to GDP as a highest magnitude in history in FY 1997 and experienced 5.21 percent share to GDP of export sector in FY 2021.

On the other hand, victims of natural disasters in Nepal have been significantly prevailing as a curse of natural disasters. EVI in 2018 triennial reviews has been rose up as compare to this may be due to 2015 earth quake. Flood landslide and like in Nepal has been occurring regular interval and a number people has been affected. Occasionally, Nepal face earthquake brutally.

4.2 Aftermaths of natural disasters in Nepal

The following table shows the profile of natural disasters of Nepal since 1971 AD to 2021 AD.

Table 4.1: Profile of natural disasters in Nepal since 1971 to 2021

Natural Disasters	Death and Missing (MD)	Affected Family (AF)	Estimated Loss	Injured (IJ)	Private house fully damaged (PHFD)	Private house partially damaged (PHPD)
Landslide	6654	605217	1517198479	2671	21588	36574
Flood	5225	4517369	16254152588	712	106878	144500
Thunderbolt	2099	13433	68597760	4916	432	799
Coldwave	888	2453	0	83	0	0
Storm	578	293709	252553976	2424	5586	17218
Hailstone	0	3127	791000	0	0	2
Drought	0	1625	0	0	0	0
Heavy railfall	190	74983	468239880	285	1904	2912
Earthquake	10040	1111910	5500000	29360	807895	356102
Forest Fire	81	16606	1170000	48	1900	2
Avalanch	339	1592	0	138	84	33
Heat wave	45	381	0	20	0	0
Flash flood	75	31	11000000	0	31	0
High Altitude	80	97	300000	22	0	0
Frost	11	0	0	0	0	0

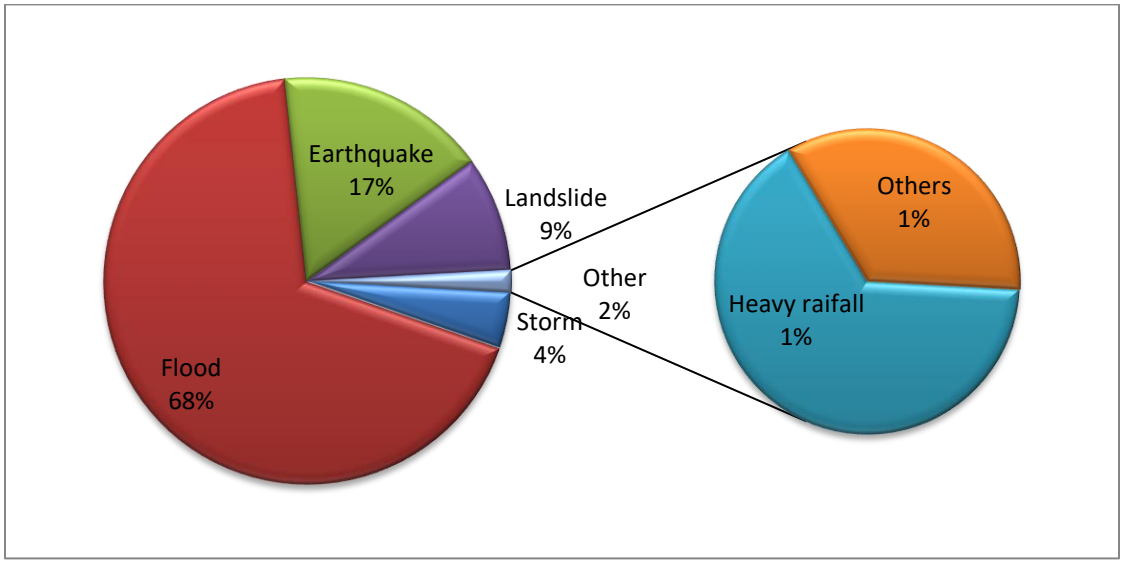
Total	26305	6642533	18579503683	40679	946298	558142

(*Note*: The estimated loss and affected of 2015 earthquake have not been in DDR portal. On the basis of sum total of private house damaged fully and partially, affected families have been inferred.)

Source: DRR-MOHA and Disinventer

The table 4.1 shows that landslide, flood, earthquake, thunderbolt, cold wave, storm, hailstone, drought, heavy rainfall, forest fire, avalanche, heat wave, flash flood, high altitude and frost are the major natural disasters of Nepal. In between 1971 to 2021, 26305 people had killed and missing, 66425 33 families got victimized, 40679 people became injured, 946298 and 558142 private houses damaged fully and partially respectively. In addition, Nepal had lost about NRs. 18579503683 equivalent properties..

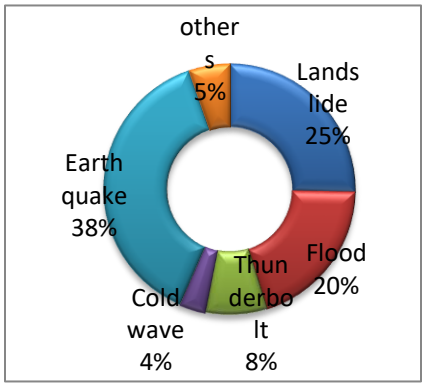
Figure 4.4: Affected family of Natural disasters



Source: Author's construction

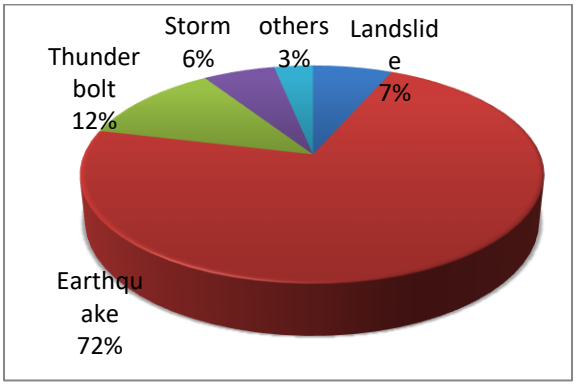
Figure 4.4 shows that among the natural disasters mention in above table, out of total affected family due to natural disasters, 68 percent people are reported only from flood then followed by 17 percent from earthquake, 9 percent from landside, 4 percent from storm, 1 percent from heavy rainfall and 1 percent affected family reported from others. This evidence shows that flood is more devastating natural disaster in terms of affected family then earthquake and landslide.

Figure 4.5: Death and missing people



Source: Author's construction

Figure 4.6: Injured people

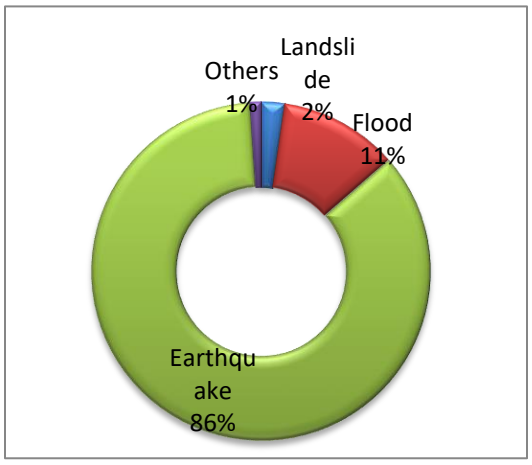


Source: Author's construction

Figure 4.5 reported that highest death and missing people caused by earthquake and it is reported 38% out of only by earthquake as of 2021 then landslide comes in second to position which is responsible for 25% of death and missing of people then flood, thunderbolt, cold wave and others respectively responsible for 20%, 8%, 4% and 5% death and missing of people.

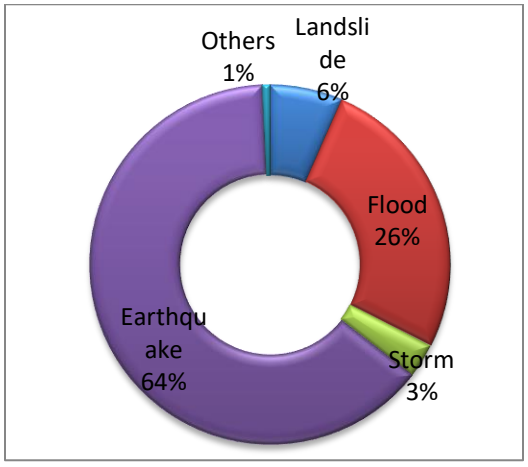
As such figure 4.6 demonstrates that earthquake is only natural disaster that is responsible for 72% out of total injured people till this date. Now, thunderbolt comes to second position which is cause of injured people at 12% of magnitude. Landside reportes7% of injured people then followed by storms and others as 6% and 3% magnitude respectively.

Figure 4.7: Private house fully damaged



Source: Author's construction

Figure 4.8: private house partially damaged



Source: Author's construction

Facts of figures 4.7 describes among total house fully damaged by natural disasters, 86% houses had been fully damages only by earthquake and flood contributed11% on it. Likewise, landslide and other disasters played role to damage private house fully at 2% and 1% level respectively. As such, as per figure 4.8, till this data earthquake damaged 64% private house partially out of total then flood reported 26%. Landslide damaged 6% private house partially then storm and other natural disasters damaged 3% and 1% private house partially out of total.

4.3 Major natural disasters in Nepal

Above discussion shows that Floods, landslides, earthquakes, thunderbolt and storms etc are major natural disasters in Nepal. Some of these are briefly explain here.

