

A Human Development Approach to Vulnerability Assessment: A Study based on East Sikkim

Thesis submitted in partial fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

by

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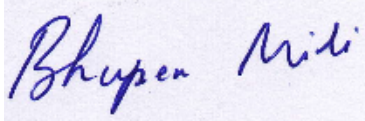
Guwahati-781039, India

November 2017

DECLARATION

I, **Mr. Bhupen Mili**, hereby declare that the matter embodied in this thesis is the result of investigations carried out by me in the Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati, under the supervision and guidance of Dr. Anamika Barua.

In keeping with the general practice of reporting observations, due acknowledgements have been made wherever the work described is based on the findings of other investigators. The sources of secondary data utilized in this thesis are duly acknowledged.



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CERTIFICATE

This is to certify that the thesis entitled “**A Human Development Approach to Vulnerability Assessment: A Study based in East Sikkim**” submitted by **Mr Bhupen Mili**, Roll No. 11614119, for the award of degree of Doctor of Philosophy in the Department of Humanities and Social Sciences of Indian Institute of Technology Guwahati, embodies bonafide record of research work carried out under my supervision and guidance. The collection of materials from the secondary sources has also been done by **Mr Bhupen Mili**. All assistance received by the researcher has been duly acknowledged.

The present thesis or any part thereof has not been submitted to any other University for the award of any degree or diploma.

Dr. Anamika Barua
Associate Professor
Thesis Supervisor



DEDICATION

'To my parents, with love and gratitude'

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ABSTRACT

The thesis aims to examine the *link between poverty and vulnerability* of natural resource dependent rural mountain communities in East district of Sikkim, through capability approach to human development. A human development approach was found to be appropriate for the research work because it is well established that climate change threatens and undermines human development across countries by limiting people's ability to live long and healthy life, to be educated, to have a decent standard of living, and to participate in community life with dignity and self-respect etc. The research was intended to contribute to formulation of pro-poor interventions on multiple dimensions of poverty in the region for strengthening community's resilience. This research builds an understanding on contextual vulnerability which focuses on the capacity of individuals and social groups to respond to, cope with, recover from, or adapt to, any external stress placed on their well-being and livelihoods. Understanding on contextual vulnerability has evolved to acknowledge the complexity of climate-society interactions and its multidimensional nature. It emphasizes that there is an intrinsic link between poverty and vulnerability, which is not only context-specific but is complex and multifaceted. This recognition came with the view that vulnerability is an inherent property of a society determined by multitude of factors such as poverty, inequality, gender patterns, lack of access to basic need such as health care and housing etc. These factors further enhance the vulnerability of the poor community to change, and makes it very difficult for them to break the poverty trap and 'bounce back' from impacts of climate variability in the short term and climate change in the long term. Therefore, climate change has the potential to undermine human development across countries. As such there was a need to identify a suitable approach to human development which considers multidimensional nature of poverty, and would make meaningful contribution to vulnerability reduction.

This thesis draws Sen's capability approach to human development for understanding the multidimensional poverty-contextual vulnerability linkage. The focus is on human capabilities, i.e., *what people are effectively able to be (beings) and to do (accomplishments)*, in other words, 'ability' or 'inherent capacity' to convert resources into sets of capabilities. In the context of multidimensional poverty-contextual vulnerability linkage, the capability approach indicates that vulnerability can be viewed as 'deprivation of human capabilities or freedoms', as uncertainty posed by climate variability and climate change threatens to 'erode human freedoms' and limits the choice of an individual.

The State of Sikkim (India) was selected to understand the ***poverty-vulnerability linkage*** of the rural mountain communities because it is characterized by a multitude of ethnic minorities, tribes and clans, where the dependence on natural resources is high, and impacts of climate change is likely to magnify the risk they face. Sikkim faces physical isolation, limited mobility, poor infrastructure, limited production & livelihood opportunities, poor access to resources, exposure to natural hazards (like earthquake, landslide, snow, storm) resulting in poor socio-economic development. Through **purposive sampling method** four GPUs, (1) Rhenock Tarpin, (2) Sudunglakha, (3) Dolepchen, and (4) Rolep Lamaten were selected from Rhenock and Regoh development blocks of East district of Sikkim to carry out field survey on establishing the multidimensional poverty-contextual vulnerability linkage. Both household survey and FGDs were conducted to capture the linkage. Multidimensional Poverty Assessment Tool (MPAT) was identified as suitable analytical framework for establishing the link between multidimensional poverty-contextual vulnerability. This is because it shares similarities with Sen's capabilities approach on viewing rural poverty as multifaceted,

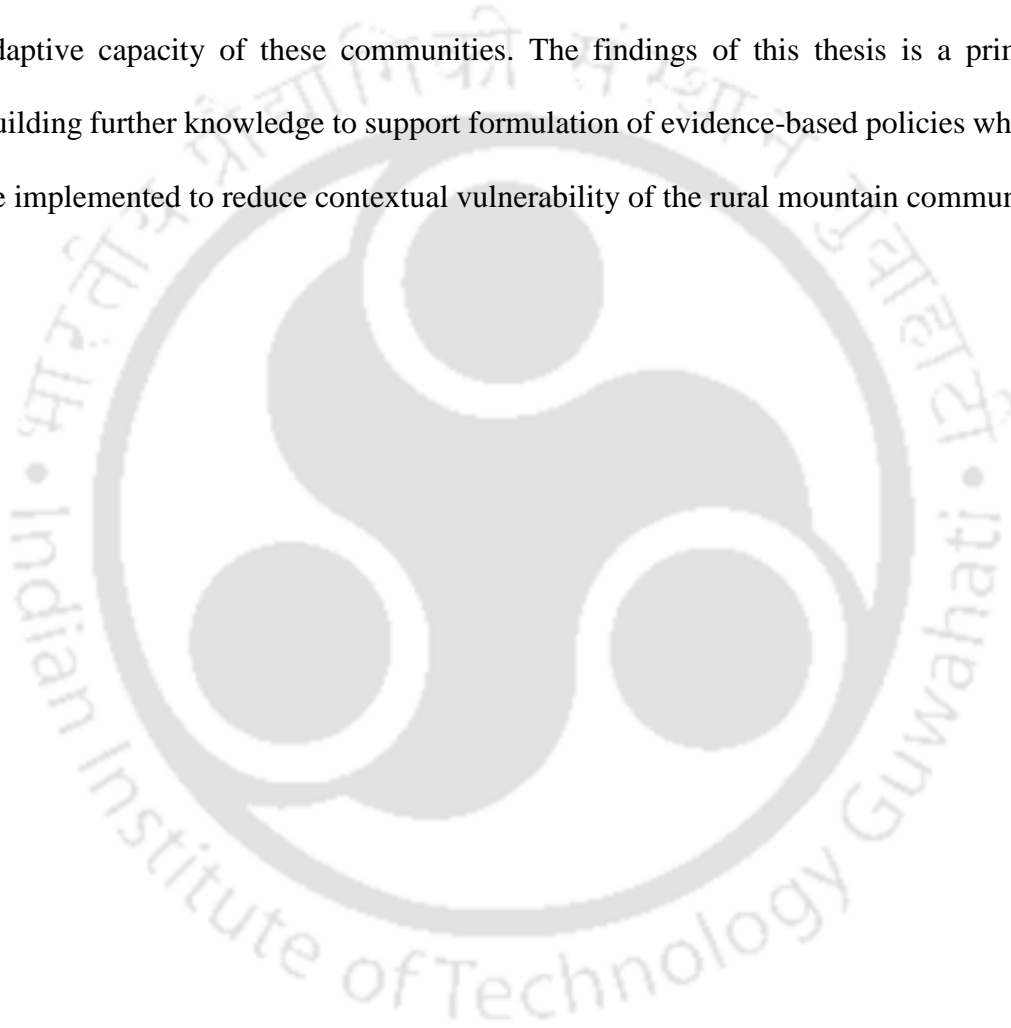
and complex. In particular, MPAT tries to capture the freedoms and the opportunities (capabilities) available to the person.

The multidimensional poverty assessment of East district of Sikkim reveals that the thematic poverty is concentrated in high (30-60%) and moderate (60-80%) poverty levels in the selected study region. Six of the themes of MPAT reflect high poverty (30-60%) – farm assets (43%), education (44%), non-farm assets (47%), health and health care (53%), exposure and resilience to shocks (58%), and food and nutrition security (58%). Four themes reflect moderate poverty (60-80%) – gender and social equality (66%), sanitation and hygiene (69%), housing and energy (70%), and domestic water supply (76%). High level of thematic poverty reflects deprivation in these sectors and has enhanced vulnerability of the communities. Similarly, there was a significant difference in multidimensional poverty among the social groups. The households from the General category had comparatively lower poverty levels than households from OBC and ST category in five of ten themes- (1) non-farm assets, (2) exposure and resilience to shock, (3) food and nutrition security, (4) sanitation and hygiene, (5) housing and energy.

The analysis of the data from the FGDs on instrumental freedoms, reveals that there are lack of freedoms among the communities. As interventions have not been made through a participatory approach, the community lacks political freedom to express their views in the planning and implementation of these interventions. The community also perceived that there is a need to enhance the transparency in implementation of interventions (social safety net schemes) as there is a lack of awareness about these interventions (social safety net schemes) among the communities. Similarly, current status of economic facilities to use the resources (such as farm assets, access to education) is limited in terms of achievements (generate economic opportunities like income

generating employment, skills and knowledge) thereby limiting the community's capability to enhance adaptive capacity.

Therefore, there is a need to enlarge the freedoms available to the communities by prioritizing interventions that are crucial human development. Interventions should ensure equitable development of the vulnerable social groups. It is important to identify the context-specific drivers of vulnerability which need to be addressed for expansion of adaptive capacity of these communities. The findings of this thesis is a primer for building further knowledge to support formulation of evidence-based policies which can be implemented to reduce contextual vulnerability of the rural mountain communities.



LIST OF PUBLICATIONS

Published paper in referred journals:

- a. Anamika Barua, Suparana Katyaini, **Bhupen Mili**, and Pernille Gooch. (2014). Climate Change and Poverty-building resilience of rural mountain communities in South Sikkim, eastern Himalaya, India, *Regional Environment Change*, DOI 10.1007/s10113-013-0471-1.
- b. Suparana Katyaini, Anamika Barua, and **Bhupen Mili**. (2012). “Assessment of adaptation to floods through bottom up Approach: A case study of three agro – climatic zones of Assam”. *International Multidisciplinary Journal The Clarion*, Vol.1, No.1, pp.157-164
- c. Anamika Barua, Suparana Katyaini and **Bhupen Mili**. (2012). ‘Understanding the multifaceted attributes to rural poverty while assessing the water-poverty-climate change linkage in the Indian Eastern Himalaya’, *International Journal of Green Economics* , Vol. 6, No. 1, pp. 73-94

