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INSTITUTE OF ENGINEERING  
PULCHOWK CAMPUS**

**A THESIS PROGRESS REPORT ON  
“CAPACITY ASSESSMENT OF LOCAL GOVERNMENT AND PREPARE  
FRAMEWORK FOR DISASTER RESPONSE PLANNING AT LOCAL LEVEL:  
A CASE STUDY OF HARION MUNICIPALITY”**

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## **ABSTRACT**

Sendai Framework for Disaster Risk reduction priorities the understanding of the disaster risk, managing the risk governance and enhancing the disaster preparedness with the investigation for resilience. To contextualize this theme into local government and governance system, a systematic macro level study of the governance system is essential for disaster risk management. It is quite challenging task to the growing cities like Harion to cope changing pattern of city with the disaster management plan because growth of cities does not correspondingly grow the capacity in relation to disaster preparedness. Capacity assessment of the city is one of primary needs to analyze the context and situation of the city which shall aid to visualize the gaps and find further needs of the city.

This research analyzes the capacity of Harion Municipal city in relation to different prevailing hazards and other possible hazards that might strike it. The data are received from municipal record, key informant's interviews and different governmental sites. The study of prevailing nature and condition, and verification and validation of mapping was done by field study. To better understand the context, a detailed questionnaire was prepared based on literature review and based on general needs of a resilient city.

The measure of capacity done in this paper shows the general ability of the municipality in terms of disaster preparedness and further suggests a response plan for the particular area visualizing the needs and demands in terms of capacity development that needs to be equipped. This research aims to enhance to develop framework for disaster preparedness and response capabilities. Also the study of capacity shall aid to find the buffer zone and the reliability of existing capacity during any disaster or hazard events. This will also help the concerned authority to and incorporate disaster management plan with the developmental works. The research aims to demonstrate the existing stage of response capacities and conclude the development of framework for response plan that can be used in context of Harion municipality.

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## **ABBREVIATIONS**

AD	Anno Domini
BS	Bikram Sambat
DIFID	Department of International Development
DPRP	Disaster Preparedness and Response Plan
DRR	Disaster Risk Reduction
EOC	Emergency Operation Center
EWS	Early Warning System
GoN	Government of Nepal
HFA	Hyogo Framework for Action
ISDR	International Strategy for Disaster Reduction
IFRC	International Federation of Red Cross and Red Crescent Societies
INGO	International Non-Governmental Organization
LDCRP	Local Disaster and Climate Resilient Plan
MoHA	Ministry of Home Affairs
NDRF	National Disaster Response Framework
NGO	Non-Governmental Organization
NSDRM	National Strategy for Disaster Risk Management
pwd	People with Disability
SFDRR	Sendai Framework for Disaster Risk Reduction
UNDP	United Nations Development Programme
UNHCR	United Nations High Commissioner for Refugees
UNISDR	United Nations International Strategy for Disaster Reduction

# CHAPTER ONE: INTRODUCTION

## 1.1 Background

There is growing recognition on DRR topic by governments and organizations because of increasing number of people being affected by natural hazards (UNISDR, 2017). Risk of disaster arises when hazards tends to materialize interacting with existing physical, social, economic and environmental vulnerabilities (Westen, Alkema, Kerle, & Kingma, 2011). Many cases of disaster are particularly linked to the geographic, environmental, historical and socio-cultural aspects of the country. On visualizing the disaster history, disasters are also often triggered by human causes. Genocide in Rwanda is an example of in which during a period of approximately 100 days, extremists of the Hutu majority slaughtered approximately 800,000 Tutsis and moderate Hutus. In addition, there was an exodus of at least two million refugees (UNHCR, 2000). The violence of the 1994 genocide and its aftermath left most Rwandans in Diaspora in Finland profoundly traumatized, far beyond the capacity of support organizations to cope with. (Banyanga, Björkqvist, Österman, & Hackett, 2017). Rwanda had no capacity to cope up after post disaster scenario so a national policy on disaster risk reduction and prevention in Rwanda was formulated in 2002 and approved by the Cabinet in July 2003. (UNISDR, 2005)

UNISDR defined hazard as ‘a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation’. It defines disaster as ‘a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.

Disaster has always been one of the greatest threats to life, economy and environment in world. The estimation of World Bank highlights the fact that disasters cost around five hundred twenty billion dollars of economy annually, thereby dragging twenty-six million people into poverty. Over 60 million people in over 100 countries have been displaced by disaster events, mainly floods, storms and droughts since 2015. Hyogo Framework for Action (HFA) 2005-2015 was proposed with a purpose for the substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of

communities and countries.(Hyogo Framework for Action, 2005-2015) Adoption of the HFA aided to achieve progress in reducing disaster risk at local, national, regional and global levels by countries and other relevant stakeholders, which led to decrease mortality in case of some hazards. HFA has been working as an important tool for raising public awareness, institutional awareness, generating political commitment, focusing on strengthening and catalyzing actions by a wide range of stakeholders at all levels. Ten years after the adoption of the Hyogo Framework for Action, disasters continue to undermine efforts to achieve sustainable development due to higher economic loss. One of the most important lesson learned during the period of implementation of Hyogo Framework for Action (2005-2015) was the need of broader and people-centered multi-hazard and multi-sector based, inclusive and accessible approach in order to achieve efficient and effective disaster risk reduction(SFDRR, 2015). Visualizing the gaps of Hyogo framework, Sendai framework for DRR (2015-2030) proposed four priorities; understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster risk reduction for resilience, and enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction(SFDRR, 2015).

Nepal is one of most at-risk countries in South Asia which frequently experiences major geologic and climatic hazards. Floods, droughts, earthquakes and landslides are the major natural hazards that have results great loss of lives, and damage to properties in both urban and rural communities of the country. Climate change has worsened hydro-climatic disasters. The 2015 earthquakes in Nepal and the 2017 floods in terai part of Nepal are the most recent example of catastrophic risk experienced. NSDRM, 2008 has claimed Nepal as a hotspot for geophysical and climatic hazards and the country is ranked relatively very high in terms of vulnerability to natural hazards. In Urban and urbanizing areas, it is believed that due to population growth the level of risk is increasing very rapidly. Mainly in this context, visualizing the rapid urbanization, Nepal should make it well prepared for the future scenario that could strike it. Recent Gorkha Earthquake (2015) has clearly shown us our coping capacity and preparedness for the disaster.

Nepal’s 2015 constitution set the course for a massive shift of power from the federal to the provincial and municipal levels of government. Disaster Risk Reduction and

Management (DRRM) are among 22 exclusive powers that are now the responsibility of devolved authorities to exercise. Schedule 9 of the constitution has spelled out the DRRM functions of all three levels of government -the federal, province and local levels- with significant decentralization for decision making, resources management and service delivery systems. For disaster resilience, the constitutional authority to local governments for “Disaster Management” falls under section 8: on the jurisdiction of local government. However, “Disaster Management” also appears on the concurrent list for federal state and local jurisdictions. In addition, “Early preparedness for rescue, relief and rehabilitation from natural and man-made calamities” is on the concurrent list for federal and state jurisdictions.

Nepal has to pass through many obstacles in this run to meet the essence of SFDRR. Any activities that increase stakeholder’s motivation to address disaster risk, or which raise trust in the strategy or in the government mechanisms and the implementing agencies, will help the strategy of the plan to achieve its objectives. The approaches to support these strategies could be using of Transparent and inclusive processes, making decisions rationally, building relationships with other groups and conducting regular public hearings. These initiatives should be further supported by coordinating initiatives, planning initiatives, arranging technical support, conducting peer review of initiatives, seeking external funding for respective agencies and publicizing successful initiatives. (NSDRM, 2008)

However, the incorporation of DRR into national and local development plans is often hard nut to crack due to lack of capacity and the absence of an effective, efficient and systematic assessment framework to recognize and address the prevailing DRR capacity gaps. Since, capacity in a broad sense is at the fundamental of a government’s ability to minimize risk, assessing such capacity in terms of needs/gaps as well as “assets” through use of an integrated framework as a point of reference will be one effective approach to supporting DRR. An integrated DRR assessment framework may also address the current lack of coordination and systematization of various components — thus, supporting the international acknowledgement that efforts to reduce disaster risks must be systematically integrated into policies, plans and programs for sustainable development. The assessment of capacity needs/gaps and supply of DRR and disaster preparedness systems as they

exist in advance of an immediate disaster response, a flexible, multi-tiered systematic assessment framework is necessary.

## 1.2 Research area

Harion municipality is located in province number 2 in Sarlahi district, Janakpur zone. It is one of the new municipalities declared by government of Nepal. The neighboring local government at the boundary of Harion municipality is Lalbandi municipality in east, Bagmati municipality in west, Barathawa municipality and Haripur municipality in south and Hariharpur Rural Municipality (Sindhuli district) in the north. Harion municipality was declared municipal city on 18 May 2016 by merging the parts of Atrouli, Sasapur, Ghurkauli and Harion VDCs. It lies in latitude between 27° 21' 13.2" to 27° 84' 45.9" and longitude between 85° 30' 52.9". As indicated in annual development plan of the city shows that the total population of city is 43924 within an area of 86.06 square kilometer. It lies in the lower plain belt of chure region. The altitude of city varies from 130 m to 550m. The municipality has eleven wards. The municipality extends from Lakhandi River in the east to Harion River in the west.

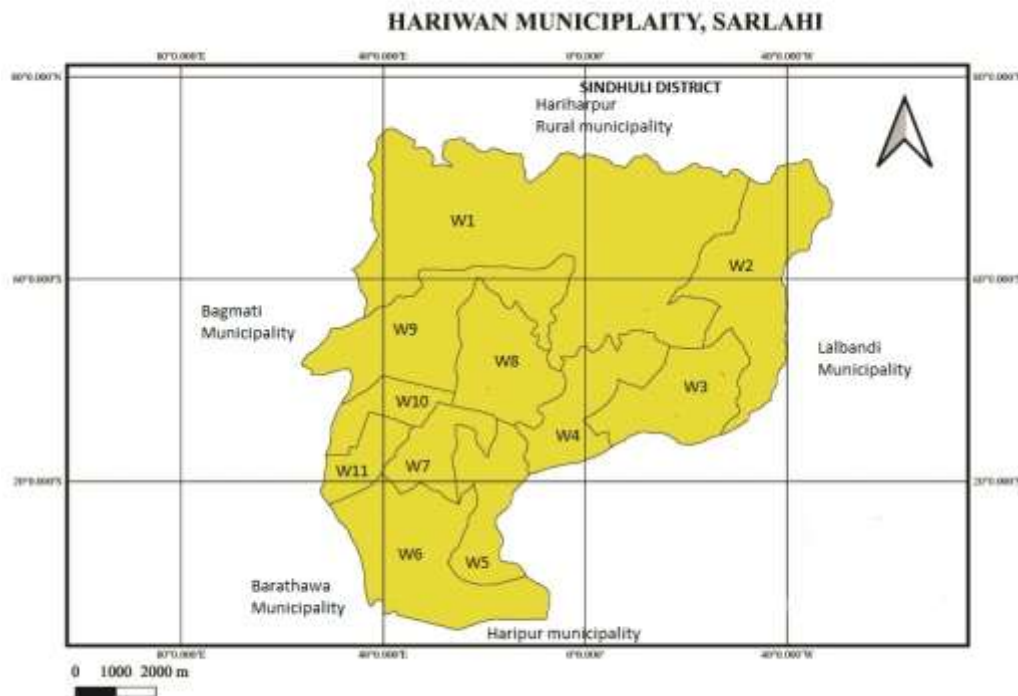


Figure 1 Map of Harion Municipality



The municipality lies in three geographical region i.e. chure, bhavar and terai. This region lies in a temperate zone. According to the metrological data from metrological station at Janakpur the average maximum temperature of this region is 31°C and average minimum temperature is 20°C with average annual rainfall of 1699.6 mm. The main market of the city lies in ward eleven.

The census report of 2068 B.S. shows the literate population to be 59.77 % of which 67.91% is male population and rest 52.13% is female population. Also the report shows that 68.5% population use hand-pump, 16.92% population use well, 6.88% population use tap water and rest use spring and river as a source of drinking water. The major industries and factories in this region are sugar factory, brick factories, rice mill, furniture, cottage industry, etc.

The DRR portal shows that Harion municipality has encountered with various disasters. The hazards like fire, thunderbolts, heavy rainfall, flood, earthquake, etc. has been frequently reported in Harion municipality. The DRR portal also shows that from 2016-2019 due to various hazards, the municipality has gone the estimated loss of Rs.1850000 with death of 7 people, missing of 2 people and around 5 injured people affecting 36 families. The hazards that are major threats to this municipality are fire, cold wave, heat wave, earthquake, snakebite and flooding. These hazards have created much fear in the citizens there than other hazards.

### **1.3 Need of research**

Sendai framework for DRR (2015-2030) proposed four priorities; understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster risk reduction for resilience, and enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction(SFDRR, 2015). DRR has now already been topic of concern fastened by Constitution of Nepal on a revised structure of governance and shifted to federal and local government. The act has given specific role to local government for DRR to camouflage the DRR activities in developmental works. The adverse effect of disaster can extend to a longer timeframe in various human, social, environmental and economic sectors resulting to the hindrance in development. Disaster resilient development is largely dependent upon the capacities

owned by the respective local government in the field of planning and managing developmental activities. Capacity development is one of the major activities to substantially reduce disaster loss (SFDRR, 2015).

Most of the local government in Terai belt seems not to be aware and careful in the subject of analysis of disaster vulnerabilities and disaster losses. Harion is one of the emerging hub cities of Sarlahi district. Disaster preparedness is an absolute need for Harion as it is one of the municipalities that lie in list of hotspot district for climate change disaster as mentioned by Nepal Government. The past disaster and its impact in social and economic sector of Harion municipality show the need of disaster preparedness. The growth in population and urbanization can be seen significant in this municipality. The annual workshop report of Chamber of Commerce Harion-2076 shows the significant growth of trade in last five years. The study of Nepal government on the capacity gaps and needs of fourteen rural and urban municipalities showed the significant lacking in disaster response capacity. Since, the three tiers of governments-federal, provincial, and local governments are newly formed in Nepal, the local governments are yet to be capacitated with human and non-human resources and so is the Harion Municipality. This research also helps to acts as a guideline for various other similar municipalities lying in the lower belt of Chure region. Thus, there is a need of capacity assessment in Harion which will be crucial in disaster resilience development planning.

#### **1.4 Significance**

Nepal is divided into seven provinces with 77 districts & 753 local levels (including six metropolises, 11 sub-metropolises, 276 municipalities and 460 rural municipalities (Gaunpalika). The local units which are currently functioning as the local government will be solely be responsible for the monitoring of their expenditures and self-governance. On this context it will be a challenge for this local government to collect the revenue and mobilize the development plan effectively and homogeneously. Striking of disaster would bring these local levels to a traumatic situation. Vulnerability to disasters in Nepal is accentuated by unregulated urban and rural planning.

The purpose of this study is to understanding the capacity assets, optimizes existing capacities that are already strong and well founded, analyzing the needs for strengthening

the other capacities, finding the gaps to find necessity of increasing capacities in other sectors and formulating a capacity development response plan in Harion Municipality. It is necessary to cope with the unexpected situation that could strike the Harion municipality due to certain disaster in some future timeframe. This would aid the municipality to visualize the capacities and capacity-gaps and work accordingly for preparedness needs and needs for response plan.

### **1.5 Problem Statement**

The municipalities in terai are generally prone to localized disasters that occur in different parts of the year. Due to geographic location of this municipality hazards that generally strike Harion municipality and surrounding rural and urban municipalities are fires, flash floods, inundation, snake bites, road accident, heat wave, cold wave, earthquake, etc. The occurrence of such hazards in the past decade, has especially affected in informal and marginalized settlements (slump area, shanty settlement, and riverbank settlement), and has resulted fear in communities blaming the local government for not being able to manage the situation. The municipality has seen phenomenal economic growth in recent years. The condition of compact and poorly managed settlement in the market area has created various problems and made the market prone to the effects of various hazards. The questions on why the local municipality is not able to sort out the problems are always on highlight. Disasters have caused that usually exceed the ability of those communities to cope with the situation. The worst affected in several deaths, injuries or diseases; damage to properties, environment, infrastructure; or disruption of the life of the communities. Such events have proved to be of magnitudes such conditions are usually the poor, who have major issues in service delivery. Similarly aged people, infants and children, pregnant woman, pwds, and unhealthy people are the one to suffer much.

There is a great variation in the way how disaster and emergency management capacity is built across the local government. The bottom up approach to capacity development seems to be much effective and hence local government has an important role in disaster mitigation and response plan(FEMA, 2016). Capacity development and Capacity assessment works are recommended to be based on a detailed understanding of the situation within the concerned authority and elected members of local government

(UNDG, 2008). The lack of regular and structured trainings in relation to disaster, the emergency responders and elected representatives often find hard nut to crack to meet the complex challenges imposed by modern day disasters. Rapid urban and socio-economic development in rural area makes it complex to plan a key role in enhancing resilience and play a proactive role to aware the local people. The gap between development expectation and existing situation points the need to undertake research to ensure they are prepared to meet the requirements of local government and hence overcome the challenges imposed.

The implications of all the research problems mentioned in the paragraph above are mostly leaded by the lack of documentation of information by the local government or authorized department. Review of efforts to the recent hazards events done by municipality shows the limitation of municipality in preparedness and response to those events. it is the responsibility of local government to ensure application of policies and build capacities to deal with major hazards, yet it seems the people and the elected members of local government are not concerned about the sensitivity of this issue. This has increased the potential impacts of disaster and continued the increase of vulnerability to the impacts of disaster. In case of emergency responders and training at local level without any awareness raising and capacity building programmes, the municipality is sure to face complex challenges in case of occurrence of major disaster.

With the lack of literatures, documentation of issues on disaster, emergency management and response capacity and lack of communication that exists in the system impose the problem to find the actual information and data. Review of recent disaster response efforts indicates limitations of local government in dealing with major disasters. Growth in economy and simultaneously growth in urban infrastructure without visualizing the future impacts in development and urban planning has a serious disruption in capacity development and response plan. Such problems and lack of clarity about the response capacity in local government level makes this research necessary.

## **1.6 Objectives**

The objective of the research is to conduct the capacity assessment of the local government and develop the suitable framework for effective disaster response plan.

## **1.7 Research Questions**

Literature review indicates several impacts of capacity gaps and need of simplified response plan on urban context for disaster preparedness. In the process of study the research puts forward the several questions to be addressed. Following are the major gaps to be analyzed to complete the research.

- Is the existing capacity sufficient for the disaster response?
- How has the city developed its capacity for disaster response?
- What are the approaches that are currently used in local government and different countries?
- How can disaster preparedness and response capacity be enhanced using capacity assessment framework in order to improve disaster resilience?
- What framework would be suitable for effective response during emergency situation?

## **1.8 Chapter Summary**

This chapter provides a general background of the research. This chapter has also provided an overview of the research area. It has defined the reason of undertaking the research and has outlined the objectives, scopes and major research questions. These all in a sum has provided the information about the specific focus of the research. The context of the study area and review of the past disaster and review of literature is an important part of the research to provide the explanation of the study. Hence, the next chapter is committed to review of existing research and articles written on the subject related to the research topic that address the research question and scope of the study.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1 Terminology**

#### **Hazard**

Hazard is defined as ‘a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption or environmental damage’. It is the hazard that goes out of control expanding its localized effect to expanded territory and takes the form of disaster. Hazards can include latent conditions that may represent future threats and can have natural causes such as geological, hydro-metrological and biological phenomenon or induced by human processes (environmental degradation and technological hazards) (HFA, 2005-2015).

#### **Disaster**

IFRC defines disaster as ‘a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community’s or society’s ability to cope using its own resources’. The surpassing of the affected community’s ability to cope is a critical differential point compared to an emergency, and external help will be required to restore functioning (UNISDR, 2009). Disasters can be either natural or human induced. Disaster risk arises when hazard interact with physical, social, economic and environmental vulnerabilities.(Hyogo Framework for Action, 2005-2015)

#### **Vulnerability**

Similarly, Vulnerability is the condition determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of community to the impact of hazard (Hyogo Framework for Action, 2005-2015). The impacts of disaster are influenced by the degree of community’s vulnerability to hazard. Vulnerability is the human dimension of disaster related to the capacity of a person, a group or a society to anticipate hazard, cope with hazard, resist hazard and recover from its impact. It is the constituents of whole range of economic, social, cultural, institutional, political and psychological factors that shape people’s lives and create the environment that they live in (Twigg , 2004).

## **Resilience**

According to the Hyogo Framework for Action, disaster resilience is determined by the degree to which individuals, communities and public and private organizations are capable of organizing themselves to learn from past disasters and minimize their risks to future ones, at international level, regional levels, national levels and local levels. Disaster Resilience is the ability of countries, communities and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses - such as earthquakes, drought or violent conflict - without compromising their long-term prospects (DFID, 2011). This clarifies that the resilience is the measured analyzing the available vulnerabilities and capacity to cope or avoid them.

Risk and resilience approaches share four key characteristics: they provide a general framework for assessing systems and their interaction, from lower household and communities through to the sub-national and national level, emphasizes capacities to manage and cope hazards, they help to explore options for dealing with uncertainties, they focus on being proactive (Berkes, 2007; Obrist et al., 2010). Resilience deals with drawing on and building capacities, and should not produce social vulnerabilities. Resilience as 'bounce-back' in the context of shocks is not enough for longer-term management of disaster, particularly if high levels of vulnerabilities exist in a locality (Ross, C.T. et.al, 2015). Determining levels of resilience is an important part of understanding the concept of capacity assessment and disaster management. The elements like context; disturbance; capacity; and reaction form a resilience framework which can be used to examine different kinds of resilience.