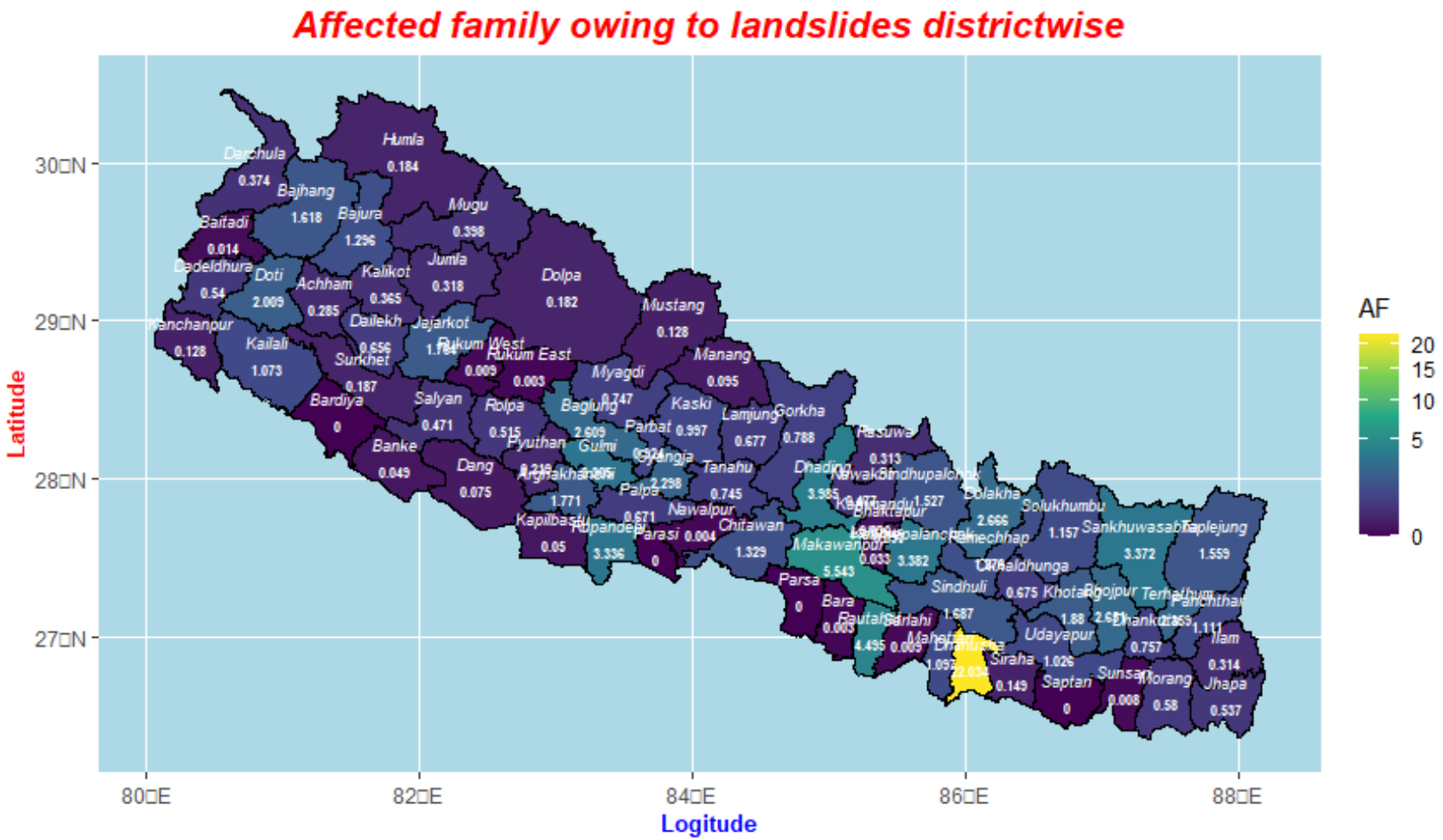
a. Landslide

Nepal had witnessed some terrifying landslide incidence in 1996, 2002, 2010, 2014 and 2020 as major incidence as maximum number of affected families and private house damaged fully, death, private house damaged partially, missing people and injured people respectively. 201455 families were affected and 4339 private hoses got damaged fully in 1996, 455 people were killed in 2002, 20266 private houses became damaged partially in 2010, 129 people got missing in 2014, and 226 people got injured in 2020 and owing to landslides. The occurrence of landslide incidence signifies that on and average about 11867 families have been affecting due to natural disasters in each year especially in monsoon season. In between 1971 to 2021, as per the DRR due to landslide, 6654 people had been killed and missing, 605217 families got affected, 2671 people got injured, 21588 and 36574 private houses had been damaged fully and partially respectively. Furthermore, Nepal has lost NRs. 1517198479 in between study time frame owing to landslides.

Figure 4.9, displays that in between 1971 to 2021, maximum affected district landslides disasters in Nepal is Dhanusha district that reports solely 22.03 percent of total of till 2021 then followed by Makawanpur-5.54, Rautahat-4.49, Dhading-3.98, Kavrepalachok-3.38, Sankhuwasabha- 3.37, Rupandehi-3.33, Gulmi-3.30, Dolakha-2.66, Bhojpur-2.65, Baglung-2.30, Terhathum-2.35, Syangja-2.29, Doti-2.00, etcetera. As such, Bardiya,

Parsa, Saptari, Sunsai, Sarlahi, Baitadi, Lalitpur, Kathmandu, etc are minimally affected districts from left to right respectively. The map shows due to landslides Hilly and Mountainous region's districts are more vulnerable as compare to Terai region. However, Dhanusha is highly prone to landslides which is a district of Terai region and Rautahat and Rupandehi are also vulnerable district of this region.

Figure 4.9: Affected family owing to landslides district wise in percentage of total



Source: Author's construction

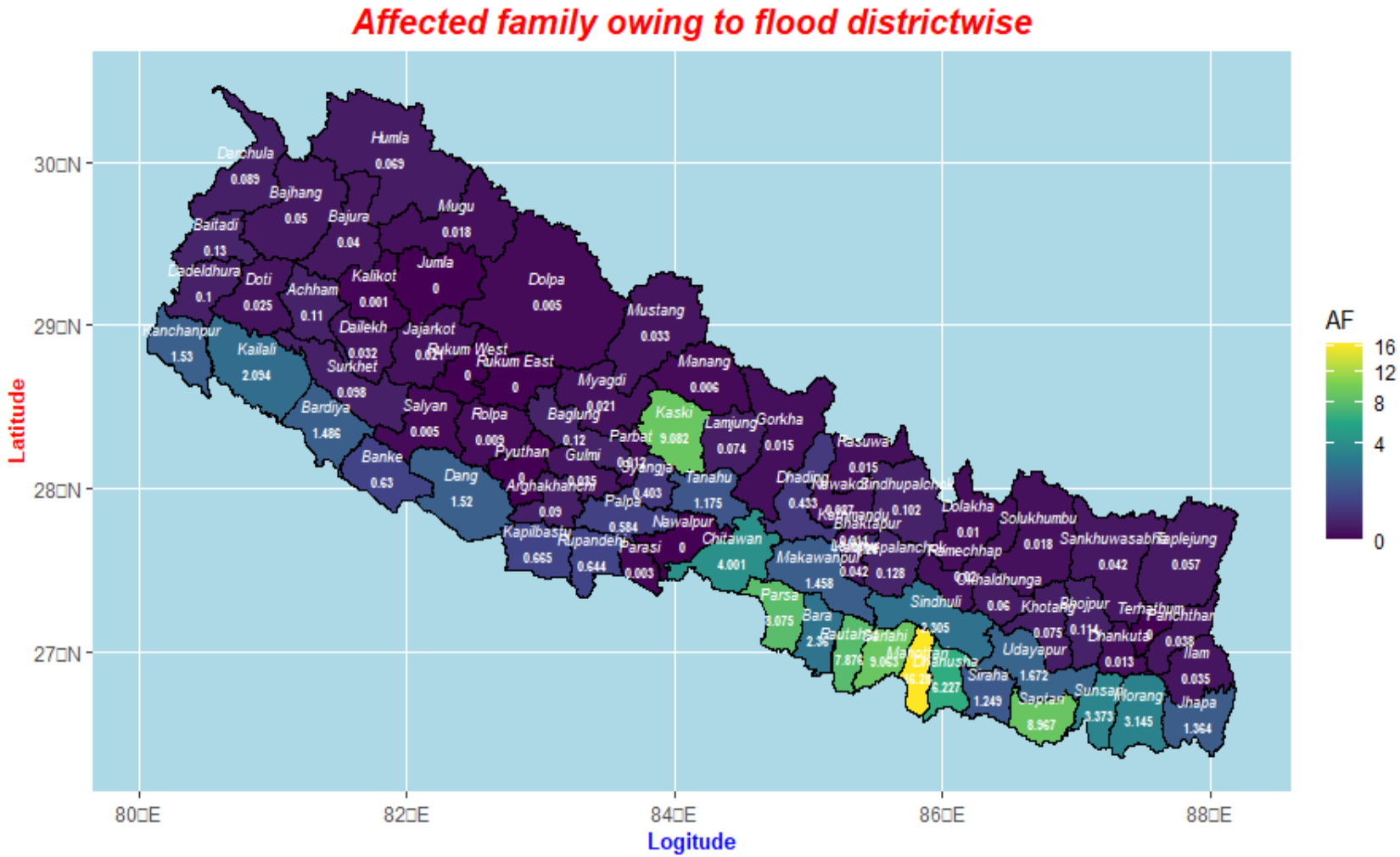
(*Note*: District wise data for Rukum East, Rukum West, Nawalpur and Parasi districts have been available since 2015. Lower part of the Map represents Terai region, middle part is Hilly region and upper part is mountain region of Nepal).

b. Flood

According to Maplecroft Nepal is ranked 30th position in terms of flood risk out of 194 countries in the world. In 1993, 1981, 1995, 2002 and 2014 Nepal had experienced the flood devastatingly.1168 people lost their life and 15164 private houses house had been fully damaged in 1993, 24447 private house had been partially damaged in 2014, 612487 families had been affected in 1995, 200 people were missed in 1981 and118 people were injured in 2002 at maximum level. The happening of flood incidence in Nepal shows that on and average 88576 families have been affecting in each year especially in monsoon season. In between 1971 to 2021, 5225 people were killed and missing, 4517369 families had victimized, 712 people got injured, 106878 and 144500 private house damaged fully and partially respectively. In addition to that, Nepal had lost about NRs. 16254152588 equivalent properties.

Figure 4.10, displays, in between 1971 to 2021, Mahottari district is highly affected by flood in terms of total affected families and reported 16.28 of total affected families i.e. 720093 due to flood till 2021 then followed by Kasli-9.08, Sarlahi- 9.06, Saptari-8.96, Parsa-8.07, Rautahat-7.87, Dhanusha-6.22, Chitawan-4.00, Sunsari-3.37, Morang-3.14, Bara-2.36, Sindhuli-2.30, Kailali-2.09, etcetera. As such, Jumla, Pyuthan, Terhathum, Kalikot, Dolpa etc. are safe district in terms of flood disasters as these countries reported minimum affected families from left to right respectively. Thus, map shows that the Terai region is highly vulnerable and Mountain region is safe from floods.

Figure4.10: Affected family owing to flood district wise in percentage of total



Source: Author's construction

(*Note*: District wise data for Rukum East, Rukum West, Nawalpur and Parasi districts have been available since 2015. Lower part of the Map represents Terai region, middle part is Hilly region and upper parst is mountain region of Nepal)

c. Earthquake

As per, Maplecroft Nepal is in ranked 11th position in the world with regard to earthquake risk. In between 1971 to 2021, due to earthquake, 9845 people had compelled to die, 195 people were missed, 29360 people got injured, 1111910 families were affected, 2687 and 3776 government houses damaged fully and partially respectively and 807895 and 356102 private houses damaged fully and partially respectively.In 2015 earthquake reported 8962 people as death, 195 as missing people, 1072093 as affected family, 22302 as injured people, 2687 and 3776 as government house damaged fully and partially respectively and 773095 and 298998 as private house damaged fully and partially respectively. According to Ministry of Home and Affairs (2017) disaster risk report 2017, due to 2015, 7.8 terrifying earthquake, Nepal has lost about one fourth of GDP of that time.

d. Thunderbolt

131people were killed in 2013, 3401 families had been affected in 1997, 451 people became injured in 2019, 96 private houses were damaged fully in 1994 and 128 private houses were damaged in 2020. The happening of thunderbolt incidence in Nepal implies that in general about 263 families have been affecting owing to the thunderbolt incidence in every year. In between 1971 to 2021, 2099 people were killed and missing, 13433 families had been affected, 4916 people got injured, 432 and 799 private houses damaged fully and partially respectively. Moreover, Nepal lost about NRs. 68597760 equivalent properties.

e. Storms

The category of storm is made of various other kinds of storms viz. storm, windstorm, hailstorm and strong wind for study purpose in the study. In the range of 1971 to 2021, 578 people had been killed and missing, 293707 families were affected, 2424 people got injured 5586 and 17218 private house damaged fully and partially respectively due to the incidence of various kind of storms. Furthermore, Nepal had lost about NRs. 252553976 equivalent properties in between given range of time.

