

SOCIO-ECONOMIC IMPACT OF 2015 EARTHQUAKE IN NEPAL
(A Case Study of Badegaun VDC of Sindhupalchok District)

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RECOMMENDATION LETTER

This thesis entitled **SOCIO-ECONOMIC IMPACT OF 2015 EARTHQUAKE IN NEPAL (A Case Study of Badegaun VDC of Sindhupalchok District)** has been prepared by Mr. Santosh Acharya under my supervision. I hereby recommend this thesis for examination by the thesis committee as a partial fulfillment of the requirement for the Degree of Master of Arts in Economics.

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Prof. Dr. Sohan Kumar Karna
(Thesis Supervisor)

Date: 2073/06/07 B.S.

2016/09/23 A.D

APPROVAL LETTER

We certify that this entitled **SOCIO-ECONOMIC IMPACT OF 2015 EARTHQUAKE IN NEPAL (A Case Study of Badegaun VDC of Sindhupalchok District)** submitted by Mr. Santosh 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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ACRONYMS/ABBREVIATIONS

%	Percentage
ADB	Asian Development Bank
CBS	Central Bureau of Statistics
CRED	Center for Research on the Epidemiology
DWIDP	Department of Water Induced Disaster Prevention
EM-DAT	Electronic Medical Dictation and Transcription
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
FY	Fiscal Year
GDP	Gross Domestic Product
GNI	Gross National Income
GoN	Government of Nepal
HDI	Human Development Index
HDR	Human Development Report
ICIMOD	International Centre for Integrated Mountain Development
ICSU	International Council for Science
IDMC	Internal Displacement Monitoring Center
IMF	International Monetary Fund
IOM	International Organization for Migration
IPCC	Inter-governmental Panel of Climate Change
IUCN	The World Conservation Union
Km	Kilometer
LDC	Least Developed Countries
MDGs	Millennium Development Goals

MOAD	Ministry of Agricultural Development
NGO	Non-Government Organization
NPC	Nepal Planning Commission
NPR	Nepalese Rupees
NRB	Nepal Rastra Bank
NRCS	Nepal Red Cross Society
NSC	National Seismological Center
OFDA	Foreign Disaster Assistance
PDNA	Post Disaster Needs Assessment
RCC	Roller-compacted concrete
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commissioner for Refugees
UNOCHA	United Nations Office for the Co-ordination Human Affairs
US	United States
\$	Dollar
VDC	Village Development Committee
WB	World Bank

CHAPTER I

INTRODUCTION

1.1 Background of the Study

Natural disasters occur and affect people's lives and livelihoods in almost all parts of the world. They constitute a severe problem, particularly for a no. of developing countries where they repeatedly cause a high number of fatalities, affect a large portion of the population and incur substantial social, economic and long-term developmental losses. A natural disaster event is commonly defined as an extreme event triggered by geophysical causes affecting an exposed and vulnerable society in such a way that society's coping capacity is exceeded and outside assistance is needed (Reinhard, 2004). Some populations are more vulnerable than others and disparity exists between nation and communities within a country. Furthermore, within communities different households may be affected differently and even within households the vulnerability of individual household members may vary (KC, 2013)

The adverse effects of climate change undermine the economic development, human security, and people's fundamental rights (UNDP, 2007). It deteriorates the poverty situation and obstructs the achievement of the Millennium Development Goals (MDGS) of the least developed countries, who are highly vulnerable to the climate-induced disasters (Vashist & Das, 2009)

Nepal is a small Himalayan country in between two big economic powers of Asia, China in the north & India in the east, west & south with an open boarder. It covers total area of 147,181 sq km. Nepal is a least developed, landlocked and geographically disadvantageously placed country. Its location is in the northern margin of south Asia. The absolute location of Nepal lies between 80°4' to 80°12' East longitude and 26°22' to 30°27' North latitude (Upadhya, 2003).

Nepal is a developing country with a low income economy, ranking 145th of 187 countries on the Human Development Index (HDI) in 2014 (HDR, 2014). It continues to struggle with high levels of hunger and poverty. Despite these challenges, the country has been making steady progress, with the government making a commitment to graduate the nation from least developed country status by 2022 (NPC, 2012).

Nepal experiences a variety of natural hazards that occur throughout the year. People live with hazards, accepting them as part of life. A fatalistic view to nature's vagaries is widely held, although Nepalese have learned, to some extent, strategies to reduce their risk and to manage the impacts of smaller disasters particularly. But the frequency and intensity of hazards is on the increase – as is the risk, because of population growth, lack of natural resources and, most importantly, the absence of organized approaches to disaster reduction and response as the traditional coping mechanisms are no longer able to address the problems. The Himalaya is believed to be the most active and fragile mountain range in the world, because it is still rising and its rocks are under constant stress. The resulting strain build-up is released from time to time as earthquakes. That stress is also responsible for the complexities in folding, faulting and fracturing of subsurface rock strata, making the entire Himalayan range very fragile and susceptible to other natural hazards such as landslides and erosion. Intense monsoon rainfall and earthquakes serve as triggers for floods, landslides, debris flow and other secondary hazards.

DWIP (2013) has declared that Nepal suffers from various types of water-induced disasters such as soil erosion, landslides, debris flow, flood, bank erosion etc. due to its rugged topography, weak geological formations, active seismic conditions, occasional glacier lake outburst, floods and concentrated monsoon rains associated with unscientific land utilizations. These phenomena induce severe impacts on the vital infrastructures of the nation such as roads, hydropower, irrigation and drinking water facilities causing loss of agricultural lands, properties and human lives posing a severe threat to the sustainable development of the country.

Earthquake is the most common and disastrous natural hazards in Nepal due to its tectonic activities. The collision between the Indian subcontinent and Eurasia, which started in Paleogene time and continues today, produced the Himalaya and the Tibetan plateau. Nepal lies completely within this collision zone, occupying the central sector of the Himalayan arc, nearly one third of the 2,400 km long Himalayas (Pandey, 1999). The Indian plate continues to move north relative to Asia at the rate of approximately 50 mm per year (Pandey, 1995)). Given the great magnitudes of the blocks of the Earth's crust involved, this is remarkably fast, about twice the speed at which human fingernails grow. As the strong Indian continental crust sub ducts beneath the relatively weak Tibetan crust, it pushes up the Himalayan Mountains. This collision zone has accommodated huge amounts of crustal shortening as the rock sequences slide one over another.

An Earthquake is a sudden and temporary vibration on the earth's surface due to the sudden release of energy stored in the rocks beneath the surface. It is a form of energy of wave motion which originates in a limited region and then spreads out in all directions from the source of disturbance. It usually lasts for a few seconds to a minute. Sometimes, the vibrations are so feeble that we cannot feel them, whereas the violent earthquakes loss huge amount of life and property (Poudyal, 2062).

The recent massive earthquakes in Nepal brought tragic major of life, injuries, trauma and physical damage. In the mid-day of 25 April 2015, a devastating earthquake of 7.8 Richter scale and in the mid-day of 12 May 2015, an aftershock struck the central region with capital Kathmandu in Nepal. They are biggest natural disasters of the century, causing the death 8712 people and leaving 505,577 families homeless (MoH, 2015). It caused damage in a densely populated area.

1.2 Statement of the Problem

The position of tectonic plates of Nepal contributes substantially to the risk of Earthquakes. The tectonic plates that provoke of amplify specific hazards like earthquake. Earthquake is most threatening hazard in Nepal. The effects of earthquake is higher than any other disaster as it directly affects the majority of the population, agricultural production and the infrastructures and finally in the sustainability of the development of the country.

The following research questions are to be answered:

- What is the socioeconomic status of people residing Nepal?
- How much is the losses and damages of biological and physical assets?
- What kind of adaptation measures be created for the community against the occur earthquakes?

1.3 Objectives of the Study

The general objective of the study is to assess the triggered loss and damage of Nepal being caused by earthquake.

The specific objectives of the study are as follows:

- To study the socioeconomic status of people residing in Nepal.

- To quantify and estimate the price of losses and damages of biological and physical assets.
- To identify adaptation measures employed by community against the occur earthquakes.

1.4 Significance of the Study

The study aims to socio-economic impact of earthquake in Nepal. The salient significance of the proposed study is that Nepal being much affected by earthquake but the people of the world and within Nepal also do not know about the physical and biological properties damaged. Another salient significance of the proposed study is to analyze the price of loss and damage of private and public assets.

Nepal's climate is as diverse as the country's topography, which extends from the highest mountains in the world to the rim of the lowland Terai, almost at sea level. Nepal's varied topography makes it susceptible to climate-related disasters and the country experiences a range of natural hazards, some of which occur yearly (e.g., floods and landslides) whereas others occur less frequently (earthquakes) (UNDP, 2009). Given its vertiginous topography and active geology together with torrential rain during the monsoon season, Nepal experiences frequent water-related disasters landslides, debris flows and floods and other disasters earthquakes and fire. IPCC summary report 2007 indicates that human beings are the main responsible for the increased amount of the greenhouse gases. Developing countries are considered to be particularly susceptible to climate due to their limited capacity to cope with hazards associated with change in the climate.

Earthquakes constitute a major natural hazard in Nepal mainly due to the tectonic activity. However there are only few studies to assess and estimates the effects of the earthquake on the community's socio-economic livelihoods. This study endeavors to estimate the total loss and damage due to occurrence of earthquakes and also establish the ongoing adapting strategies of people towards earthquakes in community. More importantly, it is envisaged that the output of the study will be key inputs in designing of sustainable mitigation measures to minimize the impact of earthquakes and the associated risks.

1.5 Limitations of the Study

The limitations of the study are as follows:

- It is limited on the basis of quantifying losses and damages of properties.
- It is studied only socio-economic impact on financial and human resources constraints.
- The objective and issues taken by the study is not sufficient to represent the empirical fact.

1.6 Organization of the Study

Socio-economic impact of 2015 earthquake in Nepal (A case study of Badegaun VDC of Sindhupalchok District) has been divided into six chapters which are as follows:

Chapter-I

This chapter deals with the introduction. It includes background, statement of the problem, objectives of the study, significance of the study, limitation of the study and organization of the study.

Chapter-II

The second chapter deals with the review of literature. It includes the review of theoretical literature and review of empirical literature. Review of theoretical literature consists international context and national context. Review of empirical literature consists of national context.

Chapter-III

The third chapter explains the research methodology use to identify socio-economic impact of of recent earthquake in Badegaun VDC of Sindhupalchok district. This chapter deals with study area and methodology. Methodology includes research design, nature and sources of data, data collection procedure and sample size and technique.

Chapter-IV

The fourth chapter deals with analysis and interpretation of data through definite courses of research methodology.

Chapter-V

The fifth chapter deals with the result and discussion. This chapter includes socio-economic status, loss and damage of biological and physical assets, estimated prices of loss and damage of private and public assets, Positive impacts of earthquake and outlook.

Chapter-VI

The sixth chapter deals summary, conclusion and recommendations. This chapter discusses summary of the study, conclusion of the study and suggestion as well as recommendations.

Besides these, appendices is also included.

CHAPTER II

REVIEW OF LITERATURE

The study focuses on the losses and damages of private and public assets and to identify major issues surrounding conceptual and empirical aspects of earthquake loss estimation and to specify future research needed to resolve them. History of earthquakes and theoretical aspect of losses and damages is explored in this chapter. This chapter reviews some basic academic courses books, journals and other related studies. Unfortunately, very few researches have been performed in this topic in Nepal. However, this chapter deals with the basic theoretical concept upon which this study is based.

2.3 Review of Theoretical Literature

2.1.1 International Context

Benson & Clay (2004) has explained the economic and financial impacts of natural disasters. Major natural disasters can and do have severe negative short-run economic impacts. Disasters also appear to have adverse longer-term consequences for economic growth, development and poverty reduction. But negative impacts are not inevitable.

Vulnerability is changing quickly, especially in countries that are experiencing economic transformation rapid growth, urbanization and related technical and social change. In the Caribbean area and in Bangladesh, there is evidence of declining sensitivity to tropical storms and floods and increased resilience as a result of economic transformation and public measures for disaster reduction. The largest concentration of high-risk countries which are increasingly vulnerable to climate hazards – is Sub-Saharan Africa. Risks emanating from geophysical hazards need to be better recognized in highly exposed urban areas across the world, as the potential costs are rising exponentially with economic development.

Natural disasters cause significant budgetary pressures, with both narrowly fiscal short-term impacts and wider long-term implications for development. Reallocation is the primary fiscal response to disaster. Disasters have little impact on trends in total aid flows.

Okuyama (2011) has explained the impacts of natural disasters. Natural disasters can cause physical destructions to built-environment and networks, such as transportation and lifelines, and can also cause casualties and injuries to human lives. These damages are often called damages and are by economics' definition the damages on stocks, which include physical and human capitals. Then, these damages lead to the interruptions of economic

activities, such as production and/or consumption, and the losses from business interruptions are called the (first-order) losses of a disaster. At the same time, there is another term called higher order effects, which take into account the system-wide impact of flow losses through inter industry relationships. (Rose, 2004). And, total impacts are the total of flow impacts, adding (first-order) losses and higher-order effects (Okuyama & Sahin, 2009). While some researchers critique that the higher-order effects of disaster are “more a possibility than a reality” (Albala-Bertrand, 1993:104), the estimation of indirect effects has been attempted to “gauge individual and community vulnerability, evaluate the worthiness of mitigation, determine the appropriate level of disaster assistance, improve recovery decisions, and inform insurers of their potential liability” (Rose, 2004:13). The economic impacts of natural disasters have been studied in various contexts and with a range of time frames. Ex-ante analysis of a hypothetical and/or potential hazard occurrence is often done for the decision-making of preparedness and mitigation strategies; and ex-post analysis of actual hazards and disasters is usually carried out to investigate how the event affected the economy and to examine to what extent the relief efforts by various levels of public sector and by other institutions are needed. The impact studies of natural disasters can be also categorized between short-run impact analysis and long-run impact analysis. Short-run analysis of disaster impact studies intends to estimate the total (flow) impacts of a hazard, defined above, for the period of a few years, and usually employs input-output model, social accounting matrix, or computable general equilibrium model of a particular region, regions, or nation. By its nature, short-run analysis measures only flow changes and can distinguish between the negative impacts based on loss data and the positive impacts from recovery and reconstruction activities, which serve as intense demand injections to the region. Several short-run analyses of disasters were compiled in (Okuyama & Chang, 2004) and the methodologies are summarized in Okuyama (2007). On the other hand, long-run analysis of disaster studies aims to measure the effects of damages on stock, which may affect the long-run growth path of the damaged region, resulted from the changes in physical and human capital accumulation level and technology replacement (Okuyama, 2003). The long-run analysis of disasters usually employs econometric models with time series data; and because of it, they cannot distinguish between negative and positive impacts of a disaster and can only derive net impacts. Notable studies in this line include (Skidmore & Toya 2002), Rasmussen (2004), & Cuaresma (2008). Comparing to short-run analysis, long-run analyses of natural disasters have been limited, due mainly to the significant noises in macroeconomic data and also to the difference in details and extent of damage data gathered over time.