There exist various factors that either support or hinder the action to create a resilient community. So, a due attention should be taken while analysing the resilience of a community. First the primary focuses should be in relation to community resilience to extreme events that may strike with higher probability (most occurring hazards), rather than longer-term stresses. It should emphasis on emergency planning by linking the role of the community to other related institutions and stakeholders in supporting responses. Resilience is to be achieved by increasing the ability of communities to reduce exposure to, prepare for, cope with, recover better from, adapt and transform as needed, to the

direct and indirect consequences of climate change, where these consequences can be both short-term shocks and longer-term stresses (Ross, C.T. et.al, 2015). Resilience should not only focus on response rather it should focus on capacity development. The varying dynamics of vulnerability enables to take the specific needs of vulnerable groups into account while planning and implementing resilience work.

Resilience is an assimilating concept that allows multiple hazard risks, traumas and their impacts to vulnerable people to be considered organized together in the context of development programs. It also highlights slow drivers of change that influence systems and the potential for non-linearity and transformation processes. It puts prime focuses on a set of institutional, community and individual capacities and particularly on learning, innovation and coping. Strengthening resilience can be associated with opportunities for change that often meets after a disturbance (Birkmann et al., 2010).

### **Acceptable Risk**

Acceptable risk represents the level of risk to which individual, house-hold, group, organization, community, region, state, or nation is prepared to accept without any specific risk management options (Glade et al., 2005). UNISDR defines coping capacity is the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during disasters or adverse conditions. It represents the ability of community or country to absorb and respond to negative impacts associated with a hazard. The definition of coping capacity and acceptable risk levels is a complex issue. As the understanding of risk level is different to different people because each person holds a unique view of the environment, capacity and environmental risk. Thus, it is difficult to determine acceptable risk levels which individuals and society may accept.

### **Coping Capacity**

Coping capacity means the way individuals and households manage their resources available during times of emergency or the occurrence of disaster. Coping includes the way of solving problems and methods for handling stress during emergency. Coping capacities contribute to the analysis and reduction of disaster risks. Resistance and



recovery are the two important properties affecting the coping capacity and level of acceptable risk of the community. Resistance refers to the effort of the community to withstand a disaster and its consequences. Recovery refers to the ability of the community to coming back normally to its pre-disaster level. Efforts to withstand a disaster and its consequences depend on risk mitigation activities and preparedness together with individual and institutional capacities.

The emergency plan so should be designed to cope with the local and regional capacity (Alexander, Disaster and Emergency Planning for Preparedness, Response, and Recovery, 2015).The concept of coping capacity, grounded in a ‘five capitals’ (natural, human, social, financial and manufactured) model of resource availability, reflects the resources, both tangible and societal, available to help individuals within society cope with the impacts of climate and socio-economic change (Porritt , 2006).

The combination of different coping capacity and risk level resulted in three options in the acceptability, make an exception or reject the hazard risk. Coping capacity ranges are flexible and respond to changes in social, economic, institutional and political conditions over time. Coping capacity is influenced by the level of acceptable risk. When the level of coping capacity increases, it will correspondingly increase the level of acceptable risk. Promoting coping capacity is necessary to reduce the threshold of vulnerability and hence reduce the risk possessed by hazard.

### **Critical Infrastructure**

“Critical Infrastructures are organizations and facilities of major importance to the community whose failure or impairment would cause a sustained shortage of supplies, significant disruptions to public order or other dramatic consequences.” (German-FMI, 2009)

Critical Infrastructure is defined as “the primary physical structures, technical facilities and systems which are socially, economically or operationally essential to the functioning of a society or community, both in routine circumstances and in the extreme circumstances of an emergency (UNISDR, 2017). Critical facilities are elements of the infrastructure that support essential services in a society. They include such things as transport systems, air and sea ports, electricity, water and communications systems,

hospitals and health clinics, and centers for fire, police and public administration services" (UN/ISDR, 2009)

Critical Infrastructures are divided into physical infrastructure and socio-economic infrastructure systems. Physical Critical Infrastructure comprises basic services such as electricity, water supply, sanitary management, transportation, and information and telecommunication technologies. Similarly, socio-economic infrastructures include amenities like hospitals, schools public administration, disaster management system and recreational areas which may exist in either public sector or private sectors, depending on how they are owned, managed and regulated.

Critical Infrastructures are characterized by the attributes like facilities, systems and organizations that have sense for the performance of societies or their failure that could cause significant disruption of societies. The degree of criticality of any infrastructure can be determined by its significance in relation to the effects that it causes in society upon its failure. Critical infrastructure resilience is a complex problem, whose dimensions directly interrupt upon achieving the SFDRR's overall goal.

### **Perception Study**

Risk perception is the subjective valuation of the likelihood of a specified type of disaster happening and how concerned we are with the consequences (Moen, Rundmo, & Sjoberg, 2004). To perceive risk includes evaluations of the probability as well as the consequences of a negative outcome. Therefore, understanding of perception of risk is essential to set priorities for the management of disaster (Adelekan & Asiyani, 2016). Disaster management relies on communities' knowledge or local population as they are the first available sources to tackle with disaster (Paton, 2007). In this regard, their knowledge in terms of their disaster management experience and perception of risk in the phases like disaster preparedness, mitigation and prevention in overall disaster planning strategies is crucial. The local communities can best identify their own immediate needs, coordinate preparations and supplement needed for any future events. Thus perception and practices of local people should not be overlooked and need to be seriously taken into account. This does not mean that all local knowledge can be applied; however, relevant

knowledge combined with other professional skills can contribute to an improvement of disaster preparedness activities (Dekens, 2007).

## 2.2 Capacity

Capacities means the resources and degree of strength, which is available in individuals, households and communities, that enable them to cope with, resist, prepare for, prevent, mitigate, or quickly recover from an intense effect of hazard or a disaster(SFDRR, 2015).

The capacities can be physical, social or attitudinal.

### *Physical / Material Capacities*

It is obvious that people with better economic status and enough material resources can survive better and are supposed to possess high coping capacity. Physical capacities may come in the form of food, cash, land, tools, jobs, assets or access to credit. The appropriate and abundant resource makes people able to handle or control any kind of threat (resilience) and can lead comparatively to a more satisfying and dignified life. For example, people with access to food and clean water shall have better health to withstand disease; those with the means can afford materials and skills to make disaster resilient homes.

### *Social / Organizational*

Social resources help people to cope with, resist and handle the threats they may face as a result of a disaster. Communities where good leadership, generous local and managed national and local institutions are in place, and where people have motive to share the physical resources they gain in times of need are more likely to sustain more. Communities that are close-knit and have social networks for support are stronger. Those communities may be economically poor but can be socially strong. High capacity government would likely have a combination of strong policy, program and resource management which in turn enabled them to be adaptable effective and efficient. Similarly low capacity government (organization) would struggle to develop and implement ideas and innovations and typically do not have capacity for tackling the possible threats and self-improvement. An organizational capability since alliances strengthens a firm's assets position by gaining access to new external resources and capabilities. The more an

organization engages in intergovernmental cooperation, the higher its effectiveness. (Pina & Avellaneda, 2017)

### *Attitudinal / Motivational*

People and communities that are aware of their abilities and have confidence in themselves are better able to cope with a hazard situation. When they have a sense of control over events and the power to change their condition, they become less vulnerable to threats. By contrast, communities that are unaware and careless in their behavior seem to be more vulnerable to the possible disaster.

### **2.3 Capacity assessment**

Capacity assessment is the process of finding out how publics cope in times of crisis to decrease the damaging effects of hazards. As per UNDP capacity assessment is an analysis of desired capacities against existing capacities which generates an understanding of capacity assets and needs that can serve as input for formulating a capacity development response that addresses those capacities that could be strengthened and optimizes existing capacities that are already strong and well founded. It can also set the platform for continuous and regular monitoring and evaluation of progress against relevant indicators and aid to create a strong foundation for long-term planning, implementation and sustainable results. Capacity development will develop a flexible shape for by working with the formulated plans that is achieved after capacity assessments are conducted. Further Capacity Assessment should be taken as a tool that provides consensus and basic information by understanding the political, cultural, and social context. It provide a starting point for formulating a capacity development response; act as a catalyst for action; confirm priorities for action; build political support for an agenda; offer a platform for dialogue among stakeholders; and provide insight into operational hurdles in order to unblock a programme or project.(UNDP, Capacity Assessment Methodology: Users Guide, 2008)

UNDP defines capacity development as the process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time. Through capacity assessment, the resources that is available in community and community's coping strategies identified

that shall aid for identifying measures for disaster preparedness, mitigation and prevention. Capacity assessments can serve several important purposes:

- For formulating a capacity development response, it provides an initiation point;
- Act as a positive catalyst for action;
- Approves priorities for action;
- Build political support for an agenda;
- Offer a platform for dialogue among stakeholders;
- Provide insight into operational hurdles in order to unblock a program or project

#### **2.4 Capacity development**

It is the process by which any people, organizations and society systematically stimulate and grow their capacities over certain time to achieve their social and economic goals. It is a concept that extends the term of capacity-building to encompass all aspects of creating and sustaining capacity growth over time. It involves learning and seeking various types of training, and also presenting continuous efforts to develop institutions, political awareness, financial resources, technology systems and the wider enabling environment.

#### **2.5 Disaster response plan**

The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected (UNISDR,2017). It covers the restoration of basic services, shelter, livelihoods, security, governance, and rule of law, environment and social dimensions, including the restoration of displaced populations. Response plans are made optimising the residual risks. Residual risks are the disaster risk other than acceptable risk that remains even when effective disaster risk reduction measures are in place. Often the institutional elements of response incorporate the provision of emergency services and public assistance by both the public and private sectors, including community and volunteer participation. Formulation of response planning and action immediately and appropriately can avoid great loss (life or assets) during the disaster. Response program should look at both the big picture and the small details to determine the risks and hazards potential to our operations (Borthwick, 2015).

## **2.6 National Disaster Response Framework**

The National Disaster Response Framework is the document that guides for the effective and efficient coordination and implementation of disaster preparedness and response activities that clearly shows the roles and responsibilities of Government and Non Government organization and agencies involved in the field of DRM in Nepal by developing a National Disaster Response plan (NDRF, 2013). The major bases for disaster response in Nepal are Natural Calamity Relief Act- 1982 and Local Self Governance Act 1999. Disaster Rescue and Relief Standard 2064 state that the Natural Disaster Relief Fund will stay active at the central, regional, district and local level. The Prime Minister Natural Disaster Relief Fund that was established shall be mobilized for disaster response in case of emergency as per the prime Minister Natural Disaster Relief Fund Regulation 2064. Other several funds are available at both the national and international humanitarian organizations for disaster response that shall be mobilized through a single window system with consent of MoHA as per response needs identified. It has been realized to establish a dedicated disaster response fund at the central, regional and district levels.

Central Natural Disaster Relief Committee, Regional Natural Disaster Relief Committees, District Natural Disaster Relief Committees and Local Natural Disaster Relief Committees are the major actors in case of disaster response. Local Self Governance Act has made provision for responsibility of local government for disaster preparedness and response. But in case of mega disaster in which country lags the capacity to cope and international assistance is required, cabinet of GoN shall request UN Humanitarian Coordinator, Red Cross Movement at national and international level, donor communities, regional organizations, I/NGO, resident and non-resident Nepalese citizen, foreign citizen, and other sources of international assistance. After the call by GoN, the UN and the Red Cross Movement appeal for the international assistance to respond to disaster. In addition to this GoN shall request International Search and Rescue Team and international military assistance in case of mega disaster if need is required and mobilized under the direction of MoHA in coordination with National Emergency Operation Center. Also NDRF sets special operation arrangement for response preparedness, immediate humanitarian service of emergency response, responsible

ministries and organization, National Emergency Operation Center, military command and different Disaster Response Committees. Working mechanism in case of disaster according to National Framework for Disaster Response is as shown:

1. After the receipt of disaster/potential disaster information from districts or the local level, the lead agencies will carry out the operational activities as specified in the matrix.
2. CNDRC, RDRC and DDRC shall organize an emergency meeting in coordination with Government agencies, International and national NGOs as required.
3. Emergency operation centers at national, regional, district and municipality level shall coordinate with different organizations to make disaster response activities effective (NDRF, 2013).
4. Within the respective mandate and scope, the respective organizations including the Disaster Management Division of MoHA, shall work as support agencies in disaster response management.

## **2.7 Phases of Disaster Cycle**

### **Risk Reduction/Mitigation Phase**

This is the stage where the community has either returned to the pre-disaster living, or may be still carrying on the recovery phase in an effort to reduce the impact of subsequent disasters (McCreight, 2011). There is recognition of the need for certain measures irrespective of the condition of living of the affected community, to minimize the impact of similar or unforeseen disaster that might strike in future (P.Coppola, 2011). Mitigation measures are mainly assembled into two categories, i.e. structural and non-structural. Structural mitigation measures are those that point the requirement for some form of construction, engineering, or other mechanical related changes or enhancements, aimed at reducing hazard risk possibility or consequence of hazard. These measures are usually expensive and include a full range of regulation, inspection, maintenance, compliance, enforcement, and renewal issues (Alexander, 2002). Non- structural mitigation, generally involves a reduction in the likelihood or consequence of risk through modification in human behavior or natural processes, without requiring the use of engineered structures (McCreight, 2011). Any mitigation should aim at ensuring adequate preparation and planning for inevitable disaster events (P.Coppola, 2011).

### **Preparedness phase**

Preparedness phase involves the development of awareness plans to various groups and levels and training related to emergency and management to all stakeholders in the community (Haddow et al 2008). This phase also ensures that the mitigating measures started during the risk reduction/mitigating phase are translated in logistical arrangements, which can help to successfully save lives while ensuring continuity of operations and business (Dillon et al. 2009). This phase encourages on coordination of every plans to be followed for an effective response by developing the capacity.

### **Response Phase**

Response phase involves the immediate reaction to the occurrence of disaster. This stage is often characterized by confusion resulting from poor coordinated reaction to the occurrence of disasters (Pelling, 2003). Though the confusion exists, this stage possesses the capability to reduce the impact of disasters in the affected area, if and when response action(s) between all involved are operationally, tactically and strategically coordinated (Dillon et al. 2009). Disaster response is critical point to be addressed for every organization and includes functions of emergency management actions aimed at reducing injuries, loss of life, and damage to property and the environment are taken in all condition before, during and immediately after a hazard event (P.Coppola, 2011). Response phase is the time that begins as soon as the hazard strikes and lasts until the emergency is declared. The response to a disaster begins as soon as the occurrence of a hazard event is recognized by officials with the authority to commence the response effort. Once disaster response begins, the first priority it aims is to save lives. This activity, which includes search and rescue, first aid, and evacuation, may continue for days or weeks, depending upon the type and severity of disaster (P.Coppola, 2011). Decisions made during emergencies can be improved by using knowledge from past events to generate current and future response procedures. Analyzing the past emergency events for lesson learned and understanding of what may work best in given situations aids emergency managers to prepare planned responses as a counter to the pressure of emergency. Decision tasks are perceived to be difficult by the emergency managers where issues involving lifesaving operations such as evacuation or triage have the



potential to have devastating results if not conducted accurately (Daneilson & Ohlsson , 1999).

### **Recovery/Rehabilitation Phase**

This is the immediate phase in which the needs of the public are met in relation to the level of impact caused by the disaster. Recovery may vary for victims and affected communities, because this stage is determined by the assessment of the disaster (Preston, 2012). Recovery can be divided into two major phases: short-term and long-term, each with very different activities (P.Coppola, 2011). The short-term recovery phase immediately follows the hazard event, beginning while emergency response operations are ongoing (Haddow et al. 2008). Short-term activities focus to stabilize the lives of the affected people and community in order to prepare them for the long plan toward rebuilding their lives. On the other hand Long-term recovery does not begin in the earnest until after the emergency phase of the disaster has ended (Preston, 2012). In long- term recovery the community or country begins to rebuild, restore and rehabilitate with a focus to build back better. Concept such as risk and hazard are major factors that influence the effectiveness of measures, activities and actions taken in all the phases leading to the recovery (Pelling 2003). Exposure to risk and hazard can increase the impacts of disaster events and the ability of affected community to recover promptly (Pelling, 2003).

## **2.8 Framework for DRR**

### **2.8.1 Hyogo Framework for Action (2005-2015)**

The Hyogo Framework for Action (HFA) was the global outline for disaster risk reduction efforts between 2005 and 2015 that was adopted in the World Conference on Disaster Reduction (2005), held in Kobe, Hyogo, Japan with a goal to substantially reduce disaster losses by 2015 – in context of lives, social assets, economic assets, and environmental assets of communities and countries. The HFA identified following five priorities for action:

- Ensure that disaster risk reduction (DRR) is a national and a local priority with a strong institutional basis for implementation
- Identify, assess and monitor disaster risks and enhance early warning

- Use knowledge, innovation and education to build a culture of safety and resilience at all levels
- Reduce the underlying risk factors
- Strengthen disaster preparedness for effective response at all levels

HFA marked a milestone in boost up local and national DRR efforts and in strengthening international support through the development of regional strategies, plans and policies. The HFA drove significant progress in developing institutions, policies, and legislation for disaster risk reduction. Stakeholders at all levels strengthened their capacities for risk assessment and identification, disaster preparedness, response and early warning (ISDR, 2005).

#### 2.8.2 Sendai Framework for disaster risk reduction (2015-2030)

The Sendai Framework is the successor tool to the Hyogo Framework for Action. (HFA) 2005-2015. It is a 15-year; voluntary, non-binding agreement which recognizes that the state has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders (including local government, the private sector and others). SFDRR has set seven global targets for action with an aim for the substantial reduction of disaster risk and losses in lives, livelihood, health, economic assets, physical assets, social assets, cultural assets and environmental assets of any persons, businesses, communities and countries.



Figure 2 Overview of SFDRR, 2015-2030 (source UNDRR)

It has also set four priorities for action:

- Understanding disaster risk,
- Strengthening disaster risk governance to manage disaster risk,
- Investing in disaster risk reduction for resilience and
- Enhancing disaster preparedness for effective response and to “build back better” in recovery, rehabilitation and reconstruction (UNDRR, 2015)..

The Sendai Framework for Disaster Risk Reduction 2015-2030 outlines seven clear targets as:

- Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015
- Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015
- Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030

- Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030
- Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020
- Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030
- Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030.

## **2.9 Global DRR**

There is growing recognition by governments and organizations because of increasing number of people being affected by natural hazards (UNISDR, 2017). Risk of disaster arises when hazards tends to materialize interacting with existing physical, social, economic and environmental vulnerabilities (Westen, Alkema, Kerle, & Kingma, 2011). HFA has been working as an important tool for raising public awareness, institutional awareness, generating political commitment, focusing on strengthening and catalyzing actions by a wide range of stakeholders at all levels. Ten years after the adoption of the Hyogo Framework for Action, disasters continue to undermine efforts to achieve sustainable development due to higher economic loss. One of the most important lesson learned during the period of implementation of Hyogo Framework for Action (2005-2015) was the need of broader and people-centered multi-hazard and multi-sector based, inclusive and accessible approach in order to achieve efficient and effective disaster risk reduction (SFDRR, 2015). Visualizing the gaps of Hyogo framework, Sendai framework for DRR (2015-2030) proposed four priorities; understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster risk reduction for resilience, and enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction (SFDRR, 2015).

## **2.10 DRR in Nepal**

Nepal is one of most at-risk countries in South Asia which encountering major geologic and climatic hazards. Floods, droughts, heat wave, cold wave, inundation, earthquakes,

GLOF and landslides are the major natural hazards that have resulted great loss of lives, and damage to properties in both urban and rural communities of the country. The 2015 earthquakes and the 2017 floods are the most recent example of catastrophic risk experienced. NSDRM, 2008 has claimed Nepal as a hotspot for geophysical and climatic hazards and the country is ranked relatively very high in terms of vulnerability to various natural hazards. In urbanizing areas, it is believed that due to population growth and lack of urban planning and development and implementation of different policies the level of risk is increasing very rapidly. Mainly in this context, visualizing the rapid urbanization, Nepal should make it well prepared for the future scenario that could strike it. Gorkha Earthquake (2015) and different disasters have time and again shown us our coping capacity and preparedness level for the disaster.

Constitution of Nepal set the course for a massive shift of power from the federal to the provincial and municipal levels of government. Disaster Risk Reduction and Management (DRRM) are among 22 exclusive powers that are now the responsibility of devolved authorities to exercise. Schedule 9 of the constitution has pointed out the DRRM functions of all three levels of government i.e. the federal government, provincial government and the local levels- with significant decentralization for aiding decision making, resources management and service delivery systems. For disaster resilience, the constitutional authority to local governments for “Disaster Management” falls under section 8: on the jurisdiction of local government. However, “Disaster Management” also appears on the concurrent list for federal state and local jurisdictions. In addition, “quick preparedness for rescue, relief and rehabilitation from all type of natural and man-made catastrophes” is on the concurrent list for federal and state jurisdictions.

However, the incorporation of DRR into national and local development plans is often difficult due to lack of capacity and the absence of an effective, efficient and systematic assessment framework to recognize and address the prevailing DRR capacity gaps. Since, capacity in a broad sense is at the fundamental of a government’s ability to minimize risk, assessing such capacity in terms of needs/gaps as well as “assets” through use of an integrated framework as a point of reference will be one effective approach to supporting DRR. An integrated DRR assessment framework may also address the current lack of coordination and systematization of various components — thus, supporting the

international acknowledgement that efforts to reduce disaster risks must be systematically integrated into policies, plans and programs for sustainable development. The assessment of capacity needs/gaps and supply of DRR and disaster preparedness systems as they exist in advance of an immediate disaster response, a flexible, multi-tiered systematic assessment framework is necessary.