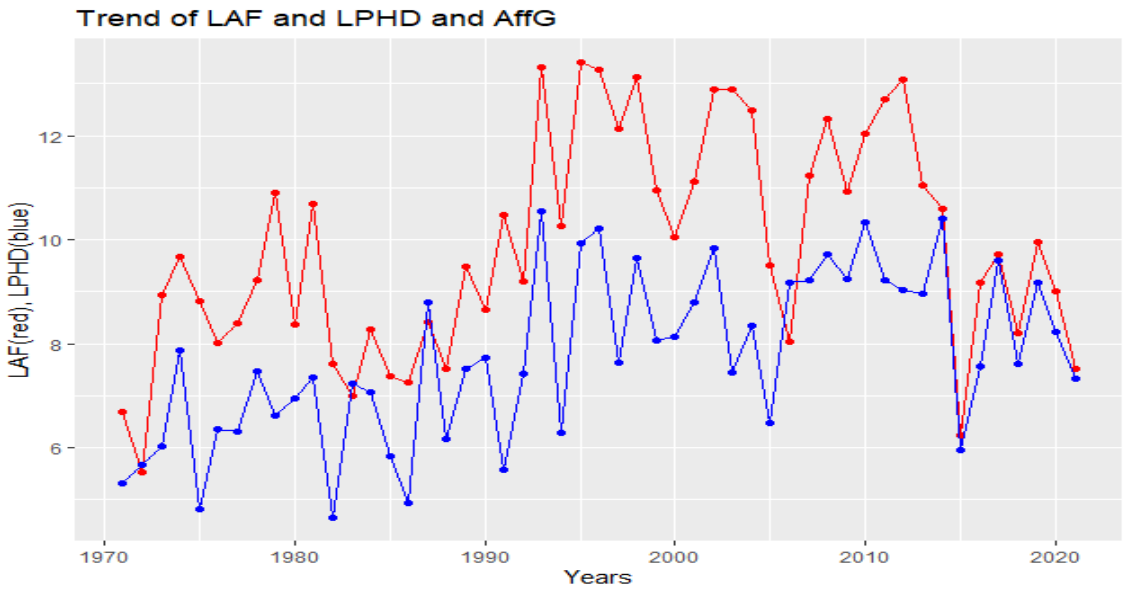
4.4 Impact of private house damaged on affected family-economic vulnerability index

To study the vulnerability of natural disasters, affected family and private house damaged have been taken into consideration. Vulnerability has been measured on the basis of causality of private house damaged on affected family. The analyses of data for AF and PHD have been segregated into descriptive and inferential technique.

4.4.1 Descriptive data analysis

A. Time series plot

Figure 4.11: trend of LAF and LPHD



Source: Author's construction

Trend of log AF (LAF) and that of PHD (LPHD) signifies that in most of the stages of trend, when LPHD increase then LAF is also increased and vice versa in figure 4.11. The trend displays that after the years of 1990 to 2012, both LAF and LPHD have been significantly increased. This may possible due the impact of climate change. However, this is also might be the part of research. The trending of both is in same rhythm so LPHD is of significant impact on LAF.

B. Descriptive statistics

Table 4.2: Descriptive statistics of AF,PHD, DM and IJ

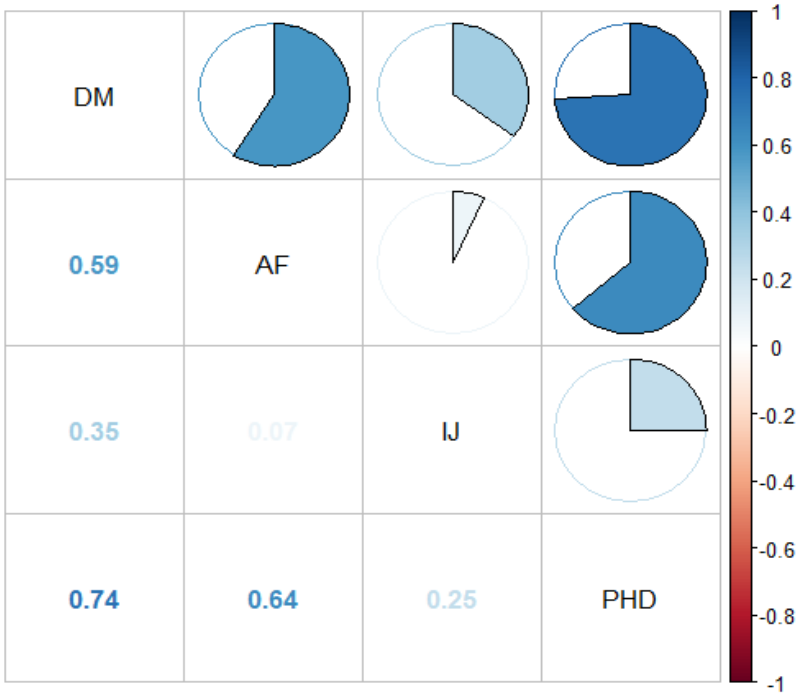
Variables / Statistics	AF	DM	IJ	PHD
Obs	51	51	51	51
Min	250	54	13	104
Mean	108443.59	318.922	221.941	6675.353
Max	674822	1559	1910	38363
Std. Dev.	183038.05	251.456	295.865	9315.149
Median	16022	295	120	2040
Skewness	1.811121	2.435407	3.784886	1.873605
Kurtosis	4.98669	12.58108	21.84764	5.817398

Source: Author's calculation

Table 4.2 of descriptive statistics displays that in between 1971 to 2021, in 1972, 250 affected families reported as a minimum mark at that time 290 private houses damaged and in 1995, 674822 families had been affected as a maximum level so far, at that time 20744 private houses were damaged. As such in 1982, only 104 private houses damaged and in the year 1993 at that time 2007 families were affected, 38363 private houses destructed which is maximum number of damaged till 2021 at that time 606536 families were affected . This fact shows that the lower the private house damaged, higher the affected families of natural disasters and vice versa.

C. Correlation matrix

Table 4.3: Correlation matrix for AF and PHD



Source: Author's calculation

The correlation matrix (table 4.3) is based on Pearson correlation that explains that there is significant and positive relation between affected family and private house damaged either fully or partially or both as 0.05 < 0.64. That means if private house damaged either partially or fully, then there occurs significant affected families. As such there is positive and significant association between affected family and death and missing people that is if there is dead or injured people due to natural disasters then affected family due to natural disasters rise up significantly since 0.59 > 0.05. Likewise, PHD and DM more positively and significantly related to each other since 0.05 < 0.74. If there is occurrence of death and missing people due to natural disasters, then private houses damaged due to same reason increase significantly.

4.4.2 Inferential analysis: Generalised least square model

A. Unit root test

To test the unit root for the time series variable for avoiding spurious econometric analysis, Augmented Dicky Fuller and Phillips-Perron test statistics have been applied. The hypothesis for unit root test is:

Null hypothesis (H_0) = Time series variable has unit root or variable is not stationary in nature.

Alternative hypothesis (H_A) = Or else

Table 4.4: Unit root test for LAF and LPHD

Level	ADF		P-P	
	t-statistics	**p-value**	**Adjusted t-statistics**	**p-value**
LAF	3.55	0.01**	3.43	0.01**
LPHD	7.21	0.00*	7.29	0.00*
First difference				
LAF	10.25	0.00*	11.60	0.00*
LPHD	10.76	0.00*	18.35	0.00*

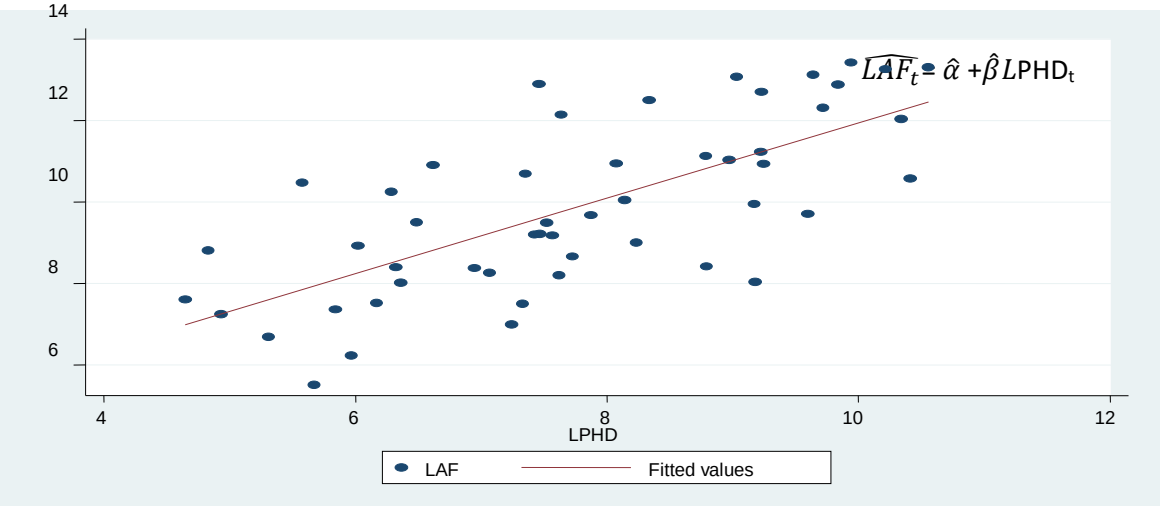
(*Notes*: * and** represent significance levels at 1% and 5% respectively. ADF = Augmented and Dickey-Fuller; (P-P) = Phillips-Perron)

Source: Author's calculation

Augmented Dicky Fuller test and P-P test statistics show that at 5% level of significance test statistic is greater than critical value or probability (0.01) < 0.05 in the case of LAF in table 4.4. So, null hypothesis for LAF has been rejected that means LAF has not unit root or it is stationary at level (I(0)). As such, at 5% level of significance for the LPHD, test statistics confirm that probability (0.00) < 0.05. This is why null hypothesis for LPHD has been cancelled out that means LPHD has not unit root or it is stationary at level (I(0)).

B. Estimated linear regression line

Figure 4.12: Estimated linear regression line



Source: Author's estimation

In the linear regression model in figure 4.12, doted points are the relationship between affected family and private house damaged both either partially or fully which established positive relationship between them that is presented as positively sloped estimated regression line as $\widehat{AF_t} = \hat{\alpha} + \hat{\beta}\text{PHD}_t$ .The errors or distance between doted point and estimated regression line is low. In other words, doted points are closer towards estimated regression line and there is not any outlier as well. That means linear regression model is well compatible to analyze the causality of private house damaged on affected family.

$\hat{e} = \text{AF}_t - \widehat{AF_t}$

$\hat{e} = \text{AF}_t - (\hat{\alpha} + \hat{\beta}\text{PHD}_t)$

$\text{AF}_t = \hat{\alpha} + \hat{\beta}\text{PHD}_t + \hat{e}$ [1.1]

C. Result of generalized least square

On the basis of estimates OLS, the value of ρ has been installed as -0.03 to estimate generalized least square regression as follows.