Akγονenc (1999) has argued that earthquakes, wherever they occur, are terrible events, abruptly ending lives, spreading terror and wreaking unspeakable havoc on often fragile economics. The world has reacted swiftly to the Turkish and the Greek earthquakes, as well as the other quakes recently afflicting in particular Taiwan but also Japan, Mexico and other parts of the world.

(UNFCCC, 2012) has defined the losses and damages. The negative consequences of climate change are losses and damages. Loss and damage is an issue of growing importance for the international community, as no country will escape their impacts of climate change (IPCC, 2014). Though there is as yet no universally agreed upon definition of loss and damage, a working definition has not been able to cope with or adapt to (Warner, K., Van der Geest, K., Kreft, S., & Huq, S., 2012). Loss and damage results from a spectrum of climate change impacts, from extreme events to slow onset process.

IPCC (2007) has concluded that some impacts of climate change may already be manifest. The impact of climate change beyond adaptation has come to be known as 'loss and damage'. Discussions started on the need for adaptation finance and action that would help countries (especially those most vulnerable to the negative impacts of climate change) to adapt and manage loss and damage incurred (Warner & Zakieldeen (2011). United Nations Framework Convention on Climate Change (UNFCCC) 14th Conference of the parties (COP 14) in 2008 in Poland, the debate on loss and damages intensified the Least Developed Countries (LDCS) to ask for more attention to be given to the loss and damage they were already experiencing. In 2010, COP 16 in Cancun, it was recognized that joint international efforts were needed to better understand and address such loss and damage.

World Bank (2010) has described loss and damage as:

Losses: Changes in economic flows arising from the disaster. They occur until economy recovery and reconstruction is achieved, in some cases lasting for several years. Typical losses include the decline in output in productive sectors (agriculture, fisheries, industry and commerce) and the lower revenues and higher operational in the provision of services (education, health, water and sanitation, electricity, transportation and communications). Also considered losses are the unexpected

expenditure. The humanitarian needs during the post disaster emergency phase. Losses are expressed in current values.

Damages: Total or partial destruction of physical assets existing in the affecting area. Damage occurs during and immediately after the disaster and is measured in physical units (i.e. square meters of housing, kilometers of roads, etc). Its monetary value is expressed in terms of replacement costs according to price prevailing just before the events.

Warner & Zakieldean (2011) has analyzed the concept of ‘loss and damage’ revolves around the question of the extent to which people in vulnerable countries are already suffering from the consequences of climate change, despite attempts to adapt

Sapir & Indhira (2013) has explained the natural disasters. So-called natural disasters are defined by their impacts on society. “Nature creates hazards, but disasters are largely man-made”, Indeed, natural hazards that have no impact on human society – such as a hurricane that never makes landfall – are not recorded in the standard disaster databases, such as [EM-DAT](#). This latest collection of essays on the topic attempts both to quantify impacts, and also to illustrate the factors that turn natural hazards into human disasters. Assessing the socio-economic effects of natural disasters is hampered by the difficulty of accurately and consistently measuring their impacts – an issue addressed in several chapters here. While the systematic recording of disaster events has improved since the Office of U.S. Foreign Disaster Assistance (OFDA) first started active data collection in 1960 and the Center for Research on the Epidemiology of Disasters (CRED) was established in 1973, estimates of economic damages are still only included for around a third of disaster events in the standard EM-DAT disaster database. Moreover, the reporting of damages also varies systematically by event type and by region, further complicating the analysis of disaster impacts on economic development. For example, we are told, of the 124 disasters that occurred in Middle Africa between 1990 and 2011, only 5 include data on damages.

Reinhard (2004) has analyzed the economics losses and impacts have remained high and constitute a large developmental burden. This places considerable pressure on governments having to bear a large part of these losses due to their role as “insurers of last resort” for the private sector and particularly the poor, and due to the losses to their own public assets (e.g. infrastructure, schools and hospitals).

Wickramasinghe (2012) has analyzed the natural disasters over the last few decades in Sri Lanka. Sri Lanka has witnessed a striking increase in both the frequency and intensity of

natural disasters over the last few decades. Natural disasters have caused human, physical, financial and environmental losses and made substantial impacts on the economy of Sri Lanka. The impacts of natural disasters are not homogeneous across various segments of the society. The distribution of impacts depends on the degree of physical vulnerability of a particular region to natural disasters and the socioeconomic vulnerability. The poor, especially those who are dependent on natural resources for their livelihoods, such as farmers and fisherman are highly vulnerable to the negative impacts of natural disasters. Given the significant economic costs of natural disasters, disaster management issues have received high policy priority. Apart from reducing the physical vulnerability of the population, social protection systems do have an important complementary role in minimizing the effects of natural disasters. Sri Lanka is well-known to have an extensive social protection system. However, the degree to which the present system provides protection against natural disasters remains unexplored. Thus, the present study assesses the degree of protection provided by the present social protection system in Sri Lanka against natural disasters, identifies gaps in doing so, and thereby suggests suitable recommendations to strengthen the system.

ICSU (2008) has argued that high population densities, poor constructions, inadequate preparations and lack of general awareness among the inhabitants in disaster-prone areas are the major factors contributing to hazards becoming disasters.

Carey (2005) has argued that worldwide human populations are vulnerable to natural disasters. Certain conditions such as geographical location of people's income level can affect the degree to which natural disasters impact people's homes and livelihoods.

IPCC (2014) has discussed the effect of climate-related hazards. Climate-related hazards affect poor people's lives directly through impacts on livelihoods, reductions in crop yields, or destruction of homes and indirectly through, for example, increased food prices and food insecurity. Observed positive effects for poor and marginalized people, which are limited and often indirect, include examples such as diversification of social networks and of agricultural practices.

Munich (2015) has analyzed the challenges of natural hazards. The frequency of earthquakes, windstorms and floods and the damage caused by them have been increasing significantly for decades. This trend poses a major challenge for governments, the corporate sector and thus for the insurance industry as risk carriers. Documenting and analyzing

natural catastrophes are important steps in preparing to cope with looming hazards and developing our ability to identify emerging trends at an early stage.

Earthquake cause effects in a number of ways. They set off landslides, they produce seismic sea waves and they also cause uplift of subsidence of large areas. However, the principle damage done by earthquakes is due to differential movements of buildings. These movements are caused mainly by the surface waves. The P and S waves vibrate fast but with small movement and therefore cause very little damage to structures. The surface waves on the other hand, have much larger amplitude in lower frequencies and are the cause of the most direct damage done by earthquakes. This is easy to understand, for if one part of a building is moved a few centimeters in one direction, while another part moves in another direction, the building will be damaged. In urban areas, another major cause of property damages due to earthquake is fires started by crossed electric wires and broken gas lines. These fires cannot be controlled because of broken water mains and disrupted communications.

Johnston (1997) has analyzed the physical and social impacts of past and future volcanic eruptions in New Zealand. The impacts of natural hazard events go far beyond the physical effects and may result in a range of social and psychological impacts on affected individuals and communities. Small scale events are often more disruptive than destructive and their social/psychological impacts are often overlooked. The social and economic impacts of adverse events are determined not only by direct physical consequences but by the interaction of psychological, social, cultural and institutional processes that can amplify and attenuate the public response (Burns,1993).

2.1.2National Context

PDNA (2015) has defined damages and losses as:

Damages are defined as the combined replacement cost of destroyed houses, the repair cost of partially damaged houses, the replacement cost of household goods destroyed, and damages to the real estate sector. Losses are the combined cost of demolition and clearing, costs of provision of transitional shelter, rental losses, and losses sustained by the real estate sector.

Historical seismicity is the historical records of earthquakes preserved in different form such as written history, chronicles, inscription etc which plays an important role

in the seismic hazard assessment because instrumentally recorded earthquakes are lacking before the current century. Historical events must be available for a long period of human civilization which should throw light on the extent of damage besides the date and place of occurrence (www.seismonepal.gov).

GoN (2012) has analyzed that Nepal is facing unprecedented disaster risks as people are being exposed to more frequent and severe hazards owing primarily of unmanaged population growth, increasing level of poverty and marginalization, environmental degradation, poor planning and preparedness and the impacts of climate change.

GoN (2010) has identified the cause of the Nepal is regarded as a disaster hotspot. Due to its geographical and other climatologically conditions, rugged and steep topography, extreme weather events and fragile geological conditions, the country is regarded as a disaster hotspot because of vulnerability of the population together with regular and frequent occurrence of different natural hazards. The country's social context characterizes with low level of development as well as low level of institutional capacity consequent to intensify the impact of disasters.

Ariyabandu&Wickramasinghe (2005) has explained the way of calculating the impact of disasters. The impact of disasters is usually measured in quantifiable ways, such as adding up the number of the dead and injured, and estimating the physical damage to housing, land livestock, agriculture, stores and infrastructure. But attention is not necessarily paid to how disasters impact on different categories of people, men, women, children, aged people, etc. Disasters affect men and women differently because of the differences in their capacities, needs and vulnerabilities. Family size may change at household level due to disasters. For example in Chitwan district, Nepal during the floods, the extended family system collapsed, leaving the women and elderly without support.

UNDP (2009) has explained the causes of natural hazards. A combination of rough topography, steep slopes, active tectonic and seismic process and the intense impact of monsoon rain has made this fragile environment vulnerable to a variety of natural hazards. Nepal is one of the world's most disaster-prone countries and has experienced several natural catastrophes causing high economic and human losses. Heavy rain and storms cause severe flooding. They trigger landslides that have an

enormous effect on property, structures and lives. As if that were not enough, fire and drought are a constant threat in the dry season. The country is also prone to epidemics, pollution and other disasters.

2.4 Review of Empirical Literature

2.2.1 International Context

National Research Council, USA (1994) has analyzed about Prieta earthquake. The moderately large (7.1 on the Richter Scale) Loma Prieta earthquake of October 17, 1989, took 63 lives, cost \$ 10 billion, and damaged more than 27,000 structures. It resulted from a slip along a 25-mile segment of the San Andreas Fault where it transverses the Santa Cruz Mountains, approximately 60 miles south of San Francisco and Okaland.

Dick (2011) has analyzed the effect of the record 9.0 Richter scale earthquake in Japan. It was compounded by the ensuing tsunami that swept as far as 6 miles inland in Japan, causing widespread destruction, and that spread out across Pacific. Earthquake and tsunami that occurred in Japan followed by the nuclear crisis are having a large negative impact on the economy of Japan. Japan has lost considerable physical and human capital. Physical damage has been estimated to be from \$195 billion to as much as \$305 billion (Greece's GDP is \$330 billion). In excess of 27,000 persons in Japan are killed or missing, and more than 202,000 homes and other buildings have been totally or partially damaged.

Clarens (2010) has studied about the 2010 Haiti earthquake. The 2010 Haiti earthquake was a catastrophic magnitude 7.0 Richter scale, approximately 25 kilometers west of the Haiti's capital. The earthquake occurred on Tuesday, 12 January 2010 (Miller, 2010). An estimated three million people were affected by the quake (Red Cross, 2010). Death toll estimates range from 220,000 to 316,000 that have been widely characterized as deliberately inflated by the Haitian government (Columbia, 2012). The government of Haiti estimated that 250,000 residences and 30,000 commercial buildings had collapsed or were severely damaged.

On October 8, 2005 a magnitude ($M_w = 7.6$) earthquake struck the Himalayan region of northern Pakistan and Kashmir. The Pakistani government's official death toll as of November 2005 stood at 87,350, although it is estimated that the death toll could reach over 100,000. Approximately 138,000 were injured and over 3.5 million rendered homeless. It is estimated that more than 780,000 buildings were either

destroyed or damaged beyond repair. Lifelines were adversely affected, especially the numerous vital roads and highways that were closed by landslides and bridges.

Lloyd (2007) has analyzed the effects of the 2004 Sumatra-Andaman Earthquake and Indian Ocean Tsunami in Aceh Province. On December, 2004, a powerful earthquake, moment magnitude (MW) 9.2, occurred in the Indian Ocean. In Aceh, the northern province of Sumatra, the United Nations (UN) Field Office reported approximately 131,000 people confirmed dead and 37,000 missing. With more than 80,000 houses sustaining major damage or collapse, the UN estimated that more than 500,000 people were displaced from their homes in Sumatra alone. In addition to the massive damage to housing, utilities, roads and bridges, the disaster significantly disrupted the social fabric and government of the affected communities.

The International Organization for Migration (IOM) (2009) has estimated that by 2050 there will be 250 million people who could be described as climate of environmental migrants. According to the EM-DAT (2012) database, 9,655 people were died due to natural disaster, and an economic loss was estimated to be US \$ 157 billion.

The findings of joint report by UNOCHA and IDMC (2009) had shown that at least 36 million people were displaced in 2008 by the sudden-onset natural disasters. Among them, 20 million people were displaced due to climate related events and the number of displaced persons is expected to rise in coming years with increased frequency and intensity of extreme weather events.

World Bank (2010) has analyzed the trend of earthquakes in the world. Over the past years, both frequency and impact of disasters have been increasing worldwide. In the first decade of the new millennium a string of severe disasters hit countries on all continents. Most notable were the 2004 Indian Ocean earthquake and Tsunami which claimed over 250,000 lives, the Haiti Earthquake which killed over 220,000 people and caused an economic impact equivalent to 120% of GDP, floods in Pakistan affecting 20 million people, but also additional earthquake in Indonesia, floods and droughts throughout Africa, heat waves and fires in Europe, hurricanes in Central America, the Caribbean and the United States, and landslides triggered by typhoons in South East Asia.

Earthquake is a natural calamity that it never gives opportunity to people to save their lives and escape. There are earthquakes almost every year causing large scale damage and devastation. In the whole earth, earthquakes of one kind or another are known to take place every few seconds. Really severe earthquakes take place every two or three weeks. Most earthquakes are small, and each year about 700,000 small earthquakes called tremors are recorded by instruments. Great earthquakes with magnitude exceeding 8.0 occur about once every few year. On the basis of the statistics, it has been estimated that earthquakes take an average yearly toll of 14,000 lives and cause damage extensive ecosystems and properties.