Nepal has to pass through many obstacles in this run to meet the essence of SFDRR. Any activities that increase stakeholder's motivation to address disaster risk, or which raise trust in the strategy or in the government mechanisms and the implementing agencies, will help the strategy of the plan to achieve its objectives. The approaches to support these strategies could be using of Transparent and inclusive processes, making decisions rationally, building relationships with other groups and conducting regular public hearings. These initiatives should be further supported by coordinating initiatives, planning initiatives, arranging technical support, conducting peer review of initiatives, seeking external funding for respective agencies and publicizing successful initiatives. (NSDRM, 2008)

#### 2.10.1 DRRM Act 2074 BS (2017 AD)

Nepal's current landscape of disaster governance is guided by it's the Disaster Risk Reduction and Management (DRRM) Act 2074 (2017 AD) under Constitution of Nepal (2072) (2015 AD). The Constitution stipulates that the work of disaster risk reduction and management as a sole authority of local government, and with an addition of shared authority among federal, provincial and local governments. The spirit of the Constitution suggests that local governments shall do as much as they can on their capacity, and provincial and federal governments shall provide back-up or lead disaster risk reduction and management where local government has limitation in terms of capacity and assets. However, the spirit is not well reflected in DRRM Act and other legal provisions and the uncertainty has created confusion in roles, responsibilities and accountability between local, provincial and federal government. The meeting of DRRM National council on 22 Baisakh 2076 decided that the sharing of authority, responsibility and accountability must be based upon a solid basis of the nature, intensity and scale of disasters. The DRRM Act 2074 sets out formal structures, roles and responsibilities at federal, provincial, district,

and local levels. At federal level there is provision for a DRRM National Council, Executive Committee, and National Disaster Risk Reduction and Management Authority.

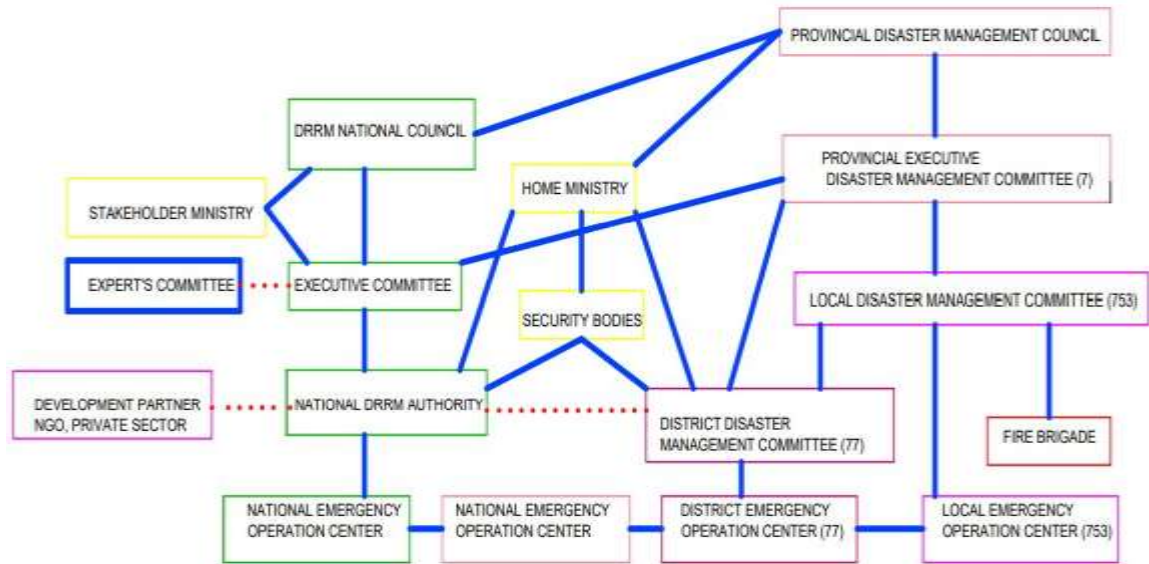


Figure 3 Disaster Management organizational framework (DRRM act 2074)

The Act also stipulates a structure (a Disaster Management Committee) and DRRM functions for each local government. Local governments are also guided by the Local Government Operationalization (LGO) Act 2074 (2017 AD), which established disaster management structures and functions for each local government and their ward units. The DRRM Act aided to the establishment of the National Disaster Risk Reduction and Management Authority, to coordinate and implement DRRM-related functions in the country. The DRRM Regulations 2076 further elaborate the functions of different government decision-making mechanisms in line with provisions of the DRRM Act 2074. The Government of Nepal (GoN) has endorsed a National DRRM Policy 2075 and Disaster Risk Reduction National Strategic Action Plan 2018-2030, which provides a comprehensive planning framework for disaster risk reduction and management in Nepal, encompassing different priority areas and guiding government actors and stakeholders to achieve targets by adopting appropriate processes.

### 2.10.2 National Policy on DRRM 2018 and the Disaster Risk Reduction National Strategic Action Plan (2018-2030)

Nepal's overarching framework for disaster risk reduction is guided by the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 (UNDRR, 2015). The four

priority actions of the SFDRR to prevent new disasters and reduce existing disaster risks, are: (i) Understanding disaster risk; (ii) Strengthening disaster risk governance to manage disaster risk; (iii) Investing in disaster reduction for resilience, and; (iv) Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction. Aligning with the principles and framework of the SFDRR, the GoN endorsed the National Policy on DRRM 2018 and the Disaster Risk Reduction National Strategic Action Plan (2018-2030).

The Disaster Risk Reduction National Strategic Action Plan (2018-2030) proposes priority actions for 2018 to 2020 in the short-term, 2018 to 2025 in the medium-term, and 2018 to 2030 in the long-term, assigning responsibilities within relevant federal, provincial and local governments. However, the Plan does not address the roles based on disaster intensity and impact. Similarly, the Local Government Operationalization Act (LGOA) 2074 lists different disaster management functions, including the management of DRRM fund, formulation of policies, rescue and relief operations. Even so, it fails to address how and when the local government need to seek support from provincial and federal level for disaster management.

### 2.10.3 DPRP Guidelines

DPRP aims to establish a standing capacity to respond to various situations that may affect the region by putting in place a broad set of preparedness measures. It focus on cluster approach and discuss on various plan made by disaster management committee through workshop.

The preparedness and response plan cycles in four steps. In the 1st phase review of DRR policies, disaster related article, disaster history, EWS, development plan and other DRR activities area done. After this on the management of Disaster Management Committee review of different resources and capacities, marking of major disaster and possible vulnerable areas, identification and prioritization of works and responsibilities, evaluation of past disaster, and, coordination with all stakeholders is done to address all cross cutting issues. After this contract for preparedness a nd response plan formulation is done followed by initialization of test plan. The working components of this plan are illustrated in table below:



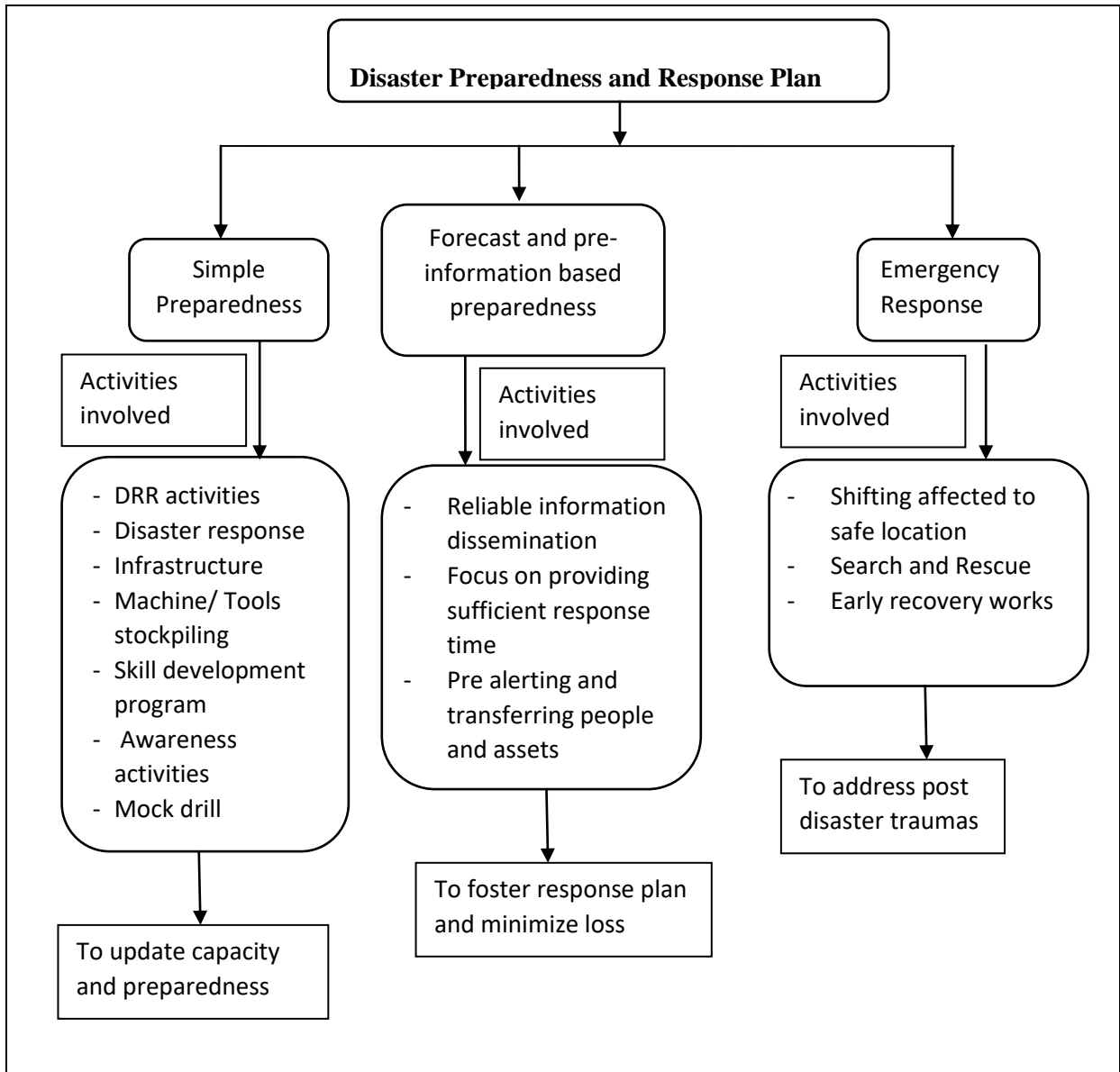


Figure 4: DPRP working flowchart

#### 2.10.4 LDCRP Guideline

Local disaster and Climate Resilient plan aims to analyze minimum basis for disaster and climate resilient plan. It analyses the subjects like vulnerability, level of risk, climate change, capacity and formulation of plan. It aims to incorporate risk management focusing on cluster approach. It prioritizes specific roles of stakeholders in DMC, municipality, DDC and the ministry. It runs in five step cycle.

- Coordination and preliminary preparation
- Vulnerability and Capacity Assessment

- Local Disaster and Climate Resilient Plan
- Approval and Implementation of plan
- Monitoring, Evaluation and Review of plan

## 2.11 Review of Capacity Assessment Methodologies

In present day different national government, regional government, donor agencies, UN agencies and various academics have made many contributions to establishing the framework for disaster capacity assessment based on various criteria and regional requirement that are identified. Capacity assessment should incorporate the local context and local needs, mobilizing stake holder, collection of data and information, ensuring local ownership and prioritize upcoming actions.

### 2.11.1 UNDP Capacity Assessment Methodology (User's Guide)

UNDP defines capacity development as the process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time. Capacity development is an iterative process of design-application-learning-adjustment in a sequential order. It follows this in a five-step process cycle as shown below:

- Engage stakeholders on capacity development;
- Assess capacity assets and needs;
- Formulate a capacity development response;
- implement a capacity development response;
- Evaluate capacity development

UNDP Capacity Assessment Framework is a three step process and supporting tool that consist of point of entry for capacity assessment, four issues (institutional arrangements, leadership, knowledge; and accountability) to be encountered, and functional and technical capabilities for managing policies, legislations, strategies and programmes. It focuses on structural arrangements for both long term and short term impact of risk.

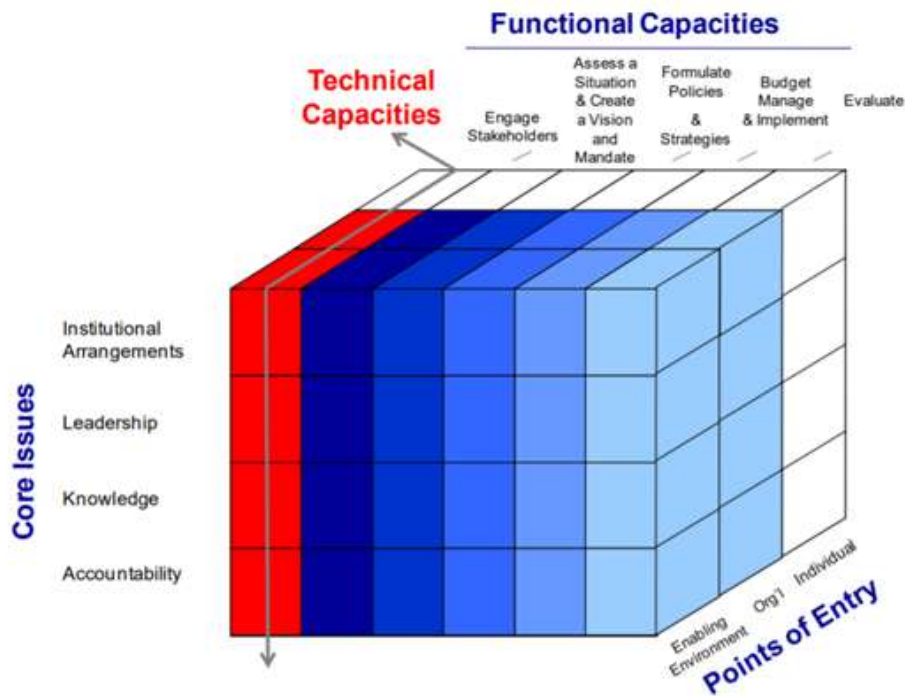


Figure 5 The UNDP Capacity Assessment Framework

UN Capacity Assessment Methodology comprises 5 steps as illustrated above. It helps to priorities long term capacity development and impact, and help to identify potential risks and risk management strategies to help stay on initially set objectives. It clearly indicates low focus on risk management, preparedness, response and recovery, but emphasize on development related aspects. This suggests that its key aim is to enhance the recovery process after events have occurred. Therefore, the framework shows that a research like this focuses on capacity assessment for response which is important in order to reduce the impact of disaster in future.

### 2.11.2 New Zealand Capability Assessment Tool

The CDEM Capability Assessment Tool is a self-assessment tool for any organization in civil defense emergency management to assess its capabilities to manage emergencies. The tool consists of a set of key performance indicators and performance measures ('capability criteria') against which organizations can assess themselves or be externally assessed. Indicators span the 4Rs and are organized in a framework based on the National CDEM Strategy (as well as issues of governance, management, administration, and organizational resilience).(Civil Defence NZ, 2014)

It focuses on finding the gaps in capacity, areas that needs improvement and strengths. It adopts a broad capacity assessment in post response phase with periodic assessment to find trends in capacity, gaps and area needed for progress. The advantage in this system is that, rather than conducting assessment in the post-response phase, capacity assessment is conducted on periodic basis. This ensures that the sum of effort needed to foster, enhance and use the skills and capabilities of people and institutions at all levels (local, national and regional). Understanding the performance level of every stakeholders and their capacity to deal with disasters when they occur is sure to be challenging, hence the focus of this research to identify critical success factors required for more effective capacity assessment system.

### 2.11.3 JICA Capacity Assessment Handbook

Capacity assessment is the process of broadly assessing both the current state of the developing countries' capabilities for handling issues (capacity) at multiple levels—including the individual, organizational, and societal level—and the extent to which development process has brought about positive changes (CD), and then sharing the results from this with concerned parties in order to formulate CD strategies.”(JICA, 2008). This handbook illustrates the possible pitfalls and the necessary action to be taken to overcome it while we conduct capacity assessment as it is the main step to be taken for capacity development. It focus on the topic that capacity assessment is the baseline for understanding baseline for capacity as well as for understanding the process in which it develops and considering the possible changes of Capacity Development strategy. Japan for itself adopted four-tiered system that consist of central government disaster response, local government disaster response, community disaster response and resident association and self-help, with a comprehensive system which links preparedness system with response. The provision for modification of national disaster management plans by local governments is allowed to accommodate emergency needs of that place.

### 2.11.4 CADRI Capacity Assessment and Planning Tool for Disaster Risk Management

The CADRI Capacity Assessment Tool for Disaster Risk Management is divided into a generic Disaster Risk Management and nine sectorial modules: Infrastructure, Human mobility, Health, Infrastructure, Agriculture and food security, Education, Environment, Nutrition, WASH, and Climate services. It focuses on the four priority area of SFDRR

and five elements of capacity development (i.e. ownership, institutional arrangement, relationship and coordination, competencies, and tools and resource. The four priorities include understanding disaster risk, strengthening governance to manage disaster risk, investing in disaster risk reduction for resilience and enhancing disaster preparedness for effective response and recovery, and reconstruction.

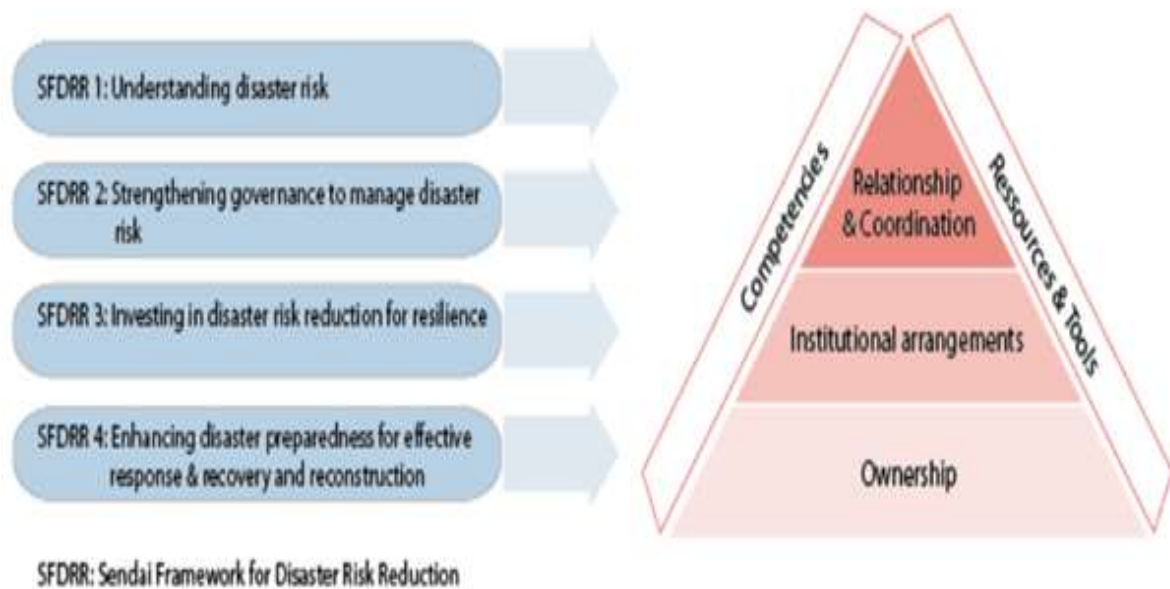


Figure 6 Priorities Action of SFDRR

The first element of ownership consists of legal provisions, DRM strategy, public awareness and DRR in education curricula. Similarly, institutional arrangements compromise institutional structures, arrangement for risk assessment and arrangement for EWSs. Next the coordination and relationship includes coordination mechanism for risk assessment, information sharing and monitoring, risk monitoring, EWS monitoring and media, collaboration, network, etc. Likewise, competencies covers technical competencies for hazard mapping, vulnerability assessment, multi-hazard risk assessment, decision making, climate change information, trainings, risk assessment and monitoring, access to DRR education, research, role of media etc. Tools and resources incorporates damage and loss database, information system/ sectorial database, methodologies for mapping and monitoring, methodologies for multi risk assessment, functioning of EWS, practices and lesson learned, public campaigns, etc.

## **2.12 Review of Response Plan Framework**

Response plan refers to the provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected (UNISDR, 2017). It incorporates the restoration of basic services like shelter, livelihoods, security, governance, and rule of law, environment and social dimensions, including the restoration of displaced populations. Response plans are made optimizing the residual risks. Formulation of response planning and action immediately and appropriately can avoid great loss (life or assets) during the disaster. Some of the response plan frameworks adopted in different national and international level are as listed below.

### **2.12.1 Disaster Response Plan of Port Moody City**

With a goal to provide the safety of all responders, save lives, reduce economic and social losses, reduce suffering and, protect public health, infrastructure, property and environment, the Port Moody city has developed response plan to use its own resources to respond to emergency situations until emergency response personnel arrive assuming some severe conditions that may be faced during the disaster. It is based on the response plan framework of British Columbia, Canada.

It has first identified the susceptible and possible hazards that could occur in their area. Visualizing the level of disaster damage EOC (Emergency Operation Center) is activated at the request of site commander if disaster is critical else the situation is handled by department operation center. It also determines the structure, function and location of emergency operation center.