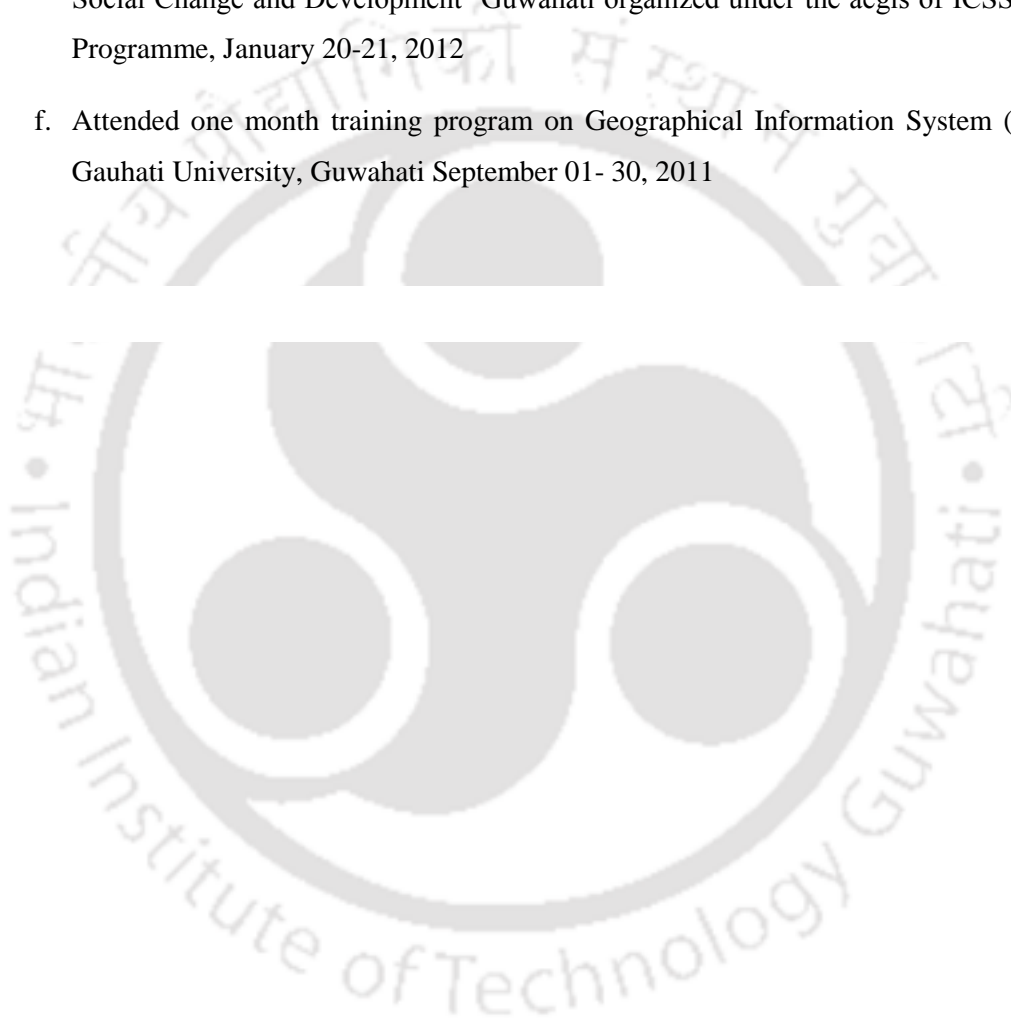
Book Chapters

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- c. **Bhupen Mili** and Anamika Barua, "Building Resilience of Rural Communities to Climate Change through Capability Approach", *The Human Development and Capability Association (HDCA) 2012 International Conference*, 5-7 September, 2012 Jakarta, Indonesia.
- d. Attended Workshop on Questionnaire Design for Social Sciences Research at Sampling and official statistical Unit, Indian Statistical Institute, Kolkata, July 23-27, 2012
- e. Participated in the 'Young Social Scientists' Meet at 'Omeo Kumar Das Institute of Social Change and Development' Guwahati organized under the aegis of ICSSR-NER Programme, January 20-21, 2012
- f. Attended one month training program on Geographical Information System (GIS) at Gauhati University, Guwahati September 01- 30, 2011



ABBREVIATIONS

ASHA	: Accredited Social Health Activist
BDO	: Block Development Officer
BPL	: Below Poverty Line
FGD	: Focus Group Discussions
GPU	: Gram Panchayat Unit
HH	: Households
ICDS	: Integrated Child Development Services
ICMR	: Indian council of medical research
IPCC	: Intergovernmental Panel on Climate Change
MGNREGA	: Mahatma Gandhi National Rural Employment Guarantee Act
NAPCC	: National Action Plan on Climate Change
OBC	: Other Backward Class
OPHI	: Oxford Poverty & Human Development Initiative
PDS	: Public Distribution System
RDA	: Recommended dietary allowance
REDRH	: Reconstruction of Earthquake Damaged Rural Houses
RWSP	: Rural Water Supply Program
SAPCC	: State Action Plan on Climate Change
SC	: Scheduled Caste
ST	: Scheduled Tribe
UNFCCC	: United Nations Framework Convention on Climate Change
UNDP	: United Nations Development Programme
UNEP	: United Nations Environment Programme
WMO	: World Meteorological Organization
WEILAI	: Water, Economy, Investment, Learning and Assessment Indicator

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1 CHAPTER 1: INTRODUCTION¹

This chapter sets the context of the thesis. It introduces the basic definitions of concepts like climate change, climate variability, vulnerability, adaptation, and resilience which will be used throughout the thesis. Particularly it highlights the importance of vulnerability assessment for planning adaptation strategies to climate change. Further, it explains the various approaches to vulnerability assessments and how multidimensional poverty contributes to vulnerability of the rural communities. The chapter ends with the research aims and research questions formulated based on the discussion.

1.1 CLIMATE CHANGE, VARIABILITY, AND VULNERABILITY

In 1992, countries joined an international treaty called as United Nations Framework Convention on Climate Change (UNFCCC), to combat climate change. It is a framework for international cooperation on climate change mitigation and adaptation. **Climate change** is defined as the change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer, while **climate variability** refers to the way climate parameters fluctuate yearly above or below a long-term average value according to the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2014). IPCC was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to provide clarity in scientific view on the existing knowledge on climate change and its potential environmental and socio-economic impacts. According to IPCC (2007) climate change is real and is already taking place. It states that “Warming of the climate system is

¹ Section 1.2 of this chapter have been published in Regional Environmental Change in 2014 entitled “Climate Change and Poverty-building resilience of rural mountain communities in South Sikkim, eastern Himalaya, India”

unequivocal, as is now evident from observations of air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level” (IPCC, 2007). Similarly, patterns and amounts of precipitation are also likely to change, and it is projected that rainfall will increase in some areas and decrease in others (IPCC, 1996).

Although the basic science of climate change is simple, the causes and likely impacts of climate change on human beings are highly complex (Hepburn and Nicholas, 2009). Climate change will have wide-ranging effects on the physical environment as well as on socio-economic sectors like water resources, agriculture, food security, health, etc., (UNFCCC, 2007a). As evident from various literatures (Adger and Kelly, 1999b, UNFCCC, 2007b, Agrawal and Perrin, 2008, Norris *et al.*, 2008b, Paavola, 2008a) the impact of climate change is not uniform across space and time and it varies within the same region/communities/individuals due to the differences in the level of **vulnerability** of different ecosystems, economic sectors, and social groups (O'Brien and Leichenko, 2000). The concepts and definition of vulnerability varies among researchers and is based on different understanding and conceptual frameworks (Adger, 2006). However, the most consistent definition of vulnerability in the context of climate change is “the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes” (IPCC, 2007a). It is a function of the exposure and sensitivity of that system to hazardous conditions and the ability to adapt from these effects (Smit and Wandel, 2006).

$$\text{Vulnerability} = \text{Exposure} + \text{Sensitivity} + \text{Adaptive Capacity}$$

Here **exposure** is in terms of the adverse effects (harm, loss, or damage) of physical events on people, their livelihoods, environment, physical, economic, social, and cultural assets (IPCC, 2001) while **sensitivity** is the degree to which a system is affected by the physical events (IPCC, 2007). Adaptive capacity refers to the potential, capability,

or ability of a system to adapt to climate change stimuli or their effects or impacts (IPCC, 2001).

Vulnerability has multiple interpretation and nuances in climate change literature (O'Brien et al., 2004). Based on this different interpretations (IPCC, 2007, O'Brien et al., 2007, Fellmann, 2012, IPCC, 2014, Murphy et al., 2015) climate change vulnerability can be broadly classified as *outcome vulnerability (end point)* and *contextual vulnerability (starting point)* (Figure 1.1).

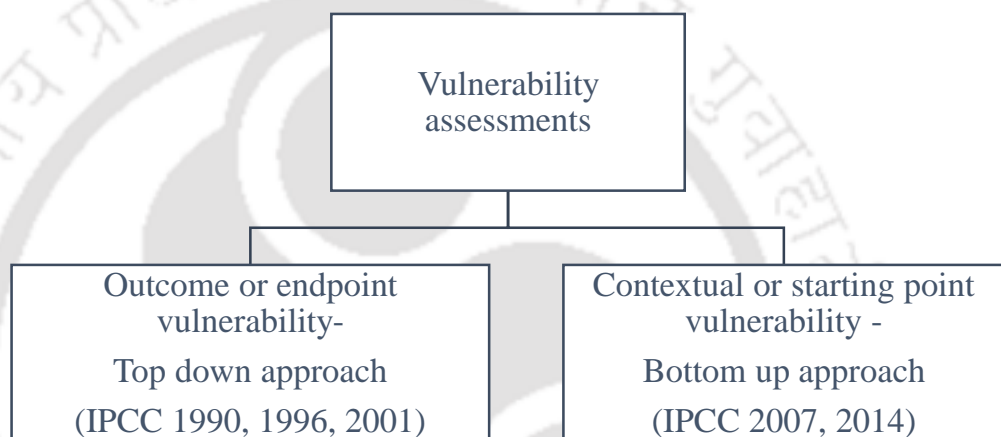


Figure 1.1: Vulnerability approaches to climate change

Outcome vulnerability is determined by the nature of physical event to which a human system is exposed to, the likelihood or frequency of occurrence of the event, the extent of human exposure, and the system's sensitivity to the impacts of a particular event (Ford and Smit, 2004). This studies emphasized on **top down approach** where the focus is on the impacts of long term changes in climate parameters such as rainfall, temperature, sea level rise, glaciers melts etc. The final outcome of this approach is in the form of suggestions for technological adaptation (Ribot, 1995, O'Brien *et al.*, 2007). In contrast, an emerging approach to vulnerability assessment is **bottom up approach** where the focus is on the **short term climate variability** (such as variation in rainfall and temperature) and capacity of individuals and social groups to respond to, cope with,

recover from or adapt to, any external stress placed on their **well-being** and livelihoods (Kelly and Adger, 2000). Hence contextual vulnerability is also referred to as social vulnerability. This approach is important as it acknowledges the complexity of multi-dimensional view of climate-society interactions such as variations in impacts of climate change based on type of society, locations, communities, and individuals. Researchers have indicated that to reduce contextual vulnerability, improvements in institutional arrangements (such as better policy for climate change responses, interventions), socio-economic factors (poverty reductions, equal access to government interventions, schools, health facilities etc.) and technological conditions (such as distribution of advanced seeds, tractors, water pump etc.) are needed. These three aspects are crucial for reducing contextual vulnerability as they influences well-being of an individual, households, groups or communities (Adger, 1999, Sen, 1999, Adger *et al.*, 2004). Further contextual vulnerability considers “climate variability and change” as one among multiple stressors, that enhance one’s vulnerability (Füssel, 2007, O’Brien *et al.*, 2007). Hence, this thesis draws mainly from contextual vulnerability to climate change to obtain a more holistic view of how and why different groups experience climate change to a variable extent as a result of other changes happening simultaneously (weADAPT, 2012).

1.2 CONTEXTUAL VULNERABILITY AND MULTIDIMENSIONAL POVERTY

The contextual vulnerability approaches define vulnerability as the exposure of groups or individuals to stress as a result of social and environmental changes, where stress refers to unexpected changes and disruption to livelihood (Adger, 1999, O’Brien *et al.*, 2007). It aids in identification of ‘who is vulnerable’, ‘what is leading to vulnerability’ and ‘what is the existing capacity to adapt to changes’(Ford and Smit, 2004). Vulnerability here has two components, i.e. an ‘exposure’ component, which primarily reflects location in an area that is subject to climatic hazards, and a ‘social’

component, which depends on a range of individual and community characteristics as well as economic, cultural, and political factors, which may increase susceptibility to harm and reduce capacity to respond to climatic shocks and stresses (Leichenko and Silva, 2014). This approach considers vulnerability as a present lack of adaptive capacity to changing climatic conditions (Okpara et al., 2016). Factors such as income, education, health status, marginalization, food entitlements, access to insurance, housing quality, governance etc., are considered as generic determinants of vulnerability (Blaikie, 1994, Cross, 2001, Brooks *et al.*, 2005). This is in agreement with the fact that the impact of climate change is disproportionately larger on developing and poor economies (IPCC, 2001). Within these economies natural resource-dependent rural **poor** households bear disproportionately larger burden of climate change (Agrawal and Perrin, 2008). According to United Nations Development Programme increased incidences of droughts, famines, floods, variability in rainfall, storms, coastal inundation, ecosystem degradation, heat waves, fires, and epidemics are a result of unprecedented climate variability (UNDP, 2007). It further contributes to poverty and calls for concerted international efforts to combat poverty.

Poverty and vulnerability have an intrinsic link, as poverty is both a condition and determinants of vulnerability (Adger and Kelly, 1999a, Tanner and Mitchell, 2008). The poor tend to be the most vulnerable in society because they face the widest array of risk and insecurities and they lack the assets, resources, savings, insurance and alternative options/choices necessary to deal with shocks and crises when they arise (Shackleton *et al.*, 2008). Hence reducing vulnerability to climate change is linked to poverty reduction (Turner *et al.*, 2003).