Daniell& Armand (2012) has reviewed of damaging earthquakes in 2011. 2011 has played host to the largest two earthquakes, economically speaking, in the history of the countries of Japan and New Zealand. The M9.0 Tohoku earthquake and tsunami of 11th March, 2011 proved to be the most expensive earthquake of all time, causing between \$400-700 billion USD in total losses and approximately 19000 deaths, while the Christchurch earthquake (a M6.3 quake close to the city of Christchurch) caused a huge building stock loss and approximately \$15-20 billion USD damage with around 80% insured losses. Their respective aftershocks caused further damage. Significant losses were also seen in Turkey from the Van earthquake in October, in the India-Nepal-Tibet region in September, in China from numerous earthquakes in the Yunnan and Xinjiang Provinces and in the USA from the Virginia earthquake.

In addition, in the first half of 2011, the news came out that the death toll in Haiti was overestimated significantly. A report from a US-based consultancy group, USAID report, showed that the death toll was between 46190 and 84961. Daniell et al. (2010f, 2011j) using various approaches concluded that a death toll of 136933, with a range of 121843 to 167082 dead, was reasonable. Both of these totals are a massive reduction on the 316000 deaths quoted by the President on 12th January, 2011.

IPCC (2012) has examined climate related disaster found that, “fatality rates and economic losses expressed as a proportion of GDP higher in developing countries”. Between 1970 and 2008, over 95% of death from natural disasters occurred in developing countries.

DWIDP (2014) has analyzed impact of natural disasters in developing countries. Poor countries (developing and under-developed countries) and people are

disproportionately vulnerable. 97% of deaths related to natural disasters between 1990 and 1998 occurred in developing countries (World Bank 2001), and 90% of all victims and 75% of all economic damages accrue in developing countries (ThouretandD'Ercole, 1996). More than half of disaster deaths occur in low human development countries even though only 11% of people exposed to hazards live there, and these countries suffer far greater economic losses relative to their GDP than richer countries (DFID XXXX).

IDMC (2015) has analyzed the migrant people in the world due to the natural hazards in 2014. Latest figures from IDMC estimate that more than 19.3 million people were forced to flee their homes by disasters in 100 countries in 2014. Hundreds of thousands more are still displaced following disasters in previous years. Since 2008, an average of 26.4 million people per year has been displaced from their homes by disasters brought on by natural hazards. This is the equivalent to one person being displaced every second. The number and scale of huge disasters creates significant fluctuation from year to year in the total number of people displaced, while the trend over decades is on the rise.

2.2.3 National Context

Poudyal (2008) has analyzed the number of earthquakes that occur around the world. It is estimated that over 1, 50,000 earthquakes occur round the world every year. At least one catastrophic quake occurred somewhere on the earth about once a year. It is observed that occurrence of quakes are not random but tend to be concentrated in certain narrow regions. The Himalaya of Nepal was formed by collision of two continental plates, 'the Tibetan' and 'the Indian'. So the mountain range is a major global seismic belt where earthquakes of magnitude 4.5 to 5.5 occur every year.

(Regmi 1965, cited in Biham 1994) has explained the impact of the great earthquake of June 7, 1255. The great earthquake of June 7, 1255 damaged palaces, temples, and houses in the Kathmandu valley and killed one-third of its population. The reigning monarch, Abhaya Mall, died six days after the earthquake as a result of injuries sustained during the event.

(Bengal Hurkaru, 1833 cited in Bilham 1994) has explained the impact of earthquake of August 26, 1833. The earthquake of August 26, 1833, destroyed 4,040 buildings, killed 414 persons, and injured many in the vicinity of Kathmandu where there were

hundreds of additional fatalities. It also destroyed houses in the eastern villages. The fort at Chisapani in the Mahabharat range south of Kathmandu was damaged and landslides blocked the passes to Tibet.

The earthquake of June 7, 1255 AD is the first recorded earthquake in the history of Nepal. During the earthquake nearly one third of the total population of Kathmandu were killed. Another big earthquake was recorded in 1260 AD. In August of 1408, a major earthquake destroyed RatoMatchendranath and many other buildings and temples. In the months of June and July of 1767 AD an earthquake of significant intensity was felt. In the earthquake that happened in May/June of 1810 AD many buildings and temples were damaged. In 1823 AD, 1833 AD and 1834 AD, earthquakes hit the Nepal. The deadliest earthquake occurred 16 January 1934 AD. The magnitude 8.4 Richter scale earthquake killed 8519 people, destroyed 80893 buildings and severely damaged 126355 more houses. At this time the government spent NRs 2,06,500 through the earthquake relief fund in Kathmandu valley alone. Another earthquake of 6.5 Richter scale happened in 1980 AD killed 125 people, destroyed 11,604 buildings and damaged 13,414 buildings. The earthquake of 1988 AD caused 721 deaths and damage to 64,174 private buildings, 468 public houses and 790 government buildings. The world bank provided a loan of NRs. 1 billion to the affected people. The earthquake of 1993 AD, 1994 AD, 1997 AD, 2001 AD, 2002 AD and 2011 AD shook the Nepal and damaged some properties (xnepali.net/Samrachana monthly).

UNDP (1997) has analyzed the impact of floods, landslides and debris flows of 1993. The south- central part of Nepal experienced unprecedented floods, landslides and debris flows following uninterrupted rainfall between 19 and 21 July 1993. The disaster was followed by further floods and landslides on 8-9 August. The total effect of the two events was 1,460 people dead or missing, 73,606 families seriously affected, 39,043 houses destroyed (fully or partially), about 43,330 ha of cultivated land washed away or covered with debris, 367km of roads damaged, 213 bridges, including six concrete bridges on national highways, 38 large to small irrigation schemes. 452 schools, hospitals and government offices were destroyed on a couple of days. Vital supplies to Kathmandu were virtually cut off for more than a month because of the road breaches and damage to the bridges. Damage to the Kulekhani hydropower system, consisting of two power plants and providing 40 per cent of the

national power, resulted in major power cuts that affected not just normal life, but the whole national economy.

CFE-DMHA (2015) has analyzed the major natural disasters in Nepal. The majority of natural disasters in Nepal consist of flooding or landslides. Heavy precipitation combined with human factors such as deforestation, rapid population growth, and unplanned settlements leave many Nepalese vulnerable. An average of 300 people dies each year due to floods and landslides with annual economic damages exceeding USD \$10 million. In the past 100 years, earthquakes have caused the most deaths of all natural disasters. However, floods have cost the most in damages at upwards of USD \$1 billion for a total of 50 reported events. In terms of total persons affected, drought is the most severe, affecting nearly 5 million people since 1915. There are 7 major earthquakes in Nepal in the last 100 years.

(ACT Alliance, 2014) has analyzed the losses and damages by floods in Nepal in 2014. In 2014, a series of massive floods hit 17 districts in mid and far western regions of Nepal at least 113 persons have died, 155 are injured, and more than 77 were missed. 12,282 houses were completely damaged, 13,695 were partially damaged and more than 40,055 houses inundated leaving 12,276 families displaced.

Maharjan (2015) has analyzed the disaster scenario in Nepal. The country is suffering from disasters like earthquakes, drought, windstorm, fire, epidemics etc. The recorded total loss of lives by different types of disasters from 1983 up to 2012 is about 23,244. Amongst the different types of disasters, the epidemic claimed the highest loss of lives of 11,503 and is followed by the flood and landslide which is about 8,181 in the period of 1983 to 2011. The conditions of loss of lives by the flood and landslide are severe. It may be of lower awareness of people and lower priority of the government of Nepal on flood and landslides damage.

2.3 Research Gap

Most of the research is not concerned with socio-economic impacts of disasters on developing countries. All the research is not concerned with the viability of ex-ante disaster management, termed risk management, to reduce the large impacts of disasters on developing countries, in particular on their economies. All the research is not concerned with the adaptation measures employed by community against the

occur earthquakes. Most of the research is not concerned with the loss and damage of biological assets.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Study Area

3.1.1 Location

The study area is situated at Sindhupalchok district in mid development region Nepal. The study district covers 1.73% land of total Nepal. It is bounded by Dolakha in the east, Kavrepalanchok and Kathmandu in south, Rasuwa and Nuwakot in West and China in North. BadegaunVDC lies southern part of Sindhupalchok district which is approximately 65km from the Kathmandu and approximately 25 km from the Araniko highway (Tathyanka weekly, 2013).

3.1.2 Demographics

The total population of the VDC is 5,353 in which 2,534 is the male population and 2,819 is the female population with sex ratio of 89.89. The total household number is 1,160 with 4.61 average household sizes, of which 1,141 households are mud bonded bricks/stone, 1 cement bonded households, 1 was wooden pillar and 17 households are categorized as not stated. Majority of population is that of Brahman (1,523), Tamang (1523), Chetree (520), Newar (463), Majhi (262), Kami (195), Thakuri (189), Damai (160), Gharti/Bhujel (151), Sarki (143), Hyolmo (82), Magar (36), Dalit others (96) and others (10). Majority in population in

term of mother language is that of Nepali (3,106), Tamang (1,527), Newar (417), Majhi (221), Hyolmo/Yholmo (73) and others (9) (CBS, 2012).

3.1.3 Income Sources

The main income sources of people of the VDC are agriculture, forest resource, tourism and remittance.

3.1.3.1 Agricultural Production

FAO, (2015) has analyzed the agricultural system of Nepal. Nepalese farming systems are characteristically complex, consisting of diverse combinations of crops, livestock, poultry, vegetables, fruits, spices, fisheries, agro-forestry and non-timber forest products. The average farm size is 0.8 ha with 47 percent landholdings of size less than 0.5 ha. Rice, maize, wheat, finger millet and barley are the major cereals grown. Maize and millet are mostly grown in the non-irrigated uplands and rice-based cropping pattern is popular in the irrigated areas.

Oilseeds, pulses, sugarcane and potato are the other important crops. Different fruits and vegetables are cultivated in summer and winter seasons in different physiographic regions. Aquaculture is popular in the southern Terai flat land and river systems originating mostly from the Himalayas harbor indigenous fish species.

Important livestock include cattle, buffalo, goat, sheep and pig. Poultry keeping is increasingly popular as demand from urban areas is rising. About two-thirds of the milk and half of the meat produced in the country is contributed by buffalo alone.

Livelihoods in Badegaun are not very diverse, because there are few economic opportunities, but most households are not able to secure enough income from one activity. Every household is engaged in agriculture (either on their own land or sharecropping) and supplement their income with wage labour, although a few households receive a significant amount of income from goat and cow rearing. Major livelihood of the VDC is agriculture which is mostly of rain fed type i.e almost all farmers depend upon seasonal rainfall for agricultural purposes. Rice, maize, wheat, potato, pulses are the main agricultural products. As most households are receiving income from different sources, household classification was based on the number of months of income from agriculture. As such, four key segments were identified:

- Households selling agricultural surplus – this is the only group of households who are accumulating in Badegaun (75%),
- Households receiving six to twelve months' food from their own agriculture (15%),
- Households receiving less than six months' food from own agriculture (9%),
- Landless households receiving less than six months' food from sharecropping (1%).

3.1.4 Transportation and Communication

Badegaun is directly linked by road transport to Kathmandu. There is some extension of road transport network in the district in which some vehicle service is available for public transport. However foot trails networks dominate district. Different means of communication such as telephone, e-mail, and internet are available. 522 households have radio, 395 households have television, 7 households have computer, 3 households have internet, 1 household has telephone and 667 households have mobiles (CBS, 2012).

3.1.5 Education

There are few people in Badegaun who are highly educated and the literacy rate of the population aged 5 years and above is 60.86. However, the benefits of education are widely appreciated. In addition to the importance of education for government/well-paid jobs, villagers also understand that education could provide them with knowledge necessary for their daily lives and improve their access and knowledge of government schemes. Poor literacy rates, combined with the relatively isolated position of Badegaun have a significant impact on the well-being of villagers. .

3.1.6 Government Schemes and Jobs

Corruption is prevalent in the administration of government schemes and generally those who have been affected by government policy have been from wealthier families. The ineffectiveness of policy has firstly to do with its implementation, rather than the nature of the policy itself. Analysis of the impact of government policy is limited to the social security payments, the co-operative society and land reform.

Attitudes to government schemes and to authority generally, vary in Badegaun. Villagers are generally unaware of their entitlements and few have made enquiries into government schemes. Many illiterate people are afraid of getting involved with anything official and they

are reluctant to question authority. It is the educated who are confident enough to work the system to their advantage and the poor that feel that the government may try to seize their assets, although it is unclear who is perpetuating this discourse. The rich are at an advantage because they feel confident and can afford to pay a bribe. Few villagers apply for government jobs. It is only those who have a good standard of education who try.

3.1.7 The Cooperative Society

One of the government schemes that have influenced livelihoods is the agricultural co-operative society. However, it is only used by more affluent farmers and therefore it does not provide a service for those who need it most. Although the society provides superior seed varieties, many plant their seeds grown at home. Small farmers often have debts with the co-operative society, which they find difficult to pay back and, they can't therefore get seeds and fertilizers in cheap from there until the debt is cleared. In Badegaun seeds and fertilizers are obtained through cooperative society who provides cheaper seeds and fertilizers. Small farmers do not receive any advice about their crops from government officers.

3.1.8 Utilities and Facilities

CBS (2012) records that in Badegaun VDC, 608 households have tap/piped water supply, 28 households depend on covered well/kuwa, 135 households depend on uncovered well/kuwa, 340 households depend on spout water, 30 households depend on river/stream, 4 households depend on others and 15 households not stated. 1091 households have electricity, 671 households have toilet facility in their own house and 827 households have at least one facility.

3.2 Methodology

This chapter deals with the techniques and the procedures used during the research study. The purpose of this study is to quantify the loss and damage of private and public assets. To achieve these objectives, some methodology have been adopted which includes research design, sampling, sources of data, data collection technique, data analysis tools and so on.

3.2.2 Research Design

The main attempt of this study will to analyze the economic impacts of the recent earthquakes in Nepal. Therefore, the research design of this study is analytical, historical, descriptive and co-relational research. The whole study will be carried out on the basis of mainly primary as well as secondary data. Reliable and relevant study

will be made only by applying scientific method. Mostly it will be used both the quantitative and qualitative techniques depending the nature and source of data and information.

3.2.2 Nature and Sources of Data

3.2.2.1 Primary Data Collection

3.2.2.1.1 Direct Observation

Observing the subjects in their normal environment, instead of bringing them to an office or laboratory, provides a unique opportunity to learn what the subjects normally do and how they normally behave. Direct observation is conducted to learn about the normal behavior of surrounding on their natural environments. Direct observation in this study involves careful watching and records of happening action.

3.2.2.1.2 Key Informant Interview

A key informant interview is a loosely structured conversation with people who have specialized knowledge about the topic. A key informant is a person with unique skills of professional background on specific issue. A good key informant can convey the specialized knowledge therefore they are crucial to the assessment process.