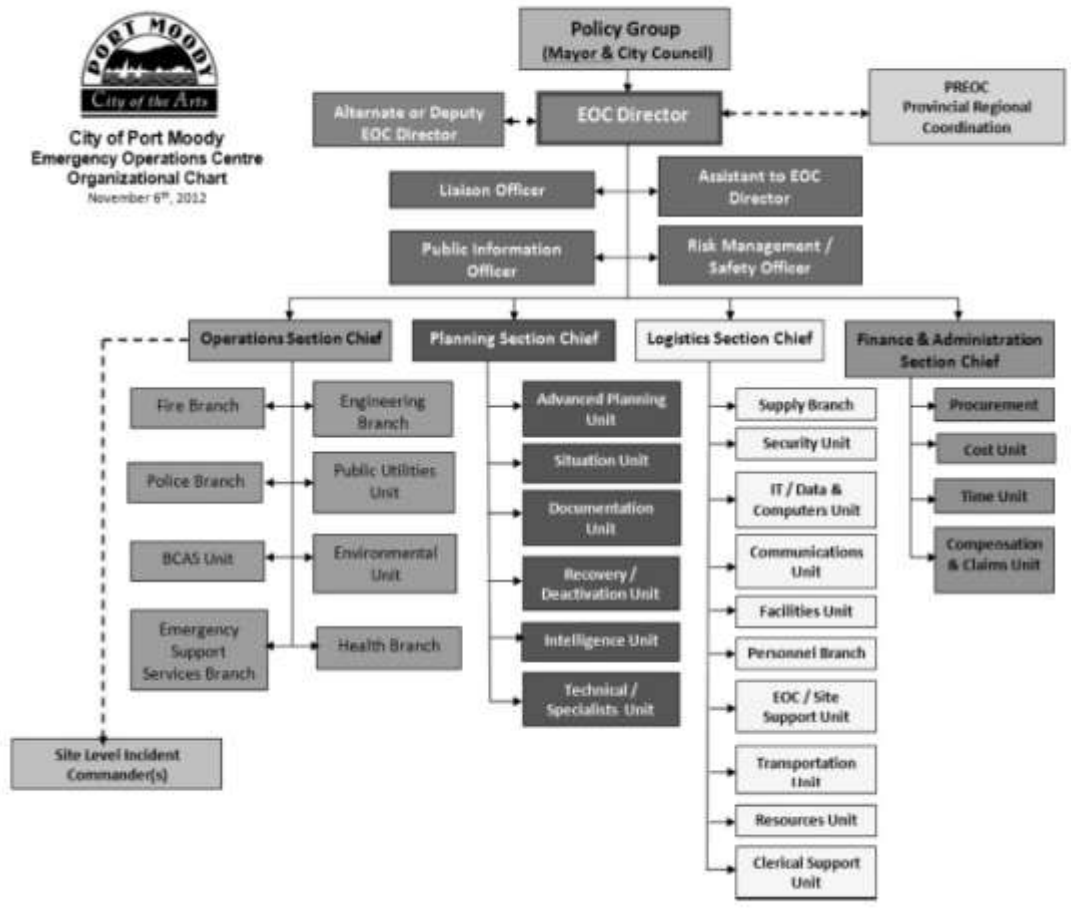


Figure 7 Port Moody EOC Site Support Organizational Chart (source: DRP, Port Moody city)

The main five function of EOC includes planning, management, logistic, operation and finance and administration. This plan has identified critical facilities and lifeline system and has pre allocated the responsibilities of different public and volunteer organization’s responsibilities. Further disaster response routes network are pre identified that can best move emergency services in disaster situation. The EOC shall request for provincial or federal assistance analyzing the situation.

### 2.12.2 Disaster Response Plan of Alaska

This plan ensures a step by step coordinated effort to provide aid to first responders, local, communities, tribal governments, and State and Federal agencies in the response

and management of emergencies caused by disaster keeping safety, health, environment, cleanup and recovery from incident the major priorities.

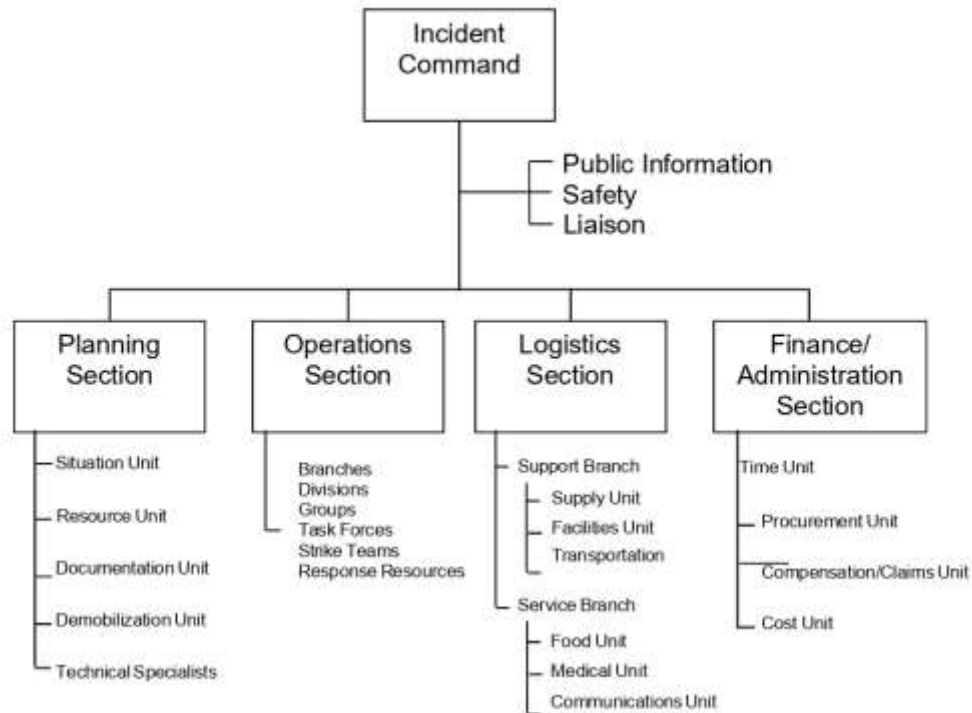


Figure 8: Incident Command System for Disaster Response (Source: DRP Alaska)

The command function is controlled by the Incident Commander, who may establish Command Staff positions consisting of a public information officer, safety officer, and liaison officer. The Command Staff provides support to the Incident Commander in planning, operation, logistic and finance or administrative section. Alaska has grouped activities in disaster according to emergency support function for which it identifies primary agency to manage and coordinate specific function and support agency to assists the primary agency with resources, capabilities, or expertise to support the specific function. The general response to any disaster includes following steps:

Disaster strikes → local response → local request for response → activate state emergency operation plan → primary agency contact ADEC (Alaska Department for environment conservation) for help → ADEC response coordinator contact appropriate program department and provide requested assistance.



### 2.12.3 District Disaster Preparedness and Response Plan (Sarlahi)

For an effective response, action plan for National Disaster Risk Reduction has adopted the concept of cluster approach. NDRF has identified eleven cluster sectors which are health, logistic, nutrition, protection, shelter, food security, water –sanitation and hygiene, education, emergency telecommunication, early recovery, and camp coordination and camp management. Visualizing different compact situation brought by past hazards District Administration Office of Sarlahi district has developed the framework for response plan identifying the following listed needs for response plan:

- Multi hazard perception, description and mapping
- Awaiting to stakeholders
- Planning to reduce disaster losses
- Enhancing and awaiting stakeholders and front responders about their responsibility
- Enhancing collaboration and organizational linkage
- Enhancing preparedness for all phases of disaster cycle
- Easing immediate rescue and aid
- Making work plan and distributing to related organizations

District administration office, Sarlahi has listed identified location of different rescue and relief materials stocked in the district to make the response plan more effective and systematic. Different plans are listed and scheduled for action focusing above listed needs dividing them into the activities to be carried out before and just after the disaster situation. In addition to this district disaster response plan has developed an aim to prepare disaster response plan in all local level with the collaboration of District Disaster Management Committee and Local Disaster Management Committee. Also, it has marked the lead agencies for different cluster-based arrangements.

### 2.13 Challenges in Effective Disaster Response

#### **Social Cause**

The main challenge that strikes in disaster response is social cause. The factors related to social and demographic causes such the high rate of illiteracy, lack of knowledge to disaster response and language barriers. It can be often problem to make understand the

safety through brochure and emergency leaflets that may affect the attitudes of people towards understanding the emergency and its impact on their lives. Language barrier can also have a negative effect on emergency readiness for people who do not understand Nepalese and English which may cause more vulnerable to disasters.

### **Availability and installation of EWS**

EWS is an effective measure for disaster response which eventually helps to avoid disaster losses in life and assets. The improvement in leadership and disaster management by using modern technology will make the response effective when disaster strikes. An early warning system can be implemented as a chain of communication systems to transfer data and information and comprises sensors, event detection and decision subsystems. They work in combination to forecast and signal disturbances that adversely affect the stability of the physical world, providing time for the response system to prepare for the adverse event and to minimize its impact.

### **Leadership and emergency management**

Leadership and emergency management is defined as organization' pre-established activities that include preparing and responding to significant catastrophic events in effective, efficient and safe procedures (Nancy, 2005). It involves organization pre-planned activities and guidelines for preparing and responding to hazard and disaster in a safe, efficient and effective manner. Leadership plays an important role in encouraging crisis team members and citizens to engage in strategies to resolve the emergency situation.

Leaders must adopt a competency-based approach in dealing with crisis management; they must take the direct responsibility of steering a work (Bass, 1985). The identification of the essential activities and task for the emergency management are needed, and the competencies are required to complete the activities successfully.

### **Awareness and trainings**

Training for disaster management and awareness dissemination is the most effective way in the process of dealing with and avoiding disaster losses that might occur in future. The most important skills that the trainees should acquire are the ability to make quick

decisions during emergency situation, and also the ability to co-ordinate with the connecting authorities to finding the suitable solution the problem that occur in the particular time The lessons learned from past disaster and disaster that have stroked in different countries is an efficient process for training. The awareness and trainings should be different according to the responsibility of particular group during disaster. The volunteer and leaders should develop their skills through leadership development programs and contribute to the development in the case of disasters and emergencies. Also the people should be aware about the possible hazards and disaster that might strike in future and should have knowledge about reacting to disaster. The knowledge about emergency rehabilitation center, safe ones should be known to avoid loss during emergencies.

#### **2.14 Summary of Literature Review**

The literature review section presents a summary of literature to provide theoretical underpinning for capacity assessment framework. The key concepts associated to disaster management have been reviewed which was further followed by a critical analysis of some of the best practice in capacity assessment methods and approaches across the globe. This part concludes that no single method and approach can be perfect for capacity assessment. It is quite necessary to recognize gaps, which may require additional and particularly flexible investigation. Further, the need of response plan and the major activities that should be run during response have been reviewed. The literature review has helped to achieve objective by identifying needs for a resilient city and finding gaps in the existing system in Harion.

## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1 General**

Before the starting of any research the methodologies of research should be clearly planned and prepared. This research deals with subjective matter to access the phenomena, consist of explanatory research process, has used natural location instead of artificial location, gathers rich data from which concept are derived incorporating stakeholder's perspective and the biasness may be present in assumption of values. So this shows that the research is based on interpretive philosophy.

In this research both quantitative and qualitative data are used so, it is a mixed research. The research collected data from survey, documents and records, including inscription, journals, reports, etc. Primary data were collected through interview and secondary data was obtained from different municipal records and online sources. So the research used an inductive approach. Since this research does not try to compare or observe changes of phenomenon over long period, it is a cross sectional study.

### **3.2 Literature Review**

The strategy of local government, governance mechanism, acts, policies and guidelines is studied to prepare the information collection framework. A critical and descriptive literature review was undertaken to capture previous work, major concepts and possible existing problems. This phase is the composition of literature review skeleton preparation for research process and questionnaire preparation including question for interview of focal person and stakeholders. It helps to see compliance of policies with growth trend and see if settlement is risk zone.

A review of the literature on existing approaches to capacity assessment and response mechanism was undertaken. Relevant sources were drawn from an extensive time span. It includes library search, electronic magazines and academic journals, internet, books, conference proceedings, and different reports and related documents.

### **3.3 Data Collection**

In this research qualitative as well as quantitative data were used. Both the primary as well as secondary data has been used during the study. Based on questionnaire for capacity assessment the data are divided into following sections:

S.N	Data Types	Source
1	Geographical data	Municipal source and GIS shape files
2	Demographical data	CBS, municipal record
3.	Infrastructure information	CBS, municipal record, key informants
4	Assets and Socio-economy	Municipal record, key informants
5	Hazard and Mapping	DRR portal, DesInventar, Municipal record, document review
6	Human and Nonhuman resource	Interviews and municipal records

**Table 1 Data types and its source**

The record of municipal data assists for the capacity study. This help to clarify what is already done and what is needed to be done. Hazards and their impacts related information were collected from the official portal of government of Nepal and DesInventar Portal. The information included the types of hazards, date of occurrence, and their impacts like injuries, fatalities, infrastructure damaged, and economic losses.

This research uses a semi-structured interview technique to collect comprehensive data as listed in questionnaire. For this research, the most dependable data come from documented source or the disaster focal person, stakeholders and people concerned/ known about disaster management and are informed about disaster managing issues. Quantitative data is collected using survey as it gives clear picture of the question to be asked to the respective individual or department. Questions were derived from the literature reviews and research objectives which needed in-depth explanations and understanding.

### **3.4 Resource Mapping**

In this research a detailed study of available resources of the municipality is carried out. Different human and non human resources available in municipality are listed and

compared with standard needs mentioned in respective standard documents and policies. The municipality's capacity was accessed mainly focusing on finance part, institutional mandate and technical resources. Resource mapping is done by characterizing specific hazard types. The comparative study of resources available and standard requirement of resource is done which elaborates the need of resource to be added and plan for the response. The effectiveness study of available resources for the preparedness and response to disaster situation is done comparing with actual and standard needs that the municipality needed to own.

### **3.5 Data analysis and interpretation**

Validity and reliability are both important in any research especially qualitative research which is subjective and easily altered by contributions and opinions of participants. Data accuracy is also important for reliability which is the credibility of a research findings and consistency of data collected that contributed to the results (Creswell and Miller, 2000). Reliability, therefore, focuses on developing a repeatable process which can facilitate the research at any time by anyone (Healy and Perry, 2000). This indicate that reliability and validity in a research can be challenging to achieve but not impossible especially in a phenomenology paradigm (Rescher, 2003). In this process the information collected from various sources is validated from the local government and concerned agencies. The information is cross checked to ensure its reliability. Two areas that require special attention during capacity assessment are the UNDP core principles of human rights-based approach and gender equality. (UNDP, Capacity Assessment Practice Note, 2008).

GIS map of built-up of past and present is prepared to study change in built-up area. The fire brigade response map the municipality is prepared to analyze response time for fire disaster and also to analyze accessibility and remoteness of the area in the municipality. Present land coverage map is prepared to study about the recent land coverage situation of the municipality. Flood inundation risk map of Harion municipality is prepared using GIS tool to visualize the susceptible inundation area. The fire stations distance to the extent of municipal boundaries was analyzed to see the response time to fire that ensures level of safety of settlement from fire. The infrastructure related data is optimized DUDBC Planning Norms and Standard 2013 for cities with population forty thousand to

one hundred thousand. Urban policies, DRR related policies, building bye laws and building code was reviewed to see its implementation towards DRR. The information and the mechanism are compared to the scenario and mechanisms of local governments of various countries as a result of which the suitable response framework would be extracted.

### **3.6 Chapter Summary**

The overview of the research methodology used for this research is provided in this. This chapter has focused to explain the research philosophy, research choices, research approach, time horizon and the process of data collection and analysis of data. It has marked the sensitivity and significance of the research objectives in achieving the purpose of this part of research which is important to the outcome of whole research.

## CHAPTER FOUR: DATA COLLECTION AND ANALYSIS

### 4.1 Urbanization and Hazard Study

As mentioned National Policy on DRRM 2018 and the Disaster Risk Reduction National Strategic Action Plan (2018-2030) it is the local government which is the main functional unit for disaster risk management. The nature and form of town plan, land use plan and urbanization are the factors that have influence in disaster risk and disaster vulnerability. In the present situation of national wide sky rocketing urbanization growth of cities with growth of urban population has increased the vulnerability within the cities.

#### 4.1.1 Impact of Past Disaster

Among the urban residents impact of disaster or any hazard is prone to them who are poor and resides in slumps or who do not have home for settlement. Also the children and aged people are also much affected by disaster. So it is needed to keep focus on managing such issues and provide prime care to the activities related to them. The infrastructure and settlement in urban areas are the main cause of increasing risk in these areas. The data achieved from DRR portal (MoHA) and desInventar portal (UN) is extracted in table below:

Hazard	Death	Injured	Missing	Estimated loss (NRs)	Household damaged
thunderstorm	6	5	-	Not mentioned	1 partially
Fire	3	7	-	44822000	92 fully 5 partially
Flood	5	1	2	Not mentioned	25 fully 90 partially
Cold wave	2				
Epidemic	4	75			



Heavy rainfall	0	0		900000	3 fully
Others	2	1		200000	1 fully 2 partially

Table 2 Different hazards and their impacts from year 1983-2020 (source DRR portal for 2011-2020 and DesInventar, UN for 1983-2010)

The loss in assets due several hazards from 1983-2020 is NRs. 48.17 million. Similarly, as mentioned in DRR portal in this period such catastrophic incident has caused death of 22 people, injured 89 people. Also in this period 98 houses were partially damaged and 122 houses fully damaged.

Fire, flood, heavy rainfall, and epidemic are the most occurring hazards from the past and are occurring periodically. Altogether 38 fire incident and 9 flood events were reported in the year 1983-2020. The losses due to thunderbolt have not been recorded in recent times. The data shows the maximum human loss in life is due to thunderstorm, flood, epidemic and fire.

Harion is one of the fast growing cities of Nepal situating at the distance of around 180 km from the capital city Kathmandu. The major rivers of this municipality are Lakhandehi, and Chapini, the large monsoon fed rivers. The illegal, haphazard and unplanned mining of river increases the risk during monsoon and heavy rainfall. Though being the municipality and having building byelaws, construction activities are not regulated strictly. The land marketing groups are filling the lands with transported soils for selling or construction without considering the natural drainage which in a run causes inundation of neighboring roads and lands during monsoon. Ward 10 and 11 seems to be densely populated with dense settlement lying at north and south of the Mahendra highway and the market also lies in ward 11 which therefore can be major threat in case of fire emergency. The presence of slump settlement in the market also intensifies the threat of fire emergency. The municipality is equipped with a fire engine but narrow roads and dense settlements create hindrance in its effective management.

Since the Mahendra highway pass through the cities the density of vehicles is increasing day by day. Also the urbanization and access to roads has increased which has further caused rise in traffic density. The building constructed for residential purposes are being used for trade and business. Also some schools and Hospitals also lie in residential buildings. These structures have no plan for emergency exits and emergency plan for disaster other than presence of fire extinguisher in some. Similarly the major incidents that stroke this municipality include fire, flood, road accident, snake bite, thunderbolt, heat wave, cold wave and epidemics. As identified from the case of New Zealand, capability assessment tool that is discussed in literature review the tool for capacity assessment is a major key in determining the readiness and the performance indicators and is crucial in determining the level of preparation for dealing hazards situation. But this type of assessment tool appears to be lacking or not in place in Harion Municipality

#### **4.2 Socio economic Factors contributing to vulnerability index**

Land use has possibly, a very strong effect on different hazard events as humans have heavily modified natural landscapes. Land use changes through urbanization, deforestation, and cultivation have resulted in increased vulnerabilities to several disasters. This is also due to reduced infiltration capacity, lower soil porosity, loss of vegetation, and lower evapo-transpiration. Similarly per capita income is also the factor affecting disaster vulnerability. The effect of disaster is prone to people living in poverty or family with low per capita income. The level of awareness and education also has significant effect on reducing vulnerability to disaster. The female literacy rate of Harion is 51.95 and male literacy rate is 67.77 i.e. in total 59.62 % population are literate. The literacy status of the city is shown in table below:

Description	Male	Female
Literate	13167	10747
Illiterate (cannot read and write)	5411	9076
Can read only	829	826

Not stated	21	37
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Table 3 Literacy status of the municipality (source: CBS)

Similarly according to census data the disable population and disability is shown in the table below:

Description	Male	Female
Speech problem	91	71
Intellectual disability	13	9
Mental disability	25	19
Multiple disability	35	27
Physical disability	152	100
No disability	20971	22199

Table 4 Disability status of the municipality (source: CBS)

The housing types in this municipality are shown in table below.

Description (Housing type)	Numbers
Institutional	50
Owned	8050
Rental	410
Others	91
<b>Total</b>	<b>8601</b>
Straw roof	665

Tile / slate roof	6310
GI plate roof	420
RCC roof	930
Wood roof	72
<b>Total</b>	<b>8601</b>
Bamboo walled	4504
Cement bonded stone/ brick walled	2154
Mud bonded stone/ brick walled	174
Unbaked bricks	5
Wood/planks	1617
Not stated and others	147
<b>Total</b>	<b>8601</b>

Table 5 Housing data of Harion municipality (source: CBS)

The data above and the field study shows that large number of houses is owned houses. Concrete houses are dense in core areas and market areas and newly settled areas. Newly settled areas are seen to have strictly following the municipal byelaws. Similarly, with large number of concrete houses core areas have equally large number of mud bonded brick or bamboo walled houses having either tile/slate, CGI sheet, or straw roof houses. Almost all houses in core market areas are being used for commercial purposes in ground and first floor while the upper floors are used for store or for residential purposes. Other than core area along the Mahendra highway the buildings are not used for commercial purposes other than daily consumables and stores. The core area of this municipality includes Harion bazaar that extends longitudinally in around 1.5 km length along

Mahendra highway and the Purano Bazaar which is at a distance of around 2 km from the main core area (from Mahendra highway).

#### 4.2.1 Population growth and population density

The total area occupied by Sarlahi district is 0.86% of total area of country with population of 769729 which is 2.91 % of total population of the country. This figure clearly represents high density of population in Sarlahi district. The yearly population growth rate of the district is 2.11. The CBS report shows that in urban part of Sarlahi district, the population density is 2625.18 per sq.km.

The total population of Harion alone is 43924 out of which 22529 are female and 21395 are male. The total area of the municipality is 88.1 sq km and the population density is 498.6 per sq km. Being, one of the hub cities of Sarlahi district the population of city is increasing rapidly. The ward wise population of the city is illustrated in the table below.