There is a spectrum of approaches to assess vulnerability. Some of the earlier studies on vulnerability focused on lack of economic resources such as income, assets, and

resources like land, housing, infrastructure development, insurance, credits facilities as determinant of vulnerability (Liverman, 1990, Adger and Kelly, 1999a, Kelly and Adger, 2000). These studies emphasized on the importance of “access” to resources and “entitlement” to use these resources across various social groups. They argued that diversification of income sources is an important aspect of enhancing resilience which is the ability to recover (Adger, 1999, Kelly and Adger, 2000). For example, individuals who are dependent on agriculture, which is climate sensitive sector, diversify their livelihood opportunities through engaging in casual employment as daily wage labour, in small scale industries, and livestock rearing. Gradually, the focus of vulnerability studies expanded to a more inclusive approach with integration of social factors (social network, human resource, skills, education, health, social influence, knowledge and information) and political/institutional factors (political influence, governance, level of government funding, policies and government processes, governance, organizational factors) (Yohe and Tol, 2002, Brooks, 2003, IPCC, 2007, OECD, 2009, UNDP, 2009, Jones *et al.*, 2010, Land and Hummel, 2013, IPCC, 2014). It is important to emphasize here that Prof. Amartya Sen’s (1999) in ‘Development as Freedom’ has illustrated that individual/communities who have the opportunity to access fundamental needs such as education, health care and others are more empowered and therefore less vulnerable (Liverman, 1990, McCarthy *et al.*, 2001, Brooks, 2003, Gentle and Maraseni, 2012). Further, social and gender equality, political freedoms, and ability to make a well informed choice are crucial for reducing vulnerability (Sen, 1999, Barnett and Adger, 2007).

From this background, it can be inferred that poverty-vulnerability linkages are not only context specific but are complex, and multifaceted (Cohen, 2009, Barua *et al.*, 2014, Leichenko and Silva, 2014). According to Oxford Poverty & Human Development

Initiative OPHI (2017), poverty is a multidimensional issue, and is determined by deprivation people face. The deprivations are in fundamental needs such as water and sanitation, food and nutrition, health, education, housing, employment, and also security, and equality. Removing these factors not only leads to human development but contributes significantly to reducing vulnerability by building people's capabilities. Therefore, this thesis emphasizes on the importance of removing multidimensional poverty to reduce vulnerability. A human development approach was found to be appropriate for the research work because it is well established that climate change threatens and undermine **human development** across countries by limiting people's ability to live long and healthy life, to be educated, to have a decent standard of living, and to participate in community life with dignity and self-respect etc., (Seath, 2010; UNDP, 2009). Therefore, adopting a human development lens to assess contextual vulnerability is crucial to support policy decisions on building resilience of the individuals/communities to climate change. Building resilience initiates with reducing vulnerability by targeting reduction of multidimensional poverty, for which adaptive capacity is the key (Gitz and Meybeck, 2012). Adaptive capacity is the capacity to preserve the existing resources and enhanced adaptive capacity builds resilience, which includes the ability to acquire new capabilities to emerge from adverse impacts of climate change (Wong-Parodi *et al.*, 2015).

It is important to look at **poverty-vulnerability linkages** in mountain communities because mountain regions are highly vulnerable to climate variability and change due to fragile and poorly accessible landscapes with sparsely scattered settlements and poor infrastructure (Sharma *et al.*, 2009). The impacts of climate change such as increased temperatures, melting of glaciers, floods, landslides, droughts, food shortage, etc., are likely to increase the marginality of the poor mountain communities (Xu and Grumbine,

2014) largely due to limited livelihood options, high dependence on rain fed agriculture, remoteness in location, fragile landscape, inaccessibility, poor infrastructure etc. (Gentle and Maraseni, 2012).

Climate change has been predicted to have direct and indirect impacts on ecosystem goods and services in Eastern Himalayan region. This is evident in the loss of biodiversity, negative impact on water balance and availability, and also on socio-economic profile of the local communities (Sharma *et al.*, 2009). Mountain communities have been conserving the biodiversity of the mountainous regions over countless generations through their strong informal rural institutions and community knowledge systems and have contributed significantly to reducing vulnerability to uncertainties arising from global change (Singh *et al.*, 2009). However, in recent times, due to various anthropogenic factors along with cultural changes among the mountain communities, these traditional social institutions as well as the indigenous community knowledge systems have started to erode mainly among the younger generation (Singh *et al.*, 2009). This has also led to rapid degradation of natural resources (Ramakrishnan, 2007) which poses serious threats to the lives and the livelihoods of the natural resource-dependent mountain communities.

While traditional practices such as subsistence agriculture and local knowledge systems provide the much needed coping capacity to offset climate risks, but limited livelihood options, lack of mainstream information, poor access to modern services and inequitable access to productive resources reduce their capacity to cope with future climate events (Gentle and Maraseni, 2012). These socio-economic factors also contribute to poverty within the mountain communities. While poverty tends to be conceptualized as linear and uni-dimensional, rather than as dynamic, multidimensional and differentiated across societies (Tanner and Mitchell, 2008), among mountain

communities poverty can be defined as deprivation of well-being related to a lack of material income or consumption (the conventional measures of poverty), low levels of education and health, poor nutrition and low food security, high levels of vulnerability and exposure to risk, and a profound lack of opportunity to be heard (Chambers, 1988, World Bank, 2000, Sunderlin *et al.*, 2004). This multidimensional and dynamic nature of poverty increases the vulnerability mountain communities to change and places severe limits on their ability to adapt to the environmental changes, therefore it is important to assess the extent of contextual vulnerability of these communities and their capacity to adapt to unforeseen risk including climate risk, through an appropriate framework on poverty-vulnerability linkage.

Based on this discussion, the research aim and questions were formulated, which are discussed in the subsequent sub-sections.

1.3 RESEARCH AIM

This thesis focuses on the contextual vulnerability of communities to climate variability in rural mountainous region of Sikkim in India. Sikkim, located in Eastern Himalayan Mountain, is known to experience diverse weather and climatic conditions due to varying altitudes. The region is characterized by high current rainfall variability, exposing it to extreme weather events such as floods, and droughts. The lives and livelihoods of people are dependent on the natural resources such as land, water, forests of the region (Kollmair *et al.*, 2005, Tse-ring *et al.*, 2010).

Against this backdrop, this thesis aims to examine the link between poverty and vulnerability of these natural resource dependent mountain communities. It adopts a human development approach to inform policies and interventions on multiple dimensions of poverty in the region, to contribute to strengthening community's resilience, i.e., the inherent capacity to recover from current as well as future climate risk.

The research aim is achieved through a set of research questions stated in the next sub-section.

1.4 RESEARCH QUESTIONS (RQ)

The research initiates with a discussion of conceptual framework of assessing contextual vulnerability considering “multidimensional poverty” of individuals/communities. This is aimed to identify the gaps in the existing frameworks to contribute to broadening the understanding on present contextual vulnerability analytical frameworks. This is achieved through adopting the human development approach to vulnerability assessment (RQ 1). To get a deeper insight of the link between contextual vulnerability and multidimensional poverty, this research provides empirical analysis of the extent of multidimensional poverty in the rural mountain communities in Eastern Himalaya (Sikkim) and its influence on the contextual vulnerability of these communities to climate change (RQ 2). The analysis of multidimensional poverty reveals the dimensions of multidimensional poverty, and the study sites where interventions are needed to reduce vulnerability and to build resilience of individuals/communities (RQ 3). These specific RQ which the research aimed to answer are stated in Figure 1.2

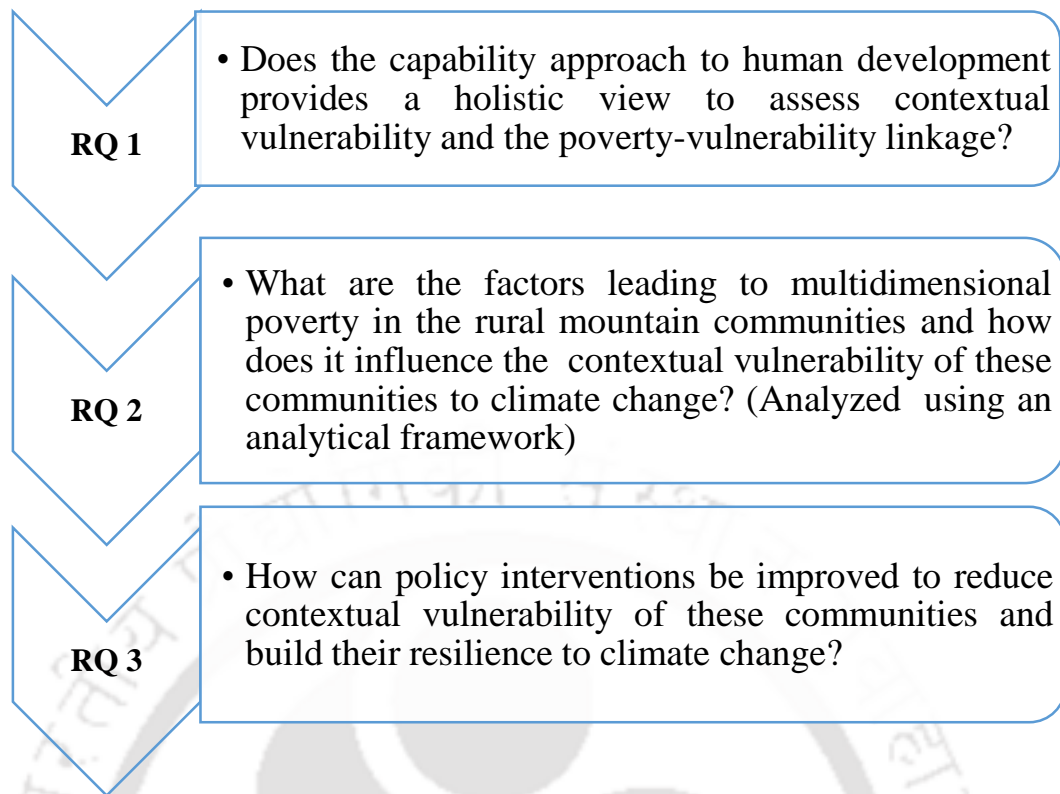


Figure 1.2: Research Questions

1.5 LAYOUT OF THE THESIS

The thesis comprises six chapters. While first three chapters are based on extensive literature review, chapters four and five are primarily based on analysis, and chapter six concludes the research work. A brief description of each chapter is discussed here.

The **first chapter** is the introduction to the thesis and it sets the context of research. It dwells on the conceptual understanding on phenomenon of climate change, vulnerability, poverty-vulnerability linkage, adaptive capacity and resilience building to the impacts of climate change. The discussion leads to formulation of research aim and research questions. The chapter ends with a brief layout of the thesis.

The **second chapter** addresses the first research question as it examines the literature on contextual vulnerability and multidimensional poverty through extensive review of literatures. It identifies the gaps in the present climate change vulnerability literatures by

critically examining it and emphasizes on the importance of capability approach to human development in enhancing the adaptive capacity to the impacts of climate change.

The **third chapter** presents discussions of the data and the research methodology used for carrying the multidimensional poverty assessment to establish the contextual vulnerability of the rural mountain communities of Sikkim (RQ2 and RQ 3). It details out the background of the study area, sampling procedure, data collection tools and methods, field survey, and the data analysis process.

The **fourth chapter** is a discussion of the multidimensional poverty assessment at the district level. In the chapter the themes of multidimensional poverty are examined to identify the themes which need to be prioritized to reduce vulnerability at district level. The chapter dwells on the interventions made in each of multidimensional poverty themes in the context of the capability approach to human development to suggest how the interventions can be improved to reduce contextual vulnerability of these communities and build their resilience to climate change.

The **fifth chapter details out the** multidimensional poverty assessment at the sub-district level. In the chapter the study sites which need to be prioritized to reduce vulnerability are identified this chapters deals with the RQ 3.

The thesis concludes with **sixth chapter** where major findings of all the chapters is summarized. Based on these key recommendations are made in the context reducing the contextual vulnerability of the rural mountain communities of Eastern Himalaya (Sikkim) to climate change The chapter ends with scoping of future research avenues to build knowledge on poverty-vulnerability linkage and capability approach to human development for enhancing the resilience of rural mountain communities to make a meaningful contribution to climate change research.