Key informant interview was introduced in the study site with the list of questionnaire (Appendix I) in Sept, 2015 to explore the subject in depth. These interviews in the study, results in the discovery of information that would not have been revealed in a survey. During the study, chairperson and secretary of Natural Disaster Committee, Badegau, Principal of all schools, VDC secretary, some affected people who are now are in vulnerable condition were chosen as key informant and interview was proceeded which provided opportunities to identify target populations or issues for further investigation, gathering information, refining data collection, generating recommendations.

3.2.2.1.3 Household Questionnaire Survey

Total household were affected by 2015 earthquakes in Badegau VDC. The households were selected through the stratified random sampling for the survey and were carried during 24-30 Sep, 2015.

3.2.2.1.4 Sample Size and Technique

For the household survey, sample size was determined by using following formula (Arkin and Colton's 1963, cited by Sharma, 2000) at 95% level of confidence and 10% level of significance and standard error is 0.05% which is given below.

$$n = \frac{NZ^2XP(1-P)}{Nd^2 + Z^2XP(1-P)} \quad [1]$$

Where,

n = Sample size

N = Total number of household

Z = Confidence level (at 95% level Z = 1.96)

P = Estimated population proportion (0.5, this maximizes the sample size)

d = Error limit of 10% (0.1)

$$n = \frac{1160 \times 1.96 \times 1.96 \times 0.5(1-0.5)}{1160 \times 0.1 \times 0.1 + 1.96 \times 0.5(1-0.5)}$$

$$n = 86.36 \approx 86$$

The number of sample for each ward is calculated by the proportional method as in the table 1. Some figures have been rounded off to the nearest final digit. This may result in a slight discrepancy between the sum of the individual item and the total as shown in the table.

Table 3.1

Sampling size of Total Households of Badegau

S.N.	Ward Number	Total Households Number	Sampled Households Number
1	1	149	11
2	2	118	9
3	3	157	12
4	4	170	13
5	5	76	6
6	6	181	13
7	7	59	4
8	8	153	11
9	9	97	7

10	Total	1160	86
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Source: CBS (2012)

3.2.2.1.5 Focus Group Discussion

Focus Group Discussion (FGD) is a rapid assessment, semi structured data gathering method in which a purposively selected set of participants gather to discuss issues and concerns based on a list of key themes drawn up by the researcher/facilitator (Kumar, 1987). FGD was conducted in Sept 2015 among the people who are directly affected by the happening disaster due to earthquake.

3.2.2.2 Secondary Data Collection

Secondary data as required to fulfill the objectives of the study were collected and reviewed throughout the whole study period to support the primary data obtained from the locals during analysis process. Secondary information are collected from the different sources. Main sources are NRB, UNDP, Line agencies of GON and local governments, ICIMOD, WB, CBS and district profile from DHM.

3.2.2.3 Overall Loss and Damage

NRC (1999) calculates the cost on the basis of different views of experts. Experts in the field of disaster cost estimation use various terms to describe the effects of disasters, not always consistently. It is therefore important to define at the outset how these terms are used in this report:

- The impacts of a disaster is the broadest term, and includes both market-based and nonmarket effects. For example, market-based impacts include destruction to property and a reduction in income and sales. Nonmarket effects include environmental consequences and psychological effects suffered by individuals involved in a disaster. In principle, individual impacts can be either negative or positive, though obviously the impacts of disasters are predominantly undesirable.
- The losses of disasters represent market-based negative economic impacts. These consist of direct losses that result from the physical destruction of buildings, crops, and natural resources and indirect losses that represent the consequences of that destruction, such as temporary unemployment and business interruption.

- The costsof disasters, as the term is conventionally used, typically refers to cash payouts by insurers and governments to reimburse some (and in certain cases all) of the losses suffered by individuals and businesses. Losses suffered by those who are uninsured, those whose losses do not make them eligible for insurance payments, and those who do not receive government relief should be counted in any complete compilation of the impacts of a disaster—but these losses are not included as "costs," as that term is used in this report.
- The damagescaused by disasters refer to physical destruction, measured by physical indicators, such as the numbers of deaths and injuries or the number of buildings destroyed. When valued in monetary terms, damages become direct losses.

Kilson (1994) has calculated the economic effects of natural disasters by calculating the various terms.

Calculating the Economic Effects of Natural Disasters: Some Definitions and Concepts

Term	Definition	Example
Losses	Change in wealth caused by damage to structures or other physical assets	Houses, buildings and structures are damaged, crops and forests destroyed, landslide damages
Direct vs. Indirect Losses	Direct losses are those resulting from building, lifeline, and infrastructure damages. Indirect losses are those that follow from the physical damages.	Direct losses: building damages, bridge collapse, loss of lives. Indirect losses: commuter disruptions, loss of local tax revenues, reduced tourism
Market vs. Non-market Effects	Market effects are those that are reflected in national income accounts data; Non-market effects do not appear in the national income accounts data	Market effect: loss of income due to disaster-caused destruction. Nonmarket effects: loss of leisure time due to longer commute as a result of the disaster.
Costs	Highest-valued of foregone alternative use of a resource	Mitigation expenditures undertaken before the disaster occurs, (for example, construction of levees or seawalls or reinforcement of

		buildings) and reconstruction of buildings, etc. during recovery period
Redistribution	Transfer of wealth between individuals or governments	Federal disaster relief, but also includes transfers that occur because resources or production are moved to a new region
Wealth	Present value of the income stream from the productive assets of society	The value of a forest or farmland is the sum of the flow of monetary benefits (income from sales of timber or crops) and non-monetary benefits (vistas and recreational benefits of a forest)

NRC (1999) has defined the outset how economic impacts of natural disasters are observed:

- The impacts of a disaster is the broadest term, and includes both market-based and nonmarket effects. For example, market-based impacts include destruction to property and a reduction in income and sales. Nonmarket effects include environmental consequences and psychological effects suffered by individuals involved in a disaster. In principle, individual impacts can be either negative or positive, though obviously the impacts of disasters are predominantly undesirable.
- The losses of disasters represents market-based negative economic impacts. These consist of direct losses that result from the physical destruction of buildings, crops, and natural resources and indirect losses that represent the consequences of that destruction, such as temporary unemployment and business interruption.
- The costs of disasters, as the term is conventionally used, typically refers to cash payouts by insurers and governments to reimburse some (and in certain cases all) of the losses suffered by individuals and businesses. Losses suffered by those who are uninsured, those whose losses do not make them eligible for insurance payments, and those who do not receive government relief should be counted in any complete compilation of the impacts of a disaster—but these losses are not included as "costs," as that term is used in this report.

- The damages caused by disasters refers to physical destruction, measured by physical indicators, such as the numbers of deaths and injuries or the number of buildings destroyed. When valued in monetary terms, damages become direct losses.

The formal charge to this committee was to "identify the cost components that, when combined, would most accurately reflect the total cost of a natural disaster event. To the extent possible, the committee will identify the relative importance of the components for accurate characterization of an individual event and the significance of the different components across the spectrum of hazards.

This study used possible sources for accurate cost information, regardless of whether data are generally available from these sources at present.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

4.1 Socioeconomic Status

4.1.1 General Description of Respondents

Table 2 represents the general descriptions of respondents. In household questionnaire survey total 86 households were selected based on stratified random sampling. Among the respondents, 45 (52.66%) were female and 41 (47.34%) were male. Ethnically 40 (47.01 %) were indigenous (Tamang, Newar, Majhi, Bhujel, Hyolmo, Magar), 33 (38.16%) were Brahman/Chettri, 10 (11.09 %) were Dalit and 3 (3.53 %) were Thakuri. 60.86 % respondents were literate and 39.14 % were illiterate.

Table 4.1

General Description of Respondents

HH Survey	No. of Respondents	Gender (%)		Ethnicity (%)				Literacy Rate (%)	
		M	F	Indege	Bra/Che	Dalit	Thaku	Lit	Illi
	86	47.34	52.66	47.01	38.16	11.09	3.53	60.86	39.14

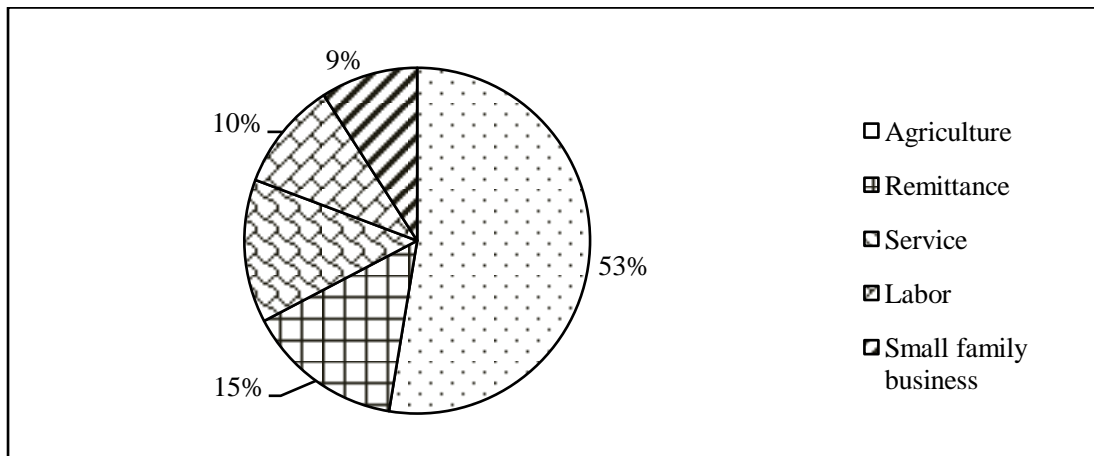
Source: Household Survey 2015

4.1.2 Employment and Income

Households engaged in agricultural activities such as cultivating crops, growing fruit trees, raising livestock were 84.6%. The product of these activities is mainly used for household purposes, however in terms of income generation it comprises only about 55.6%.

Figure (4.1) indicates that agriculture was the largest source of household income with 52.6% respondents. Remittance was the second largest source of household income with 14.7% of respondents indicating that their household received remittances with the average amount sent per household per month being NPR 20,000. Most remittances were sent by husbands, sons, daughters, brothers, and sisters. Among the respondents, 13.4% rely on service, 10.2% households were involved as labors and 9.08% were involved in small family business.

Figure 4.1
Households Engaged in Income

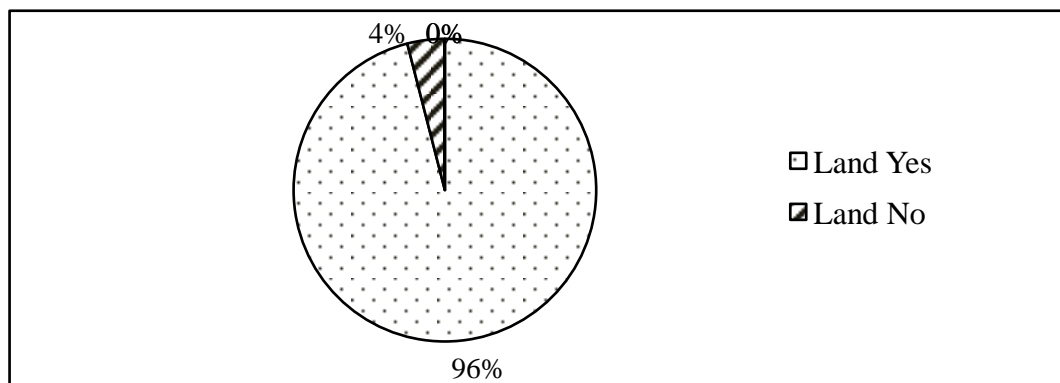


Source: Household Survey 2015

4.1.3 Land and Farm

Of the total 96% of household have their land and house they farm and live in whereas 4% respondents did not have not their own land and house (figure 4.2). The average land size per household was 0.31 hectare. Crop production mainly consists of cash crop such as Paddy, Maize, Wheat, Millet and Cereals such as black lintel soyabeans (Mass and Bhatmass). Of those engaged in agriculture, 30.08% have irrigation facility. Crop cultivation is mainly carried out for household consumption, 32.34% of respondents stated that the main purpose of production was for sale. The total average sale of agricultural produce is NPR 25,000 per year per household.

Figure 4.2
Household having Own Land and no Land

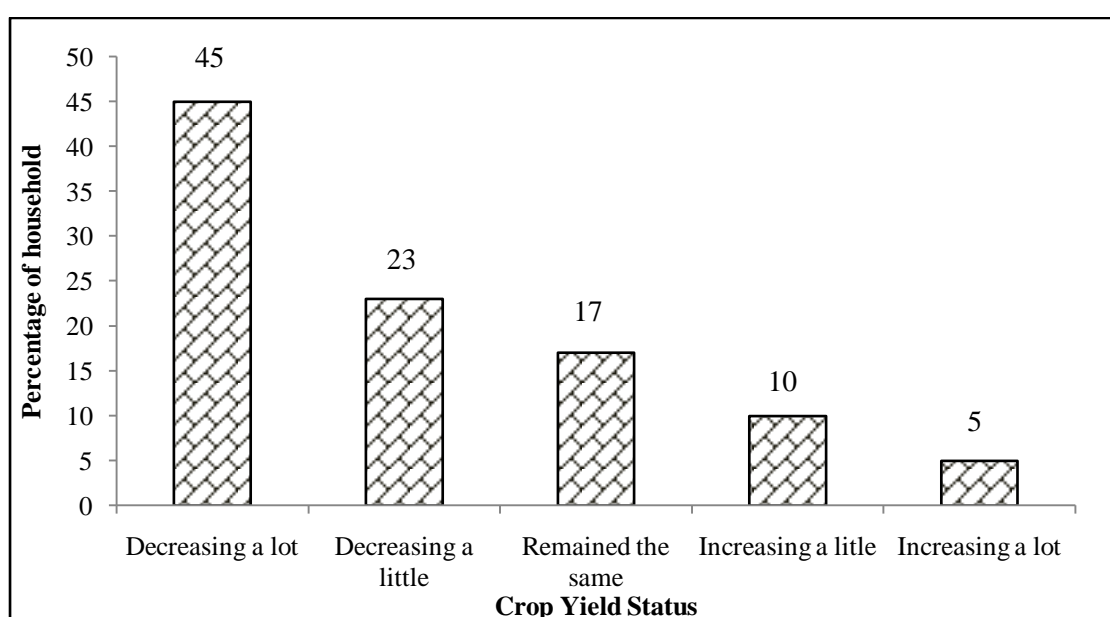


Source: Household Survey 2015

4.1.4 Crop Yield Status

In the survey, 45 % of respondents said that crop yields were decreasing a lot, and 23 % said crops were decreasing a little. The main reason given for this decrease was scarcity of water. 17 % of the households indicated that crop yields remained the same, whereas 10 % indicated that crops were increasing a little, and 5 % indicated that they were increasing a lot (Figure 4.3). The main reasons given for the increase was increasing uses of chemical fertilizer.