Ward No.	HH	Male	Female	Total	Population Density
1	909	2215	2396	4611	201
2	599	1476	1525	3001	283
3	633	1502	1709	3211	499
4	613	1209	1677	3186	551
5	679	1788	1882	3670	738
6	669	1630	1741	3371	319
7	465	1246	1278	2524	747
8	1034	2370	2531	4901	961
9	778	1810	1865	3675	371

10	946	2230	2313	4543	1689
11	1276	3619	3612	7231	1918
<b>Total</b>	<b>8601</b>	<b>21395</b>	<b>22529</b>	<b>43924</b>	<b>499</b>

Table 6 Ward-wise Male-Female Population and Population Density

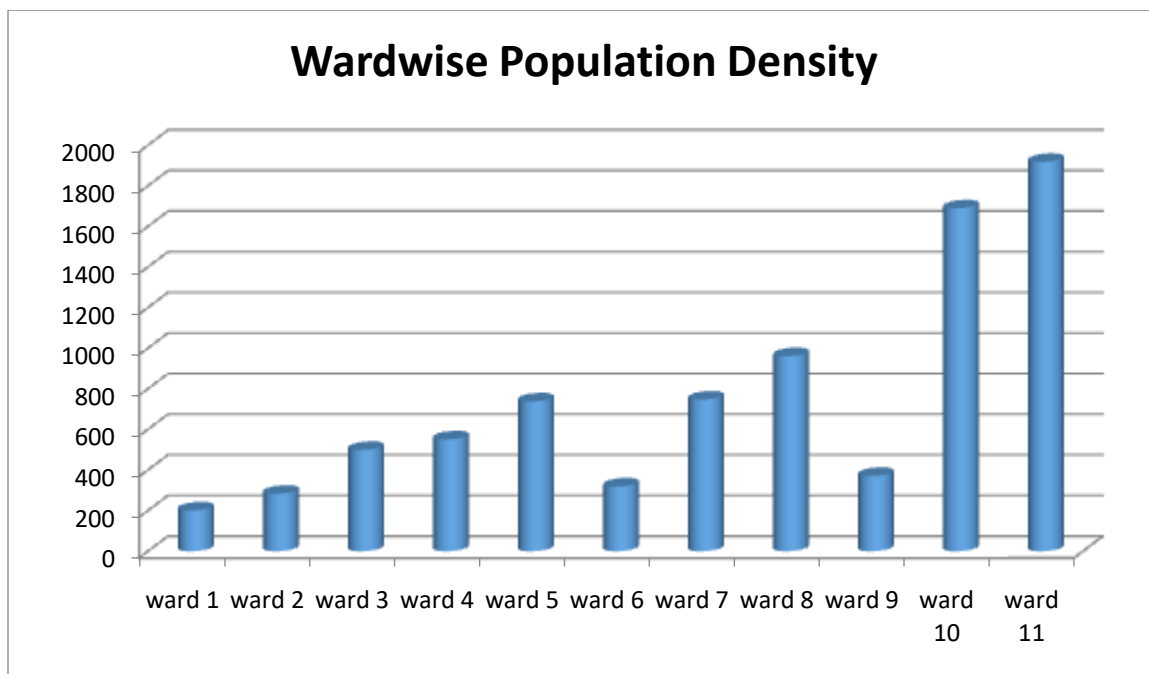


Figure 9 Ward wise population density graph

The graph above shows the ward wise population density of Harion municipality. The graph clearly illustrate that the highest population density is in ward no 11 with total population of 7231 within 1276 household and lowest is in ward 1 with total population of 4611 within 909 households. The wards near the highway seem to be highly populated. Similarly, Ward 10 also has high population density which is also the market area near the highway.

#### 4.2.2 Urban Growth and Urban Development

The growth trend is seen to be increasing dramatically during 2000-2010. Harion Municipality is one of the new Municipalities declared by Nepal Government on May 18, 2014. It is formed by joining four contemporary VDCs namely Atrouli, Sasapur, Ghurkauli and Harion VDCs that spreads to 88.1 sq. km. The areas near Mahendra

highway are the fastest growing areas of the municipality as seen from the population census of 2001 and 2011. These new settlements in the area seem to have been developed as the continuation of urbanization making it as one of the hub cities in province 2. People migrated from different places especially due to facilities like education, transportation, opportunities, other infrastructural services, easy banking and financial services, etc. This city is getting more vibrant after the construction declaration of municipality merging parts of other VDCs.

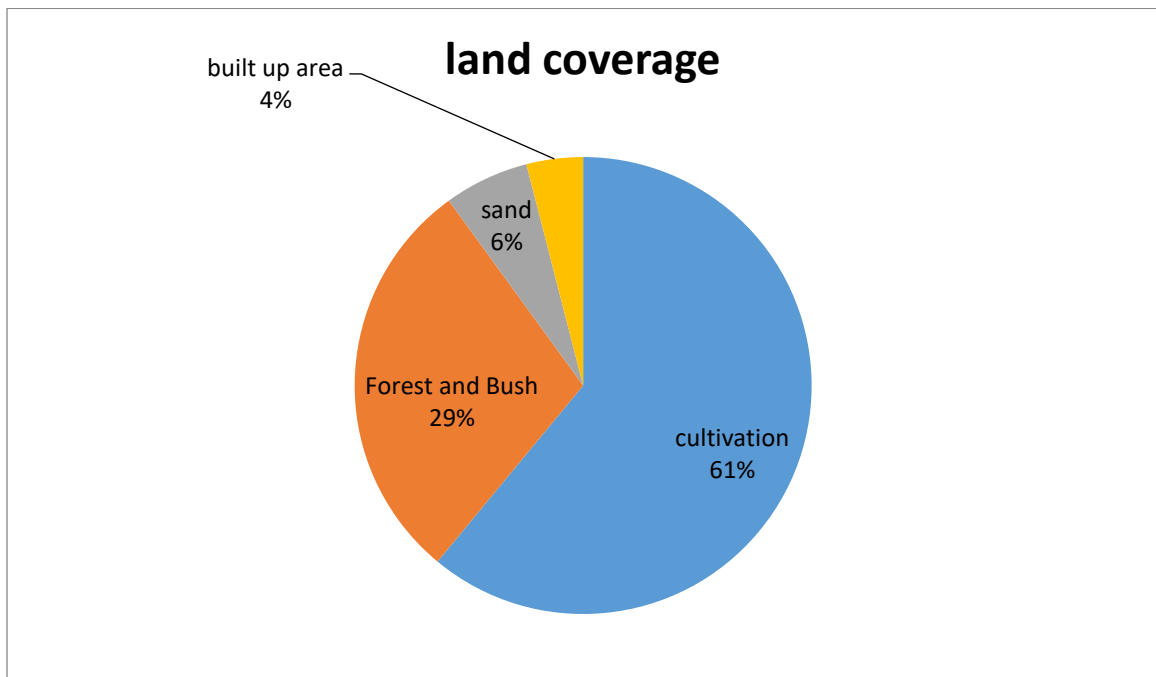


Figure 10 Land coverage pattern in Harion Municipality

Major projects like road, municipal complex, hospitals, sugar industry, brick industry has acted as catalyst in the rate of urbanization of this city. There is no definite land use plan in Harion. The land coverage pattern of this municipality is as shown in the graph above. The major coverage of land is occupied by cultivable land i.e. 61%. Also the graph shows that 29% land is covered with bush and forest and only 4% of the total area is incorporated in built-up areas. The population growth rate of Harion municipality is increasing day by day. Looking at the current trend of this municipality the urbanization is taking place near the Mahendra highway rapidly. The google image of the area was overlaid on various built up years to visualize the growth trend and validate the information.

Land use pattern also have significant role in vulnerability. The sprawl is engulfing the area of forest and agricultural land. The conversion of agricultural land into settlement, market or industries for the growth of city and deforestation in private lands for either business or converting into other form of land use has been common in Harion.

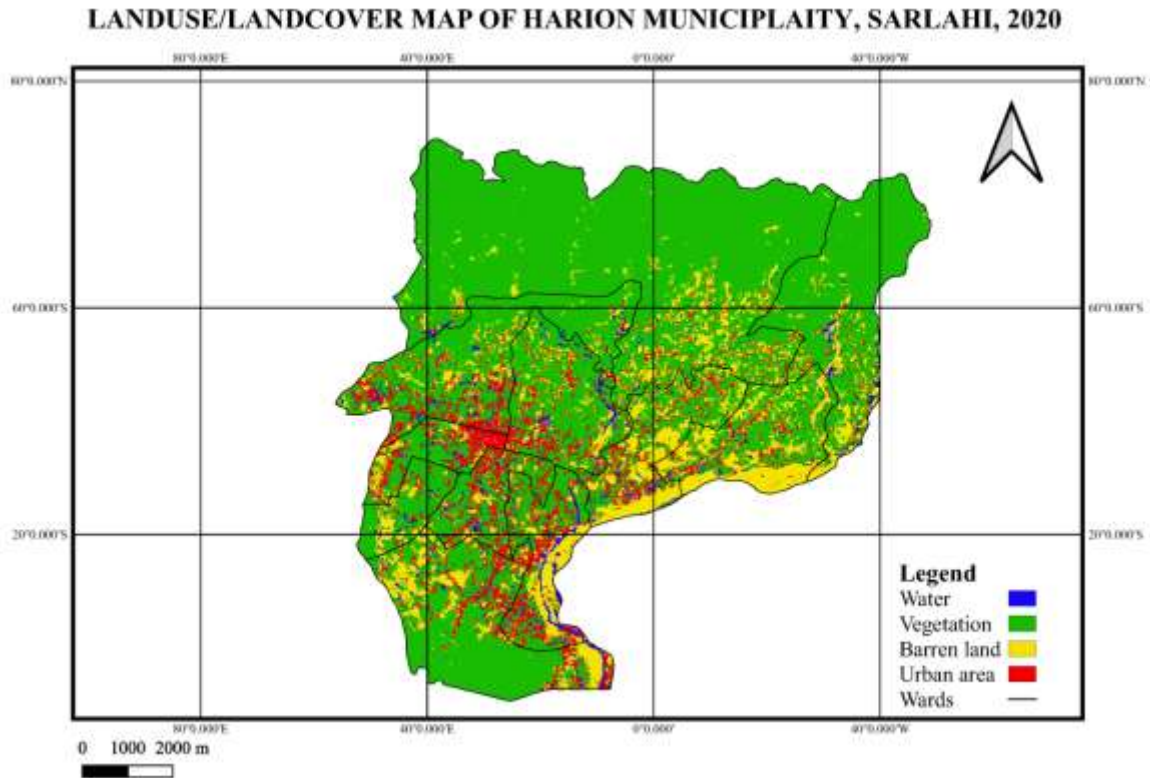


Figure 11 Land-use/ Land-coverage map of Harion municipality in 2020

The maximum part of Harion municipality is covered with vegetation. Also in the past 10 years period built-up areas has been remarkably increased. The land cover map of Harion overlaid via GIS shows the abundant amount of barren land. These barren lands are seen to be mainly along the river bank. The maximum concentration of built-up area is seen to be mainly in ward 10 and in the junction area of ward 7, ward 8, ward 9 and ward 10. This is the major market area of the town and the highway pass through this zone. This shows that the built-up area concentration is maximum in these areas and distribution is being sparse in a radial from the main market area and the highway (Mahendra Highway). The map below presents the land coverage status of Harion municipality in the year 2020.



The image of 2010 and 2020 were observed to see the change and process of urbanization. Also to observe the change in built-up area of Harion municipality map was overlaid using GIS which is presented below. These maps clearly show the intensity of increase in built-up area in those 10 years gap. From concentrated built-up area in the central part in 2010 the built-up area has significantly increased and is being extending in a radial pattern from the center core. The more increase in concentration of built-up area is in central part which is followed by the southern part of the city. Ward 1, Ward 2 and Ward 6 have very low concentration of built-up areas. It is majorly covered with vegetations. The maximum concentration of built-up area is seen to be mainly in ward 10 and in the junction area of ward 7, ward 8, ward 9 and ward 10. This is the major market area of the town and the highway pass through this zone. This shows that the built-up area concentration is high in these areas and distribution is being sparse in a radial from the main market area and the highway (Mahendra highway). Similarly, the southern part is seen to be more concentrated than the northern part. It is due to linkage of Haripur municipality to the southern border with India.

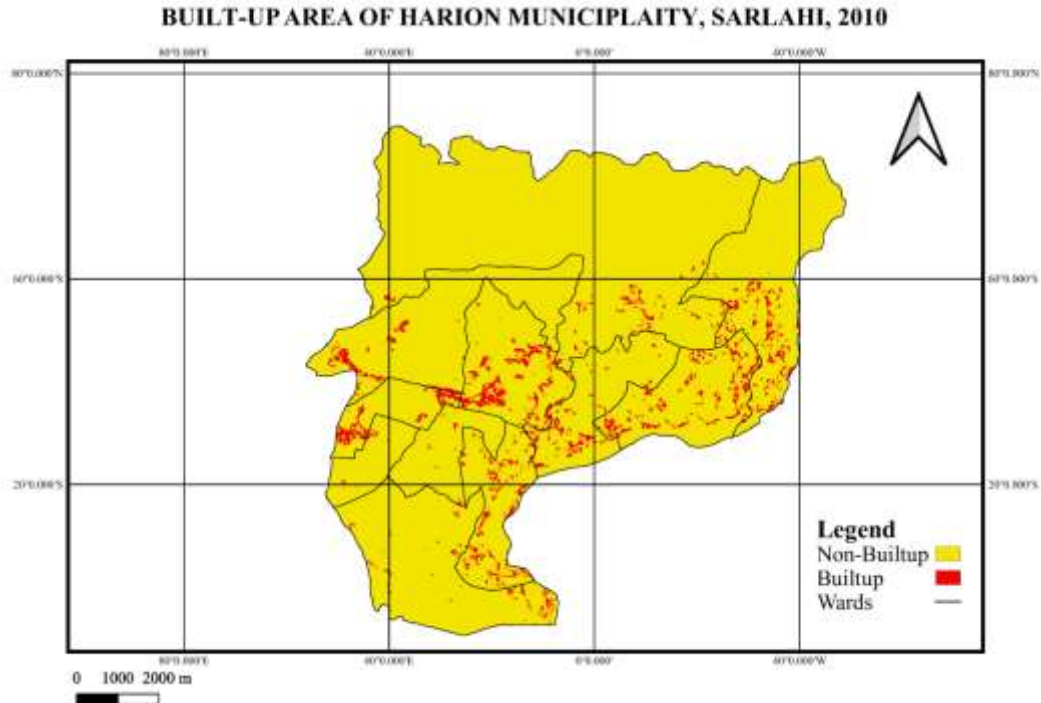


Figure 12 Built-up area of Harion municipality in 2010

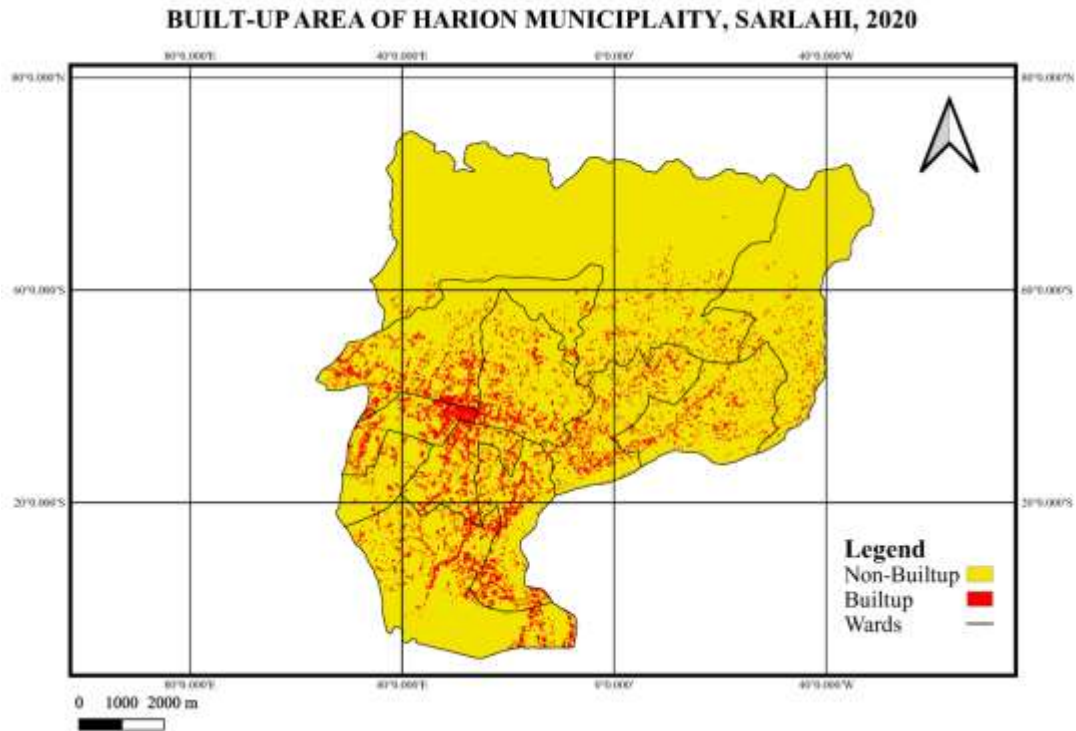


Figure 13 Built-up area of Harion municipality in 2020

According to the norms and standard of planning (National Urban Policy 2064) there should be one primary school at a distance of around 0.5 km, one higher secondary school and one graduation institute at a transportation distance of 30 minutes and 45 minutes respectively via public transportation. The number of educational institute and their types are shown in table below:

S.N.	Institutional Types	Number
1	Montessori	2
2.	Primary School	7
3.	Secondary School	16 private 5 governmental

4.	University Level	4 Private college 1 Governmental college
5	University	None

Table 7 Types of educational institute and their number

According to the area of municipality and number of students the number of educational institutes are seen to be sufficient. Similarly, the number of student in higher secondary and graduation level is seen to be quite low in comparison to primary school student. It is mainly due to discontinuation of studies or migration to larger cities for higher studies for quality education and wide range of subject/ faculty choices. Mainly students go to cities like Birgunj, Janakpur, Hetauda, Sindhuli or Kathmandu for higher studies.

As mentioned in ‘Planning Norms and Standard 2013’ the norms for cities (40000 to 1 lakh population) are shown in table below with comparison of existing condition:

S	Infrastructure	Norms	Existing Condition		Remarks	
A	Physical Infrastructure					
1	Road	ROW for:	Planned	Exsiting		
		Arterial	30	30	6-12	Footpath and cycle track are not managed. Road width is not sufficient as per planning norms and
		Sub Arterial	22	22	6-8	
		Collector	14	6	6	
		Local	10	6	3-6	

					standard.
2	Water Supply				
		80-100 lpcd	Not sufficient		
		minimum pipe dia 80 mm with 10 MLD capacity	Min 80 ok		
		storage capacity = 25% of treatment capacity	No treatment plant		
		80% HH with metered connection	Available in all houses with pipeline water supply (CBS 2068)		
		treatment plant	No treatment plant		
		Rain water harvesting in public building	None		
3	Sanitation/Sewerage / Storm drainage				8 new municipal building with 32 public toilets is under construction
		Sewerage system	None		
		treatment plant	None		
		public latrine 1/2000 passerby at	1 poorly managed public toilet		

		500m		
4	Integrated solid Waste Management			
		Collection Point (0.3 kg/person/day) from door to door	House to house collection in market areas only in a routine schedule	Poor Solid waste collection and management system
		collection point/container/ roadside pickup point serves a radius of 200m	none	
		Transfer Station and Sanitary Landfill Site	No landfill site instead has dumping site	
5	HH with electricity	Power access to 100% coverage or 150 – 200 Watt Solar Home System	100%	Source CBS 2068
6	HH with communication	100 % coverage	100%	Source: CBS 2068
<b>B</b>	<b>Social Infrastructure</b>			

7	Education			
	Primary	1 per 3000 population at a distance of 0.4–0.8 km	Accessible	
	higher secondary	1 per 7500 population at a distance of 30min in public transportation	accessible	
	graduate/post graduate	1 per 25,000 population at a distance of 45min in public transportation	accessible	
	University	1 per 40,000 population at a distance of 1hr in public transportation	Not available	Only one university in whole province 2 (Rajarshi Janak University)
8	Health			
	primary health care/ health post	1 per 20000 population (5- 15 beds)	1 maternal health care centre 4 health post	
	hospital	1 per 50000 population (25 – 50	4 general hospital of with Beds	

		beds)	2 eye hospital	
9	Open Space		plenty open space which includes school area, parks, temple area, playing area	
10	Fire station	1 fire station for 5 to 7 km radius	1 Fire brigade available	
11	Security	police post and police station 1 per 10,000 population	1 APF station, 1 NP station	
	<b>Economic C Infrastructure</b>			
12	Exhibition centre	1 per 50,000 population	Not available	
13	Movie hall	5 seat per 1000 population	insufficient	
14	Vegetable market	1 wholesale, 1 retail and 1 Slaughter House for 2 neighbourhood (1 Neighbourhood = 3000 population)	Scheduled market at different locations. Main market in ward 11 in an area of more than 7500 sq.m, slaughter house under construction	

15	Parking	1 parking lot for 3000 population (1 Neighbourhood = 3000 population)	None specific parking areas.	
16	Transportation	1 parking lot for 100 buses and 100 trucks 1 parking lot for 100 buses	No bus park but highway side is used as bus stops	
17	Airport	National Airport	Nearest airport in Simara and janakpur at a distance of 67 km and 77 km respectively with flight to Kathmandu	No airport in the district
18	Multipurpose hall	1 per 10000	2 available (SITA and SAMRAT ) (not sufficient as per standard)	
19	Cinema hall	5 seats per 1000 population	150 seats (not sufficient)	Old and junked
20	Old-age home, gallery and library	1 old-age home per 20000 population 1 child home	Running- 2 underconstruction-1	
		1 library per 10000 population	One available	



		1 gallery/ museum	None	
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Table 8 Comparison of existing condition of Harion with DUDBC planning norms and standard

### 4.3 Development Plans and Projects

#### 4.3.1 Integrated development plans

Integrated development planning can be described as that plan which places clear focus on what is the condition of municipality at present and gives direction to where the municipality will be in the near future, by indicating the core business and purposes of the municipality (IDP-CapeTown, 2012). Integrated Development Plan acts as a tool for better planning, which is the key for sustainable development and an integrated system of planning and service delivery.