Table 4.5: ρ derived from OLS residual

Esq	Coef.	Robust St.Err.	t-value	p-value	[99% Conf	Interval]	Sig

LPHD	-.031	.19	-0.16	.871	-.412	.35	
Constant	2.383	1.535	1.55	.127	-.701	5.467	
Mean dependent var	2.143	SD dependent var	2.542				
R-squared	0.000	Number of obs	51				
F-test	0.027	Prob > F	0.871				
Akaike crit. (AIC)	242.879	Bayesian crit. (BIC)	246.743				
*** p<.01, ** p<.05, * p<.1							

Source: Author's estimation

Here,

$LAHh_t = \hat{\alpha} + \hat{\beta}LPHD_t + \hat{e}_t$ where, $\hat{e}_t$ = residual

$esq_t = \hat{\theta} + \hat{\gamma}LPHD_t + \hat{u}_t$ where, esq_t = square of $\hat{e}_t$

Where, $\rho = \hat{u} = -0.3$

$\therefore \hat{e}_t = -0.3\hat{e}_{t-1} + \hat{\varepsilon_t}$

Table 4.6: Generalized least square regression result

LAF	Coef.	Robust St.Err.	t-value	p-value	[99% Conf	Interval]	Sig
LPHD	.928	.123	7.56	0	.682	1.175	***
Constant	2.671	.982	2.72	.009	.698	4.644	***
Mean dependent var	9.879	SD dependent var	2.098				
R-squared	0.504	Number of obs	51				
F-test	57.149	Prob > F	0.000				
Akaike crit. (AIC)	187.579	Bayesian crit. (BIC)	191.442				
*** p<.01, ** p<.05, * p<.1							

Source: Author's estimation

The output of GLS model has been presented above table. On the basis of this regression output, values of sample statistics of LPHD and constant term can be fitted as

$$LAHh_t^* = 2.67 + 0.93LPHD_t^* + \hat{\varepsilon_t}$$

This estimated model tells at 99% confidence interval or 1% significance level, LPHD significantly and positively affects LAF as probability (0.00) <0.01. This fact discards the null hypothesis that private house damaged due to natural disasters does not significantly

or statistically affect the affected family of natural disasters. The 99% confidence interval has assured that the estimated regression model has only 1% chance of being Type I error i.e. 0.01 probability of selecting null hypothesis when it is wrong.

D. Discussion

Table 4.5 of estimated GLS model reports, when 1% private house damaged out of total damaged either partially, fully or both, then 0.93% households will be affected out of total affected households due to natural disasters while other things remaining same viz., death, missing, injured people and destruction of infrastructure due to natural disasters. In other words, if 10 household (including cowshed) will be damaged either fully or partially or both owing to natural disasters, then about 9 households will be victims of natural disasters and remaining households will be affected due to death and missing people, injured people and destruction of infrastructure may also impact on affected households of natural disasters. The goodness of fit or R^2 shows that the exogenous variable private house damaged solely explained 50% variation in endogenous variable viz. affected households of natural disaster. Then remaining of 50% variation will be explained by injured, death and missing people who fall under error term.

This result shows that Nepalese environment is vulnerable owing to natural disasters. This is because natural disasters have damaged houses where house is a major and most valuable property of general Nepali people. A general people should spend their whole saving of his or her life or else that is they spend their ancestral properties and even ought to incur a big amount of loan to build a house. If house would be collapsed, they would be bankrupt suddenly and dramatically. Then they fall into poverty line if they are not poor before disasters. It should be noted that, Nepal has only $ 1027 GNI per capita as of 2021 triennial review of UN CDP which is far below than threshold level $ 1222 for the same triennial review and Nepal has still 17.4 percent multi-dimentional poverty as per HDR, 2022. So a house has a great social and economical importance for a general people.

The estimated GLS also reports that constant term is also significant and positively affects the affected family. If private house damaged is not taken into consideration to

explain the affected households of natural disasters then constant term may comprise the impact of physical infrastructure damage, death and missing, injured people due natural disasters on affected households. If natural disaster damage infrastructure viz., roads, bridges, telecommunications and internet and electricity then about 2.7 percent family will be affected out of total figure of victims.

E. Residual diagnostic test of error term

a. Heteroscedasticity

The GLS estimation is based on the hypothesis as

$H_0 = \varepsilon_t$ are homoscedastic

$H_A = \varepsilon_t$ are heteroscedastic

Robust standard errors has been deployed to obtain unbiased standard errors of GLS coefficients as the presence of heteroscedasticity violates the Gauss Markov assumptions that are necessary to render OLS the best linear unbiased estimator (BLUE) ,where GLS is the extended version of OLS.

$$\sigma^2(\hat{\beta})|_{\text{Robust}} = \frac{\sum_{t=1}^{n} (LPHD_t - \overline{LPHD})^2 \ \varepsilon_t^2}{(\sum_{t=1}^{n}(LPHD_t - \overline{LPHD})^2)^2}$$

This is variance of test statistic$\hat{\beta}$, which gives robust standard error which ascertains that the error terms are homoscedastic in nature.

b. Normality

GLS follows the assumptions that the disturbances terms are normally distributed.

Table 4.7: Skewness and Kurtosis test

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	Joint	
				Adj chi2(2)	Prob>chi2

Error/residual	51	0.8720	0.3549	0.91	0.6330

Source: Author's calculation

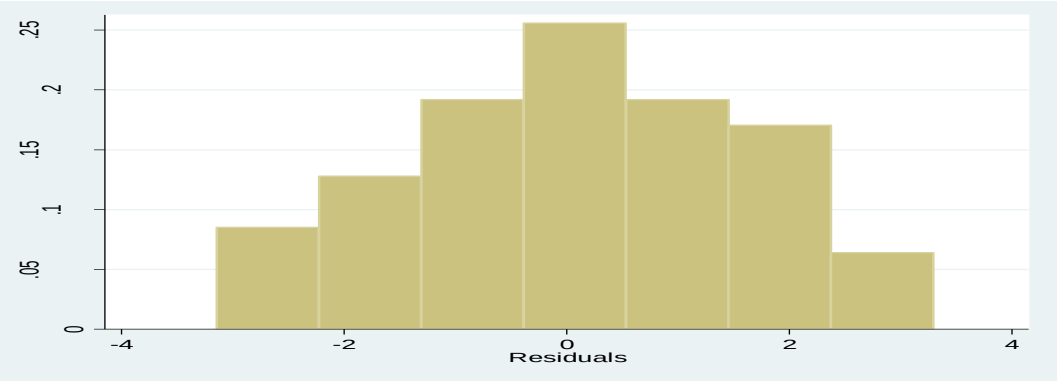
The Skewness and Kurtosis test for normality has been taken to test normality of error term which based on the hypothesis as:

H_0 = error terms are normally distributed

H_A = error terms are not normally distributed

The SK test for normality shows that at 5% level of significance, the probability 0.63 > 0.05 which do not support the alternative hypothesis. This fact proves that the error term is normally distributed.

Figure 4.13: Histogram of residual



Source: Author's estimation

This histogram shows that error terms of GLS about normally distributed. However, in time series regression analysis, to obtain perfectly normally distributed histogram is a difficult task as in time series data analyses; we get only limited years' data as sample size. The central limit theory suggests as sample size is sufficiently increased, the error terms become normally distributed.

i.e $\bar{X} \sim \mathrm{N}\ (\mu, \frac{\sigma}{\sqrt{n}})$

c. Autocorrelation

The GLS method of regression per se a method of removing autocorrelation from the estimated regression which ensure there is no autocorrelation in the estimated regression. The Durbin-Watson test statistics has been deployed to test the autocorrelation of error term along with the following hypothesis as

H_0 = There is no autocorrelation

H_A = There is autocorrelation in error terms

$D_w = \frac{\sum_{t=1}^{n}(\varepsilon_t - \varepsilon_{t-1})^2}{\sum_{t=1}^{n}\varepsilon_t^2} = 1.30$, which is near 2. So, Durbin Watson test statistics shows that there is no autocorrelation i.e. cov(ε_t , ε_{t-1}) = 0.

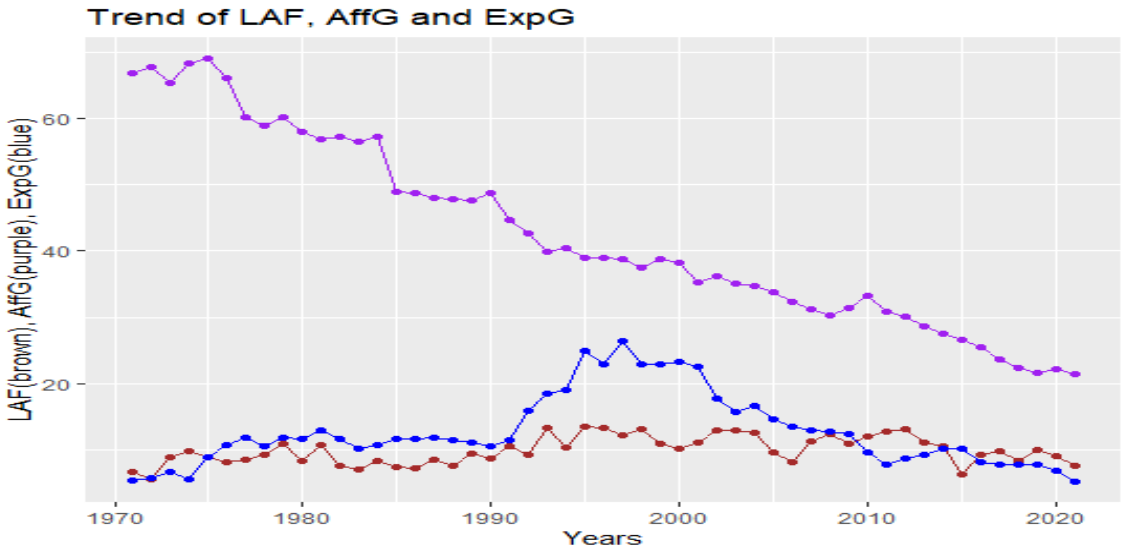
4.5 Impact of affected family in share of agriculture, forestry and fishing to GDP and share of export of goods and services to GDP

To quantify the impact of natural disasters on economic vulnerability index, affected family of natural disasters (AF) has been employed as a shock of natural disasters in share of agriculture, forestry and fishing to GDP (AffG) and share of export of goods and services to GDP (ExpG). The analyses of data for AF, AffG and ExpG haves been separated into descriptive and inferential data analysis.

4.5.1. Descriptive data analysis

A. Time series trend of LAF, AffG and ExpG

Figure 4.14: Time series trend of LAF, AffG and ExpG



Source: Author's calculation

The trend of AffG in figure 4.14 implies that the share of agriculture, forestry and fishing to GDP (AffG) of Nepal has been persistently decline in most of the stages of the trend. In FY 1975, Nepal achieved 69 percent share to GDP of this sector as a maximum level in history. However, in FY 2021, Nepal marked 21.31 percent to GDP as minimum level in history. The trend of AffG in study time frame depicted that on and average Nepal got 42.55 percent to GDP throughout the time frame. The trend of AffG also indicates that AffG is not vulnerable per se as there is no any oscillation in the tendency of AffG. As such the trend of log of affected family of natural disasters LAF is steady in nature which is deployed as a shock of natural disasters to AffG. The trend between LAF and AffG apparently signifies there is no any statistical significant association. So, AffG is not vulnerable with respect to natural disasters.