Figure 4.3
Crop Yield Status



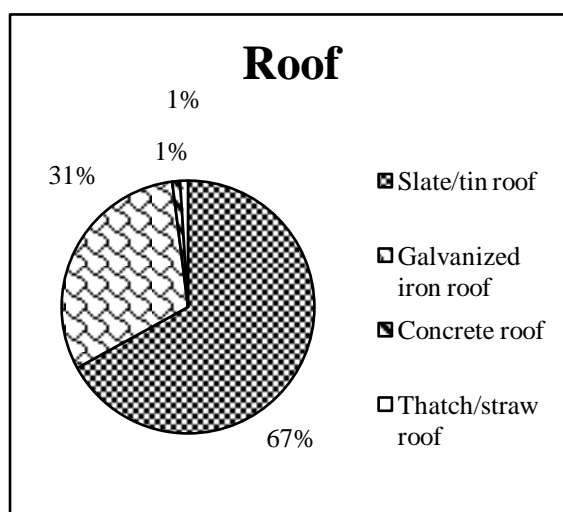
Source: Household Survey 2015

4.1.5 House Type

Houses were typically built with slate/tin roofs and mud walls. Slate/tin for roofing was used by 67% of households, followed by roofs made of galvanized iron 31%, concrete roofs 1% and thatch/straw roofs 1% (Figure 4.4). Mud walls were used by 98%, followed by cement walls 1% only in a few cases 1% natural materials were used for the walls. Some households use cement for walls even though the roof is not plastered so as to make the house more resistant to earthquakes (Figure 4.5)

Figure 4.4

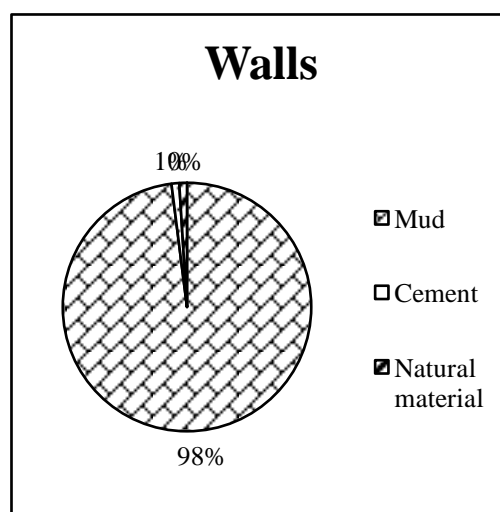
Types of Roof



Source: Household Survey 2015

Figure 4.5

Types of house walls



Source: Household Survey 2015

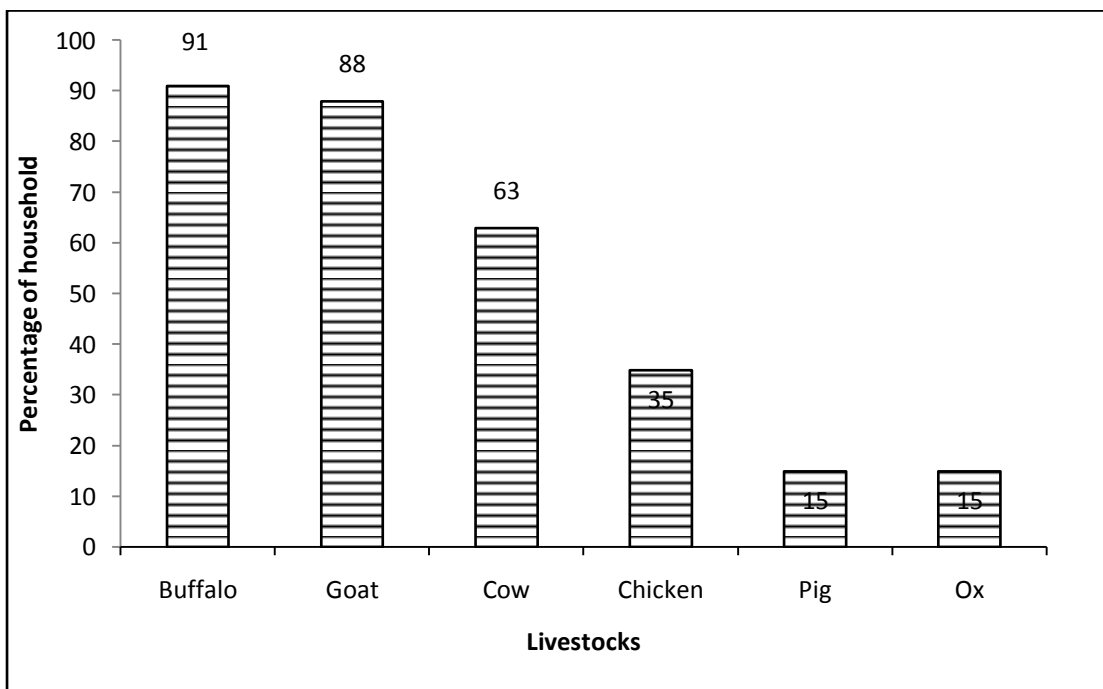
4.1.6 Livestock Types and Number

Livestock raising was carried out by nearly 94% of the households interviewed, with respondents raising buffaloes, cows, oxes, goats, chicken, pigs. Buffalo rearing was the main livestock activity; 91 % of all households own buffalos, with an average number of 2 Buffalos per household. Approximately, 88 % of the households surveyed owned goat, with an average of 3 goats per household. Of the total, 63 % of household have cow in their house, with an average number of 1 cow per household. Chicken was raised by 35 % of household, with an average of 8 chickens per household. Pig rearing was done by 15 % of household with an average of 3 pigs per household. (Figure 4.6)

Of those who owned livestock, 36% said the main purpose was household consumption; 61 % said livestock were intended for sale. The average income of livestock rearing was NPR 5000 per month.

Figure 4.6

Percentage of Households having Different Livestock



Source: Household Survey 2015

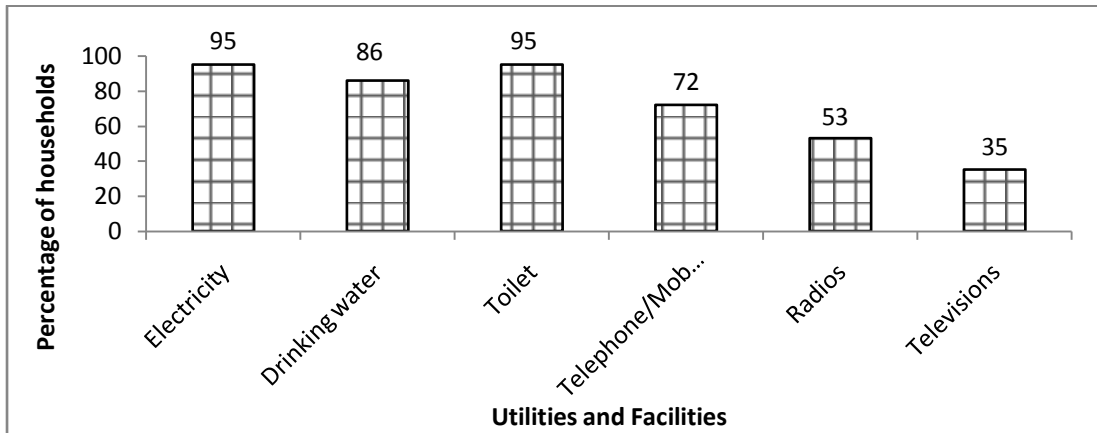
4.1.7 Utilities and Facilities

Majority of respondents 63% believed their income was average, 31% believed their household income was below average and 6 % believed it to be more than average.

As an indication of their relative income to utilities and facilities, most households owned electricity (95%) followed by drinking water facilities (86%) and availability of toilet was found in 95% of household. The main assets owned by households were telephones/mobiles (72%), radios (53%), televisions (35%), computer (1%) and motorcycle (1%) (Figure 4.7).

Figure 4.7

Percentage of Household Having Different Utilities and Facilities



Source: Household Survey 2015

4.2 Economic Impacts of Earthquake 2015

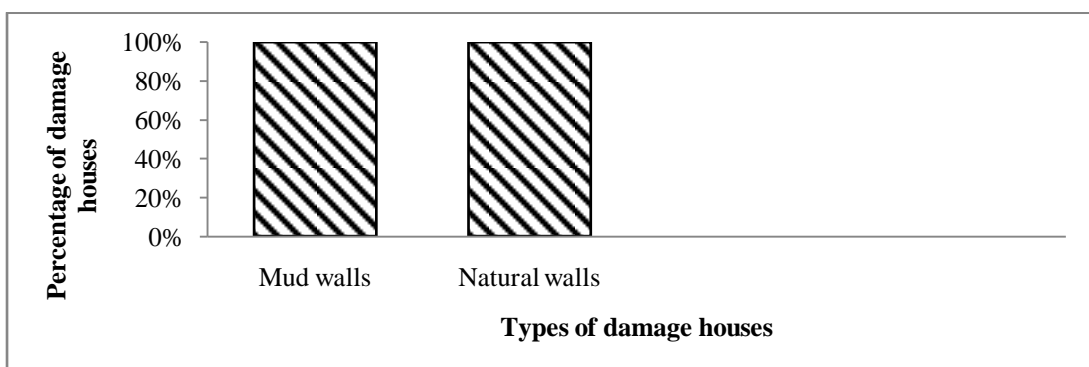
BadegauVDC has experienced earthquake in 2015 with frequent earthquakes after. The earthquakes caused severe damage to agriculture land with heavy loss in household and public sector. Many livestock animals were lost. The entire area of the VDC has experienced a rapid change, primarily caused by earthquakes.

4.2.1 Household

The shallow depth of the quake and the nature of BadegauVDC have contributed to the high losses. However, it should be noted that the quality of construction and materials of buildings is very poor. Of total household, 99.5% reported that their houses were damaged. The percentage of damages is shown in figure (4.8).

Figure 4.8

Damage Percentage of House



Source: Household Survey 2015

4.2.2 Agriculture Sector

The impact of the earthquake on the agriculture sector is yet to be assessed in terms of the anticipated losses in production and output. While the agriculture land might not have been severely affected, agriculture labor, inputs, markets and infrastructures such as irrigation systems, drainage canals, and roads have incurred damages. As a result, output of this sector is anticipated to drop significantly leading to potential food security problems.

4.2.2.1 Disruption of Agriculture

With the harvesting season approaching farmers have been unable to prepare the fields for sowing which will eventually impact the output of the sector. Additionally immediate agro-input supply for sowing preparation is impossible due to damages to roads, distribution centers, and agro-vets. The monsoon is further expected to trigger landslides in the hilly areas as the earthquake has loosened the soil and made the land more vulnerable. Livestock farming has also suffered colossal damages as domesticated and commercial farmed livestock have perished. Similarly, damage of livestock inputs might limit the food supplies to the remaining ones.

4.2.2.2 Losses of the Sector

According to the VDC office the total loss to the agriculture sector amounts to NPR 70-80 million. Losses of food stocked by farmers in houses alone stood at NPR 50-60 million. Similarly, livestock losses amount to NPR 15-20 million.

The Food and Agriculture Organization (FAO) estimated Nepal's wheat production in 2015 to stand at 1.8 million tons, 5% below last year's harvest. But the estimation is likely to change due to damages to agricultural inputs and the inability of farmers to harvest. The output of rice and maize is also expected to decrease as the earthquake affected districts contribute approximately 9.3% and 18.1% of the total national output.

4.2.2.3 Employment and Food Prices

As the agriculture sectors employs 33.7% of the total population, damages to the sector is also likely to impact employment within the village. With direct and indirect employment provided by the sector, severely impacted; slow economic growth of the country should be expected this year.

Transportation and infrastructural damages are also expected to limit internal trade and have negative impact on food prices. Likewise, with internal production of food likely to decline an increased dependency on imported food is expected eventually leading to rise in

food prices. The Ministry of Agricultural Development has however stated that it has sufficient food balance to meet the extra demand, due to which a food deficit is unlikely to occur. The biggest challenge for the government will therefore be to create a proper distribution channel that is effective in the distribution of food.

4.2.3 Crops

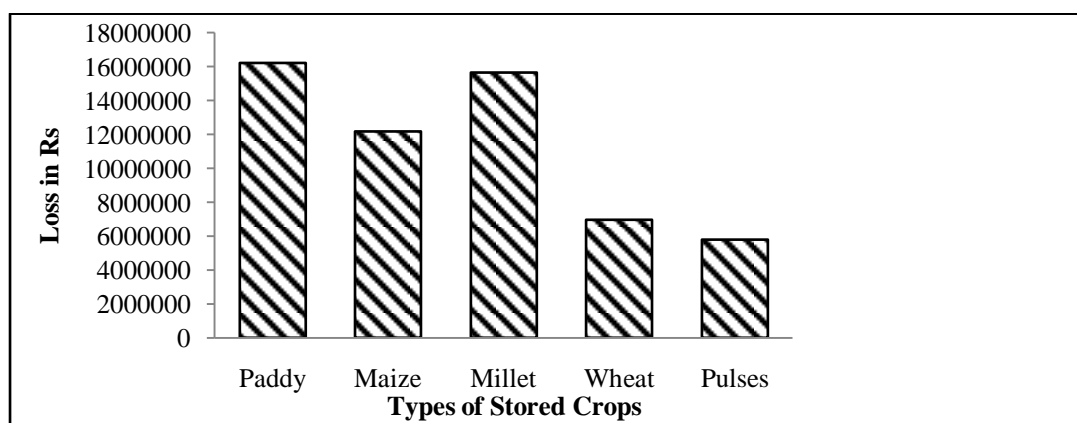
As can be seen, at the time of the earthquake, the wheat harvest was underway. Wheat is an important food source for farming families during the monsoon season (June – September) in the districts hit by the earthquake. It appears that most of the wheat had already been harvested at the time of the earthquake. Depending upon altitude, summer maize planting and/or first weeding was also taking place, and this has been disrupted which will have negative consequences on yields and consequently on household food insecurity from August onwards. Finally, the earthquake came a few weeks before the planting of the main food crop – rice. The most important impact as far as rice is concerned will be in relation to the destruction of rice seed needed for planting, this is normally stored within the house.

4.2.3.1 Stored Crops Loss

Data from the household survey confirms that losses of stored crops in the VDC were significant (Figure 4.9).

Figure 4.9

Loss Amount of Stored Crops in Rs



Source: Household Survey 2015

4.2.3.2 Seed Losses

Seed is generally stored in the house near to the stored grain. Therefore as houses collapsed or were damaged after the earthquake seed as well as stored grain was lost.