Community participation is the key essentials for making integrated development plan. Integrated development plan should be followed by the allocation of adequate budget with a valid and strong source. Integrated development plan is not just a plan but is a plan with different benefits. The common benefits includes guiding the municipality to suitable utilization of available resources of municipality, encourage municipality to effective and efficient service delivery, provide sources and space for more funding from investors, and acts as a medium for public participation in the key developmental activities and links communities and government spheres (Stamer, 2006).

Harion municipality is seen to have not developed integrated development plan for overall developmental activities to be run in the municipality. But for the transportation development within the municipality, it has developed municipal transport master plan for the identification, classification and prioritization of roads within municipality with a motive to construct, upgrade, maintain and rehabilitate prioritized roads on the basis of approved criteria with calculation of financial budget. The master plan has separated road into four classes: class A, class B, class C and class D roads with right of way of 30m, 20m, 10m and 6m respectively. The setback distance is 6m for class A and class B roads and 2m for class C and lass D roads. The extra widening for them are 3m, 2.5m, 1.5m and 1m respectively. The budget allocation for this master plan includes 70% on

construction and 30% on maintenance. The resource for each of this road includes 40% on class A road, 30% on class B, 20% on class C and 10% on class D roads. The brief five years financial plan for this master plan is as shown in table below:

Year	Construction cost in lakhs				Maintenance Cost (in lakhs)	Total cost (in lakhs)
	Class A	Class B	Class C	Class D		
Year 1	308	231	154	77	330	1099
Year 2	338	254	169	85	363	1209
Year 3	372	279	186	93	399	1329
Year 4	409	307	205	102	48	1461
Year 5	450	338	225	113	483	1609

Table 9 Five Years Financial Plan for Municipal Transport Master Plan of Harion municipality (source MTMP Harion)

Though the Harion municipality lags integrated development plan the yearly annual budget plan is as discussed. The major spending of budget are in the field of infrastructure and urban development, administration, training and empowerment, sanitary and health, emergency management and environment conservation.

#### 4.3.2 Undergoing Programs and projects

The undergoing projects are the important factors to determine the future preparedness to disaster. The undergoing projects should be planned so that it can be sustainable and should corporate disaster criteria and policies. The major projects infrastructure projects that are running in Harion are Harion Municipal Market, Municipal hospital, ring-road, road under municipal transport master plan, old-age home, and reconstruction of school building. The municipality is seen to have lagged in storm drainage management. Road side drains are merged in road construction but most of those drains have no access to disposal. Inundation during the rainy season shows the lack of drainage management along the major highway. Similarly, the undergoing projects lack the engagement in large

scale water supply program and water treatment plant. Also the management of solid waste is seen to have been a problem for the needs to be incorporated in the upcoming programs of the municipality.

#### **4.4 Capacity of Municipality**

The term capability in this study means the ability of Harion Municipality to organize assets, knowledge and competence to protect community from potential effect of disaster and how this has been transformed into municipal ability in institutional and human resources policy for effective implementation and for providing technical, leadership and financial capabilities that are specially relevant to the situation of community at the instance of disaster. The capacities can be physical, social or attitudinal. The capacities here are divided into institutional, financial, technical and human resource capability. Capacity of municipality is analyzed on the basis of its capability or strength to bear the responsibility assigned to it in constitution of Nepal and DRRM act 2017.

##### **4.4.1 Institutional Capability**

Institutional capability of local government relates to the clear structure, role, responsibilities and relationship of local government with all other levels of government in managing disaster. In order to be fully functional, institutions must be dynamic entities that have the resilience, durability and flexibility to adapt and modify in an emergency situation.

In Harion municipality most of the plans have laid emphasis on flood, inundation and erosion followed by earthquake and most of them are centrally treated rather than locally. It is often paid less attention towards rehabilitation and mitigation. This context in a broad sense signifies that the policy formulation and institutional set-up alone does not give much expected output unless they are supplemented by the ability and competence to operationalize the intent of the relevant acts and policies, i.e., preparing, responding, rehabilitating and mitigating the consequences throughout the disaster cycle.

As documented in work division regulation by the municipality, the organization is divided into nine sections i.e.

- Forest/ environment/ sanitation and DRR,

- General Administration,
- Finance and revenue,
- Urban infrastructure development,
- Social development,
- Land management and Building Regulation,
- Justice, law and human right,
- Economic development
- Planning, controlling and statistics

The forest, environment, sanitation and DRR section is responsible for the conservation of forest, wildlife and land- landscape preservation. Similarly the conservation of environment, conservation of nature and conservation of watershed is under this department. It works for wastage management and disaster management activities too. Under DRM it holds the control of fire-brigade, ambulance, tools and equipments. It has separated a disaster focal person from the department.

The major threat in this municipality seems to be fire, flood and inundation. These incidents are have repeatedly occurred great loss in assets every year. The fire incident is more critical than inundation in both market and resident area. There is high number of houses made of bamboo or wooden planks. Similarly beyond the core market area much large number of houses in older settlement area still have straw or wooden roof of tile roof supported by wooden planks. These types of houses are more critical to fire hazard. In addition to being critical to fire hazard these houses seem to be weak, bearing a chance to be collapsed during fire extinguishing by fire engine. This condition effects on the performance (effectiveness) of fire engine. A part from this distance and accessibility of roads also affect the effectiveness of the fire brigade.

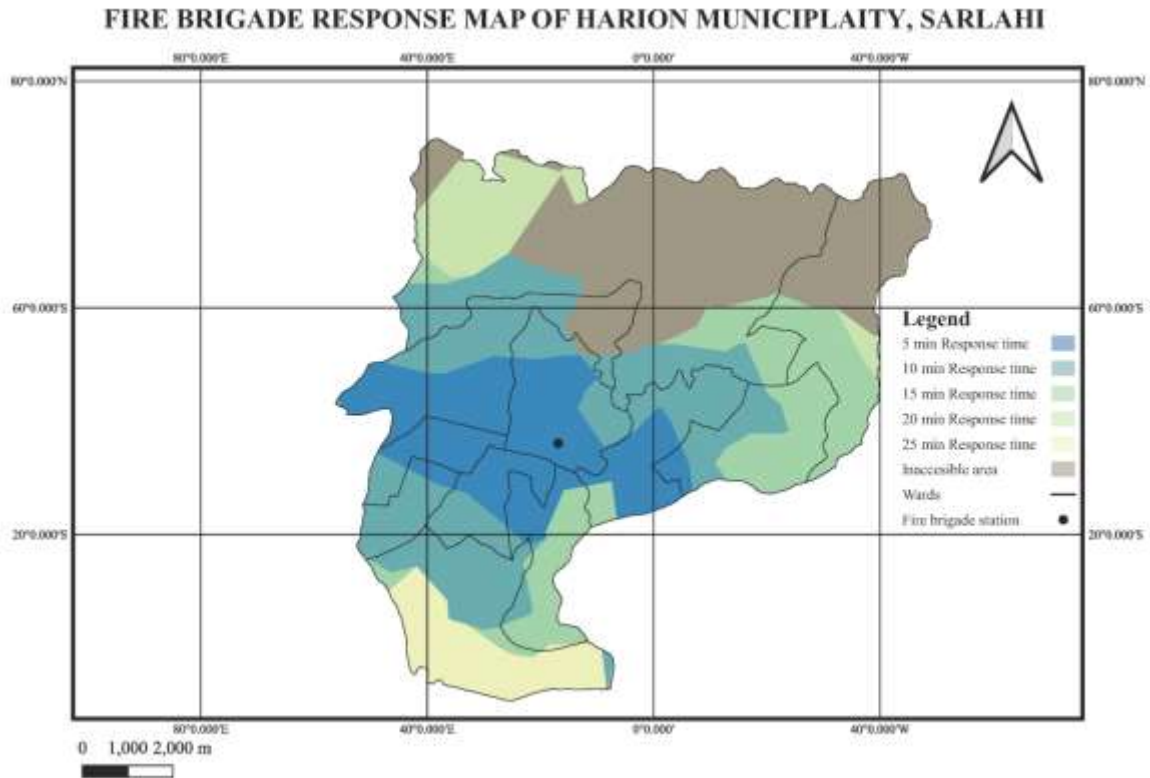


Figure 14 Fire Brigade Response Map of Harion Municipality

The fire brigade response map prepared using GIS show that the fire engine can reach any accessible within 25 minutes. If the incident is reported in time the fire can be controlled with a minimum loss. But the large fire can end everything within that period. So for the areas with high response time help should be taken from the neighboring local level. Also those areas need to be equipped with local level or mini scale fire control system which shall control the fire until the fire brigade arrives. Some areas in ward 1 and ward 2 seem to be inaccessible to fire brigade. These are the areas with forest and agricultural land. Accessibility to fire brigade needs to be planned by municipality in those areas.

#### 4.4.2 Financial Capability

The third essential for making resilient city includes strengthening financial capability for resilience. Strong financial resource to support different activities of DRR cycle is important for enhancing resiliency of the local government. The municipality has fairly separated fund for preparedness works, awareness programmes, construction of

infrastructure to avoid loss from possible future disaster and research, study and consulting service in case of DRR activities.

The expenditure report of past years and the budget plan shows that around 3-4 % of total expenditure is on salary of staff. The maximum part of budget is spent on infrastructural works. This includes construction of road, building, drain, embankments, electricity, water supply etc. Though small amount of budget is separated for emergency management yet DRR activities are seen to be linked with infrastructural development. The local government operation act 2074, the local government are allowed to fix different taxes, infrastructure and resource cost by themselves within the provincial policies. This has eased the local government to visualize their conditions and analyze the possible rate for tax based on land use, local resource consumption or other business.

Source	Allocated Budget (NRs)	
	Fiscal year 2076/77	Fiscal year 2077/78
Internal source	698,085,000	761,863,000
Provincial government	12,94,000	134,145,000
People participation	6,000,000	20,328,000
Loan	70,000,000	360,679,000
Federal government	358,372,000	469,300,000

**Table 10 Source of budget allocated in two different fiscal years**

The major spending of budget are in the field of infrastructure and urban development, administration, training and empowerment, sanitary and health, emergency management and environment conservation. The municipality had spent 5.5 million rupees in flood control. Also, the municipality had separated around 10 million for emergency in case of road accident management and control, and other epidemic and disasters. In this year for empowerment, skill development training, awareness programmes the municipality had separated around two million rupees.

The fiscal year budget 2077/78 of Harion Municipality shows that the estimated source of income of municipality includes revenue, internal source, and revenue distribution of provincial government, province budget, people participation and the federal government.

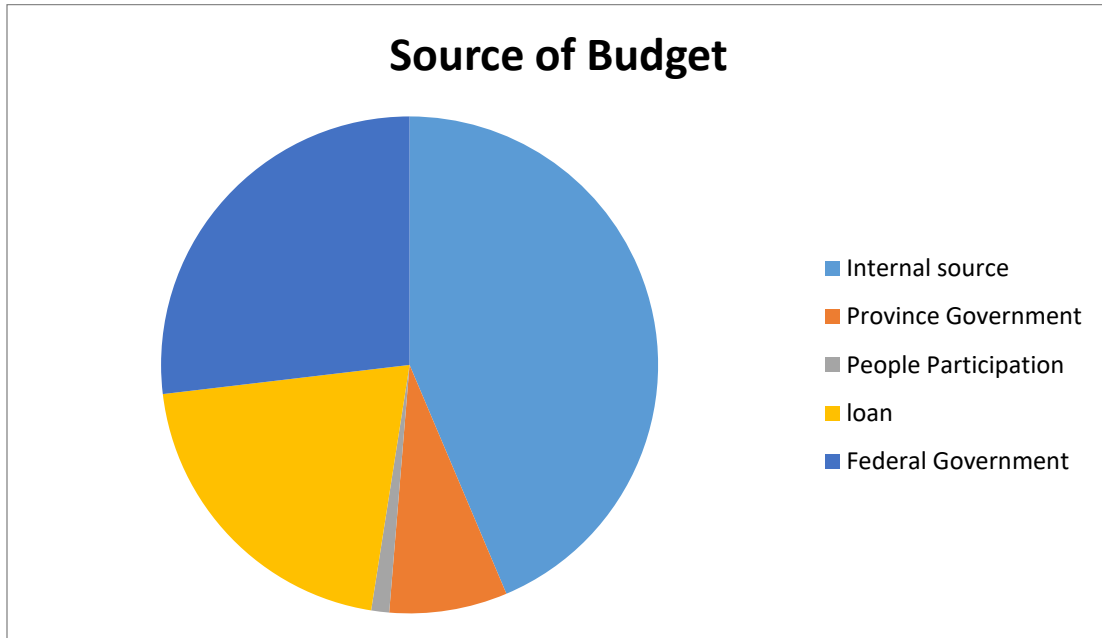


Figure 15 Fiscal Year 2077/78 budget source

Out of total NRs 995,398,067.920/- estimated budget the municipality to spend around 45 % of budget in general and administration and the rest around 55% budget in development sector. The fiscal year 2077/78's budget plan shows that the municipality has separated NRs 14,775,000/- for the empowerment of women, socially and economically backward communities via different awareness programmes and skill development trainings. Similarly NRs. 390,000/- was separated for the programmes targeting pwds. NRs 6,935,000/- has been separated for health and sanitary sector. The total of 2,075,000/- has been separated for DRR and emergency mobilization during disaster situation.

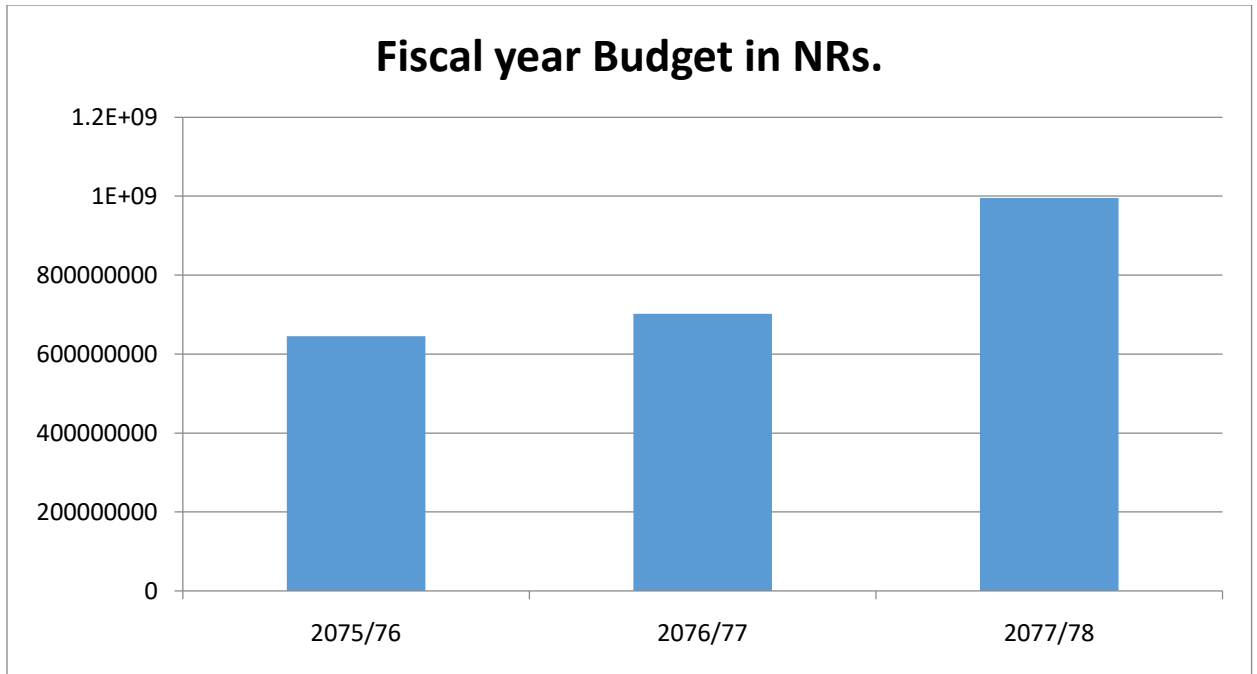


Figure 16 Change in Fiscal Year budget in four consecutive Year

Harion is sure to face increase in cross-cutting issues due to population growth and accelerating urbanization. This shall create pressure to the municipality to improve its efficiency in allocating optimum available financial resource by enhancing its revenue base to increase the productivity and meet the growing expectation of the people living within. In comparison with fiscal year 2066/67 the budget has increased by NRs 293,283,406/- which is the growth 41% from previous year. The major source of municipal budget in case of DRR is used for tree plantation, river bank embankment, flood controlling structure and health and sanitation.

#### 4.4.3 Technical Capability

Technical Capability is one of the important factors that determine the overall capacity of the local government. As per LDCRP guidelines the municipality needs to map both of its human and non human resources. Harion municipality being not aware about this, it is unaware about the actual technical capacities it gains. The municipality has developed a DRR and environment department to foresee the activities related to DRR with a focal person to respond to disaster scenario. After the arrival of IT engineer the data related to information of elected representative, department heads, fiscal year budget, bid opening, and photos related to municipal programs are updated in the website. The IT officer says



that very few complaints are registered through online portal. Also the municipality has one suggestion box outside the municipality. Though having its own website the data related to DRR and disaster resistant development is barely present in the website of the municipality. The Harion municipality has made no provision to report disaster or hazard data to DRR portal or BIPAD platform. To address the future scenario and to self analyze technical capacity the particular technical person should be trained for reporting procedure and pursue their own BIPAD portal's username and password from the concerned municipality to localize it.

#### 4.4.4 Human Resource

Human resource is the competitive factor that reflects the strength of the local government. The sufficient and qualified human resource shall aid to increase capability of the municipality. The staffs in municipality are separated as technical and administrative staffs. Technical staffs can further be categorized into health sector, and infrastructure and development sector.

SN	Sector	Total working under municipality
1	Health	35
2	Veterinary and Agriculture	6
3	Technical (Infrastructure)	1 Engineer, 4 sub engineer, 1 Surveyor

Health workers in above table include health assistant, pharmacist and deputy health assistant in municipal executive office and different health post of municipality. The veterinary and agriculture relates persons are responsible to carry out different programs related to animal health, awareness programs, training to framers, programs related animal husbandry information, agricultural development, and other activities related to farmers welfare.

Comparing the number of projects and area of municipality the technical personnel working in animal and farming sector and engineering sector seems to be insufficient for the municipality. Though the works related to DRR is under Environment section and Engineer of the municipality it seems to be quite tough to handle all projects and DRR

activities. The municipality seems to have neglecting training and assessment related to urban DRR. The technical aspect of planning for disaster risk mitigation and reduction is deprived of enough and trained human resource. This in a whole may push DRR related subject to be skipped to the corner.

#### 4.4.5 Policies and Implementation

The success factors that contributes to policy for an effective implementation-related capability are mainly the availability of appropriate rules, regulations and policies, for making various decisions, mobilizing available resources, and engaging stakeholders and public or private organizations (Alam, Kusumasari, & Siddiqui, 2010). A policy for an effective implementation of associated capability is highlighted in the policies, rules and regulations have been enacted by municipality for providing guidelines and overseeing during different stages of disaster management.

After 2017 it has been the most effective year for municipality to publish policy for effective implementation. No legislation was available before that so there was no obligation for the local government to enforce implementation of disaster coordination mechanisms, vulnerable area identification, maximizing early warning systems at the local level and other DRR activities. The findings of this research have clearly shown that Harion municipality was only acting as facilitator during disaster relating activities. But recent change in the set-up provides the local government with various role and responsibilities through the constitution of Nepal, DRM act, National DRR Policy, LDCRP guidelines, and Strategic Action Plan.

Though DRRM act has mentioned clear roles of any municipality to develop planning at local level and policies and guidelines at local level to develop disaster and climate resilient community, yet the municipality has not prepared the LDCRP and DPRP. This has created legal obstruction is Disaster Management Fund Operation Procedure.

Theoretically policies, guidelines and national protocols could aid and speed up disaster risk reduction efforts. So the planning and implementation of such plans and policies is important part in disaster response. The municipality has not identified vulnerable areas, early warning system was not optimized and moreover very less awareness and mitigation programmes had been conducted in the field of disaster risk management. It

can be seen that the municipality has taken only few initiatives as per the assigned roles and responsibilities as stated in DRRM guidelines.

#### **4.5 Disaster Response Framework**

This section is presentation of the initial outcomes from data collection and framework development course. Concluding from literature review and analyzing the field condition, a set of success factors were identified. This part presents ranking of identified success. It elaborates the research to meet the objectives of the research and point out main initial results. This section demonstrates main aspects of disaster management capacity framework. The framework guides the development and implementation of capacity assessment at local government level, with an aim to enhance disaster response capabilities. Also the framework can serve as a strategic base against which reporting and evaluation of results can be undertaken.

The seven strategic elements were identified based on analysis presented in the section above which in addition provides a general description of key strategic areas and basics that are included in each area. The seven strategic elements that are identified are: community engagement, effective response plan, inters organizational linkage, communication, financial planning, monitoring and control and, regular trainings to the stakeholders. These seven strategic elements have their own corresponding goals which are needed to be achieved. The target of community engagement is to achieve integrated planning, creating awareness, and support for volunteer participation for enhancing community resilience. Secondly, effective response planning has a goal to use DRR strategies and increase so-ordination between the stakeholders for better understanding of disaster. Next, the training of first responders has the goal to professional development and conducting regular drills through an improved training programme. Similarly, inter-organizational structure has the target to incorporate the culture, organizational structure and business continuation. Inter-organizational communication has a goal to clear accountability, improving communication flow process and incorporate formal reporting system. Monitoring and control has target to manage all the activities and control each of the activities during disaster response. Regular training to stakeholders and volunteers has the target to early respond to disaster and aid for rescue and temporary movement to safer areas.