2 CHAPTER 2: VULNERABILITY ASSESSMENT THROUGH THE LENS OF HUMAN DEVELOPMENT APPROACH: A CONCEPTUAL FRAMEWORK²

This chapter primarily addresses the first research questions by focusing on the existing indicators of contextual vulnerability to examine whether they are holistic and robust enough to enhance adaptive capacity of individuals/communities. Subsequently, identifying the gaps in the present contextual vulnerability frameworks which need to be addressed to inform policy decisions. These research questions are explored through a review of literatures on- (a) **Climate change vulnerability assessments**, (b) **Multidimensional poverty and vulnerability**, and (c) **Human Development approach to Vulnerability assessments**. The second sub-section which is on multidimensional poverty and vulnerability dwells on the influence of multidimensional poverty on vulnerability of the individual/communities. It sets the context for significance of human development approach to vulnerability assessments for informing policy decisions.

The literature reviewed to develop the conceptual understanding includes peer-reviewed journal articles, books, published reports of relevant government departments, academic institutions. These were collected from online repositories such as Science Direct, Elsevier, Wiley Online Library, Springer, and web portals of government departments and academic institutions. The publications of government departments and academic institutions were also collected through visits to these institutions. Some of the institute and libraries visited for the purpose of this research are Indian Statistical Institute, Kolkata; IIT Delhi; IIT Mumbai; Indira Gandhi Institute of Development

² Section 2.1 and 2.3 of this chapter has been published in “*Handbook of Research on Climate Change Impact on Health and Environmental Sustainability*” in 2015 titled “Climate Change and Adaptation Through the Lens of Capability Approach: A case Study from Eastern Himalaya”

Research Mumbai; University of Georgetown, Washington DC; Lund University, Sweden.

2.1 CLIMATE CHANGE VULNERABILITY ASSESSMENTS

According to UNFCCC (2007a), “rising fossil fuel burning, land use changes, many factories producing long-lasting industrial gases, deforestation, and population growth are some of the factors which releases greenhouse gases into the Earth’s atmosphere. These greenhouse gases include carbon dioxide (CO₂), methane (CH₄) and nitrogen dioxide (NO₂), and a rise in these gases has caused a rise in the amount of heat from the sun withheld in the Earth’s atmosphere, heat that would normally be radiated back into space. This increase in heat has led to the greenhouse effect, resulting in climate change”. Climate change poses a serious risk to human and natural systems (IPCC, 2014). It is one of the most important global environmental challenges being faced by humanity today. Both scientific as well as socio-economic studies have brought forth substantial evidences that climate is changing (Adger and Kelly, 1999a, IPCC, 2007, UNFCCC, 2007a, Norris *et al.*, 2008a, American Meteorological Society, 2012, IPCC, 2014). For instance, the fifth Assessment Report (AR5) by IPCC (2014) shows the globally averaged combined land and ocean surface temperature data as calculated by a linear trend show a warming of 0.85 [0.65 to 1.06] °C over the period 1880 to 2012. Similarly, global mean precipitation is predicted to increase in tropical regions but decreases in the subtropics (IPCC, 2007). According to International Organization for Migration (IOM), the impacts of these changes has resulted in sea-level rise, salinization of agriculture land, desertification and growing water scarcity, and climate events such as flooding, storms, glacier lake outburst etc., (IOM, 2008). It has reduced access to drinking water, affected health of the poor, posed a threat to food security (IPCC, 2001). There are already evidences of crop failures arising due to climate events such as droughts and extreme

weather events resulting in migration for better economic opportunities (Adger, 1999, IOM, 2008, Tacoli, 2009). As discussed in *section 1.2* the physical and social impacts of climate change are not uniform or homogenous as the magnitude and direction of climate change across the globe vary and even within the same region experiencing climate change are likely to vary because some ecosystem, economic sectors, or social groups are **more vulnerable** to climate change than others (O'Brien et al., 2004). Therefore, it is crucial to understand and investigate the underlying causes of variation in **vulnerability** among communities and individuals.

The concept of vulnerability has its origin in the discipline of Geography and natural hazard research. It has been defined and assessed in different ways by researchers in various disciplines. At present, this concept is central to various development issues like poverty and human development, ecology, public health, land use changes, and impacts of climate change and adaptation (Fussler, 2007). Vulnerability (in the context of climate change) as defined in *section 1.1* has two main components, i.e. the bio-physical characteristic of the region and the socio-economic characteristic of the population. While the earlier focus of climate change were mainly on the bio-physical aspects of climate change, recent studies have emphasized on the socio-economic vulnerability. For example, Books (2003) defined vulnerability as not only a function of the bio-physical characteristics of climate events, but more importantly an inherent property of a society determined by factors such as poverty, inequality, gender patterns, access to health care and housing etc. Similarly, Adger and Kelly (1999a) have defined vulnerability as the state of individuals, groups, or communities, defined in terms of their *ability to cope* with and *adapt* to any external stress placed on their livelihoods and well-beings. Here, well-being of an individual or community is multidimensional and directly linked to availability of resource, assets and livelihood options (Moser, 2006). Turner *et al.* (2003)

has referred 'vulnerability' as the capacity to be wounded i.e. the degree to which a system is likely to be harmed due to exposure to hazards. Another important definition put forward by Smit and Wandel (2006) and Cutter *et al.* (2003) considers vulnerability as the *susceptibility* of a given population to harm from exposure to the hazard and directly affects the ability to prepare for, respond to, and recover from hazards and disasters. Although there are not general agreements on the concepts and definitions of vulnerability, the central focus of all the definitions is associated with the 'risk of a subject (system, individual, communities etc.)' arising due to unwanted changes. These strands of literature suggest that assessment of **socio-economic and bio-physical** vulnerability are both essential parts of a comprehensive understanding of vulnerability of the individual/communities under consideration. As socio-economic vulnerability dimension has been explored to the lesser extent than the bio-physical vulnerability, the focus of this research is on assessment of **social-economic vulnerability** (i.e. the contextual vulnerability). The contextual vulnerability approach emphasizes on the importance of specific socio-economic context (Fellmann, 2012) such as economic resources, technology, infrastructure, information and skills, institution, and equity etc., as crucial to reduce vulnerability.

Figure 2.1 below shows the most commonly used economic, social and political determinants of contextual vulnerability. The relative prioritization of these determinants of vulnerability is context-specific and has temporal and spatial dimension (Pearson *et al.*, 2008). For example, a study conducted by Adger (1999) and Kelly and Adger (2000) in Vietnam, looked at the processes that shape vulnerability of individuals/collective groups' livelihoods due to exposure to environmental change. Further, it acknowledged that vulnerability is socially and politically differentiated and is determined by complex interactions of social norms, political institution, and inequalities

which influence access, use, management, and governance of resources (Kelly and Adger, 2000). The study particularly emphasized on the vulnerability caused by the differences in “access” to resources and “entitlement” to use these resources across various social groups. The authors argued that equality in access to resources of different social groups, and clearly defined entitlements are significant in reducing vulnerability. In particular, access to diversified income sources, equal distribution of resources, and institutional interventions in the form of infrastructure development, insurance, credits facilities to enhance access to resources have led to decreased vulnerability.

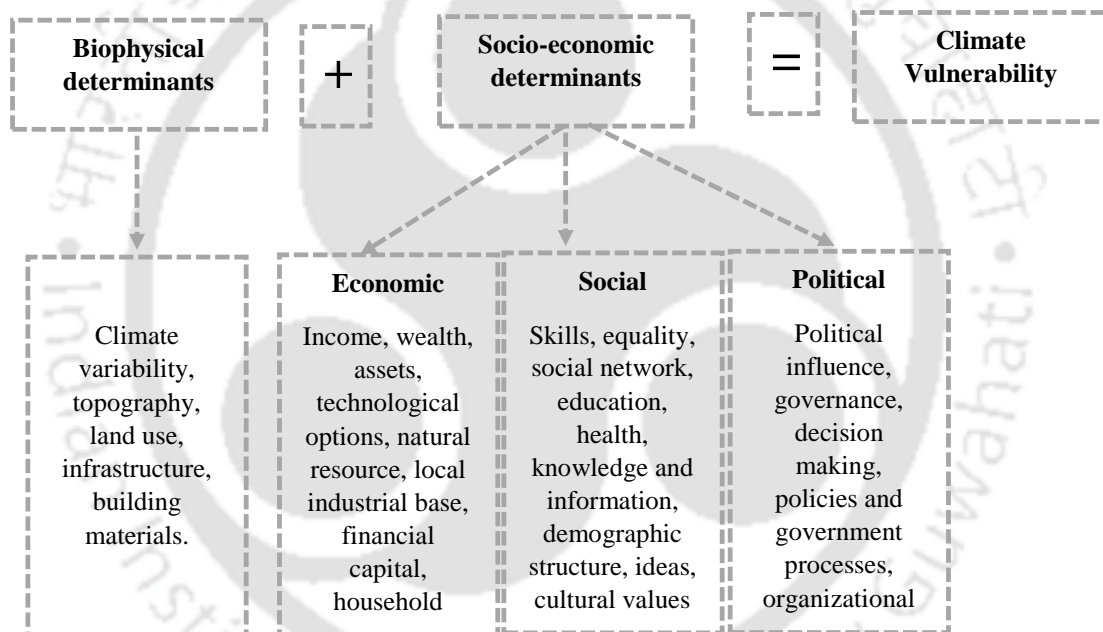


Figure 2.1 Socio-economic determinants of vulnerability

Source: Adapted from Preston and Stafford-Smith (2009) and Fellmann (2012)

In agreement with Kelly and Adger (2000), Brooks (2003) laid emphasis on the

inherent characteristics of a society which influence access to resources such as poverty, inequality, gender norms, as important determinants of vulnerability. Another important study which was carried out by United Nations (2004) emphasized on the influence of environmental factors in addition to economic and social factors on vulnerability. The economic **factors** were described as the economic resources available to individuals,

populations groups, and communities; **social factors** were described as the non-economic factors such as the level of education, security, access to basic human rights, and good governance that determine the well-being of individuals, population groups, and communities; and **environmental factors** were described as the state of the environment within a region. Further, Brooks *et al.* (2005) in addition to access to resources, finance, technology and information, education, healthcare, emphasized on management, distribution, and institutional arrangements. They also focused on the influence in political, social and economic spheres as an important factor in the process of reducing vulnerability and building adaptive capacity. Vincent (2007) developed a framework which looks at the household adaptive capacity through an index comprising five indicators, i.e. economic wellbeing and stability, demographic structure, interconnectivity in higher-level processes, natural resource dependency, and housing quality. Jones *et al.* (2010) established a framework to assess vulnerability at local community level. The framework brought in the dimensions of innovation and flexibility, forward thinking-decision making and governance, and entitlements in addition to assets, knowledge and information, and institutions. The framework incorporates both intangible and tangible (capitals and resource based) components. Another framework related to communities' vulnerability was proposed by Williamson *et al.* (2012b). The approach adopted assumes that access to, and ownership of resource and assets enhances a communities' general capacity to respond to sudden impacts. Further, access to education and health are considered to be crucial to reduce vulnerability. For example, individuals/communities having access to schools as well health centers are assumed to be more empowered and less vulnerable to the impacts of climate change (Liverman, 1990, McCarthy *et al.*, 2001, Brooks, 2003). According to Mutarak and Lutz (2014a), education by enhancing knowledge, skills, and competencies plays an important role in

reducing vulnerability of an individual/community. Leichenko and Silva (2014), argued that considering only income poverty to understand vulnerability to climate change does not give a holistic view as vulnerability is a combinations of **multi dimensions of poverty** including income, social exclusion, lack of assets and capabilities, and policies which are context-specific.

From the above discussions it can be inferred that to identify the determinants of vulnerability, it is important to look beyond the income poverty into multidimensional nature of poverty. Taking this as the basis, the relationship between multidimensional poverty and vulnerability, and the gaps in the present vulnerability assessment frameworks are examined in the next sub-section.