The proportion of households reporting near total loss of seed is very high for millet and rice. For potato it is lower, with around 99 % of households reporting loss, with lower proportions for maize wheat and barley. When asked, most households reported that seed was not currently available on the market. This raised serious concerns regarding the availability of seed for planting during the summer season and the winter season.

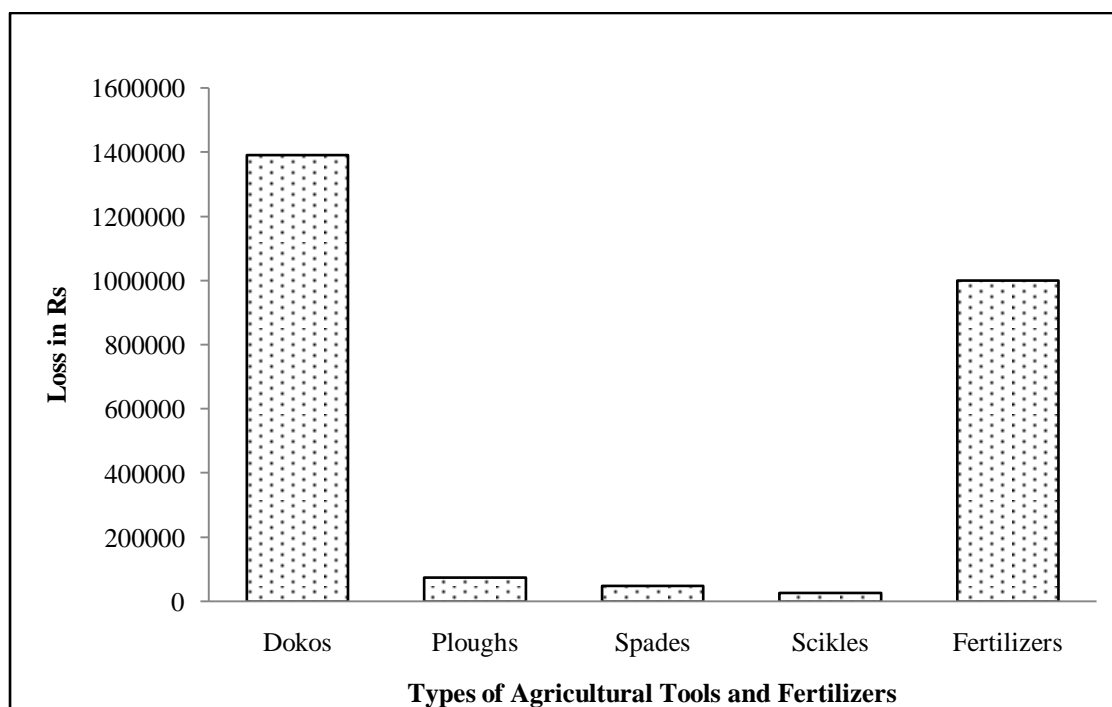
4.2.4 Agricultural Tools, Fertilizers and Labour

4.2.4.1 Tools and Equipments

Damage to and destruction of agricultural assets is significant. Key tools lost or rendered unusable include ploughs, spades, sickles and dokos. In addition, livestock shelters and water tanks for livestock were also destroyed. The level of destruction is shown in Figure (4.10).

Figure 4.10

Loss of Agriculture Tools and Fertilizers



Source: Household Survey 2015

4.2.4.2 Fertilizers

Losses of chemical fertilizers stored in or near the house were reported by VDC level key informants as being significant (Figure 10). At the time of the qualitative field survey,

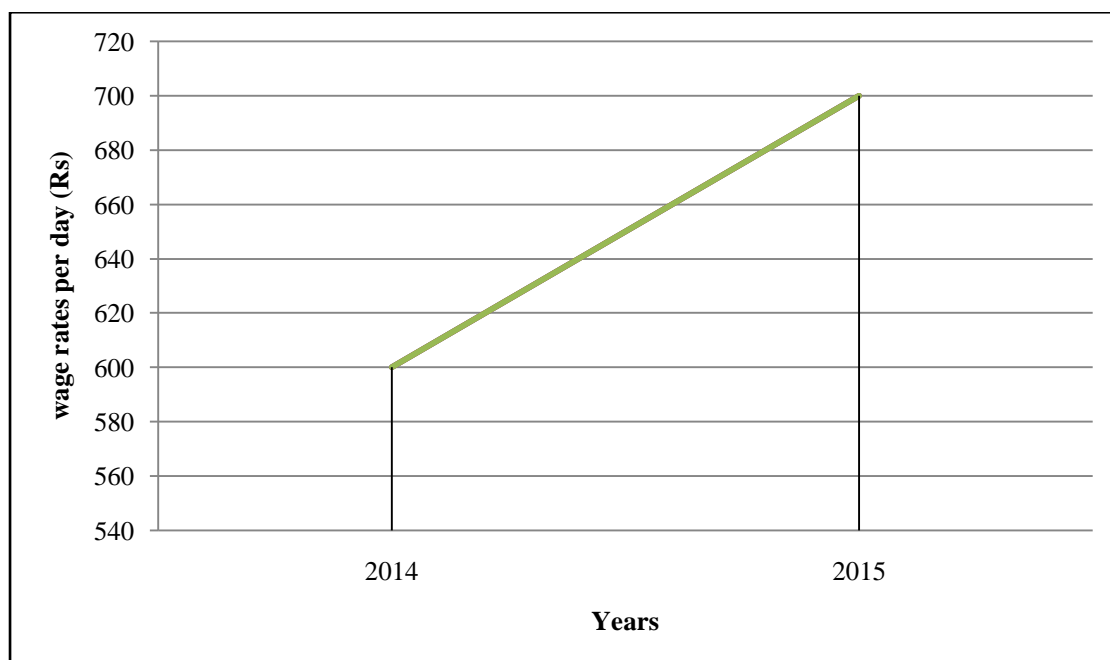
fertilizers were reported to be available (in the market and in farmer cooperatives) in the VDCs visited in village. Use of fertilizers for summer planted crops is very common and necessary for good yields. The loss of livestock which provides manure for fertilizing the crops will exacerbate the problem in the coming weeks and months.

4.2.4.3 Labour

The earthquake has had a major effect on reducing labour availability for agricultural tasks. In VDC level discussions, it was clear that an important reason for this was that household members were too busy trying to find shelter for themselves and their livestock as well as being in a state of shock. Death and injury of household members was another factor, as well as unavailability of the persons usually providing wage labour and consequent increase in wage rates (Fig 4.11). But 200 of workers have returned from overseas to help reconstruct their houses.

Fig 4.11

Wage Rates per Day of a Labor



Source: Household Survey 2015

4.2.5 Livestock

4.2.5.1 Introduction

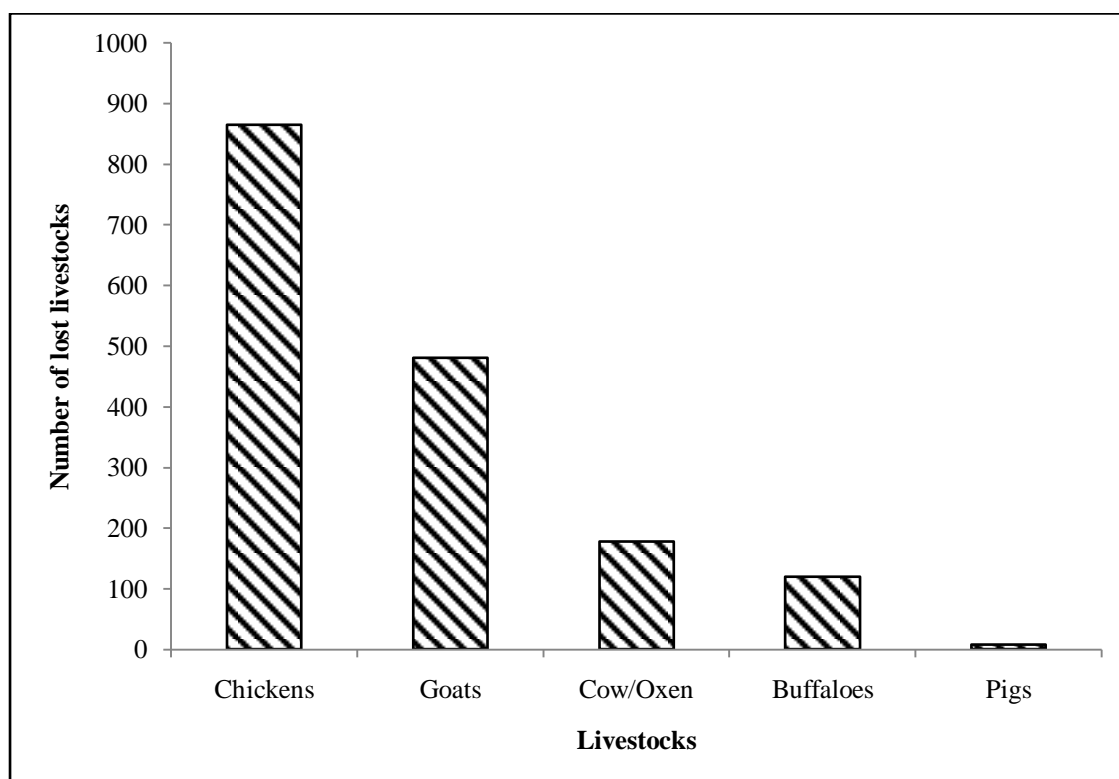
Livestock ownership is significant in Nepal and particularly in hills and mountains, where it is a major component of livelihoods both as source of food and income.

4.2.5.2 Livestock Death

Of total household, 12.8% had lost their livestock due to the effect of earthquake, 2015. Total numbers of chickens, goats, cow/oxen, buffaloes and pigs lost were found 865, 480, 177, 119 and 8 respectively (Figure 4.12).

Figure 4.12

Livestock Lost



Source: Household Survey 2015

The numbers of households directly affected by these losses vary according to the type of livestock lost. Overall the proportion of households affected by loss of oxen appears light, with just 12% of those households which owned oxen reporting losses. In the case of cattle the figure was 15%; for sheep and goats 15% and for poultry 38%.

Livestock are commonly kept either on the ground floor of the house, or under a specific shelter next to the house, or tied outside along the house. Thus, many animals were killed as houses or shelters collapsed - this is particularly the case for cattle which would explain the higher loss. Poultry is also kept in specific constructions, especially for larger farming, which resulted in higher loss.

4.2.5.3 Livestock Injuries and Illness

Reports from the qualitative assessment at VDC level indicate very diverse proportion of animals being injured or sick, mostly higher than the proportion of animals killed, but this would require further investigation. Overall but with some exceptions, the level of veterinary support was reported to be very limited by VDC Key Informants. It was reported that in the vast majority of cases livestock carcasses were being properly buried, reducing concerns over infections and diseases due to rotting carcasses. This will be confirmed as data is being compiled by the District Livestock Support Officers. In addition severe stress syndromes have been reported among livestock due to the trauma, resulting in abortions, disturbed eating behavior, and even mortality during subsequent shocks. There is therefore a real risk of further livestock mortality due to both injuries inflicted during the earthquake and subsequent degradation of living conditions.

4.2.5.4 Shelter, Feed and Water

A critical concern is the lack of shelter. Overall, 95% of households report that their livestock shelter was destroyed. As an emergency solution and when available, households are using tarpaulins to protect livestock. However when the monsoon comes, these temporary shelters might not hold and would not be sufficient to protect animals. Animals deprived of shelter are also more exposed to predators and an increase in loss of animals due to attacks by tigers and leopards has been reported. As livestock is mostly kept next to the house instead of grazing, it is usually fed with grain, mostly maize and rice bran, stored in the house together with all cereal stocks. Thus the large losses of stored grain will have a direct negative impact on availability of livestock feed. Some grain is being recovered from collapsed buildings and fed to livestock, however, after weeks in the mud this is becoming mouldy and therefore carries the risk of ingestion of aflatoxins, which poses risks to animal health and human health if animal products are consumed. In addition, access to forest areas to collect fodder for animals has also been reduced by fear of landslides and fear of aftershocks – almost half (47%) of households reported that they no longer had access to forest resources as a result of the earthquake. As noted earlier, the household survey found that availability of water for livestock has also been reduced, as water tanks and pipes for livestock have been destroyed. This was confirmed by Key Informants who further explained that water systems had been damaged and some sources had dried up due to the earthquake.

4.2.6 Irrigation and Agricultural Infrastructure

Irrigation is important in spring, summer and winter seasons. In summer it is used to irrigate rice at the start of the monsoon, whilst in the winter season it is necessary for wheat, hybrid maize, barley, buckwheat and potato in critical growing periods (e.g. crown initiation tillering and flowering in wheat) and in the spring it is used for spring rice and spring maize.

The results of the household survey indicate that a sizable minority (36%) of households in the village use irrigation. There is less extent of damage to small-scale irrigation infrastructure.

Many Agriculture and Livestock Service Centers have been severely damaged or destroyed, affecting their capacity to provide services to farmers. MOAD (2015) reports indicate that many Service Centre buildings across the district and neighbor districts have been completely destroyed with the same number again seriously damaged. In addition, agricultural infrastructures such as seed stores and processing plants, and cooperative buildings across the VDC have been completely destroyed.

4.2.7 Health Sector

4.2.7.1 Destruction of Health Services

The April 25th earthquake destroyed 4 health posts of Rs 1,50,00,000 out of 6 of VDC.

4.2.7.2 Women and Children among the Most Affected

UNFPA estimates that of the 2 million women of reproductive age affected by the disaster, 126,000 pregnant women were in urgent need of health services. A lot of compromises have been seen in terms of access to reproductive health services. Medical supplies are severely depleted which has also affected the proportion of safe deliveries.

4.2.7.3 Response from Nepal Health Sector

There has been a lot of effort from local health service organizations as well as international medical teams. The government classified international medical teams into three categories: Type 1, 2 and 3. Type 1 for basic health services, Type 2 for more intensive hospital care and Type 3 for best equipped teams, who can provide continued care for at least a couple of months.

4.2.7.4 The Survivors' Fear of Health

Survivors faced threat of a disease outbreak due to severe shortages of clean water and toilets. With many people living out in open spaces, there is an increased risk of diseases

spreading, as well as the speed at which they spread. Diarrhea, respiratory diseases and measles outbreak are some of the main concerns for health experts in the aftermath of the earthquake. Safe sanitation systems are therefore essential.

4.2.7.5 Psychological Consequences of the Earthquake

Trauma is common for all natural disaster survivors, who often worry whether they will ever be safe again. Survivors have reported a constant feeling of anxiety, depression, sleeplessness and flashbacks. Many traumatized children remain quiet. Save the Children has set up a series of child friendly spaces that allow kids to work through their own fear or just play a game. There have also been many organizations and individual counselors from different countries that have come in to help people undergoing trauma.