The cluster should be developed assigning the focal person each of the key cluster components. The sector of health, nutrition, education and, food and security is led by social development sector. Infrastructure department leads early recovery and communication. Forest, Environment and Sanitation section is responsible for WASH sectors. The administrative and security section leads logistic, camp coordination, and shelter cluster. Protection cluster is led by Justice, Law and Human right section.

The major works that need to be executed for response to any disaster include the following:

- Initial Rapid assessment of the disaster area should be done to find out damage and losses occurred in agriculture, infrastructure, human and other assets
- Using MIRA tool to get data and information and analyzing it
- Finding and listing the victims to disaster
- Activating local information and coordination committee at both municipal level and ward level
- Continuously taking information from the affected area and reporting to press
- Establishing emergency information collection center
- Managing alternative communication system if necessary

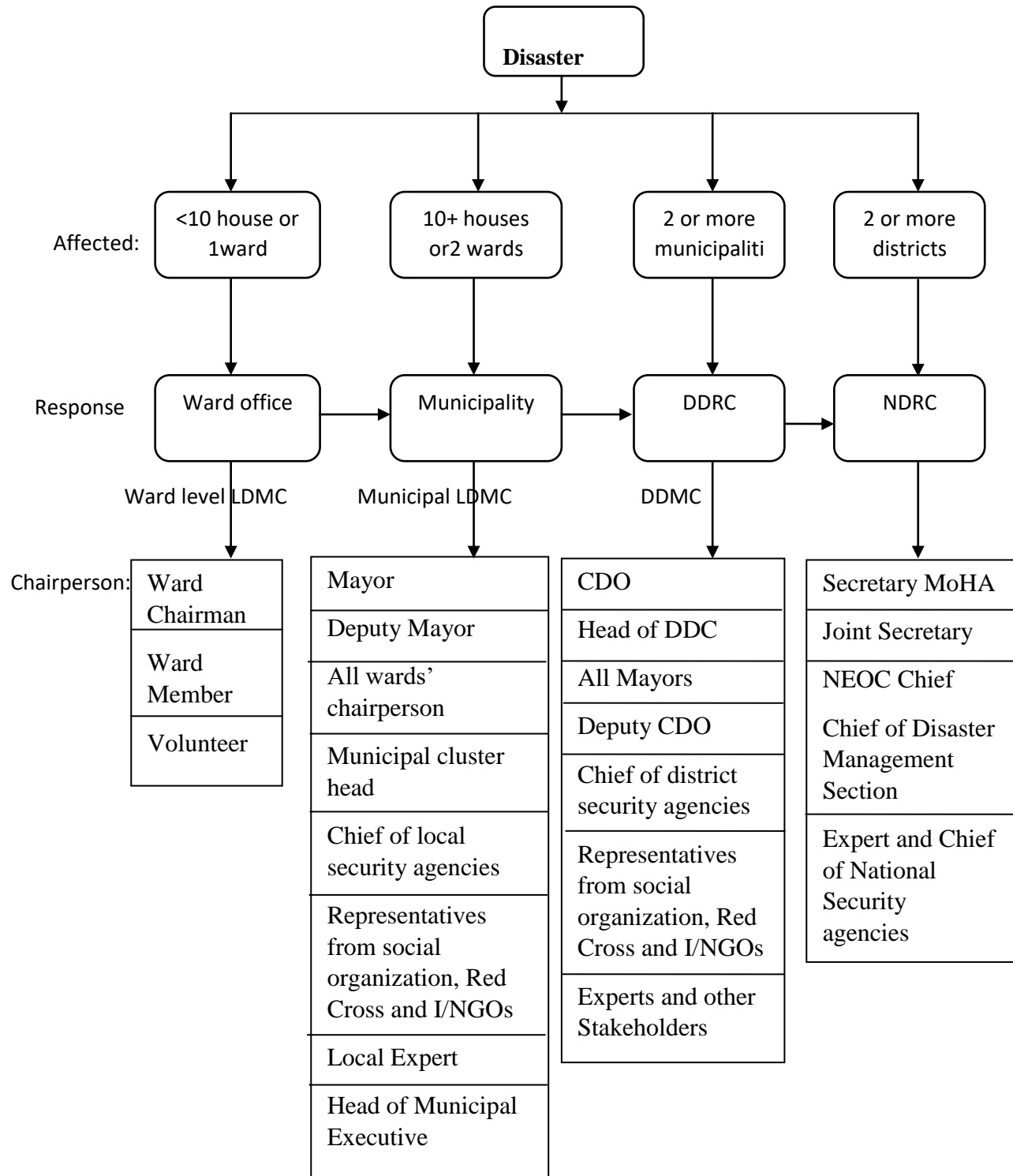


Figure 17: Disaster Response Action Framework

#### **4.6 Prioritization of Critical Factors for Disaster Response**

From the different research and literature review seven critical success factor for disaster response are identified. The seven identified critical success factor include community engagement, effective response plan, inter organizational linkage, communication, financial planning, monitoring and control and, regular trainings to the stakeholders. These are the key points to ensure sufficient capability for disaster response in any possible emergency situation for the organization at local level. For the effective disaster response these critical factors should be analyzed first to prepare the plan to achieve the goals. After this goals are analyzed during the performance period and revised again. This should run in a continuous cycle thereby modifying goals as per previous performance and outcomes.

The goals for each of this success factors are different. Corresponding goals for each factors is needed to develop the response plan. The goals for community engagement are public awareness, information management, enhancing volunteer participation, integrated planning and enhancing community resilience through disaster preparedness. Similarly effective response plan will have goal to better understanding of disaster, increasing the coordination of stakeholders and use of disaster reduction strategies. Next, the inter-organizational linkage will have goal to the improving structure of organization, sharing the culture and motive and avoiding duplication. Similarly the goal of communication is to improve accountability, improving communication flow process, enhance coordination and enhance reporting system. The next factor is financial planning which has goal to managing the resource, planning and scheduling the flow of necessary assets and enhancing optimum use of resources. Monitoring and control has goal to enhance participation, improve schedule and manage resources. And lastly the training to stakeholder has goal to professional development, enhance and focus regular drills and improving training programs. While the outline of success factor is to clarify the corresponding goals, it also aids further to indicate how the corresponding goals can be followed and implemented as a process that leads to disaster preparedness. It is by attaining integrated planning which is a step where all organizations which are responsible for disaster response plan to work in collaboration in a cooperative manner so that communication flow processes may be improved. This shall aid to develop improved

framework that guides the development and implementation of capacity assessment at the municipal level.

#### **4.7 Chapter Summary**

This research focuses on extracting baseline information about the available resources and capacities. Further this helps to identify gaps and capacity needs in the municipality. In addition to the capacity assessment this research is focused in developing a framework of a response plan for the Harion municipality. The limitations of research can be traced to the limited available data in Harion municipality. The major part of the statistical (census) data was of last census i.e. census 2068 (10 years back). Despite this limitation, studies were interpreted from existing literature on disaster management written by GON and different national and international organizations and authors. However, the field study and discussion with stakeholders aided to analysis and deliberate decision by minimizing the impact of this limitation. Combining data from the field study, discussion with stakeholder and questionnaire data enabled reliable and valid data that were analyzed to arrive at the findings and conclusion made. Hence, this research is not without any limitations, but they were analyzed and managed in a constructive way so that the research can be completed with no any major problem that may have created barrier for successful completion of research.

## **CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATION**

### **5.1 Discussion and Conclusion**

Harion municipality being the focused city for the people of neighboring district and from the study it is seen that Harion municipality continue to experience growth that can be seen through comparing built-up of different past years and present year in GIS and Google earth image. This can be concluded as unplanned growth trend as trend in built-up area scatter is too random which thus accumulates the risk. The municipality is facing problem in expanding access to infrastructure services with the available financial and technical resources. This is the reason that the municipality has not been able to pay sufficient attention to address different problems and minimize the accumulated risk.

The question on how has the city developed its capacity for disaster response is one of the major points to be addressed in this research. In Harion Municipality, though municipal disaster management committee has been formed under the chairmanship of Mayor but its work is seen to be limited in distributing relief materials. No other activities have taken place so far than the relief distribution through this committee. The municipality has not been able to map or list human and non-human resources. The legislative needs like making LDCRP, DPRP, etc has not been done. LDRRM is made and is under formulation. There exist lack in formation of volunteer groups and training to them, preparation of guideline for utilizing disaster funds as per LDRRM act, self recognition of available resources and other activities. Due to this integration of key municipality functions has not been in an effective way for disaster response so as to take actions whenever needed. No hazard maps, vulnerability map, risk map, susceptibility maps or other maps for disaster preparedness and response has been prepared so far. Land use / land cover map has been prepared during study of transportation master plan. Listing and distribution of fund to vulnerable population (old-aged, pwd, new mothers, backward community) is done. Municipality is found to be aware of the major possible hazards but still lacks the hazard maps and data on risk. Since the BIPAD portal has not been localized, it has created obstruction in real time monitoring, hazard data analysis and resource and capacity assessment.



The current approaches that the municipality has been focusing on are not sufficient for multi hazard response. The major approach to DRR activities includes emergency fund allocation, stocking of rescue and response equipments and relief distribution activities. Budgets have been allocated every year for relief materials but annual development plan shows no additional budgets been allocated for preparedness activities other than flood and inundation hazard. Building codes and standards are somehow applied in recent years along with land zoning in some places in Harion municipality. Building codes or standards as per the NBC exist in municipality that addresses specific known hazards and risks for the municipality. There are not much approaches promoted through the design and development of new urban development to promote resilience. As per consultation with the technical staff of Harion municipality, it has been found that the municipality has prioritized critical infrastructure and are continuously monitored. Infrastructures like schools, private hospitals and markets are established in leased private houses which are not made for institutional purposes. This arise risk in functioning of that structure in major hazards. Newly formed infrastructures are built as per the building codes. But most of the infrastructures and houses in the municipality are aged with minimum safety measures.

Harion Municipality has been found to have access to the manpower in different fields like infrastructure, health, administration, education, nutrition, etc. and also access to different tools needed to rescue and relief related works but the municipality misses the trainings and drilling related works in all sectors other than health and agriculture related trainings. Also since mapping of human and non human resources have not been done, the sufficiency of such human resource is still in dilemma. This as a result is hindering the allocation of responsibility and effectiveness of the work. Harion municipality though having human resources, yet it lacks the sufficient acute healthcare capabilities to manage expected major injuries in 'worst case' circumstances. For the response during the disaster, since municipality has no trained volunteers, it depends on the security forces (APF and Nepal Police) as early responders. Preparedness and response plan will decrease the dependency on other actors and makes the work of first responder run effectively and efficiently. Capacity assessment helps the municipality to self realize the

sufficiency and need of the resource in a distinct figure thereby enhancing preparedness and response capacity.

For predicting the appropriate risk reduction measures both the physiological and socio economic parameters can be used. So, it is necessary for the municipality to strengthen own source revenue collection adopting the appropriate strategies to find the tax payers for adopting risk reduction measures in urban area. Also the municipality should focus on boosting the community participation and perception as an important factor for successful DRR measures. The gaps seen in different sectors like infrastructure, making policies, preparedness plan and technical, human resource and financial sectors highlights the insufficiency of resource and capacity for disaster response and these gaps needs to be addressed by the municipality. The infrastructure in market area and slump settlement is at major threats to different hazards. Visualizing the availability and gaps in the capacity, capacity development can be done which promote preparedness and enhance disaster response. As per WHO standard the number of ambulance is sufficient based on the population of the municipality. The number of fire engines and fire station seems to be insufficient visualizing the fire brigade response map and built up area of Harion.

To wrap up with the theme, this study shows that both the policy implementation and stakeholders and public participation is essential to counter fort the financial deficiency and encourage people to avoid and manage their exposure to vulnerable situation. The constraints of vision, plan, funds and awareness exists in the municipality that needs to be tackled by upgrading existing methodologies, approaches and tools based on the available resource, prevailing institutional setup and understanding and knowledge of needs and priorities of the community and people. Developing all necessary legislative needs and parameter is necessary which helps municipal executive in each step of disaster cycle. The programs to enhance the capacity of local stakeholders and formation of youth volunteers there by making them capable for disaster response are needed. This can be effective plan to response during emergency situation

## **5.2 RECOMMENDATION**

It's quite a challenging and most necessary to establish disaster risk reduction structures at local government level. There will be poor achievements in substantial reduction of

disaster losses in absence of such sphere structure. Following listed recommendation are proposed in order to foster capacity development and address the challenge of disaster preparedness and disaster response.

- Existing vulnerability, capacity gaps and land use plan should be mapped and worked for improvement accordingly so that possible losses in life, assets, health and resources can be minimized and response during disaster can be smoothening.
- Develop strategy for evaluation and implementation of capacity assessment, disaster preparedness or any other DRR methodologies. This will help to determine if the method or practice adopted is effective for that particular context.
- The municipality should understand, analyse and access different assessment and response plan practices before developing and implementing it. This will help to realize that for that particular context, what can be the best measures for different DRR activities.
- The response plan and assessment of capacity should be revised and updated on a regular interval based on the guidelines to address area of improvement and address the gaps in old methodologies.
- Trainings and drills should be organized for awareness and to test effectiveness of arrangements for any DRR practices

## REFERENCES

- (2016). Flood Risk perception in flood affected communities in Lagos, Nigeria. In I. O. Adelekan, & A. P. Asiyambi, *Natural Hazards* (pp. 80(1):445-469).
- Ader, T., Avouac, J.P., Liu-Zeng, J., Lyon-Caen, H., Bollinger, L., et al. (2012). *Convergence rate across the Nepal Himalaya and interseismic coupling on the Main Himalayan Thrust: implications for seismic hazard*. *J. Geophys. Res.*117, B04403.
- Adhikari, B. R. (2017). Chapter 7: Tectonic Division of Nepal. Pulchowk Campus, Lalitpur.
- Aksha, S., Juran, L., Resler, L., & Zhang, Y. (2019). An Analysis of Social Vulnerability to Natural Hazards in Nepal Using a Modified Social Vulnerability Index. *International Journal of Disaster Risk Science* .
- Alam, Q., Kusumasari, B., & Siddiqui, K. (2010). Resource Capacity of Local Government in Managing Disaster. *Disaster Prevention and Management* .
- Alexander, D. (2015). *Disaster and Emergency Planning for Preparedness, Response, and Recovery*. Oxford Research Encyclopedia of Natural Hazard.
- Alexander, D. (2002). *Principle of Emergency Planning and Management*. Harpenden: Dunedin Academic Press Ltd.
- Alves, F. (2015). *Cost-Benefit Analysis in Climate Change Adaptation*.
- Arbon, P., Gebbie, K., Cusack, L., & S., V. (n.d.). *Developing a Model and Tool to Measure Community Disaster Resilience. Final Report. Torrens Resilience*. Retrieved from (<http://www.flinders.edu.au/centres-files/TRI/pdfs/trireport.pdf>)
- Bank, A. (2016). Envisioning Nepal 2030: Proceedings of the International Seminar. Asian Development Bank.
- Banyanga, J. d., Björkqvist, K., Österman, K., & Hackett, J. (2017). Trauma inflicted by genocide: Experiences of the Rwandan Diaspora in Finland. *Cogent Psychology* .
- Bass, B. (1985). *Leadership and performance beyond expectations*. New York Press.
- Berkes, F. (2007). Understanding uncertainty and reducing vulnerability: Lessons from resilience thinking. *Natural Hazards* , pp. 41:283-295.
- Bilham, R., Bodin, P., & Jackson, M. (1995). Entertaining a great Earthquake in Western Nepal: Historic activity and geodetic tests for development of strain. *Nepal Geological Society* , 73-88.
- Birkmann, J., Buckle, P., Jaeger, J., & Pelling, M. (n.d.). Extreme Events and Disasters: a window of opportunity for change? Analysis of organisational, institutional and political change, formal and informal responses after mega-disasters. *Natural Hazards* , p. 55(3).
- Blaikie, P., T., C., I., D., & and B., W. (1994). *At Risk: Natural Hazards, People's Vulnerability, and Disasters*. London and New York: Routledge.

- Bollinger, L., Sapkota, S., Tapponnier, P., Klinger, Y., Rizza, M., Van der Woerd, J., et al. (2014). *Estimating the return times of great Himalayan earthquakes in eastern Nepal: evidence from the Patu and Bardibas strands of the Main Frontal Thrust*. *J. Geophys. Res., Solid Earth* 119.
- Borthwick, T. (2015). *The Importance of an Emergency Response Program*.
- Burton, C. (2015). *A Validation of Metrics for Community Resilience to Natural Hazards and Disasters Using the Recovery from Hurricane Katrina as a Case Study*. *Annals of the Association of American*.
- CBS. (2012). *National Population and Housing Census 2011*. Nepal, Kathmandu: Central Bureau of Statistics (CBS) and National Planning.
- Civil Defence NZ. (2014). *CDEM Capabilit Assessment Tool*.
- Collis, J., & Hussey, R. (2014). *Business research*.
- Creswell, J. W., & Miller, D. L. (2000). *Determining Validity in Qualitative Inquiry*. 124-130.
- Cutter, S. (2016). *Resilience to what? Resilience for whom?* , 110-113.
- Cutter, S., & Burton, C. (2010, 17). *Disaster resilience indicators for benchmarking baseline conditions*. Retrieved from *Secur. Emerg. Manag.*: <http://dx.doi.org/10.2202/1547-7355.1732>
- Cutter, S., Burton, C., & Emrich, C. (2010). *Disaster resilience indicators for benchmarking baseline conditions*. *J. Homel. Secur. Emerg. Manag.* , 1-22.
- Daneilson , M., & Ohlsson , K. (1999). *Decision Making in Emergency Mngement: A survey Study*. *International Journal Of Cognitive Ergonomics* , 3 (2), 91-99.
- Dekens, J. (2007). *Local knowledge for disaster Preparedness: a literature review*, Kathmandu: International Center for Integrated Mountaion Development.
- DFID. (2011). *Defining Disaster Resilience: A DFID Approach Paper*.
- DFID. (2019). *TOOLS FOR MEASUREMENT OF RESILIENCE IN NEPAL*. DFID.
- FEMA. (2016). *Federal Emergency Management Authority*. FEMA Homeland Security exercise.
- Gerlitz, J.-Y., Macchi, M., Brooks, N., Pandey, R., Banerjee, S., & Jha, S. (2017). *The Multidimensional Livelihood Vulnerability Index – an instrument to measure livelihood vulnerability to change in the Hindu Kush Himalayas*. *Climate and Development* 9. 124–140.
- German-FMI. (2009). *Federal Ministry of the Interior of the Federal Republic of Germany (FMI) : National Strategy for Critical Infrastructure Protection (CIP Strategy), Berlin*. Retrieved from [http://www.bmi.bund.de/SharedDocs/Downloads/EN/Broschueren/cip\\_strategy.pdf;jsessionid=8](http://www.bmi.bund.de/SharedDocs/Downloads/EN/Broschueren/cip_strategy.pdf;jsessionid=8)
- Glade, T., Anderson , G. M., & Crozier, J. M. (n.d.). *Landslide hazard and risk: 643-674*. *Chichester* , 643-674.
- GOAL. (2015). *Toolkit for Measuring Community Disaster Resilience: Guidance Manual*. GOAL.

- GoN. (2015). *Earthquake in Gorkha*. Nepal, Kathmandu: Ministry of Home Affairs.
- GoN. (2020, 10 10). *Nepal Disaster Risk Reduction Portal*. Retrieved from <http://drrportal.gov.np/risk-profile-of-nepal>
- Government of Nepal. (2016). *Third United Nations Conference on Housing and Sustainable Urban Development (Habitat III) – Nepal National Report*. Kathmandu: Government of Nepal, Ministry of Urban Development. MoUD.
- Guillaumont, P. (2017). *Vulnerability and Resilience:: A Conceptual Framework Applied to Three Asian Countries—Bhutan, Maldives, and Nepal (ADB South Asia Working Paper Series)*. Manila, Philippines: Asian Development Bank.
- Healy, M., & Perry, C. (2000). Comprehensive criteria to judge validity and reliability of qualitative research within the realism paradigm. *Qualitative Market Research* .
- Holling, C. (1973). Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics*. 1-23.
- (2005-2015). *Hyogo Framework for Action*.
- IDP-CapeTown. (2012). *Disaster Risk Management and the Integrated Development Planning Process*. *Disaster Risk Management and the Integrated Development Planning Process*. Cape Town: Disaster Management Solutions.
- ISDR. (2005). *Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters*. United Nations.
- Jane, B., Damon , C. P., & Haddow, G. D. (2008). *Introduction to Emergency Management* . Burlington: Butterworth-Heinemann.
- JICA. (2008). *Capacity Assessment Handbook*.
- Kafle, S. (2012). Measuring disaster-resilient communities: A case study of coastal communities in Indonesia. *J.Bus. Contin. Emerg. Plan* , 316-326.
- Keating, A., Campbell, K., Szoenyi, M., McQuistan, C., Nash, D., & Burer, M. (2017). Development and testing of a community flood resilience measurement tool. *Natural Hazards and Earth System Sciences*. 77–101.
- Mayunga, J. (2007). Understanding and applying the concept of community disaster resilience: A capital-based approach. *Summer Acad. Soc. Vulnerabil. Resil. Build* , 1-16.
- McCreight, R. (2011). *An introduction to emergency exercise design and evaluation*. Plymouth, UK: Government Institutes THE Scarecrow Press, Inc.
- (2004). Explaining risk perception. an evaluation of the psychometric paradigm. Trondheim. In B. E. Moen, T. Rundmo, & L. Sjoberg. Rotunde Publication.
- MoHA. (2017). . *Disaster Risk Reduction and Management Act 2074*. Kathmandu: Ministry of Home Affairs.