2.2 MULTIDIMENSIONAL POVERTY AND VULNERABILITY

Poverty in the context of climate change has been defined in various ways by researchers to suit the context of the study. From the discussions in section 2.1, it can be inferred that earlier researchers (Liverman, 1990, Adger, 1999, IPCC, 2001) had emphasized on the importance of income/resource poverty as crucial determinants of vulnerability. Here poverty is understood as an individual's or household's ability to obtain basic goods and services where income and consumption are basic parameters (Coudouel *et al.*, 2002). Gradually there was an expansion of dimensions which were considered to understand the extent of poverty. Multidimensional nature of poverty is determined by economic (income, wealth, assets, technological options, natural resource, entitlement), social (social network, human resource, skills, education, health, social influence, knowledge and information) and political/institutional factors (political influence, governance, level of government funding, policies and government processes, governance, organizational factors) (Brooks, 2003, United Nations, 2004, IPCC, 2007, Williamson *et al.*, 2012a, Barua *et al.*, 2014, IPCC, 2014). In agreement with these

authors Sapkota *et al.* (2016) describes vulnerability as a largely socially produced phenomenon, shaped by complex interactions between social, cultural, economic and political processes. Sapkota *et al.* (2016) laid emphasis on the temporal and spatial dimension of contextual vulnerability by suggesting that vulnerability varies with places, and time scales. This indicates that multidimensional nature of poverty adds dynamism and complexity to vulnerability. It also reinforces the need to assess the contextual vulnerability to strategize adaptation process and building resilience of individuals and communities to shocks and change. According to these studies the multidimensional poverty increases the vulnerability of the poor community to change, and makes it very difficult for the poor families or communities to break the poverty trap and ‘bounce back’ from impacts of climate variability in the short term and climate change in the long term. Hence climate change poses a serious threat on the individuals and communities facing multidimensional poverty. These studies argue that to reduce the vulnerability of individuals and communities through enhancing their resilience, it is important to plan for ***pro-poor interventions***, considering multidimensional nature of poverty.

Despite a lot of advancement in research on vulnerability to climate variability and change, there is no general agreements on the indicators of vulnerability (Adger *et al.*, 2004). Further, the research to a large extent has focused on lack of resources. Constraints such as income, access to school, health facilities, road connectivity, and infrastructure are the main focus to describe the component of ‘lack of adaptive capacity’ in vulnerability assessment (see section 1.1). There has been a lack of sufficient attention on the inherent capacity of individuals/communities which can be termed as *means* to convert the *resource* into an *achievement* or a functioning³ i.e. for example ‘able’ to use

³ Functioning are the valuable activities and states that make up people’s well-being – such as a healthy body, being safe, being educated, having a good job, being able to visit loved ones etc. It is the beings (existence) and doings (accomplishments) of a particular individual.

the land (resource) to reduce vulnerability. The inherent capacity is an outcome of the set of opportunities these individuals/communities had, and the choices they made (Murphy *et al.*, 2015).

In agreement to this, Robeyns (2016) argues that having access to resources is not sufficient to know whether she/he is able to use the resources as desired. For instance, if a farmer is from an underprivileged group, uneducated, a female, then in spite of having access and right over the resource, may still be incapable to convert the resources into productive functioning due to socio-cultural construct of the society he/she lives in. This is because the socio-cultural construct of the society governs the gendered and social norms and put this individual in a disadvantageous situation by limiting the capacity to convert the resources available to him/her hence reinforcing vulnerability. Therefore, there is a need to move beyond “access” to look into more complex issues such as “prevalence of discrimination”, “quality of schooling and health facilities” etc., i.e. the real ability to attend schools and utilize health facilities (Unterhalter *et al.*, 2007, Unni, 2009b, Thorat *et al.*, 2016). According to Robeyns (2005), the ability to convert the resources available depends on the characteristic of the society, communities, as well of the individual. Hence, it is important to understand the institutional constraint that are placed on the members of the society (such as gendered discriminations, lower caste, or religious groups), which prevent them from accessing education and jobs with better returns (Unni, 2009b). For example, a study conducted by Unni (2009b) in India, shows how despite primary schools in almost every village, the capacity to stay within the formal educational system to acquire higher levels of educations are limited for lower caste (ST/SC), minority communities as well female members due to economic constraints, social and cultural norms. According to Thorat *et al.* (2016), children of upper caste household in India had never suffered discrimination in the society leading

to better achievements (within the same villages) to education/knowledge than compared to those children of Dalit/ST household who have suffered historical deprivation/isolation in the society. Similarly, Unterhalter et al. (2007) mentioned “the same level of resources may be quite inadequate for children who are shy, hungry, with poor concentration, always sit at the back of the class and talk a minority language”. Hence while school, as a resource is available or accessible but to assume that having access to resource will lead to an outcome such as being educated, able to access information, able to get a job, become financially independent etc. is not assured, and if such functioning are not achieved then having access to resource will not reduce vulnerability. This is because, their effective opportunities to undertake the actions and activities that they want to engage in, may be restricted due to factors such as societal hierarchies, discriminating practices, norms etc.

Vulnerability also results from a lack of freedom to make a choice, specifically poor and marginalized are vulnerable as they have constrained freedom. This aspect has not received adequate emphasis in the vulnerability assessment although it is a significant contributor to vulnerability. The freedom to make a choice is linked with capability, a lack of this freedom leads to a lack of adaptive capacity. Studies shows that large number of people in rural areas lack the freedom to choose a profession and are engaged in farming not by choice but because it is a traditional occupation (Birthal *et al.*, 2015, Agarwal and Agrawal, 2017). It is important to mention here that although occupations are no longer determined by the institution of caste and tribes, it is still influenced by the historically-acquired capital. The acquired capital is in tangible forms (land, money, and other assets) and intangible forms (particularly networks) (Kumar, 2013). Further, Prof. Amartya Sen in ‘Development as Freedom’ argues that human development can be viewed as a process of expanding the freedoms people have and enjoy (Sen, 1999). The

Sustainable Development Goals (SDG) which are a ‘ universal call to end poverty, protect the planet and ensure that all people enjoy peace and prosperity’ are intended to contribute to human development in the wake of climate change (UNDP, 2017b). It aims to **end poverty and improve well-being** through access to education, employment and information, better health and housing, reduced inequality while moving towards sustainable consumption and production. These factors are crucial to build adaptation to the impacts of climate change. Therefore to break the vicious cycle of multidimensional poverty and thereby reduce vulnerability to climate variability and change, it is important to take a **human development** approach to enhance people’s resilience and expanding their adaptive capacity. This is only possible if the focus of vulnerability assessments moves away from means or resource to achievements and functioning, i.e. on the human development aspects.

The next sub-section dwells on the human development approach to vulnerability assessment.

2.3 HUMAN DEVELOPMENT APPROACH TO VULNERABILITY ASSESSMENTS

Climate change poses an enormous challenge in the pathways to human development, and development processes are contributing to speeding up of climate change. In this work, the focus is only on the first aspect, i.e., vulnerability to climate variability and change. Uncertainty posed by climate variability and climate change threatens to erode human freedoms⁴ and limits the choice of an individual (UNDP, 2007). Hence it is important to assess vulnerability from a **human development perspective**, with the aim

⁴ Freedoms here refers as the sets of valuable options or alternatives, in the sense of opportunities, that do not exist only formally or legally but are also effectively available to the individual/communities (Robeyns 2016)

of **broader social development** to increase the response and adaptive capacity of human population (Fellmann, 2012).

There is an urgent need to move beyond resources, to look at the real freedoms people have to utilize these resources. Sen (1999) in his capability approach argues that utility of resources varies among different individual and are likely to be influenced by various important factors which shape the use of these resources. These factors are largely political, social, economic, environmental conditions that are shaped by personal factors, social and gender norms, power relations, opportunities etc. Further, Sen emphasizes that an interplay of these factors influence the use of resources. For example, gender equality in school education would build her knowledge and skills, but to use this knowledge and skills in availing economic opportunities requires political will to reduce the mismatch in the set of knowledge and skills the girl has acquired and livelihood opportunities in the local labor market (UNDP, 1990, Sen, 1999). Thus, there is a need to expand the focus from resources and opportunities as *end* in themselves to focus on freedoms people have to convert those resources/facilities into valuable achievements, which in turn will enhance capacity to adapt and reduce vulnerability.

As the human development discourse is conceptually underpinned in the capability approach by Sen (1999), it has been used in this research to understand the essential components of human development (UNDP, 2017a). The capability approach prioritizes capabilities over resources, adopts a multidimensional view, and takes a broad focus on the constraints (conversion factors and choices) that may restrict human lives (Hick, 2012). Therefore, integrating the concepts of **Capability Approach** in climate change vulnerability assessments would give us a broader perspective through inclusion of wide range of factors that mediates the conversion of resources into actual achievements that people values.

The next sub-section details out the essential components of human development according to the capability approach.

2.3.1 THE CAPABILITY APPROACH:

The Capability Approach is a broad normative framework for the evaluation and assessment of individual's well-being and social arrangements, the design of policies, and proposals about social change in society (Robeyns, 2005). The core characteristic of Capability Approach is its focus on *what people are effectively able to do and to be* i.e. on their capabilities. Capability Approach contrasts with the approaches that concentrates on "utility". The term utility can mean different things and it loosely implies anything having value, which is considered to be as indicator of person's wellbeing (Unni, 2009b). However such an approach, as stated by Unni (2009b) is deficient in analyzing the motivation behind a person's choice. Against this backdrop, Sen (1993) argues that our evaluation and policies should focus on what people are able to do and be on the quality of their life, and on removing obstacle in their life so that they have more freedoms to live the kind of life they have reasons to value (Robeyns, 2016).

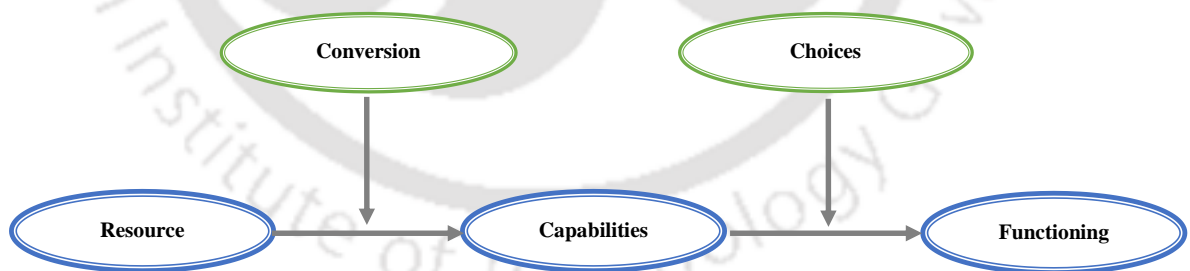


Figure 2.2: Theoretical foundation of Capability approach

Source: Sen (1999)

The theoretical foundations of Capability Approach by Sen (1999) is based on three key concepts: resources, capabilities, and functioning (Alkire, 2003, Verd and Lopez, 2011) (Figure 2.2). Crucial distinction in the Capability Approach is the distinction between the *means* such as goods and services on one hand, functioning and capabilities

on the other hand (Robeyns, 2005). To explain the difference between means and functioning Sen has used a classic example of bicycle. According to Sen we are not interested in bicycle because it is an object from certain material with specific shape and color but because of its function, i.e., it can take us to places where we want to go and in a faster way than if we were walking (Robeyns, 2005). This characteristic of a good, enables a functioning i.e. the bicycle enables the functioning of mobility i.e. to be able to move oneself more freely and rapidly. Functioning are the valuable activities and states that make up people's well-being, such as a healthy body, being safe, being educated, having a good job, being able to visit loved ones etc.,(Alkire, 2005). It is the *beings (existence)* and *doings (accomplishments)* of a particular individual (Sen, 1999).

As shown in Figure 2.2 between resources and functioning, Sen introduces the term "Capability". Capabilities correspond to the various options that a person can choose from, according to his or her values (Sen, 1999). It is, thus, a set of vectors of functioning, reflecting the person's freedom to lead one type of life or another to choose from possible livings. It is important to note here that while capabilities are composed of a bundle of achievable functioning, functioning are the achievements that a particular individual finally achieves (Robeyns, 2005). Sen (1999) also argued that goods and services are not the only means to people's capabilities, **conversion factors** are crucial means in converting the resources into sets of capabilities.

The conversion factors can broadly be classified into three groups. First, *personal conversion factors* (physical conditions, intelligence, skills, knowledge, age, sex etc.) which influences how a person convert the characteristic of a commodity (resource) into a functioning. Taking the example of bicycle given by Sen (1999), if a person is disable or in bad physical conditions, or has never learned to cycle, then bicycle will be of limited help to enable the functioning of mobility. Second social conversion factors (customs,

public policies, societal hierarchy, power relations etc.) play a role in conversion from characteristic of good or resources or commodity to the individual functioning. Again taking the example of bicycle, if there are no paved roads or if social or legal norms, does not allow a woman to cycle, than it restricts the use of the good (bicycle) to enable the functioning. Third, *environmental conversion factors* (as weather, geographical locations, clean air, and climate, infrastructure like roads, buildings, bridges, and transportation) also influences the conversion of the characteristic of the good/commodity/resources into a functioning. For example, for a person living in plains, it will be easy to use the bicycle to enable the functioning of mobility while for a person living in a mountainous region, it becomes much more difficult or impossible to use the bicycle to enable the functioning due to the terrain. Hence, as mentioned by Robeyns (2005) knowing the goods a person owns or can use is not sufficient to know which functioning she/he can achieve; therefore, we need to know much more about the person and the circumstances in which she/he is living.