4.2.8 Remittance

4.2.8.1 Surge in Remittance

Remittance flow through informal channels such as Hundi came down as banks and remittance companies gave exemptions on service charges for a month. According to International Money Express, remittance inflow has increased by 20% over the last few weeks. Similarly, NRB and other major banks confirmed that there was a massive increase in remittance inflow. Natural disasters worldwide in recent times have also shown the same trends. For instance remittance has been high in Indonesia ever since the earthquake and tsunami in 2004. Likewise, the hurricane in Jamaica in the late 80's resulted in higher migration which increased their remittance by 46% per annum in 15 years.

4.2.8.2 More Jobs to be Created

There is much work that the earthquake has left behind in Nepal. Creation of jobs at this point of time will be very crucial. Restoration and rebuilding of the affected areas will require thousands of skilled and semi-skilled workers who can be paid salaries similar to what they would earn doing the same work in the Middle East. With reconstruction a priority, the country will however struggle to handle new influx workers. We are already seeing more workers from India and even Bangladesh that are filling the gap of workers in Nepal.

4.2.8.3 Remittance for Reconstruction

Migration is likely to increase following the earthquake as the youth go in search of better income opportunities. This is expected to increase the country's dependence on remittance, meanwhile also changing the pattern of how remittances are used. At present nearly 80% of

remittance income is used for household necessities, a large portion of which will now be directed towards reconstruction.

4.2.8.4 The Cost of Rebuilding

Given the scale of destruction wreaked by the earthquake, rebuilding is likely to require a lot of investment. There could be financial instruments created that will be able to channel remittances for rebuilding. Further, there could be schemes that can be created to encourage skill building.

4.2.9 Infrastructure

4.2.9.1 Damage to Infrastructure

The full extent of the damage from the earthquake that hit village is not yet known. Early economic damages are currently being estimated at over NPR 100 million.

4.2.9.2 Transportation

Road transport is the most important transport sector in the VDC with gravel roading system fed by a network of collector roads and streets. Roads are extremely vulnerable to landslides after earthquake, being subject to widespread disruptions and damage. The damaged road was including loss of access for emergency services, stranding of travelers, disruption to food and temporary shelter and economic impacts on business. 5 km of the road was damaged which costs about NPR 5,000,000.

4.2.9.3 Electrical Distribution System

Earthquake caused many different problems to electrical distribution systems. Supply outaged resulting from insulator flashover, landslides and damaging pole. 3km with 20 poles were damaged which costs about NPR 2,000,000.

4.2.9.4 Communications

Communications were disrupted around the area during the earthquake. Such disruption was due to the overloading of telephone systems due to increased demand, direct damage to communications facilities, and operations or maintenance workers.

4.2.10 Poverty

The report shows that the income shock from the earthquake will likely push an additional 500 - 800 people below the poverty line. This translates into an additional 9-15% of the estimated population in 2015 pushed into poverty on top of the 21% who were estimated to

be living below the poverty line. The income shock will largely be felt through the loss of income-generating opportunities and livelihoods including death and injuries to primary wage earners and the loss of housing, productive assets like seeds, livestock, and farm equipment, and of durable assets such as assorted household items.

Beyond this monetary-based poverty estimate, a larger impact can be expected when factoring in multidimensional poverty, which includes additional factors such as water and sanitation services, disruption of schools and health services and the possibility of an uptick in food insecurity. The poor and vulnerable are particularly dependent on local infrastructure such as roads, bridges, health posts, and schools for access to labor and commodity markets, and for accumulation of human capital (especially those of children). Reviving local economic activities and the resumption of basic public services along with an accelerated implementation of reconstruction projects will be critical to make up for the setback on poverty reduction caused by the earthquake.

4.2.11 Monuments

Historical monuments as well as religious structures associated with Buddhism suffered tremendous damage induced by the 2015 earthquake. Most of these structures are of masonry type using bricks and earth-mortar as a bonding-agent. 65% of monuments were damaged in the village. The loss in it estimates that NPR 5,000,000.

4.3 Overall Loss and Damage

Study area is experiencing earthquakes which directly impact on the household and government economy. The percentage of experienced stressor was 100%, experienced impact was 100%, No households adopted coping or adapting measures, 100% of households expressed that they were still in impact of earthquake despite some adapting measure.

4.4 Estimated Valuation of Loss and Damage

4.4.1 Public Assets

Public assets are known as infrastructure either made by government agency, communities, or by different non-government/international organization from which all the residents of particular area are benefited. Loss and damage of public assets was obtained from focus group discussion and the loss and damage was calculated as NPR 129,428,000 (Table 4.2)

Table 4.2**Estimated Price of Loss and Damage of Public Assets**

S.N	Assets	Quantity	Estimated Price of Loss and Damage (NPR)
1	Schools	11	105,828,000
2	Health Posts	2	8,000,000
3	Road	5km	5,000,000
4	Electrical distribution system	16km	1,600,000
5	Monuments	7	7,000,000
6	Post office	1	2,000,000
	Total		129,428,000

Source: Household Survey 2015

The estimated loss and damage of public assets was obtained from focus group discussion, the loss and damage was calculated as NPR 129,428,000 (Table 4.3).

4.4.2 Private Assets

Loss and damage of private assets by the earthquakes of 2015 are calculated in the current price which was calculated to be NPR **1,065,789,000** (Table 4.3)

Table 4.3**Estimated Price of Loss and Damage of Private Assets**

S.N.	Assets	Categories	Estimated price of Loss and Damage
1	Livestocks	Chicken	865,000
		Goat	3,360,000
		Cow/ox	5,310,000
		Buffalo	7,735,000
		Pig	240,000
2	Houses		579,000,000

3	Cowsheds		348,000,000
4	Toilets		60,000,000
5	Stored Crops	Paddy	16,240,000
		Maize	12,180,000
		Millet	15,660,000
		Wheat	6,960,000
		Pulses	5,800,000
6	Agricultural tools & fertilizers		4,439,000
	Total		1,065,789,000

Source: Household Survey 2015

CHAPTER V

RESULT AND DISCUSSION

5.1 Socio economic Status

Nepal is classified as a low income developing country and a low human development nation, ranked 145th out of 185 countries in the composite human development index (UNDP, 2014). An estimated 82% of the population can be classified as 'rural' (UN Statistics Division 2009), living in extreme poverty and depending upon weak agricultural production as their only source of cash income (Tianchi & Behrens, 2002). Nepal is characterized by inequality based on socio-economic factors including ethnic and caste discrimination (Pradhan & Shrestha, 2005). The high castes and relatively advantageous groups (including the Brahmin-Chhetri-Newar) constitute only 37.1% of the population, yet their human development indicators can be up to 50% greater than the hill ethnic, Terai ethnic and occupational caste groups (Murshed & Gates, 2005)

Nepal falls among least developed countries in the world with almost one quarter of its population living below the poverty line. Agriculture is the mainstay of the economy

providing a livelihood for three-quarters of the population and accounting for about one third of gross domestic product (Khadka&Verma, 2012). In the study of BadegauVDC, the major occupation was agriculture where 84.6 % households were engaged in agricultural activities such as cultivating crops, raising livestock. Livestock raising being carried out by nearly 98% of the households interviewed, with respondents raising buffalos, cows, oxen, goat, chicken, pigs. Of those who owned livestock, 36% said the main purpose was household consumption; 61% said livestock were intended for; the remaining percentage was bull used for mate. The average income of household from livestock rearing was NPR 60,000 per year.

Presently, remittances are the largest source of household income with 14.7% of respondents indicating that their household received remittances with the average amount sent per household per month being NPR 20,000. Remittance is central to Nepal's contemporary economy. While Nepalese have long migrated outside the nation's borders to earn money, the insurgency and following period since 1996 have accelerated and intensified outmigration by 2010. It is estimated that 4 million Nepalese were working in foreign countries according to Nepal's national census (GON, 2010). Therefore, country has made recent stride in poverty alleviation largely due to the high amount of remittances, now received by 55.8 % of all household an astonishing drop by points from 31 % under the poverty limit to 13 % under the poverty limit (CBS, 2012).

In Nepal, nearly 60% of rural households are 'functionally landless' with insufficient land to meet their basic food requirements (Wily, 2008). Of total surveyed household, 96% of household own the land and house whereas 4% respondents do not have their own land and house. The average land size per household was 0.31 Ha. Houses are typically built with slate/tin and mud walls. Slate/tin for roofing was used by 67% of households, followed by roofs made of galvanized iron 31%, concrete roofs 1% and thatch/straw roofs 1%. Mud walls were used by 98%, followed by cement walls 1% only in a few cases 1% natural materials were used for the walls.

5.2 Loss and Damage of Biological and Physical Assets

Destruction of natural environment not only results in loss of plants and animals it also impacts on human life and livelihoods through changes to ecosystem functioning and the availability of ecosystem goods and services that people depend upon. Many ecosystems are already under pressure from global change drivers such as changes in land use. Pollution and over-exploitation of resources; climate change compounds these and also threatens ever-

greater levels of ecological devastation, often with multiple threats acting together. The current rate of extinction is 100-1,000 times what is normal, and is increasing (Pimon , 1995)

Households still experience 99% of residual loss and damage, 99% of respondents still suffered from negative effects of climate change and was unable to counter the effects of earthquakes. The ability to carry out adaptation measures was often curtailed by material, technical and financial limitations. The majority of those who did not carry out adaptation strategies indicated this was due to lack of resources, skills of knowledge. In order to improve future adaptation measures, collective, collaboration and planned adaptation measures are necessary, for example relocation and advanced technological defenses should be introduced among locals.

Adaptation measures were not effective enough to avoid adverse earthquakes effects and that many coping strategies had negative effects. In the case of poor and vulnerable households, severe earthquakes have the capacity to affect livelihoods to such extent that it takes households a long time to recover, if at all. Their coping strategies of people were not sustainable, which means that these may provide short-term relief, but have long-term negative effects on the household economy (Geest& Dietz, 2004)

5.3 Estimated Prices of Loss and Damage of Private and Public Assets

PDNA (2015) estimated that the total value of disaster effects (damages and losses) caused by the earthquakes all over Nepal is NPR 706 billion or its equivalent of US\$ 7 billion. Of that amount, NPR 517 billion (or 76 percent of the total effects) represents the value of destroyed physical assets, and NPR 189 billion (24 percent of the total effects) reflects the losses and higher costs of production of goods and services arising from the disaster. This value of total damages and losses (changes in flows) is equivalent to about one third of the Gross Domestic Product (GDP) in FY 2013- 2014. In addition, the estimated value of damage is equivalent to more than 100 percent of the Gross Fixed Capital Formation (GFCF) for FY 2013-2014. From the study, the cost of loss and damage of private property was estimated to be NPR 1,065,789,000 and the loss and damage of public property was estimated to be NPR 129,428,000 and the total cost of loss and damage was found to be NPR 1,195,217,000.

PDNA (2015) is estimated the total recovery needs of NPR 669 billion or US\$ 6.7 billion take into account the cost of reconstruction with better specifications, equipment, improved governance and risk reduction. While calculating the recovery needs, it does not consider the replacement value, particularly with respect to the housing sector. It specifies a core house with a minimum area as the recovery need, and estimates the total needs on the basis

of the cost of construction per square feet. In the study area, the total cost of reconstructing houses, land and infrastructure was estimated to be about NPR 1 billion. The investment for reconstruction substantially exceeds the original costs, which ultimately lead society to become erosive in terms of livelihood.

5.4 Positive Impacts of Earthquake

5.4.1 Changing Attitudes and Preferences

Prior to this event an average resident of this rural area like was interested in making a light building rather than a heavy building because of number of reasons. Increasing cost of constructional operations coupled with a number of problems associated like maintenance and security are some of such reasons. This phenomenon has

5.4.2 Building Byelaws

This earthquake not only affected the architecture of the village but also influenced architectural practice as a whole. Building Byelaws in all villages throughout the VDC have been modified after this event and provisions for earthquake resistance making which were previously not observed. Consultancy services are increased as far as structural designers are concerned

5.4.3 Increasing Awareness

One of the positive aspects of this earthquake is that it has resulted in an increased awareness of a common man towards seismic safety. Earlier this aspect, which was ignored by the client while buying a residential unit, now, became probably one of the major criteria. The brochures and the project information which was previously devoid of any structural details is now found to be well equipped with structural details and specifications provided for earthquake resistance. In a number of cases such provisions are highlighted and they are used to attract the perspective clients. Builders who had constructed the multistoried apartments located in the affected areas and which survived this earthquake are making a profitable business their sales figures are unbelievable.

5.5 Psychological Aspects

Earthquake leaves behind a long lasting impression on the human's mind and may adversely affect the growth of the person who has experienced an earthquake. The psychological effects of an earthquake can be broadly classified in two categories viz. long term effects and short term effects (Joshi, 2004). The intensity of short -term effect is more but its duration ranges from a minute to an hour depending on the mental status of the individual. The

number of victims is less as far as this type of disorder is concerned but it is dangerous to certain extent as it may result in serious psychological disorders like madness or even may cause heart failure. Long- term effects are those, which sustain for a period longer than one hour and so on. Their intensity is comparatively less but their effect is more serious and considerable as far as the mental health of the individuals is concerned who have survived an earthquake. These effects basically depend on the age group, mental set up of the victims while economic status is also one of the aspects as observed in the past earthquakes. Victims are found having Acute Stress Disorders, Post Traumatic Disorder, Adjustment Disorders and Depression, in a large number of cases as observed in the last earthquakes. The psychological impact of an earthquake has direct concern not only with the mental health of children below 5 years but also with their growth, which is not normal as noticed in a number of the cases. Many children were got affected with depression and lost the valuable period of learning and growth. Number of children affected by such type of disorders is although less, but seriousness of the problems is more. Fig.3 and 4 illustrates the psychological disorders amongst adults and children respectively.

5.6 Adaptation Measure

Of those households who were affected by earthquakes, No one had carried out adaptation measures. All houses are not earthquake resist. There was not government plan for the prevention of earthquake.

5.7 Outlook

The Nepal earthquake left over 9,000 people dead and over 25,000 injured. With health and medical infrastructure still relatively unsteady, the recovery and rebuilding costs of the earthquake is expected to be high. Tremendous investment will be required for repairing damaged structures, and building new structures on the ones that have been destroyed. This requires agencies to work on war footing and help in restoring services. Nepal has been lucky in the sense that no major epidemic broke out, and international teams have helped tremendously in the immediate treatment of victims. More investments will be required in areas of mental health and rehabilitation of people with major injuries.

The monsoons are a key factor for irrigation in the village, and any disruption will have a major impact. In quake hit areas, how quickly people can resume plantation work will impact food production. Impact of livestock losses is already visible and schemes to replenish livestock will be important. The Nepali markets have always been habituated in taking advantage of crisis situations to push prices, therefore major increase in agricultural output

will be noticed and this is expected to impact inflation in the first two quarters of next fiscal year.