As such, the trend of ExpG implies that in between 1971 to 1990, the share of export of goods and services to GDP (ExpG) was in moderately rose up the after 1990 to 1997 At the period of post 1990, ExpG had been sky rocketed. As such, after 1997, ExpG had been drastically or significantly reduced especially after the membership of WTO The overall trend of ExpG depict that the ExpG of Nepal is somehow vulnerable per se as trend shows somehow oscillation.

Likewise the trend between LAF and ExpG display that in most of the cases when LAF increased, ExpG also increased and vice versa. However, before late 1970s and after 2009 there is an inverse relation between LAF and ExpG. But, overall performance between them implies LAF does not affect ExpG significantly. However, there is still some room for doubt.

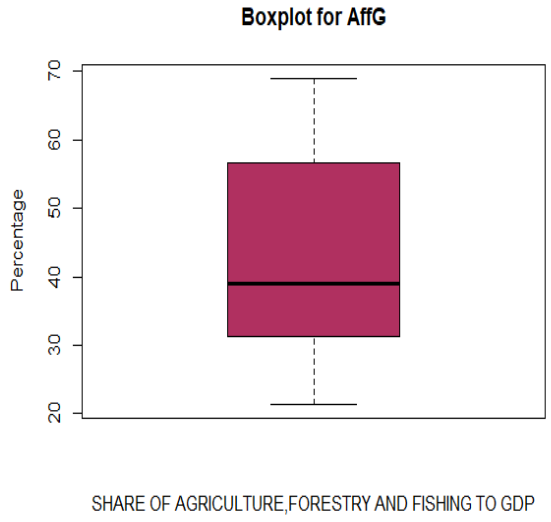
B. Descriptive statistics

Table 4.8: Descriptive statistics for AF, AffG and ExpG

Statistics / Variables	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
AffG	21.32	31.24	38.93	42.56	56.66	69.01
ExpG	5.209	9.098	11.529	12.702	15.142	26.328
AF	250	4117	16022	108444	71736	674822

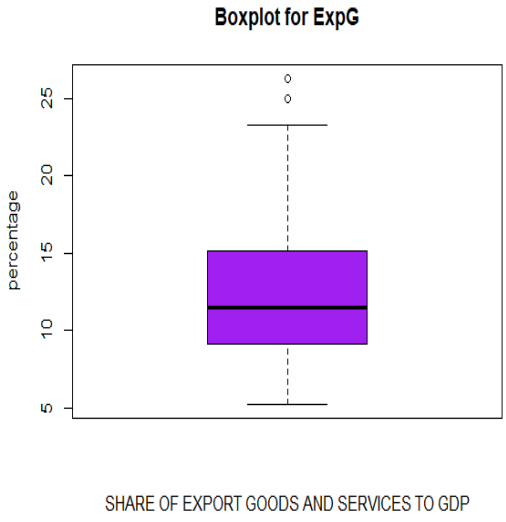
Source: Author's calculation

Figure 4.15: Boxplot for AffG



Source: Author's calculation

Figure 4.16: Boxplot For ExpG



Source: Author's calculation

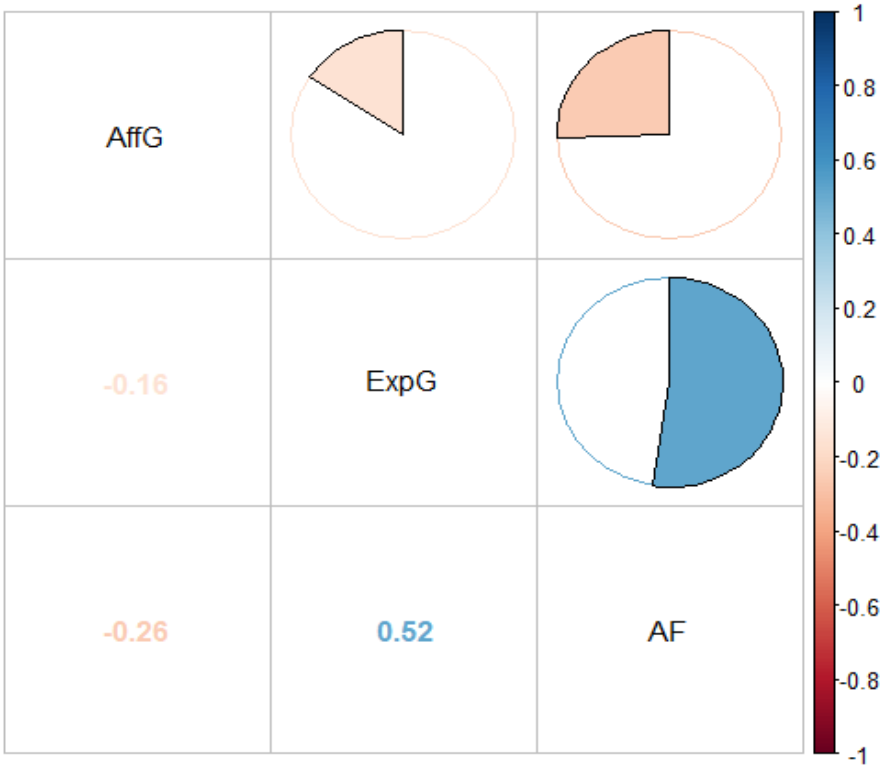
The descriptive test statistics in table 4.8 and boxplot in figure 4.15 display that the minimum AffG was marked at 21.3 percent in 2021 and in the year 1975 maximum AffG was reported at 69.01. The average performance of Nepal on AffG stay at 42.56. The upper quartile or Q_3 = 56.66 of AffG shows 25 percent of the observation of AffG in between 1971 to 2021 lies above 56.66 and Q_1 = 31.24 shows that 25 percent observation of AffG fall bellow 31.24. The median = 38.93 of AffG in the related boxplot is closer to lower quartile and whisker is shorter on the lower end of the boxplot that means the normal distribution of the AffG is posively skewed i.e. most of the observation lies above the middle value.

As such as per figure 4.16, in between taken time frame of study, Nepal got 26.33 percent of ExpG as a highest magnitude in in history in FY 1997 which has been staying as a apex level. On the other hand, Nepal experienced 5.21 percent share to GDP of export sector in FY 2021 which was even less than FY 1971 which was 5.40 percent. The average performance of ExpG remains only 12.70 percent only to GDP. The upper quartile or Q_3 = 15.14 of ExpG shows 25 percent of the observation of ExpG in between 1971 to 2021 lies above 15.14 and Q_1 = 9.09 shows that 25 percent observation of ExpG fall bellow 9.09. The median = 11.52 of ExpG in the related boxplot is closer to lower quartile and whisker is shorter on the lower end of the boxplot that means the normal distribution of the ExpG is posively skewed i.e. most of the observation lies above the middle value.

When AF was minimum number of 250 in 1972 in, AffG was 67.84 which is immediate left to maximum value of AFFG i.e 69.01 and when AF was maximum number of 674822 in 1995, AffG was 39.04 which is more greater than minimum value of AffG i.e.21.32. As such, when AffG was minimum 21.32 in 2021, AF was 1828 which is far below than maximum value of AF and when AffG was maximum 69.01 in 1975, AF was 6725 which is far greater than minimum value of AF. These evidences show that AF does not significantly and negatively impact on AffG. Likewise, when AF was 250 (min.), ExpG was 5.66 which is immediate right to minimum value of ExpG and AF was 674822 (max.), ExpG was 24.97. Thus, from descriptive point of view, AF does not negatively and significantly impact on ExpG of Nepal.

C. Correlation matrix

Table 4.9: Correlation matrix for AF, AffG and ExpG



Source: Author's calculation

This correlation matrix (in table 4.9) is based on Pearson correlation that lies in between +1 and -1 . The matrix displays that affected family and share of export to GDP is positively and significantly related to each others. This may due to sufficient raining in monsoon, the cash crop production rise up and suppy of sufficient electricity in this season strengthen the manufacturing production lead to support export and at the same time due to more raining, the water induced disasters viz. floods, landsides, thunderbolt, etc may lead to more affected family of disasters. The matrix further tells that there is negative association between affected family and share of agriculture, forestry and fishing to GDP but this is not significant. Thus, the matrix shows affected family does not affect share of agriculture, forestry and fishing to GDP and share of goods and services to GDP.

4.5.2 Econometric analysis: Vector auto regressions (VAR) model

To discover the economic vulnerability, share of agriculture, forestry and fishing and instability of export of goods and services as share of export of goods and services to GDP sub-indexes of environmental vulnerability index have been taken into consideration. Then vulnerability of these two economic sub-indexes have been quantified in terms of victims of natural disasters as total affected family of natural disasters on the basis of following VAR econometric model.

$X_t = \alpha_t + \sum_{i=1}^{n} A_i X_{t-i} + U_t$ [2]

A. Unit root test

To test the unit root for the time series variables for avoiding spurious econometric analysis, Augmented Dicky Fuller and Phillips-Perron test statistics have been applied. The hypothesis for unit root test is

Null hypothesis (H_0) = Time series variable has unit root or variable is not stationary in nature.

Table 4.10: Unit root test for ExpG and AffG

Level	ADF		P-P	
	t-statistics	**p-value**	**Adjusted t-statistics**	**p-value**
AFFG	0.84	0.79	1.33	0.60
ExpG	1.21	0.66	1.42	0.56
LAF	3.55	0.01**	3.43	0.01**
LPHD	7.21	0.00*	7.29	0.00*
First difference				
AFFG	7.79	0.00*	10.72	0.00*
ExpG	6.55	0.00*	0.63	0.00*
LAF	10.25	0.00*	11.60	0.00*
LPHD	10.76	0.00*	18.35	0.00*

(*Note*: * and** represent significance levels at 1% and 5% respectively. ADF = Augmented and Dickey-Fuller; (P-P) = Phillips-Perron)

Source: Author's calculaion

In table 4.10, for variable ExpG, the augmented dicky fuller and Phillips-Perron test show, it is stationary at first difference i.e. I(1) as probability of test statistics is lower than 5% level of significance i.e. 0.00 < 0.05 that means we do not accept null hypothesis viz. there is unit root in ExpG. As such in the case of AffG, probability of test statistic is lower than 0.05 which ensure AffG has not unit root at first difference i.e. I(1). But, LAF is stationary at level i.e. I(0) as already tested.

B. VAR model lag order selection

Table 4.11: Lag selection for VAR model

Lag	LogL	LR	FPE	A/C	SC	HQ
0	-282.3349	NA	49.02134	12.40587	12.52513*	12.45054
1	-269.6534	23.15749*	41.82489*	12.24580*	12.72284	12.42450*
2	-264.7138	8.375933	50.19196	12.42234	13.25715	12.73507
3	-254.9607	15.26572	49.26010	12.38960	13.58219	12.83635
4	-246.9171	11.54083	52.71940	12.43118	13.98155	13.01196

(Note: * indicates lag order selected by the criterion at 5 % level where, LR = sequential modified LR test statistic, FPE = final prediction error, AIC = Akaike information criterion, SC = Schwarz information criterion, HQ = Hannan Quinn information criterion.)

Source: Author's estimation

The lag selection criteria of SC indicate, there should not be any lag. However, lag selection criteria of LR, FPE, AIC abd HQ suggests that an ideal lag for VAR has to be 1. So, for VAR model, 1 lag has been selected for VAR estimation which is denoted as VAR (1).