Further, the Capability Approach emphasizes on enlarging the freedoms available to an individual/community. Sen (1999) has classified the freedoms important for human development into substantive and *instrumental* freedoms. *Substantive* freedoms are the freedoms that people actually have (e.g. such as being healthy, well nourished, escape morbidity, being literate, freedoms of speech, and political participation) whereas *instrumental* freedoms in the form of political, social, economic, transparency and protective security are actually the means to achieve these substantive freedoms. These instrumental freedoms emphasizes on the importance of various kinds of rights, opportunities, and entitlements which play a crucial role in expansion of capabilities (Sen, 1999).

The next section describes the conceptual framework on understanding the multidimensional poverty- contextual vulnerability linkage through capability approach to human development.

2.3.2 THE CONCEPTUAL FRAMEWORK

In this section the relevance of conceptual framework of Sen's capability approach to human development in understanding contextual vulnerability is discussed (*Figure 2.3*). The contextual vulnerability can be viewed as the 'deprivation of capabilities or freedoms' which is influenced by social and environmental conversion factors. Hence to enhance the adaptive capacity of the communities, it is important that interventions focus on expansion of the freedoms/opportunities available to the people to strengthen their capabilities.

According to Sen, capability approach views expansion of freedoms as both primary end and primary means of development which plays constitutive (substantive freedoms) as well as instrumental (instrumental freedoms) role in the process of human development. Thus, it is important to focus on the instrumental freedoms as it acts as the means to achieve better functioning (Sen, 1999) which would lead to higher adaptive capacity. The five types of instrumental freedoms- (1) political freedoms, (2) economic facilities, (3) social opportunities, (4) protective security, (5) transparency guarantees are discussed in the next section

2.3.2.1 POLITICAL FREEDOMS

Political freedoms are mainly concerned with *participation, accountability, and transparency* in the system of governance. These are considered as key aspects in reducing vulnerability according to Hill (2013). This is substantiated by a study conducted by CARE (2014) where good governance is considered as essential in successful implementation of interventions to reduce vulnerability. For instance, the key

functions of governance such as information gathering and dissemination, resource mobilization and allocation, skill development and capacity building, providing leadership, and networking with other decision makers and institutions are crucial for building adaptation to the impacts of climate change (IPCC, 2008). Similar functions of governance such as granting ownership and rights in the form of accessibility to land, forest, and water also play a crucial role in climate change adaptation. Therefore, having the freedom to elect Government and participate in the functioning of the governance are crucial to reduce vulnerability. This framework endorses the need to assess whether people *participated in formulation and implementation of policy interventions to understand their political freedom*. This is crucial for reducing the vulnerability of the communities and building adaptive capacity among rural communities as it ensures that the interventions are targeted and demand driven and reflect the accessibility and accountability in the governance system.

2.3.2.2 ECONOMIC FACILITIES

Economic resources are considered as an important indicators to reduce vulnerability to climate change as it enlarges the possessions of resources among the individual/communities to build adaptation (Adger, 1999, Adger and Kelly, 1999a, IPCC, 2001, IPCC, 2014). It has been observed that the ability to use the available resources for the purpose of production, consumption and exchange are limited due to various factors like lack of proper market, poor infrastructure such as roads, poor networking etc. According to Adger (1999) individuals having economic facilities in the form of access to market, employment opportunities, opportunities for agriculture etc., are assumed to have higher adaptive capacity. Therefore, it is essential that facilities for economic activity should be available to each and every member of the society.

Resource includes food, clothing, housing and natural resources such as water, forest, and land. These factors are crucial and helps in coping with climate induced hazards such as earthquake, drought, flood, erratic rainfall etc. Similarly, both farm (land holding size, fertile land, agricultural inputs etc.) and non-farm (TV, household assets etc.) assets determine the ability to cope and adapt to the impacts of climate change (Barua *et al.*, 2014). For instance both farm and non- farm assets are a form of reserve property that can be sold off during crisis (CARE, 2014). Further the opportunity for income generations in the form of wages, savings, credits, and remittances are important in adapting to climate change (Barua *et al.*, 2014). Therefore, to enhance adaptive capacity and reduce vulnerability, economic facilities in the form of *income generations, assets, resources, access to market, credits, infrastructure, skills, and knowledge and employment opportunities* are crucial.

2.3.2.3 SOCIAL OPPORTUNITIES

Social opportunities deal with the social norms and culture prevalent in the society such as caste, religion, and gender. Social norms limit and restrict individual's decision-making power and status in the household and family; it also limits access to participation and voice in the public and social sphere (Ferrant, 2013). Accessibility to services such as schools, health, economic facilities, and political freedoms are likely to be hampered due to prevalence of social and cultural norms leading to discrimination on the basis of gender, race, caste, religion etc. The utility of interventions focused on distribution of resources, assets, and income varies among individuals/communities in a socially diverse society. This variation is attributed to difference in caste, race, religion, and gender (Unni, 2009a).

Equal social opportunities are crucial in enhancing the adaptive capacity of the people as the marginalized sections of the society who lack social opportunities are highly

vulnerable to climate change. Providing equal opportunities and choices irrespective of their caste, race, religion and gender would help them withstand the impact of climate change. *Therefore the research is intended to look at whether individual/communities from different gender and social groups have equal opportunities to participate in social process and activities, and equal access to education and healthcare.*

2.3.2.4 PROTECTIVE SECURITY

Protective security is focused on protecting the vulnerable section of the population like aged, unemployed, poor, (Sen, 1999). Various studies have revealed that the impact of climate change varies across societies, and within societies it is the children, women, unemployed and old age people who are more vulnerable to the impacts of climate change (Adger and Kelly, 1999a, UNFCCC, 2007a, Agrawal and Perrin, 2008, Norris *et al.*, 2008a, Paavola, 2008b). Sense of social security in terms of pension, unemployment benefits and *social safety net schemes* for the poor and vulnerable are necessary for the well-being of the vulnerable section of the society. According to Mark *et al.* (2008), social service provision, social safety nets, and public work programs enhances social protection from the impacts of climate change and are crucial for building adaptive capacity of the communities.

2.3.2.5 TRANSPARENCY GUARANTEES

Transparency guarantees refers to transparency or 'openness' in functioning of the governance during the process of implementation of policies, schemes, projects and programs (Sen, 1999). Governance includes complex interaction between and within government, business and civil society (Adger *et al.*, 2003), therefore transparency is of utmost important for good governance. Transparency guarantees plays an important role to ensure openness and accountability in transactions against corruption and to maintain faith in market processes (Barnett and Adger, 2007). Indicators like *access to*

information, access to government intervention, corrupt free governance build the awareness of the communities and is crucial in building adaptive capacity. Transparency in the system of governance can be instrumental in the process of attaining political freedoms along with economic development of the society.

Figure 2.3 enlists these five instrumental freedoms. The advantage of using the capability approach to human development in understanding contextual vulnerability is that these freedoms are generic in nature and the interpretations are very context-specific. These freedoms provide a holistic view of the political, social, and economic context as the freedoms supplement and complement each other (Johnson, 2009). That is the freedoms are inter-related and deprivation of one form of freedoms might lead to deprivation of another forms of freedoms. To illustrate, a person who has been deprived of education (social opportunities) due to lack of income (economic opportunities) may fail to participate in political process due to lack of knowledge, resulting in failure to elect dedicated leaders, thereby leading to lack of good governance (political freedoms) and so on. Therefore, it is important to analyze each and every freedom.

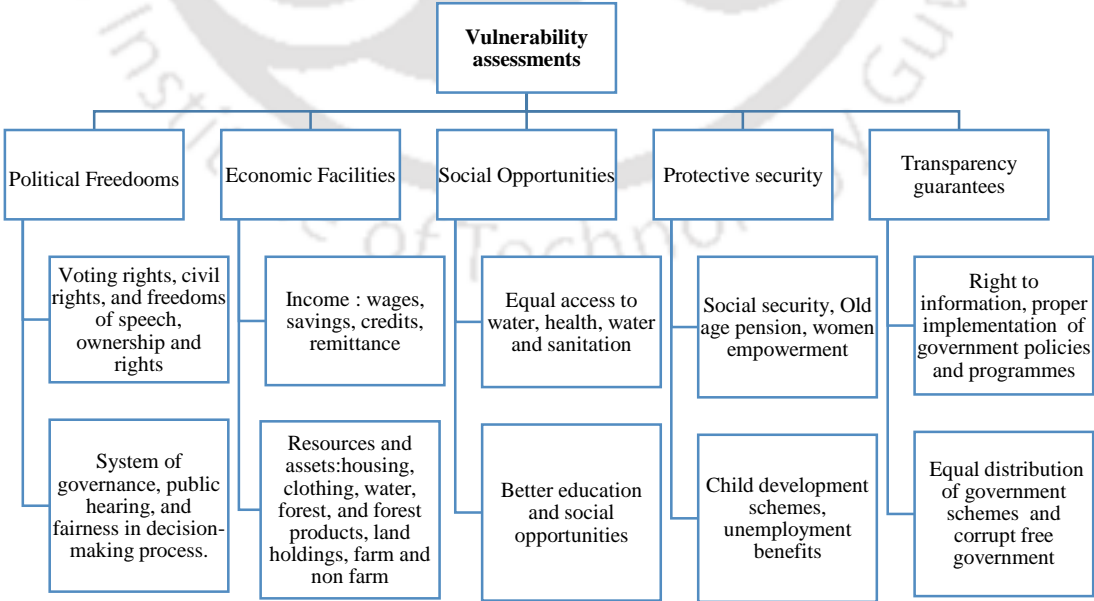


Figure 2.3: Freedoms essential for reducing vulnerability

2.4 SUMMING UP

The discussion in the chapters was based on the notion that vulnerability is the ‘deprivation of capabilities’ and therefore ‘enhancement of capabilities in the form of expansion of real freedoms and choices’ reduces contextual vulnerability and enhances the resilience of individuals/communities. To assess the vulnerability to the impacts of climate change it is crucial to evaluate substantive and instrumental freedoms - quality of life, wellbeing, effectiveness of social arrangements, opportunities and their barriers.

Relevance of the framework on capability approach to human development in assessment of contextual vulnerability discussed in the chapter was used in the case of rural mountain communities of Sikkim. A case study approach was adopted because it is suitable for understanding the dynamics present within the case (Eisenhardt, 1989), and helps in unearthing the contextual conditions of a particular location (Yin, 2003). The next chapter details out the selection of study area, data collection procedure, and the research methods used for analysis.

3 CHAPTER 3: METHODOLOGY⁵

The chapter dwells on the methodological steps to assess contextual vulnerability based on human development approach. As the human development approach establishes the link between multidimensional poverty and contextual vulnerability, the chapter details out the process of estimating the extent of multidimensional poverty in the rural mountain communities (RQ 2).

The chapter ends with a discussion on the method used for identifying the themes of multidimensional poverty that need to be prioritized, the areas which are most vulnerable and need to be focused on, and the nature of policy interventions needed to reduce contextual vulnerability of the rural mountain communities in Eastern Himalaya (Sikkim) (RQ 3).

3.1 CONTEXTUAL VULNERABILITY ASSESSMENT: MULTIDIMENSIONAL POVERTY ASSESSMENT TOOL (MPAT)

This section begins with the background of the study area, deals with the sampling method and procedure, data collection methods and techniques, field survey, and the methods used in data analysis.