CHAPTER VI

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary and Conclusion

The study showed that the earthquake had adverse impact on the socio-economic status of people in BadegaunVDC. To a large extent, the study has established that socioeconomic status play an important role in settlement patterns as well as building a earthquake resists houses. There could be many reasons why a family becomes unable to cope with climate stressors (i.e. earthquake). Among the household sample there were truly poor families, landless, low caste and indigenous group. Structural characteristics such as gender, income, education, ethnicity, among others, all affect a household's vulnerability in relation to earthquake.

After one or successive natural disasters, poor families with insufficient financial, land, or other assets are likely to lose the minimal properties they have and face increasing indebtedness and poverty. Such vulnerable populations are advantaged in terms of accessing resources, which exposes them to increased risks during disasters and in the wake of climate-related events. These risks include physical dislocation and psychological trauma, the loss of household resources (e.g., live stock, built capital such as paddy walls and structures), and catastrophic harvest failure, among others.

In some cases, families have poor resilience, when a household is living in subsistence economy. For instance, when loss and damage strike a household, the family's savings or subsistence capital can be wiped out. Such households and communities face barriers that erode livelihoods, food security and asset bases and that prevent them from accessing appropriate, sufficient adaptation options to manage climate risks.

It is also evident that there are varying underlying causes of people's vulnerability to adapt and then poses a challenge for reducing or minimizing vulnerability. Proximity to the landslide prone area further demonstrated that effects of earthquakes in one sector can affect other sectors of society.

6.2 Recommendations

Since earthquakes are ultimately caused by forces strong enough to move continents, human efforts to stop earthquakes from occurring would seem to be futile. However, there has been speculation about the possibility of moderating of some of earthquakes most severe effects. In order to minimize loss of life, preserve public safety, guard national economy and defense in quake prone countries several earthquake safety measures have been recommended.

- Earthquake-risk zoning (seismic zoning) and preparation of earthquake maps of regions and formulation of building codes.
- Construction of earthquake proof structures.
- Land use planning
- Instrumentation
- Earthquake hazard education and disaster preparedness.
- Earthquake retrofitting (repairs, redesign, reconstruction of damaged structures to resist future quakes)
- Earthquake insurance

Community Level

- The socioeconomic condition of the community should be enhanced through diversification of income generation activities.
- Availability of climate information and services including early warning system, news, social media campaign etc. could help the community and its people for early preparedness to adapt strategies, to reduce loss from climatic extremes in the area.

Policy Level

- Strong legal provision should be made and public are to be educated for building earthquake resists structures.

Research Level

- Academic and research organization should undertake studies on loss and damage at various geographic and socioeconomic landscape.

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APPENDICES

Appendix - I: Checklist for Key Informant Interview

1. Basic Information

- a. Name of respondent _____
- b. Age i) 10-24 ii) 25-39 iii) 40-54 iv) >55
- c. Sex i) Male ii) Female
- d. Education i) Illiterate ii) Literate/Below SLC iii) SLC iv) + 2 v) > +2
- e. Ethnicity: i) Dalit ii) Indigenous iii) Others (Brahmin, Chhetri)
- f. Major occupation: i) Agriculture ii) Services iii) Business iv) Labor v) Remittance vi) Others (specify)

2. Information about disaster

- a. What are the major natural disasters of the area?
- b. Which area is mostly affected by the disaster?
- c. How vulnerable is the disaster to the community
 - i) High ii) Low iii) Moderate
- d. What are the consequences of disaster (please rank them in the order)?

S.N	Disaster Consequences	Rank
1.	Loss of natural resources	
2.	Loss of infrastructure	
3.	Loss of natural habitat	

- e. Have you noticed about impact of natural disaster? If yes please rank following disaster?

Disaster	Indicators	Rank	Remarks
Earthquake			
Landslide			
Flood			
Drought			
Fire			

3. Information about adaptation

- a. What are the local practices to address the disaster adaptation?
- b. Do you know any organization involved in adaptation in your area?
 - i) Yes ii) No
 If yes name of organization

Appendix -II: Household Questionnaire

Questionnaire Number:

Date of interview: __/__/__

Ward no.:

1. Respondent and household information

a. Name of respondent _____

b. Age i) 10-24 ii) 25-39 iii) 40-45 iv) >55

c. Sex i) Male ii) Female

d. Ethnicity i) Dalit ii) Indigenous iii) Others (Brahmin, Chettri)

e. Education i) Illiterate ii) Literate/Below SLC iii) SLC iv)

Intermediate

v) Bachelor vi) Master vii) Other (specify)

f. Number of families _____

g. Major occupation i. Agriculture ii) Services iii) Business iv) Labor

v) Remittances vi) Others (specify) _____

h. Total income (per month, NPR) of household

i) < 1500 ii) 15000-25000 iii) 25000-35000 iv) >35000

2. Land and farm

a. Do you (or does your household) 'own' land? i) Yes ii) No

I) If yes, for what do you use your land i) House ii) Crop cultivation iii)

Livestock raising

iv) Renting out v) Fallowing vi) Nothing vii) Other specify

II) If yes, please estimate the total land size? Number _____ Unit _____

b. Do you farm? i) Yes ii) No (if no, go to section 3)

c. What is the size of the land that you cultivate this year? Number _____ Unit _____

d. Do you own the land your farm? i) Yes ii) No, none iii) Partly

I) If 2 or 3 how do you get access to this land? i) Renting ii) Sharecropping

iii) Borrow iv) Community land v) Other, specify _____

e. Is some of the land you farm irrigated? i) Yes ii) No

I) If yes, how much? Number _____ Unit _____

f. Which crops did you cultivate last year? [In order of importance] i) _____ ii) _____

iii) _____ iv) _____ v) _____ vi) _____ vii) _____ viii) _____

g. What is the main purpose of your crop production (choose one)?

i) Household consumption ii) Sale iii) Other, specify _____

h. How much of your crop production do you usually sell? i) Everything ii) More than half

iii) Approximately half iv) Less than half v) Hardly anything vi)

Nothing

i. How much income did your household derive from crop sales in the last 12 months?

—

8	Others(specify)	
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f. Did your land damage? i) Yes ___ ii) No ___

S.N	Land types	Area (ropani)
1	Khet	
2	Bari	
3	Pakha	
4	Others (specify)	

g. Did your house damage or loss? i) Yes ___ ii) No ___

S.N	House types	Damage	Loss
1	Slate/tin roof		
2	Thatch roof		
3	RCC		
4	Others(specify)		

h. Did the house lose any of the following property or asset? i) Yes ii) No If
yes,

S.N	Types of assets	Number or kg
1	Beds	
2	Racks	
3	Dokos	
4	Spades	
5	Ploughs	
6	Sickles	
8	Electronic devices	
9	Fertilizers	
10	Others, specify _____	

i. Stored crop loss i) Yes ___ ii) No ___

S.N	Types	Amount(in kg)
1	Rice	
2.	Maize	
3	Wheat	
4	Millet	
5	Pulses	

j. How did you do to recover for the loss of property?

- i) Taking loan ii) Borrowing cash from relatives iii) Support from
organization
- iv) Personal savings v) Selling other properties vii) Others, specify _____

5. Climate changes (impact + adaptation)

a. Have you experienced (more/any changes) in occurrence of landslides over the past twenty years? I) Yes, a lot ii) Yes, but only a little iii) About the same iv) No, less than before v) Not existed at all

b. If 1 or 2, does this adversely affect (the economic situation of) your household? I) Yes, a lot ii) Yes, but only a little iii) No, it doesn't affect us at all

c. If yes, how does it affect your household?

I) Negative effect on crops: i) None ii) Moderate iii) Severe iv) Not applicable (NA)

If 2 or 3, explain _____

II) Negative effect on livestock: i) None ii) Moderate iii) Severe iv) NA

If 2 or 3, explain _____

III) Effect on food prices: i) None ii) Moderate iii) Severe iv) NA

If 2 or 3, explain _____

IV) Damage to house/ properties: i) None ii) Moderate ii) Severe iv) NA

If 2 or 3, explain _____

V) Other negative effects, specify i) None ii) Moderate iii) Severe iv) Na

If 2 or 3, explain _____

6. Questions about what households do/did to adapt to (impacts of) climate changes:

a. Did you modify agricultural production/fishing to deal with landslides?

i) No ii) 2= Yes, shift to other crops/livestock/fish, specify _____ iii) shift from rain fed to irrigated agriculture iv) Modify production techniques/inputs, specify _____ v) Other, specify _____

b. Did you engage(more) in non-farm activities to deal with landslides?

i) No ii) Yes, switch to new economic activities, specify _____ iii) Expand existing non-farm activities iv) Other, specify _____

c. Did you or household members migrate (more) to deal with landslides?

i) No ii) Yes, I migrated iii) Yes, other household member(s) migrated iv) Yes, whole household migrated.

d. Did you do anything else to deal with landslides?

i) No ii) Yes, specify _____

e. Are these things you did to deal with landslides enough to avoid negative effects on the living standard and well-being of your household?

i) No, still severe negative effects ii) No, still moderate negative effects

iii) Yes, it allows us to carry on iv) Yes, it has even improved our situation

Appendix - III: Questionnaire for Focus Group Discussion

1. Information of participants

S.N	Participants Name	Address	Age	Education Level	Occupation

2. Which wards are mostly affected by earthquakes 2072?
3. What may be the cause of earthquakes (please rank the following in order?)
4. In your locality, is the earthquake trigger the vulnerability in each year?
5. What change have you found after construction of earthquake proof buildings in your area?
6. Which of the following infrastructure are damaged or lost?

S.N	Infrastructure	Unit	Damage/Lost
1	Land	(Ropani)	
2	Road	(km)	
3	Electricity wire	(km)	
4	Electricity poles	(Number)	
5	Schools	(Number)	
6	Health posts	(Number)	
7	Post offices	(Number)	
8	Other gov. offices	(Number)	

7. What do you feel about the environment around you?
 - i) Vulnerable
 - ii) Non vulnerable
8. Information about climate change
 - a. Do you know about climate change?
 - i) Yes
 - ii) No
 - b. In your opinion do you think climate change will cause disaster?
 - i) Yes
 - ii) No
 - c. What are the indicators of climate change in your area?
 - i) Extreme hot
 - ii) Extreme cold
 - iii) Irregular rainfall
 - iv) Change in frequency of rainfall
 - v) Others _____
 - d. Have you noticed about impact of natural disaster?

S.N	Disasters	Indicators	Rank	Remarks
1	Earthquakes			
2	Landslides			
3	Floods			
4	Fire			

- e. Information about natural disasters.
 - a) What are the local practices to address the climate change adaptation?
 - b) Do you know any organization involved in climate change adaptation in your area?
 - i) Yes
 - ii) No

If yes name of organization.

Appendix - IV: Semi Structured Questions for Key Informant Interview

1. What initiative did you/your organization take to support the earthquake displaced people in Badegau VDC?

Immediately after the earthquake:

In the camp:

In the recovery phase:

2. How do you evaluate the different supports provided by the organization? What was adequate and what was lacking?

3. Did displaced local people ask you for support? If yes, what type of support were they anticipating?

Immediately after the earthquake:

In the camp:

In the recovery phase:

4. What were the major difficulties of displaced people that you noticed?

5. How do you evaluate the role of institute to recover their livelihood?

Appendix - V: Category Wise Price Rate Physical Assets

S.N	Assets	Categories	Rate (Rs)
1	Livestocks	Buffalo	65,000
		Chicken	1,000
		Cow/Ox	30,000
		Pig	30,000
		Goat	7,000
2	Stored crops	Paddy(kg)	40
		Maize(kg)	35
		Millet(kg)	45
		Wheat(kg)	40
		Pulses(kg)	200

3	Houses	Muddy walls	500,000
		RCC	100,000
4	Schools	Fully damaged classrooms	1,000,000
		Major damaged classrooms	1,000,000
		Minor damaged classrooms	400,000
		Printer	50,000
		Computer	30,000
		Library	2,000,000
		Desk/bench	3,000
		Lab	2,000,000
5	Healthposts	-	2,000,000
6	Road(km)	-	1,000,000
7	Electricity(km)	-	630,000
8	Agriculture tools/fertilizers	Dokos	400
		Ploughs	1500
		Spades	500
		Scikles	400
		Fertilizers(kg)	30

Appendix - VI: Loss of Lives by Different Disasters in Nepal (from 1983 to 2012)

Types of Disaster	Total numbers of people	Percentage
Floods and Landslides	8181	35.20%
Earthquakes	734	3.16%
Wind storms, hailstorms	1027	4.42%
Avalanche	138	0.59%
Fire	1444	6.21%
Epidemic	11503	49.49%
Stampede	71	0.31%
Rainfall	22	0.09%
Boat collapse	13	0.06%
Bridge collapse	2	0.01%
Cold wave	73	0.31%
Air crash	34	0.15%
Others	2	0.01%

Total	23244	100.00%
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Source: Bulletin July 2014 series XV, cited by DWIDP 2014

Appendix - VII: Major Earthquakes in Nepal in the Last 100 years.

Year	Location	Magnitude	Damages	Cost
1934	Nepal	8.4	10,700 dead 126,355 houses damaged 80,893 buildings destroyed	206500 rupees (Kathmandu Valley only)
1980	Baitadi, Bajhang & Darchula	6.5	125 dead 248 seriously injured 13,414 buildings damaged 11,604 buildings destroyed	Unknown
1988	Eastern Development region, Some parts of Central Development region	6.8	721 dead 6,553 injured 65,432 buildings damaged 1,566 livestock dead 22 districts of eastern	5 billion rupees

			Nepal affected	
1993	Central region Midwestern region	Unknown	1 dead 11 injured 72 houses destroyed 451 buildings damaged	48.39 million rupees
1994	Midwestern region	Unknown	12 injured 623 affected 84 houses destroyed 287 buildings damaged	16.35 million rupees
1997	Central region Far Western region	Unknown	1 injured 1,489 affected 196 houses destroyed 60 buildings damaged	51.29 million rupees
2015	Northwest of Kathmandu	7.8	As of May 25, 2015: 8,669 deaths 16,808 injured 288,793 buildings damaged 254,114 building partially damaged	TBD

Source: Nepal Disaster Management Reference Handbook, cited by CFE-DMHA 2015

Appendix 8: Photographs



Photograph 1: Overview of Badegaun VDC



Photograph 2: Overview of Badegaun VDC



Photograph 5: Temporary classrooms of a school of Badegaun VDC



Photograph 6: A health camp for earthquake victims in Badegaun



Photograph 7: Focus Group Discussion



Photograph 8: Key Informant Interview