C. VAR (1) model

a. VAR (1)) estimates

Table 4.12: VAR (1) result

	LAF	D(AFFG)	D(EXPG)
LAF (-1)	0.551917 (0.11834) [4.66387]	0.219008 (0.12993) [1.68555]	-0.072424 (0.13895) [-0.52124]
D (AFFG (-1))	0.014169 (0.13028) [0.10876]	-0.186341 (0.14304) [-1.30268]	0.047667 (0.15297) [0.301161)

D (EXPG (-1))	-0.0009977 (0.13088) [-0.07623]	-0.214345 (0.13028) [0.10876]	0.046747 (0.15367) [0.30420]
C	4.530945 (1.22169) [3.70876]	-3.301501 (1.34138) [-2.46128]	0.756530 (1.43444) [0.52741]

(Note: standard error in ( ) and t- statistics in [ ])

Source: Author's estimation

The estimated VAR (1) model can be formulated as

$X_t = \hat{\alpha} + \sum_{i=1}^{n} \widehat{A_1} X_{t-1} + \widehat{U}_t$ Where, n = 1 so

$X_t = \hat{\alpha} + \widehat{A_1} X_{t-1} + \widehat{U}_t$ [3]

Matrix representation is

$$\begin{bmatrix} LAF_t \\ D(AffG_t) \\ D(ExpG_t) \end{bmatrix} = \begin{bmatrix} 4.53 \\ -3.30 \\ 0.75 \end{bmatrix} + \begin{bmatrix} 0.53 & 0.014 & -0.009 \\ 0.219 & -0.186 & -0.214 \\ -0.072 & 0.047 & 0.046 \end{bmatrix} \begin{bmatrix} LAF_{t-1} \\ D(AffG_{t-1}) \\ D(ExpG_{t-1}) \end{bmatrix} + \begin{bmatrix} \widehat{u_{1t}} \\ \widehat{u_{2t}} \\ \widehat{u_{3t}} \end{bmatrix}$$

This implies that

Where,

$LAF_t = 4.53 + 0.552LAF_{t-1} + 0.014\ D(AffG_{t-1}) - 0.009\ D(ExpG_{t-1}) + \widehat{u_{1t}}$ [3.1]

$D(AffG_t) = -3.30 + 0.219LAF_{t-1} - 0.186D(AffG_{t-1}) - 0.214D(ExpG_{t-1}) + \hat{u}_{2t}$ [3.2]

$D(ExpG_t) = 0.75 - 0.072LAF_{t-1} + 0.047D(AffG_{t-1}) + 0.046D(ExpG_{t-1}) + \widehat{u_{3t}}$ [3.3]

b. Granger causality or exogeneity Wald test

Tabele 4.13: Granger causality or exogeneity Wald test

Dependent variable: LAF			
Excluded	Chi-sq	Df	Prob.
D (AFFG)	0.011828	1	0134
D (EXPG)	0.005811	1	0.9392
All	0.022628	2	0.9888

Dependent variable: D (AFFG)			
Excluded	Chi-sq	Df	Prob.
LAF	2.841087	1	0.0919
D (EXPG)	2.224932	1	0.1358
All	50171728	2	0.0753
Dependent variable: D (EXPG)			
Excluded	Chi-sq	Df	Prob.
LAF	0.271687	1	0.6022
D (AffG)	0.097103	1	0.7553
All	0.344907	2	0.8416

Source: Author's estimation

The Granger causality or Wald test based on the hypothesis that

H_0: independent variable does not cause to dependent variable and

H_A: otherwise

c. Discussion

In table 4.13 Granger causality or Wald test statistic shows that LAF is not granger cause to AffG as probability (0.09) > 0.05. By this reason null hypothesis cannot be rejected i.e. LAF does not cause to AffG. Thus, it is concluded that natural disasters in Nepal have not been affecting negatively and statistical significantly on Share of agriculture, forestry and fishing to GDP. According to UN CDP, share of agriculture, forestry and fishing in GDP is a sub-index of EVI is directly subject to natural and economic shocks (CDP, 2014) However, in the context of Nepal, natural disasters have not been significantly and adversely impact on AFFG.

One of the reasons of so is that in VAR model, only seasonal natural disasters viz. flood, landside, storms etcetera have been taken into consideration and on the other side agricultural productions have been cultivating in different season so all the natural disasters cannot negatively and statistically affect on agricultural productions. However, Nepal's agriculture is heavily based on monsoon owing to lower irrigation facility. As

such, monsoon is also the season of major natural disasters including flood and landslide. So, it is rational to say that the benefits of monsoon on agricultural production are much higher than the destruction of flood and landslide in agricultural production in monsoon season. This is why; destruction of natural disasters has not significant on share of agriculture, forestry and fishing in GDP.

There are agro-commodities which are imported from India and other countries in huge quantity by the scarce hard currency earned through remittance. Evidence shows that almost 70% of the remittance is spent for agriculture commodities which have high potentiality to produce within the country even after local consumption. Such production could be exported to other countries to mitigate trade imbalance, enhance export promotion and import reduction and promote graduating Nepal from LDC to developing country within the stipulated time frame as proposed by the government of Nepal. Nepal is culturally an agriculture based country. One third of GDP comes from agriculture and there are numerous opportunities in agriculture mainly because of varied agro-climate prevailed in the country. Trade deficit, food insecurity, income generation, poverty reduction, and employment generation could be addressed by turning present status of subsistence agriculture into robust, vibrant and commercial agriculture through technology led agro-industrialization (Paudel, 2016).

This evidence suggests that it has been urgent to provide the facilities to agricultural sector of Nepal in terms of irrigation, financial accession etc. The Government has targeted to expand agricultural credit through banking and financial institutions (BFIs) by implementing several acts, policies, strategies and programs through Nepal Rastra Bank (NRB), Ministry of Agricultural and Livestock Development (MoALD) and Ministry of Finance (MoF). However, constraints like credit ceiling, high value collateral demand, limited redemption facilities, limited agriculture insurance, financial illiteracy, lack of farmer friendly technologies, and poor monitoring and regulation of BFIs are responsible for lower credit expansion (Pandey, 2022).

As such, LAF is not a granger cause on ExpG as probability (0.6) > 0.05 significance level. So, affected families or households of natural disasters do not negatively and significantly impact on share of export of goods and services to GDP. This result can be

generalized as natural disasters in Nepal have not negative impact on exports of goods and services.

In general intuition it gets rational to say that the destruction of natural disasters like damage of roads, bridges, electricity related infrastructure- power station and grid and other infrastructures which facilitates industrial sectors etc. has not negative influence on export sectors of the country significantly. On the other side share of export to GDP of Nepal has been persistently decreasing state but it is not volatile in nature i.e. variance of ExpG is lower that indicates that export of Nepal is not volatile in terms of natural disasters and its own past shocks.

However, it is noted that, access to all LDC-specific Special and Differential Treatment (SDT) provisions and technical assistance under WTO rules as well as WTO-compliant zonal business contracts, along with those meet by their business partners, will be lost after graduation. These will affect policy space and flexibility thereby increase adjustment cost (CDP, 2017). As such, the export performance of Nepal is very low which is creating the problem of rapidly increasing trade deficit. Nepal is also unable to diversify its trade in terms of countries and commodities. The major causes of increasing trade deficit are low export, high import, low-quality products, improper trade policy, higher cost of production, lack of publicity and advertisement, low production, slow industrial development, lack of trade diversification, etc (Acharya, 2019).

D. Impulse response function analysis

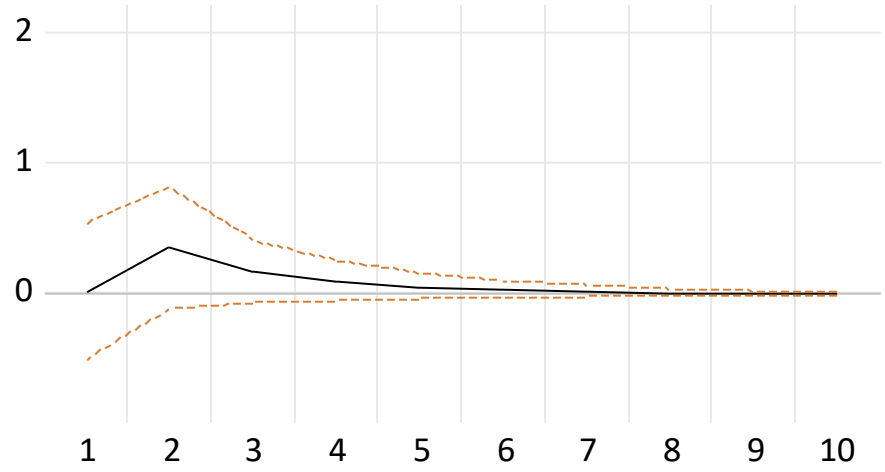
Impulse response functions allow us to trace out the path both current and future of the variables in VAR model to a one unit increase in the current value of one of the VAR error. In other words, it shows impact of one unit shock on one variable to others. Thus, main purpose of the impulse response analysis is to describe the evolution of the one variable in reaction to a shock or innovation in other variables or same variables.

In this way, Impulse response functions are used to describe how the economy reacts over time to exogenous impulses-which is also called shocks. Impulses are often treated as exogenous from a macroeconomic point of view. Impulse response functions describe

the reaction of endogenous macroeconomic variables at the time of the shock and over subsequent points in time.

The following asymmetric impulse response functions have been derived via "Response of Cholesky one standard deviation (S.D.) (degree of freedom adjusted) innovation along with ±2 analytic asymptotic S.Es " method where doted lines are standard error (S.E) confidence bands. The confidence intervals are computed as ±2 S.E. bands. Likewise, x-axis represents periods and y- axis shows variation.

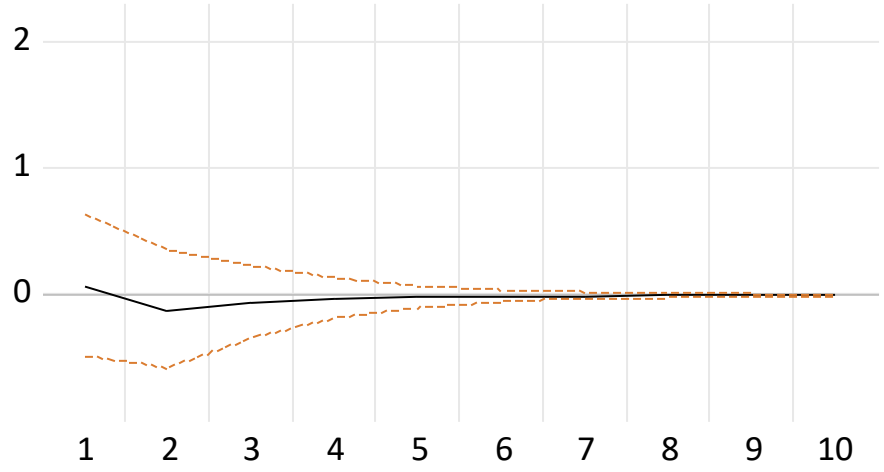
Figure 4.17: Response of D(AffG) to LAF innovation



Source: Author's estimation

Figure 4.17 shows that if there is one standard error shock or innovation in affected families of natural disasters, then share of agriculture, forestry and fishing to GDP (AffG) will increase up to period 2 and then starts decreasing. Then after period 6, AffG would be stabilized. This shows that there is a positive association of AffG and LAF in the short run but not such relation in the long term.