3.1.1 BACKGROUND OF THE STUDY AREA

Sikkim, a State located in Eastern Himalaya was selected for vulnerability assessment in the context of climate change. Although the state's contribution to global emission is negligible, adverse effects of climate change are evident in the state as it

⁵ Section 3.1, 3.1.2, 3.1.3 and 3.1.5 of this chapter has been published in *Regional Environmental Change* (2014) and *International Journal of Green Economic* (2012) titled "Climate Change and Poverty-building resilience of rural mountain communities in South Sikkim, eastern Himalaya, India, *Regional Environment Change*"

has sensitive bio-physical conditions (vulnerable to earthquakes, and landslides), poor socio-economic development (Barua *et al.*, 2014). Further, a large proportion of rural population (nearly 70 %) rely on climate sensitive livelihood sectors such as agriculture and allied activities (Government of Sikkim, 2011d). Sikkim is situated in the inner ranges of the mountains in the Himalaya with elevation ranging from 300 to 8583 meters (above means sea level) (Government of India, 2014). It shares international boundaries with Tibet, Bhutan, and Nepal. Sikkim is geographically a small State (Figure 3.1), constituting a mere 0.22 % of the total geographical area of India (Government of India, 2011a). Changes in temperature (increase of 0.2 degree per decade) and rainfall (increase of 50 mm per decade) have been seen in the State with winters becoming increasingly warmer and drier (Ravindranath *et al.*, 2006, Seetharaman, 2008, IISC, 2010, Tambe *et al.*, 2012a). Temperature and rainfall data shows a trend towards warmer nights and cooler days, with increased rainfall except in winter (Seetharaman, 2008). According to the State Action Plan on Climate Change (SAPCC), rainfall patterns have become erratic, monsoons are usually late and in general torrential rainfall has replaced the monsoon drizzle (Government of Sikkim, 2011d). Although, culturally people in the State consider the air, soil, water and the biota all sacred and any human-induced perturbation to spell disaster for Sikkim as a whole (Ramakrishnan, 1998), due to development activities like industrialization, construction of dams for hydropower, degradation of the environment in the State is inevitable.

Sikkim is inhabited by a multitude of ethnic minorities, tribes and clans, where the dependence on natural resources is high, and impacts of climate change is likely to magnify the risk they face. Sikkim is characterized by physical isolation, limited mobility, poor infrastructure, limited production & livelihood opportunities, poor access

to resources, exposure to natural hazards (like earthquake, landslide, snow, storm) resulting in poor socio-economic development.

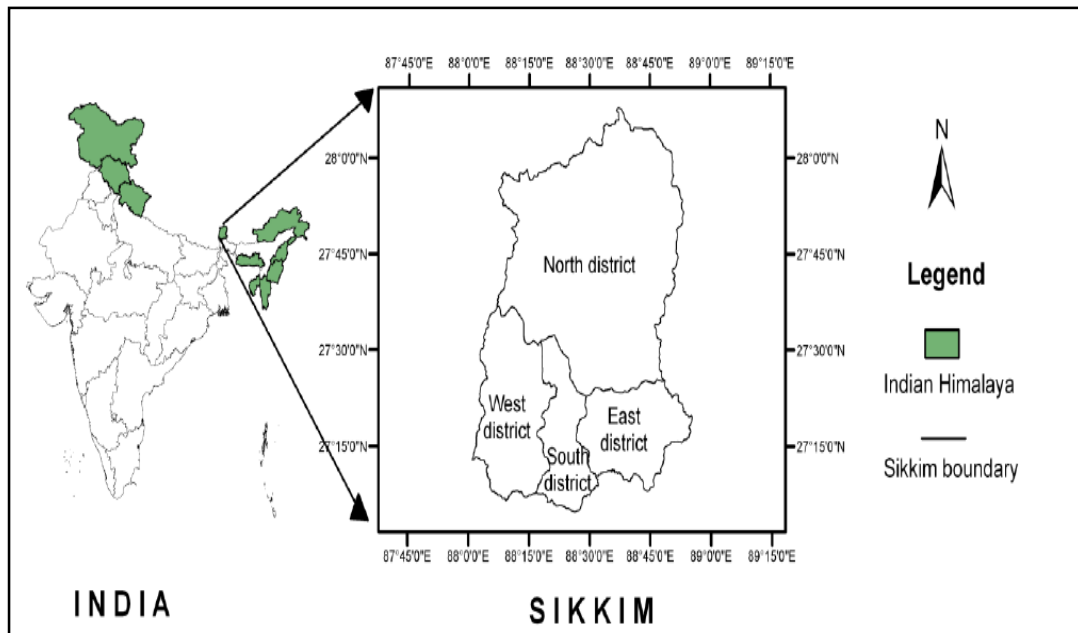


Figure 3.1: Map of Sikkim depicting its location in India and as a part of the Eastern Himalayan Region
Source: Tambe et al. (2012b)

Most of the farmers in the State practice subsistence farming as the landholding sizes are small (1-2 hectares) or marginal (below 1 hectares). Land for agriculture is highly scarce as only 11 % of the land in the state is cultivable (Government of Sikkim, 2014). Agricultural productivity in Sikkim has remained stagnant due to high dependence on rain-fed agriculture, limited land holding sizes, and lack of mechanization in the context of exposure to frequent occurrence of calamities like drought, and landslides (Government of Sikkim, 2009). As the economy of the state is agriculture dependent with limited opportunities to diversify livelihoods, there is a high incidence of poverty. This non-diversified nature of the economy is a major cause of poverty (Allan, 2011). Here, it is important to state that the poverty is seen through a multidimensional lens as income poverty is an incomplete measure. This is evident in the fact that although Sikkim has only 8% income poverty (Government of Sikkim, 2014), this measure does not convey meaningful information for building adaptive capacity of the communities or enhance

their resilience. The research is intended to examine the various important factors such as political, economic and social opportunities, and the choices available other than income which contribute significantly to poverty.

The social stratification based on religion reveals that most of the inhabitant of the State follow Hinduism (70%), followed by Buddhism (25%). Sikkim has a long tradition of Buddhism (Ramakrishnan, 1998). Further, 70% of the people in Sikkim belong to General category (Brahmins), 22% to scheduled tribe (ST) and 6% to schedule caste (SC) (Lama, 2001). Caste system among Nepalese⁶ Hindus are very similar to that prevalent in a Hindu society in mainland India where the upper caste Brahmins still maintain social distinction and follow norms of caste purity (Choudhury, 2006).

Education is a fundamental need for human development and is an important theme of multidimensional poverty. It also reflects the adaptive capacity to climate variability and change (Land and Hummel, 2013). Literacy rate, which is defined as the ability to read and write, is high in Sikkim with 86.55% of the male and 75.61% of the female being literate (Government of India, 2011a). However, when we look at the education sector, there is a concern over a strikingly high rate of school dropouts. The statistics reveal that it is as high as 85% in Sikkim (NIRD, 2012). Lack of quality education, economic compulsion and social issues such as early marriage are the factors which have been identified as the contributing factors towards high school dropout rates in the State (Government of Sikkim, 2014). Further, early marriage constrains the possibility of higher education. The average age at which females get married is 21.5 years, and as high as 16% of the females below 18 years get married (Government of Sikkim, 2014).

⁶ Nepalese Hindus in Sikkim have their roots in Nepal, where their ancestors have migrated as agricultural labourers to the State of Sikkim and Darjeeling during the 19th century under the British rule Joshi, H.G., 1980. *Sikkim Past and Present* (New Delhi: Mittal Publications).

This aggravates gender inequality. Gender inequality persist in the State as it is a patriarchal society and inheritance of property by the male members, female members engaged in larger share of laborious agricultural activities, limited participation of females in political discussions and activities, under representation of females in bureaucracy, early female marriage, and female exclusion from DZUMSA⁷ (Government of Sikkim, 2014, Subba, 2014).

3.1.2 SAMPLING METHODS AND PROCEDURE

This section discusses the methods used for selection of study district, development blocks, and GPUs for the study.

3.1.2.1 SITE SELECTION

Research on climate change vulnerability, poverty and resilience necessitated the researchers to adopt the purposive sampling method for site selection (Ongoro and Ogara, 2012, Sovacool *et al.*, 2012). Therefore, in this study, purposive sampling was used for the selection of district, blocks, and GPUs from each of the blocks for carrying out the field survey.

3.1.2.1.1 SITE SELECTION – DISTRICT

Among the four districts of Sikkim, East district was selected for the research primarily because it (a) is the second smallest district of Sikkim with a geographical area of 954 sq. km.; (b) receives maximum mean annual rainfall (Gangtok- 3494mm) and is highly vulnerable to the impacts of climate change with frequent occurrence of landslides during rainy season; (c) is vulnerable to impacts on climate-sensitive agriculture sector as agriculture activities of the state are concentrated in the district due to lower mountain ranges (NIDM, 2017), East district has 45% of the total workers (main and marginal) of

⁷ Traditional system of governance in North Sikkim

the state; (d) is the most populous district of the state with 46% of the state's population (281,293 persons), and has the highest population density in the state with approximately 297 persons/ sq. km.(state's population density - 86 persons/sq. km.), a higher population density indicates a larger vulnerable population; (e) has high social diversity as it inhabits highest percentage of scheduled tribe (38% of 206,360) in the state (Government of India, 2011b) .

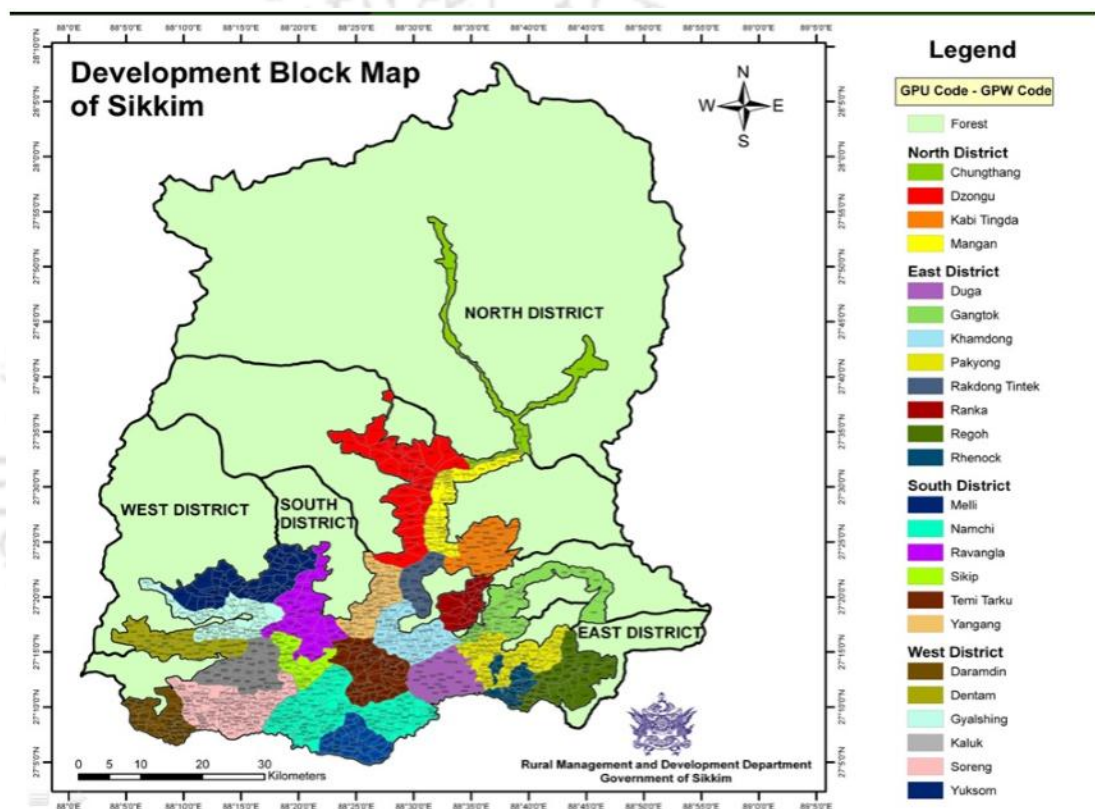


Figure 3.2: Development block map of Sikkim

Source: (Government of Sikkim, 2015)

East district has 8 development blocks (Figure 3.2) comprising 46 Gram Panchayat Units (GPU) which consists of 251 Gram Panchayat Wards (GPW) according to census of 2011 (Government of India, 2011b). The district's population comprises around 53.4% male, and 46.6% females. It is interesting to note that 56.8% of the district's population resides in the rural areas, which is lesser than the state average of 74.8%, this is because the four main town of the state are located in the district.