- National Research Council. (2012). *Disaster Resilience: A National Imperative*. Washington, DC, USA: The National Academies Press.
- NDRF. (2013). *National Disaster Response Framework*. MoHA.
- (2008). *NSDRM*.
- Obrist, B., Pfeiffer, C., & Henley, R. (2010). 'Multi-layered social resilience: a new approach in mitigation research'. *Progress in Development Studies* , pp. 10(4): 283-293.
- OECD. (2018). Retrieved from oecd.org: <http://www.oecd.org/cfe/regional-policy/resilient-cities.htm>
- P.Coppola, D. (2011). *Introduction to International Disaster Management*. Burlington, USA: Elsevier Inc.
- Paton, D. (2007). Preparing for natural hazard: the role of community trust. *Disaster Prevention and Management: An International Journal* , 16(3) 370-379.
- Pelling, M. (2003). *The vulnerability of cities*. London: Earthscan.
- Pina, G., & Avellaneda, C. (2017). *Local Government Effectiveness: Assessing the Role of Administrative Capacity*.
- Porritt , J. (2006). *Capitalism as if the World matters*. London,UK: Earthscan.
- Preston, J. (2012). *Disaster Education: 'Race', Equity and Pedagogy*. Rotterdam, the Netherlands:Sense.
- Pringle, P. (2020, 10 12). *AdaptME: Adaptation Monitoring and Evaluation*. Retrieved from UKCIP, Oxford,UK: <http://www.ukcip.org.uk/adaptme-toolkit/>
- Punch, K. (2005). *Introduction to Social Research: Quantitative and Qualitative Approaches*. London: Sage.
- Rescher, N. (2003). *Epistemology: An Introduction to the Theory of Knowledge*. State University of New York Press.
- Ross, C. T., Brooks, K., Papadopoulou, L., Orr, P., Sadauskis, R., & Coke, A. (2015). *Community resilience to climate change: an evidence review*. Joseph Rowntree Foundation.
- Scherzer, S., Lujala, P., & Rød, J. (2019). A community resilience index for Norway: An adaptation of the Baseline. *Int. J. Disaster Risk Reduct* .
- SFDRR. (2015). *Sendai Framework for Disaster Risk Reduction (2015-2030)*. UNISDR.
- Sharifi, A., & Yamagata, Y. (2016). A critical review of selected tools for assessing community resilience,. *Ecol. Indic* , 629-647.
- Singh-Peterson, L., Salmon, P., Goode, N., & Gallina, J. (2014). Translation and evaluation of the baseline resilience indicators for communities on the Sunshine Coast, Queensland Australia. *Int. J. Disaster Risk Reduct* , 10116–10126.

Stamer, J. M. (2006). *The hexagon of local economic development and LED in South Africa*. mesopartner.

Torrens Resilience Institute. (2012). *Developing a model and tool to measure community disaster*.

Tran Tuan Anh, T. H. (2016). *Cost-Benefit Analysis of Climate-Resilient Housing in Central Vietnam (No. 2016-RR6), EEPSEA Research Report*. Laguna, Phippines: Economy and Environment Program in Southeast Asia.

Tuan, T., Tran, P., Hawley, K., Khan, F., & Moench, M. (2015). Quantitative cost-benefit analysis for typhoon resilient housing in Danang city, Vietnam. *Urban Climate* , 85–103.

Turner, S. M. (2014). *A Review of the Monitoring and Evaluation Literature for Climate Change Adaptation*. Centre for Urban. Melbourn: RMIT University.

Twigg , J. (2004). Disaster Risk Reduction, Mitigation and Preparedness in Development and Emergency Programming. *Humanitarian Practice Network, Overseas Development Institute, London* .

UN/ISDR. (2009). *United Nations International Strategy for Disaster Reduction*. Retrieved from UNISDR Terminology on Disaster Risk Reduction, Geneva:  
[http://unisdr.org/files/7817\\_UNISDRTerminologyEnglish.pdf](http://unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf)

UNDG. (2008). *Capacity Development Group, Supporting Capacity Development: the UNDP*. Retrieved from <http://www.undp.org/capacity>.

UNDP. (2008). *Capacity Assessment Methodology: Users Guide*.

UNDP. (2008). *Capacity Assessment Practice Note*.

UNDP, N. (2018). 2018-2022 United Nations Development Assistance Framework for Nepal.

UNDRR. (2015). *Sendai Framework for Disaster Risk Reduction 2015-2030*. UNDRR.

UNDRR. (2009). *UNISDR Terminology on Disaster Risk Reduction*.

UNEP. (2007). *Cities and Urban Vulnerability in the context of Urban Environmental Management*.

UNHCR. (2000). *The State of the World's Refugees 2000*. Oxford University Press.

UNISDR. (2005). Rwanda: DISASTER RISK REDUCTION AND PREVENTION IN RWANDA.

UNISDR. (2017). Retrieved 11 20, 2018, from <https://www.unisdr.org/who-we-are/history>

UNISDR. (2017). *Disaster resilience scorecard for cities*.

UNISDR. (2017). *Disaster Resilience Scorecard for Cities: Detailed Level Assessment*. Retrieved from  
 (<[http://www.unisdr.org/campaign/resilientcities/assets/documents/guidelines/UNISDR\\_Disaster%20resilience%20scorecard%20for%20cities\\_Detailed.pdf](http://www.unisdr.org/campaign/resilientcities/assets/documents/guidelines/UNISDR_Disaster%20resilience%20scorecard%20for%20cities_Detailed.pdf)>).



UNISDR. (2018). Making Cities Resilient:.

UNISDR. (2013). *My city is getting ready*. UNISDR.

Vollenweider, X. (2015). *Measuring Climate Resilience and Vulnerability: A Case Study from Ethiopia*. Washington, D.C., USA.: USAID.

Westen, C. V., Alkema, D., Kerle, N., & Kingma, N. C. (2011). Risk Analysis. In C. V. Westen, *Multi Hazard Risk Assessment, Distance education course guidebook* (pp. 6-1). UN university- ITC school on Geo-information Management.

Whiteford, F., Dickenson, L., Dillion, B. D., & Willanson, J. B. (2009). *Emergency planning officers'*. Oxford: Oxford Universit Press.

Yaron, G., Win, K., & Wilson, D. (2017). *Resilience Dividends of Community-Level Interventions: Evidence from Myanmar*. ITAD.

## ANNEX

### ANNEX 1: Questionnaire for data collection

#### 1. Geography

What is the Area of municipality?

- a. Which VDCs, VDCs ward and municipality were merged to make metropolitan city?

S.N.	Name of VDC/municipality	Wards merged

- b. What are the major rivers and lakes of the municipality?
- c. What is the terrain type in general consideration?
- d. What are the adjoining rural and urban municipalities?

S.N.	Direction	Name of rural/urban municipality
1	East	
2	West	
3	North	
4	South	

- e. Specify about climate and weather pattern

#### 2. Demography

- a. What is the total population?
- b. Specify the disaggregated population (ward-wise if possible)

Ward	Male	Female	Others	Elderly	Children	Orphan children	P.W. D	Single woman	Marginalized group

- Male, Female and others
  - Elderly
  - PWD with its type (profound, severe, moderate, mild), Single women (widow)
  - Children
  - Orphan children
  - marginalized groups (dalits, back warded community, poor)
  - Internally displaced population
- c. Specify
- Literacy rate
  - Life expectancy
  - Infant mortality
  - Maternal mortality
  - Migrants (seasonal and non-seasonal)
  - Population growth rate
  - HH percentage with electricity
  - HH percentage with water supply (tap)
  - HH percentage with access to telecommunication
  - HH percentage with access to bank or financial service
  - Average per capita income
  - Remittance
- d. Specify financial information of income and expenditure of the city on every fiscal year.
- 3. Infrastructure information**
- i. Housing

S.N.	Housing types	Percentage
i.	Concrete	
ii.	Semiconcrete	
iii.	Mud	

S.N.	Housing types	Percentage
i.	Owned	
ii.	Rented	
iii.	Institutional	

ii. Roads

S.N.	Types of road	Total Distance
i.	Blacktopped	
ii.	Concrete	
iii.	Gravel	
iv.	Earthen	

iii. Bridges

- Number of Motorable bridge
- Number of Trial bridge

iv. Airport and capacity

- International (under construction)
- National

v. Highway

S.N.	Name of Highway	Length of highway	Linking to	Status

i.				
ii.				
iii.				
iv.				

Linkage at present and future

- vi. Plan for alternative routes for supply during emergency
- vii. Water supply

S.N.	Source/Location	Supply to ward no.	Treatments	Capacity (m3/day)
i.				
ii.				
iii.				

(present and future)

#### 4. Hazard Information and Mapping

- a. Different maps prepared, Supporting Organization and Date of preparation

S.N.	Type of map	Supporting Organization	Date of Preparation
i.	Hazard Map		
ii.	Vulnerability Map		
iii.	Susceptibility map		
iv.	Risk profile Map		
v.	Topographical Map		
vi.	Geographical Map		
vii.	Lithological Map		
viii.	NSK map		

ix.	Other		
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**5. Assets and socio-economy**

a. Specify about Health services

S.N.	Hospitals	Ownership	Capacity	Services
i.				
ii.				
iii.				
iv.				
v.				

S.N.	Nursing homes	Ownership	Capacity	Services
i.				
ii.				
iii.				
iv.				
v.				

S.N.	Health center and health post	Ownership	Capacity	Services
i.				
ii.				
iii.				
iv.				

v.				
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- Number of Ambulance

b. Specify

S.N.	School	Pvt/gvn/total	Students m/f/total	remarks
i.	Primary			
ii.	Secondary			
iii.	H. Secondary			
iv.	College			
v.	Technical Institute			
vi.	University			

c. Specify squatters and slumps

S.N.	Name of squatter	Area	Household	Detail of location and area
i.				
ii.				
iii.				
iv.				
v.				

d. Protected area and heritages

e. Institute and facilities like

- Agricultural

- Pharmaceutical

- Construction company
- Public transport
- Meat shop
- Kirana shop
- Utensils
- Garments
- Medical
- Mechanical
- Cottage industry
- Departmental stores
- Guest house and hotels (capacity and growth, DRR consideration and special needs to be fulfilled to be registered)
- Restaurants
- Star hotel (capacity)

**6. Hazard, Vulnerability and Exposure**

- a. Year/hazard/death/inured/loss
- b. Is there any record of disaster data in municipality? How is it kept and managed (softcopy/hardcopy)?

**7. Preparedness**

- a. Open space for emergency camp, their area and facilities available there
- b. Numbers of fire-engine and their standby location
- c. stockpiled Light Search and Rescue /First Aid items in municipality
- d. trained task forces within the municipality to undertake emergency response, their location and capacity
- e. Any safe shelter/ evacuation building in your municipality?
- f. List of search and rescue materials, with whom and where stored?
- g. stockpiling of emergency relief materials in municipality?
- h. Do you have trained human resources in Camp coordination and camp Management?
- i. EWS and their location and effectiveness
- j. Emergency management center (department during emergency)



- k. Application of municipal bye laws and What incase of violation of municipal bye laws?

**8. Training and Capacity development programs**

- a. List of trainings on DRRM or risk assessment, its title and number of trainees
- b. Training on climate change
- c. Specify Trained community groups or if any training to clubs and others

**9. Others**

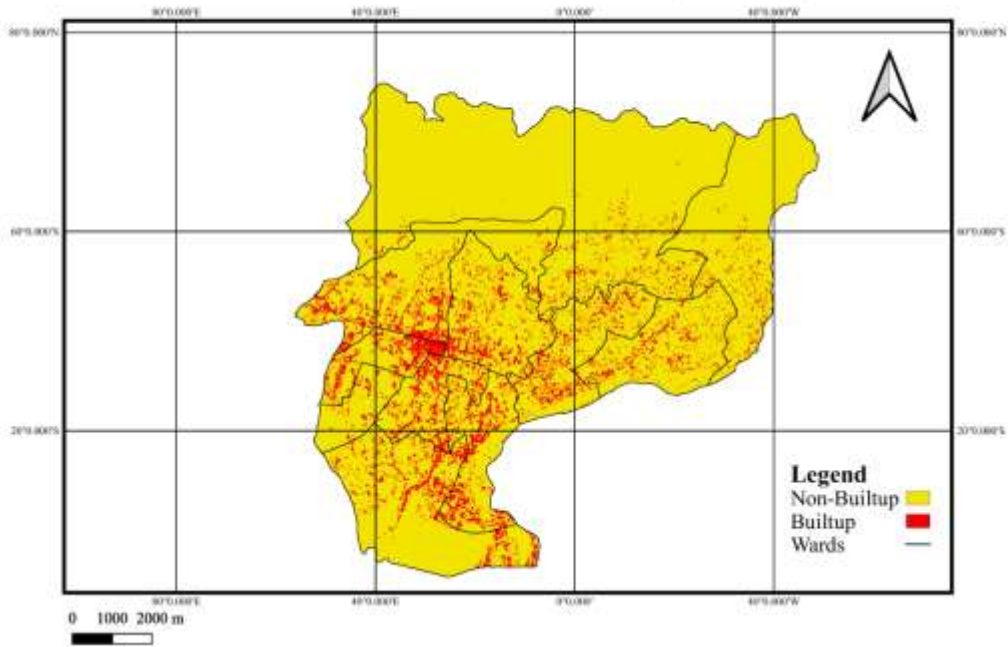
- a. NGOs, their working area and donor
- b. Are there procedures for evacuation, assigning roles and responsibilities?
- c. How is coordination between government line agencies, I/NGOs and private sectors?
- d. Insurance company and types of insurance
- e. Ware house for stocking search and rescue material

**10. Documentations**

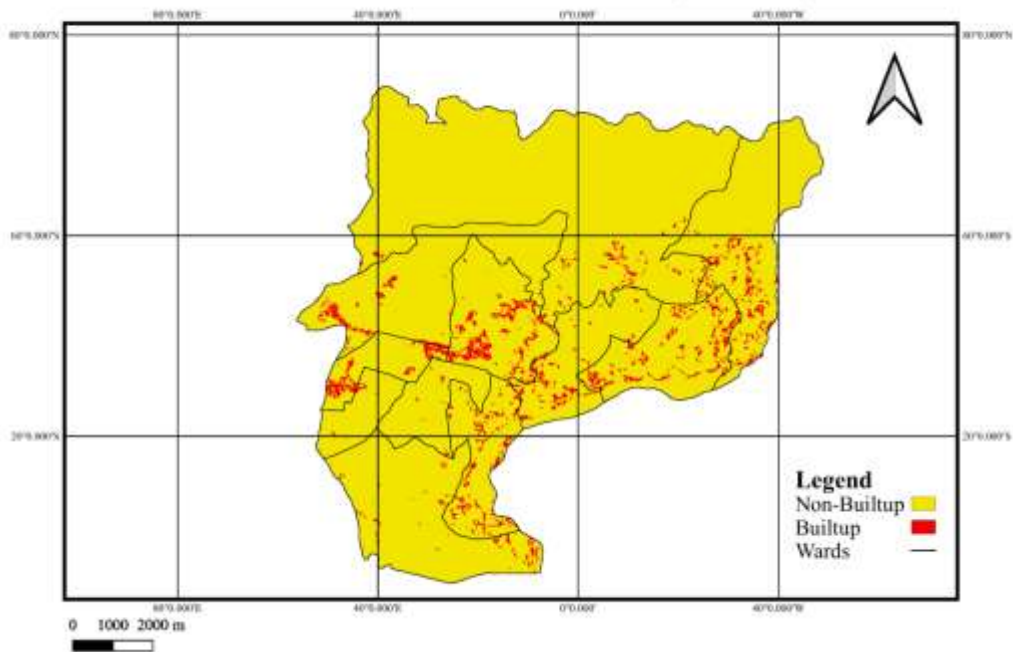
- a. Municipal profile
- b. Fiscal year budget
- c. Policies and documents related to DRRM (DRM act, Disaster management fund operational guideline)
- d. Hazard map, risk map and vulnerability map

## ANNEX 2: Maps

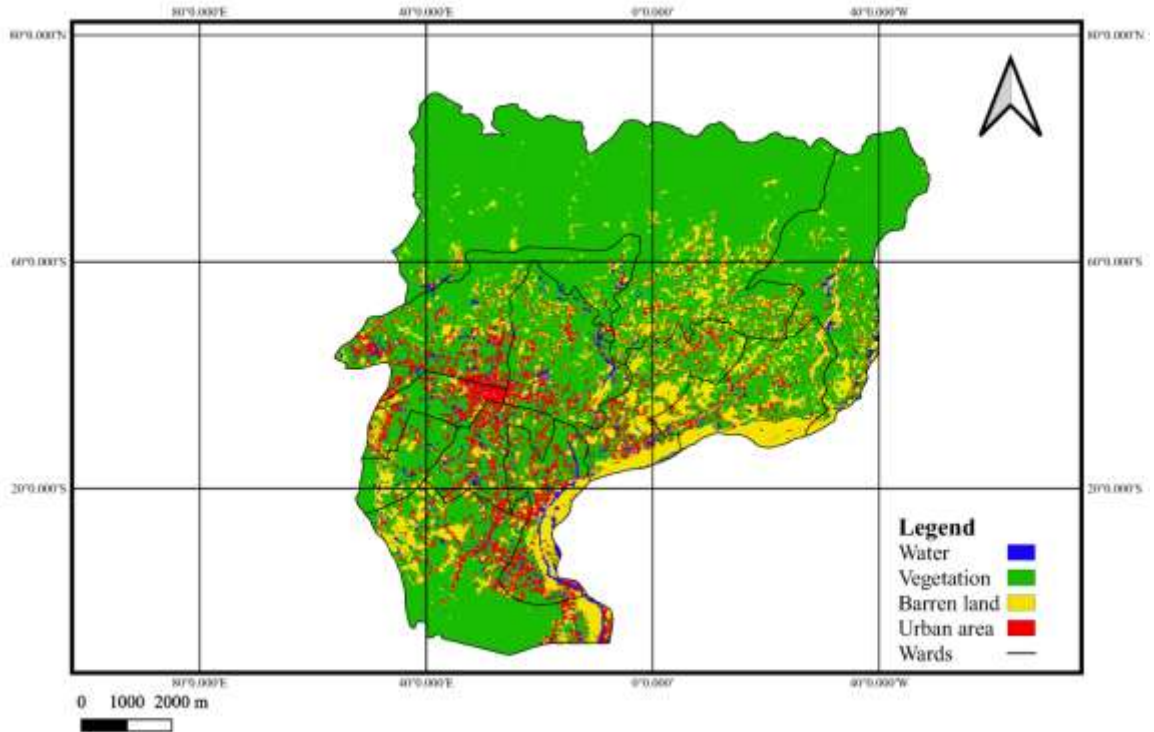
**BUILT-UP AREA OF HARION MUNICIPLAITY, SARLAHI, 2020**



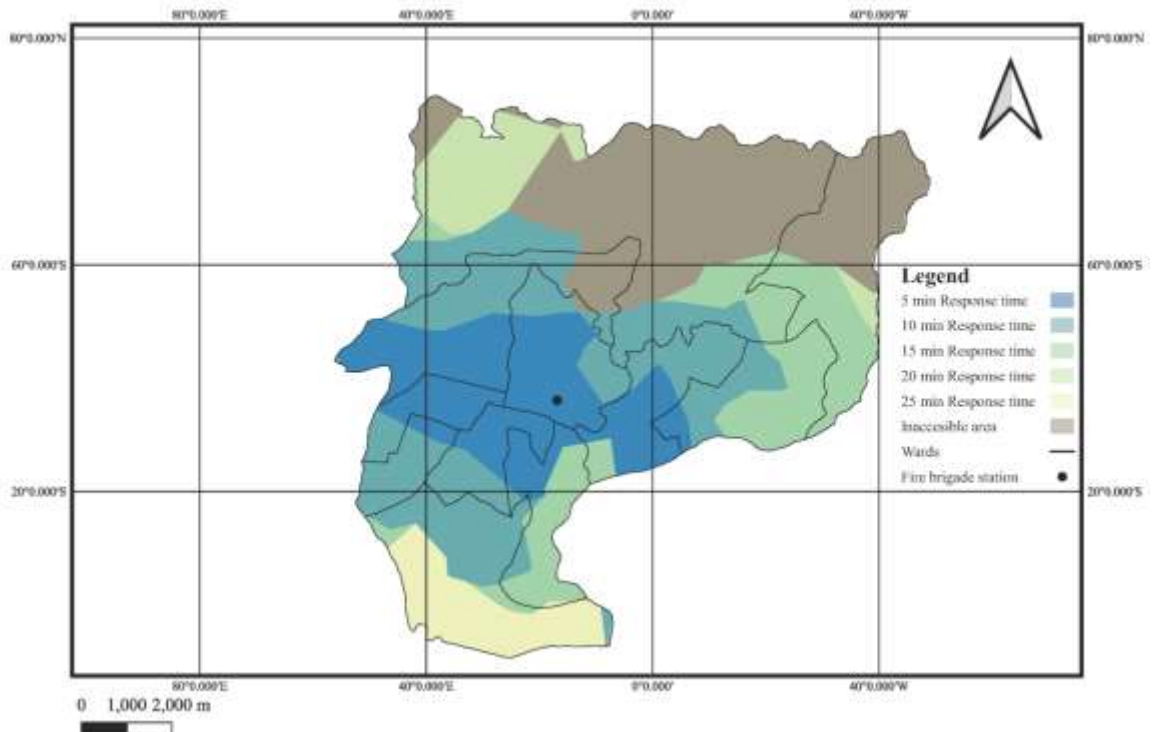
**BUILT-UP AREA OF HARION MUNICIPLAITY, SARLAHI, 2010**



### LANDUSE/LANDCOVER MAP OF HARION MUNICIPLAITY, SARLAHI, 2020



### FIRE BRIGADE RESPONSE MAP OF HARION MUNICIPLAITY, SARLAHI



### FLOOD INUNDATION AREA OF HARION MUNICIPLAITY, SARLAHI