Figure 4.18: Response of D(ExpG) to LAF innovation



Source: Author's estimation

Figure 4.18 can be exposited as if there is one S.E. shock or innovation in affected family of natural disasters, then share of export of goods and services (ExpG) responses initially negatively or ExpG will decrease up to 2 period then it will recover up to 5 periods and then will be stabilized. This shows that, there is negative relation between victims of natural disasters and share of export to GDP in the short run but not such relation in the long term.

E. Variance decomposition or forecast error variance decompositions

Variance decomposition displays the percentage of the error made forecasting a variable over time due to a specific shock. In other words, how much of the variability in the dependent variable is explained by its own shocks versus the shocks in the other variables in the system.

Thus, variance decomposition refers to the breakdown of the forecast error variance for a specific time horizon. The variance decomposition can indicate which variables have short-term and long-term impacts on others and per ser. Besides, the variance decomposition considers the percentage of the fluctuation in a time series attributable to the variables at select time horizons.

Table 4.14: Variance decomposition of AffG and ExpG

Variance decomposition of D (AFFG)				
Period	S.E.	LAF	D (AFFG)	D (EXPG)
1	1.84	0.008	99.99	0.00
2	1.94	3.25	92.22	4.25
3	1.94	3.93	91.50	4.52
4	1.95	4.15	91.28	4.55
5	1.95	4.22	91.22	4.55
6	1.95	4.24	91.20	4.55
7	1.95	4.25	91.19	4.55
8	1.95	4.25	91.19	4.54
9	1.95	4.25	91.19	4.54
10	1.95	4.25	91.19	4.54
Variance decomposition of D (EXPG)				
Period	S.E.	LAF	D (AFFG)	D (EXPG)
1	1.97	0.13	4.76	95.10
2	1.98	0.48	4.84	94.66
3	1.98	0.56	4.84	94.58
4	1.98	0.58	4.84	94.56
5	1.98	0.59	4.84	94.55
6	1.98	0.60	4.84	94.55
7	1.98	0.60	4.84	94.55
8	1.98	0.60	4.84	94.55
9	1.98	0.60	4.84	94.55
10	1.98	0.60	4.84	94.55

Source: Author's estimation

In the analyzed variables impact in the medium and longterm, the variance decomposition test is applied to forecast the AffG and ExpG impacts for the next 10 years. Period 1 to 3 has been considered as short run and after that it presumes as long run periods. In the short run, endogenous impact level of share of agriculture, forestry and fishing to GDP (AffG) decreases gradually from 99.99% to 91.50% and exogenous

impact level or impact of LAF increases from almost 0% to 3.9% . At period 1 LAF has not contemporaneous impact on AffG. In the long run endogenous impact level of AffG has been stabilized around 91.2% to 91.1% and exogenous impact level of LAF on AffG has also been stabilized around 4.1% to 4.2%. This shows that explanatory power of LAF has lower on AffG and AffG has higher explanatory power to explain its own past values that ensure AffG is not statistically vulnerable on the basis natural disasters and its own past values.

As such, in the short run, endogenous impact level of share of export of goods and services to GDP (ExpG) decreases gradually from 95.10% to 94.58% and exogenous impact level or impact of LAF increases from almost 0.13% to 0.56% . In the long run endogenous impact level of ExpG has been stabilized around 94.56% to 94.55% and exogenous impact level of LAF on ExpG has also been stabilized around 0.58% to 0.60%. This shows that explanatory power of LAF has lower explanatory power on ExpG and ExpG has higher explanatory power to explain its own past values that ensure Expg is not statistically vulnerable on the basis natural disasters and its own past values

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F. Diagnostic test

a. VAR (1) model stability

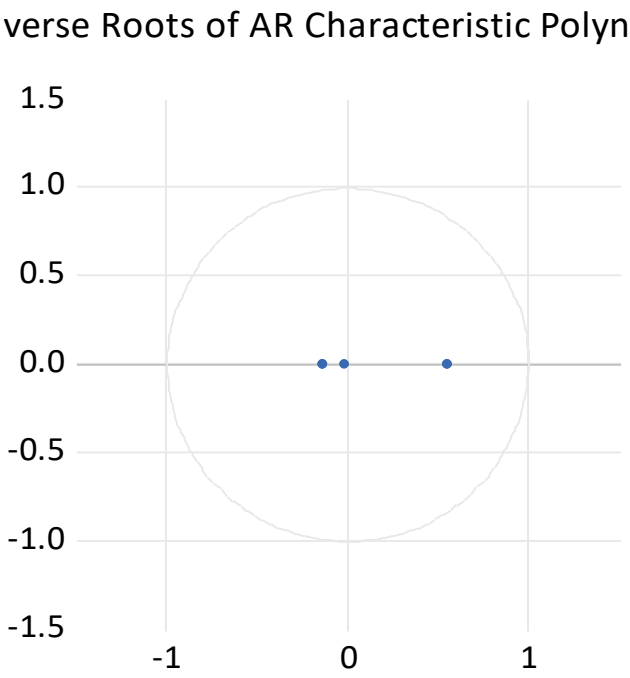
The dynamically-stable model is considered after fitting the VAR that is tested by Roots of Characteristic Polynomial to check the dynamical stability condition. If all the eigen-values lie inside the unit circle, the VAR satisfies stability condition. Because the modulus of each eigen-value is strictly less than 1, the estimates satisfy the eigen-value stability condition. Besides, specifying the graph option produced a graph of the eigen-values with the real components on the x-axis and the complex components on the y-axis. The graph below indicates visually that these eigen-values are well inside the unit circle. The results are the basis for assessing the impact of affected family of natural disasters on share agriculture, forestry and fishing to GDP and share of export of goods and services to GDP.

Table 4.15: Roots of characteristic polynomial

Root	0.74	0.51	-0.41-0.09i	-0.41+0.09i	-0.05-0.40i	-0.05+0.40i
Modulus	0.74	0.51	0.42	0.42	0.41	0.41

Author's calculation

Figure 4.19: Dynamically stability test



Source: Author's estimation

All the Eigen-values or root of characteristics polynomial are less than 1 and they all fall inside the unit circle in figure 4.16. So, the operated VAR (1) model satisfies the VAR stability condition.

b. Autocorrelation test

Table 4.16: Autocorrelation test for VAR(1) model

Null hypothsis: No serial correlation at lag h						
Lag	LRE*stat	Df	Prob.	Rao F-stat	Df	Prob
1	4.74	9	0.85	0.52	(9, 97.5)	0.85
2	11.64	9	0.23	1.32	(9, 97.5)	0.23
Null hypothsis: No serial correlation at lag 1 to h						
Lag	LRE*stat	Df	Prob.	Rao F-stat	Df	Prob
1	4.74	9	0.85	0.52	(9, 97.5)	0.85

2	21.70	18	0.24	1.23	(18, 105.1)	0.24

(Note: * is Edgeworth expansion corrected lilelihood ratio statistics.)

Source: Author's calculation

The Lagrange- Multiplier test statistic of autocorrelation shows at 5% level of significance, the probability of test statistic at 1 lag selection is 0.85 which is higher than 0.05. This evidence, thus, suggests that the hull hypothesis that is no serial autocorrelation at lag 1 cannot be rejected. At lag 2, this conclusion is also applicable.

CHAPTER V

SUMMARY AND CONCLUSION

This section includes summary of overall thesis including introduction, research problem, research questions, methodological aspects, results and interpretation of the econometric model. On the basis of overall result the inference has been drawn as a conclusion.

5.1 **Summary**

The EVI index of Nepal has been persistently achieved since 2015 triennial review of UN CDP. But natural disasters in Nepal especially water induced and other season based natural calamities have been damaged human life and property severely on regular interval. So, study sets the objective as to discover the impact of natural disasters on EVI index as to discover the impact of private house damaged as a shock of natural disasters on families level, to show the effects of total affected families of natural disasters in share of agriculture, forestry and fishing to GDP and to show the effects of total affected families of natural disasters in share of exports of goods and services to GDP.. Private house damaged has been used as shock of natural disasters to victims of natural disasters as affected family whereas affected family of natural disaster has been deployed as a shock of natural disasters to economic vulnerability index that are share of agriculture, forestry and fishing to GDP and share of export of goods and services to GDP.

The research design is basically explanatory, descriptive and correlation in nature and before only study design has been deployed. The data for the study have been taken dominantly from MOHA and Disinventer, and Word Bank. Generalized least square (GLS) regression has been adapted to test the impact of private house damaged as shock of natural disaster in family level or household as victims of natural disasters. As such VAR (1) model has been deployed to test the impact of affected family of natural disaster as a shock of natural disasters in both share of agriculture, forestry and fishing to GDP and share of export to GDP.

The estimated regression model reports, if 10 household (including cowshed) will be damaged either fully or partially or both owing to natural disasters, then about 9 families

will be victims of natural disasters and remaining families will be affected due to death and missing people, injured people damaged in harvest and destruction of infrastructure may also impact on affected families of natural disasters.

The granger causality of VAR (1) shows affected family is not granger cause on share of agriculture, forestry and fishing to GDP. One of the reasons of so is that in VAR model, only seasonal natural disasters viz. flood, landside, storms etcetera have been taken into consideration and on the other side agricultural productions have been cultivating in different season so all the natural disasters cannot negatively and statistically affect on agricultural productions. However, Nepal's agriculture is heavily based on monsoon owing to lower irrigation facility. As such, monsoon is also the season of major natural disasters including flood and landslide. So, it is rational to say that the benefits of monsoon on agricultural production are much higher than the destruction of flood and landslide in agricultural production in monsoon season. The impulse response functions show that there is a positive association of AffG and AF in the short run but not such relation in the long term. As such, there is negative relation between AF and ExpG in the short run but not such relation in the long term. Likewise, variance decomposition tests show that AffG is not statistically vulnerable on the basis of AF and its own past values in both short and long run evidence and ExpG is not statistically vulnerable on the basis of AF and its own past values in both short and long run time horizon.

5.2 Conclusion

Based on the objectives, methodology and econometric model, the findings of study concluded as the natural disasters do Impact on economic vulnerability index that is her environment is significantly vulnerable with respect to natural disasters as derived via the GLS that is if 10 household (including cowshed) will be damaged owing to natural disasters, then about 9 families will be affected. However, natural disaster does not significantly impact on share of agriculture, forestry and fishing to GDP and share of export of goods and services to GDP. It is because the granger causality of VAR (1) shows AF does not impact on AffG and ExpG. The impulse response functions show that there is a positive association of AffG and AF in the short run but not such relation in the long term. As such, there is negative relation between AF and ExpG in the short run but

not such relation in the long term. Likewise, variance decomposition tests show that AffG is not statistically vulnerable on the basis of AF and its own past values in both short and long run evidence and ExpG is not statistically vulnerable on the basis of AF and its own past values in both short and long run time horizon. That is national macro economy of her is not vulnerable with reference to season based natural disasters statistically significantly.

There are a lot of aspects as future research direction for researchers including relation between GNI per capita and some sub index of EVI or HAI, relation within sub index of same criteria like HAI and EVI, impact of some external factors like foreign direct investment (FDI), official development assistance (ODA), remittance, etc in some aspects of LDC graduation and so forth.

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APPENDIX

APPENDIX A: Raw data sets

1. Impact of natural disasters other than earthquakes since 1971 to 2021

Years	Death	Missing	Affected Family	Estimated loss	Injured	Private house damaged fully	Private house damaged partially
1971	139	0	810	0	15	72	130
1972	120	7	250	0	81	210	80
1973	62	9	7554	0	29	308	104
1974	108	1	16022	0	97	1774	849
1975	66	21	6725	0	43	94	31
1976	164	28	3047	0	31	145	434
1977	90	4	4468	0	25	99	456
1978	86	0	10093	0	49	1682	58
1979	54	0	54626	0	21	728	20
1980	239	1	4342	0	288	12426	13628
1981	198	201	43892	0	19	571	992
1982	218	13	2007	0	14	83	21
1983	168	15	1098	0	60	192	1206
1984	271	24	3892	0	38	714	459
1985	64	7	1582	0	32	281	62
1986	106	0	1411	0	30	134	4
1987	73	0	4542	0	13	476	6112
1988	903	2	1851	0	6610	22160	41138
1989	194	5	13269	0	64	507	1336
1990	109	35	5771	0	43	922	1346
1991	118	0	35702	0	48	68	196
1992	62	61	9958	0	20	1605	70
1993	1488	72	605945	0	198	17241	21645
1994	124	26	29106	0	129	583	324
1995	287	29	674840	0	85	5059	15689
1996	346	91	576278	0	132	13617	13734
1997	194	4	189495	0	195	1410	899
1998	379	16	505175	0	247	14965	455
1999	317	41	56884	0	156	2587	619
2000	247	16	23273	0	120	2036	1395

2001	446	74	68136	0	286	4221	2322
2002	626	85	394121	0	285	13342	5363
2003	461	76	397897	0	339	986	750
2004	322	47	268803	0	142	865	3310
2005	115	7	13501	0	90	157	501
2006	253	92	3126	0	258	1193	8466
2007	264	41	75335	0	312	8842	1323
2008	407	69	223767	0	453	13630	3046
2009	420	67	56383	0	352	1323	9004
2010	436	48	170615	0	374	3185	27654
2011	549	83	363814	8166000	740	5128	7822
2012	466	55	477273	14573278	405	580	7817
2013	447	63	62634	2100000	380	366	7537
2014	397	275	39618	15102729917	381	8779	24515
2015	9216	212	512	22307400	22593	773272	299211
2016	391	45	9730	887960201	434	1151	780
2017	357	58	16504	137327000	428	548	14146
2018	286	5	3679	271240558	540	633	1407
2019	334	39	20984	1629846349	1910	3299	6353
2020	450	101	8201	199670600	621	1072	2702
2021	330	67	1899	303582380	424	977	621
Grand Total	23967	2338	5570440	18579503683	40679	946298	558142

Source: MOHA and Disinventer (DRR portal)

2. Affected families district wise since 1971 to 2021

S.N.	DISTRICT	Affected family of floods	Percentage of total	Affected family landslides	Percentage of total
1	Achham	5004	0.11	1706	0.285
2	Arghakhanchi	4204	0.09	10592	1.771
3	Baglung	5734	0.12	15605	2.609
4	Baitadi	6081	0.13	86	0.014
5	Bajhang	2317	0.05	9676	1.618
6	Bajura	1849	0.04	7748	1.296
7	Banke	28154	0.63	295	0.049

8	Bara	104764	2.36	15	0.003
9	Bardiya	65734	1.486	0	0
10	Bhaktapur	11912	0.26	583	0.097
11	Bhojpur	5031	0.114	15852	2.651
12	Chitawan	176962	4.001	7948	1.329
13	Dadeldhura	4434	0.1	3230	0.54
14	Dailekh	1416	0.032	3926	0.656
15	Dang	67216	1.52	450	0.075
16	Darchula	3954	0.089	2234	0.374
17	Dhading	19149	0.433	23830	3.985
18	Dhankuta	586	0.013	4527	0.757
19	Dhanusha	275403	6.227	131769	22.034
20	Dolakha	452	0.01	15945	2.666
21	Dolpa	204	0.005	1086	0.182
22	Doti	1124	0.025	12013	2.009
23	Gorkha	672	0.015	4714	0.788
24	Gulmi	1535	0.035	19763	3.305
25	Humla	3037	0.069	1098	0.184
26	Ilam	1567	0.035	1875	0.314
27	Jajarkot	923	0.021	10552	1.764
28	Jhapa	60327	1.364	3212	0.537
29	Jumla	4	0	1903	0.318
30	Kailali	92617	2.094	6414	1.073
31	Kalikot	62	0.001	2183	0.365
32	Kanchanpur	67691	1.53	767	0.128
33	Kapilbastu	29408	0.665	300	0.05
34	Kaski	401686	9.082	5960	0.997

35	Kathmandu	505	0.011	217	0.036
36	Kabhrepalanchok	5667	0.128	20228	3.382
37	Khotang	3309	0.075	11243	1.88
38	Lalitpur	1863	0.042	199	0.033
39	Lamjung	3254	0.074	4050	0.677
40	Mahottari	720093	16.28	6562	1.097
41	Makawanpur	64488	1.458	33149	5.543
42	Manang	281	0.006	570	0.095
43	Morang	139087	3.145	3469	0.58
44	Mugu	817	0.018	2383	0.398
45	Mustang	1444	0.033	767	0.128
46	Myagdi	934	0.021	4469	0.747
47	Nawalpur	12	0	24	0.004
48	Nuwakot	1179	0.027	2852	0.477
49	Okhaldhunga	2646	0.06	4037	0.675
50	Palpa	25835	0.584	4010	0.671
51	Panchthar	1682	0.038	6646	1.111
52	Parasi	141	0.003	2	0
53	Parbat	526	0.012	5523	0.924
54	Parsa	357164	8.075	0	0
55	Pyuthan	200	0	1312	0.219
56	Ramechhap	900	0.02	7628	1.276
57	Rasuwa	671	0.015	1869	0.313
58	Rautahat	348341	7.876	26880	4.495
59	Rolpa	415	0.009	3082	0.515
60	Rukum East	0	0	16	0.003
61	Rukum West	19	0	56	0.009

62	Rupandehi	28504	0.644	19952	3.336
63	Salyan	214	0.005	2815	0.471
64	Saptari	396598	8.967	0	0
65	Sarlahi	400847	9.063	52	0.009
66	Sankhuwasabha	1866	0.042	20166	3.372
67	Syangja	17846	0.403	13742	2.298
68	Sindhuli	101943	2.305	10086	1.687
69	Sindhupalchok	4506	0.102	9131	1.527
70	Siraha	55256	1.249	891	0.149
71	Solukhumbu	817	0.018	6918	1.157
72	Sunsari	149210	3.373	48	0.008
73	Surkhet	4328	0.098	1116	0.187
74	Tanahu	51953	1.175	4453	0.745
75	Taplejung	2510	0.057	9326	1.559
76	Terhathum	3	0	14105	2.359
77	Udayapur	73965	1.672	6135	1.026

Source: MOHA and Disinventer (DRR portal)

3. AffG, ExpG and GNIPC since 1971 to 2021

Years	AffG	ExpG	GNIPC	RGNIPC	CPI_2010
1971	66.838217	5.40	70	1643.99437	4.26
1972	67.8464609	5.66	80	1733.43263	4.62
1973	65.3325272	6.61	80	1555.6279	5.14
1974	68.4181772	5.45	100	1623.06511	6.16
1975	69.0060946	8.90	110	1659.48345	6.63
1976	66.0860076	10.77	120	1868.51692	6.42
1977	60.1215289	11.79	120	1700.21513	7.06
1978	58.8688401	10.57	120	1583.8631	7.58
1979	60.1620533	11.78	130	1656.77997	7.85
1980	57.8990218	11.54	140	1555.76781	9.00
1981	56.798622	12.90	160	1599.73247	10.00

1982	57.1672898	11.59	150	1342.67565	11.17
1983	56.522513	10.23	140	1115.14036	12.55
1984	57.2988091	10.65	160	1239.18168	12.91
1985	48.858026	11.53	160	1146.83146	13.95
1986	48.6971502	11.66	170	1023.9657	16.60
1987	47.950332	11.81	180	978.957801	18.39
1988	47.7921098	11.45	200	998.07388	20.04
1989	47.6895675	11.07	210	962.799767	21.81
1990	48.8028932	10.53	210	889.507051	23.61
1991	44.7233867	11.49	210	769.753078	27.28
1992	42.6652627	15.96	200	625.779898	31.96
1993	39.8959484	18.43	190	552.987046	34.36
1994	40.4417078	18.99	200	537.236234	37.23
1995	39.0414053	24.97	200	499.183619	40.07
1996	38.9276575	22.82	210	479.894305	43.76
1997	38.7807339	26.33	220	483.36359	45.51
1998	37.3930097	22.82	210	414.755472	50.63
1999	38.7014817	22.85	220	404.375276	54.40
2000	38.243897	23.28	230	412.530091	55.75
2001	35.24767	22.56	240	419.196896	57.25
2002	36.150295	17.74	240	406.871144	58.99
2003	35.1058751	15.70	260	416.979986	62.35
2004	34.6763571	16.68	280	436.646694	64.13
2005	33.8248967	14.58	310	452.496128	68.51
2006	32.366485	13.45	340	464.164344	73.25
2007	31.1644113	12.86	370	493.912074	74.91
2008	30.3057164	12.78	430	522.261174	82.33
2009	31.3226521	12.42	480	524.76722	91.47
2010	33.1793785	9.58	540	540	100.00
2011	30.8054797	7.81	630	576.780068	109.23
2012	30.076057	8.75	770	644.029455	119.56
2013	28.6226575	9.29	860	659.670349	130.37
2014	27.4618954	10.12	880	622.910336	141.27
2015	26.5185084	10.21	890	584.031922	152.39
2016	25.5178754	8.18	880	530.809765	165.78
2017	23.6995485	7.81	990	576.2595	171.80
2018	22.3346721	7.82	1120	626.487268	178.77
2019	21.5833728	7.78	1230	651.724765	188.73
2020	22.1800902	6.81	1190	600.205863	198.27
2021	21.3198897	5.21	1230	596.01624	206.37

Source: World bank

4. Profile of Nepal since 2000 to 2021 triennial reviews of UN CDP

Triennial reviews	**HAI**	**EVI**	**GNI per capita (USD)**
2000		36.37	
2003	47.1	29.46	240
2006	56	37	243
2009	58.3	33.6	320
2012	59.8	27.8	420
2015	68.7	26.8	659
2018	71.2	28.4	745
2021	74.9	24.7	1027

Source: UN CDP various triennial reviews

5. Impact of earthquake in Nepal

Years	Death	Missing People	Affected Family	Injured	Government house fully damaged	Government house partially damaged	Private house fully damaged	Private house partially damaged
1974							1	0
1980	125	0	0	248	0	0	11604	13414
1988	744	0	0	6566	0	0	21744	41076
1993	1		2409	11			72	451
1994			623	12			84	287
1995			18				4	
1997			1489	1			179	60
2001	2			0			3	
2003	1			2				
2007								24
2011	9		35057	184			1102	1692
2012	1		42				2	6
2013			98	25			1	20
2014								
2015	8962	195		22302	2687	3776	773095	298998
2020			10	2			4	4
2021			71	7				70

Source: MOHA and Disinventer (DRR portal)