Religion is an important aspect of social profile, just like the state, majority of the people in East district practice Hinduism (62.74 %) followed by Buddhism (25.55 %). Lepcha and Bhutia are the indigenous tribes of Sikkim and follow Buddhism; Sherpa & Tamang are the Nepali speaking section of the population who follow Buddhism. The Nepali speaking population who follow Hinduism consist of two sub-groups: the Tagadhari (Brahmins and Gurkhas) and Matwali (Joshi, 2004). Classification based on caste reflects that around 66.9% of the population belongs to the general category (Brahmins), 27.7% belong to the ST (Lepcha and Bhutia), and 5.4% to SC (Kami, Damai, Lobar, Sarki and Majhi) and other backward castes (OBC) (Tamang, Gurung, Rai, Limbu, and Sunwar) (Lama, 2001, Census of India, 2011). Traditional occupation associated with the social group is still practiced by some people in addition to agriculture. For example, Brahmins perform most of the religious ceremonies, while some people belonging to SC and OBC are metal workers, tailors, etc.

Gender differences in fundamental needs such as education is an important indicator of the social –economic vulnerability, a difference is evident in the literacy rate of the district as there is a higher male literacy rate (88.47%) in comparison to female literacy rate (78.50%). Although the literacy rate of the district is 83.85%, the proportion of people with higher level of education is low which has led to East district accounting 50% of the unemployed youth of the state. More than 75 % of these unemployed youth had secondary school or lower education level (Government of Sikkim, 2014).

Approximately 45% of the total workers (main and marginal) of the state are employed in the East district (308138 in number). It is interesting to note that larger proportion of main workers are males (71.4% of 111,058), while larger proportion of marginal workers are females (54.4% of 28620). Among the total workers there are cultivators and agriculture labourers. Around 26.8% of total cultivators (117,401) and

44.2% of agricultural labourers (25,986) of Sikkim are from East district. An interesting inference in terms of gender dimension is that relatively larger percentage of cultivators are male (52% of 31,489), while a larger proportion of agricultural labourers are females (53% of 11,483) (Government of India, 2011b).

Major crops grown in East district are rice, maize, finger millet, pulses, mustard, soyabean, large cardamom, ginger, turmeric. Scientific research indicates that there has been an increase in diseases in crops such as cardamom (viral diseases) and ginger (dry and soft rot diseases) due to the impacts of climate variability and change (Government of Sikkim, 2014).

3.1.2.1.2 SITE SELECTION-DEVELOPMENT BLOCKS

For selection of the development blocks and GPU for the field research consultation were held with the experts of Rural Management and Development Department (RMDD) of Government of Sikkim at the (a) district level, (b) block level (with the Block Development Officer-BDO), and (c) GPU level (field facilitator). Among the 8 development blocks of East district, 2 blocks were selected based on three criteria – (a) exposure to multiple hazards such as drought, earthquake, flash floods, landslides (b) diversity of social groups, (c) economic profile (Table 3.2).

a. BIO-PHYSICAL CHARACTERISTIC OF THE BLOCK

Rhenock and Regoh development blocks were selected in consultation with the BDO as they experience a spectrum of vulnerability to multiple hazards (Figure 3.3). The region face medium, medium to high and high vulnerability. The elevation of the Regoh block (Table 3.1) lies within the range of 1300-2100 meters while Rhenock development block is located at a slightly lower range of 750-1500 meters. This has an impacts on the temperature of the regions with lower temperature for Regoh block (13.5-17.5 Degree Celsius) while the temperature of Rhenock block located a lower elevation were higher

at 18-20 Degree Celsius. The annual rainfall for both the blocks ranges from 2900-3200 mm.

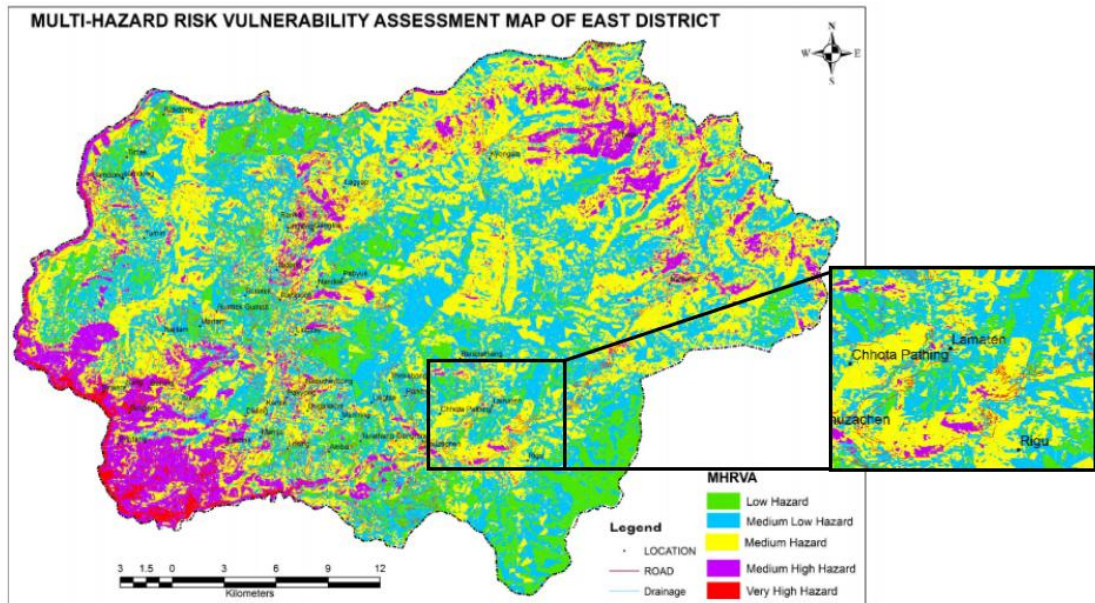


Figure 3.3: Multi- Hazard Risk Vulnerability Assessment Map of East District (selected study regions are located in the box)

Source: (SSDMA, 2010)

Sl. No.	Indicators	State: Sikkim	
		District: East Sikkim	
		Rhenock Development Block	Regoh Development Block
1	Elevation (m)	750-1500	1300-2100
2	Annual Mean Temperature (⁰ C)	18-20	13.5-17.5
3	Annual rainfall (mm)	2900-3100	2900-3200

Table 3.1: Bio-physical profile of the Development blocks
Source: (Government of Sikkim, 2010)

b. SOCIO-ECONOMIC CHARACTERISTICS OF THE BLOCKS:

The socio-economic characteristic (*Table 3.2*) of both the development blocks reflects high poverty in the region with 28% in Rhenock and 42% in Regoh development block falling below poverty line (BPL). This is further aggravated due to high dependency on agriculture (58% in Rhenock and 73% in Regoh) despite limited land holding size (0.28

hectares for Rhenock and 0.49 hectares in Regoh) in both the Development blocks. The communities in the block are also highly vulnerable to natural disasters such as earthquake, landslides due to weak housing structure where majority of the households live in semi pucca (Semi-temporary) and Kutcha houses (Temporary).

Sl. No	Indicators	Units	State: Sikkim	
			District: East Sikkim	
			Rhenock Development Block	Regoh Development Block
1	No of HH	No	2934	2183
2	Total population	No	12756	12742
3	BPL HH	No	570	898
		%	28	42
4	Average land holding size	Hectares	0.28	0.49
5	Household Dependent on Agriculture	No	1701	1594
		%	58	73
6	Household living in weak housing structure (semi-pucca and Kutcha houses)	No	1132	1739
		%	38	80

Table 3.2: Socio-economic Profile of the selected study blocks

Source: (Government of Sikkim, 2010)

3.1.2.1.3 SITE SELECTION-GPU

Within the two development blocks, Rhenock Tarpin, and Sudunglakha GPUs from Rhenock block; Dolepchen, and Rolep Lamaten GPUs from Regoh block were selected in consultation with the BDOs, representatives of all the GPUs of these two blocks and the field facilitators (Figure 3.4) (Appendix 4). The criteria for selection of these GPUs was their biophysical and socio-economic characteristics. A brief description of the bio-

physical and socio-economic characteristics of the selected GPU are discussed in the next sub-section.

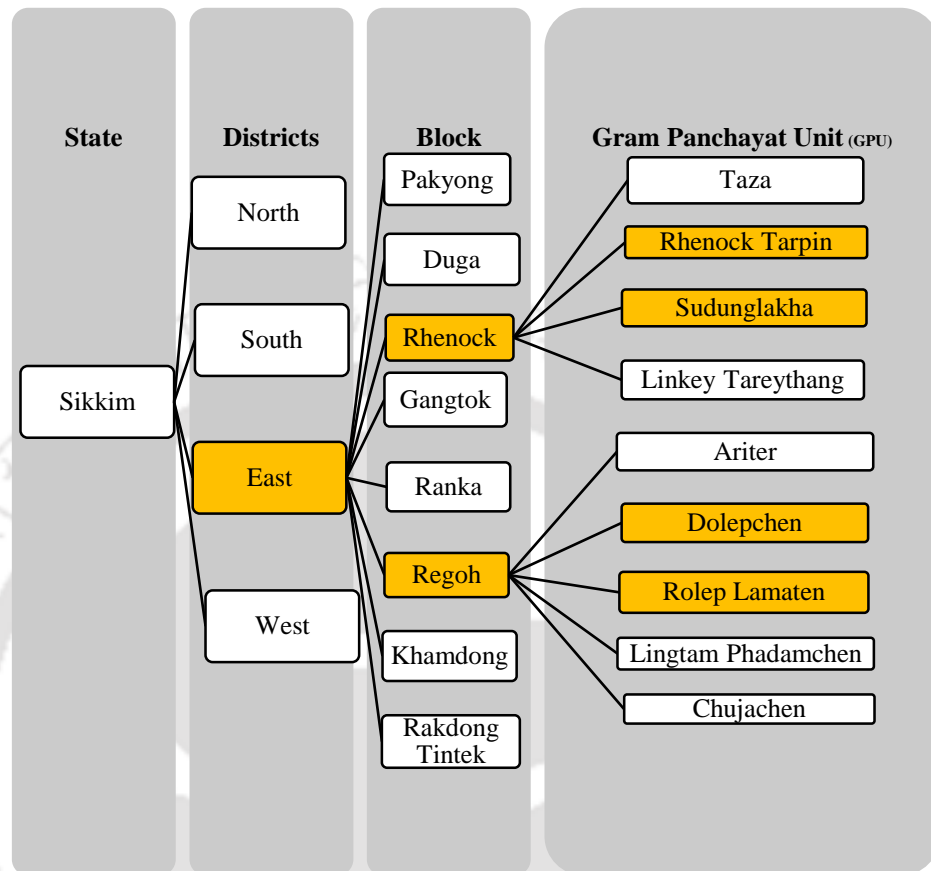


Figure 3.4: The sampling process for identification of study area

a. BIO-PHYSICAL CHARACTERISTICS OF THE GPU_s

The elevation of the GPU_s range from 900-2000m, both the GPU_s of Regoh Development Block have higher elevation, are relatively cooler and wetter than Rhenock Development Block (Table 3.3). The annual rainfall ranges from 2900-3200 mm. However, there are reports of erratic rainfall in the region leading to low agricultural production (SSDMA, 2010). The region is highly vulnerable to earthquake and landslides and damages have been reported in all the GPU_s (SSDMA, 2010).

Sl. No.	Indicators	State: Sikkim			
		District: East Sikkim			
		Rhenock Development Block		Regoh Development Block	
		Rhenock Tarpin GPU	Sudunglakha GPU	Dolepchen GPU	Rolep Lamaten GPU
1	Elevation (m)	1100	900	1500	2000
2	Annual Mean Temperature (°C)	20.0	18.0	17.5	17.0
3	Annual rainfall (mm)	2900	3100	3100	3200

Table 3.3: Bio-physical characteristic of the GPUs
Source: (Government of Sikkim, 2010)

The subsequent sub-section details out the socio-economic characteristics of the GPUs.

b. SOCIO-ECONOMIC CHARACTERISTICS OF THE GPUS

Among the four GPUs, Rhenock Tarpin has the highest population, highest no. of households below poverty line (BPL) (216), and has the smallest land holding size (0.13 hectares) (Table 3.4). Rolep Lamaten is the GPU with least population among the four GPUs, but has the largest proportion of households below poverty line (BPL), i.e. 61% even though the average landholding size is the largest (1.07 hectares). There is a high dependence on agriculture sector, ranging from 25% - 57%, however, they largely practice subsistence agriculture due to limited land holding size. Sudunglakha GPU with 57% of the HH's dependence on agriculture with the average landholding size of 0.29 hectares. Rhenock Tarpin has the highest number of household depending on agriculture (i.e., 301). Majority of the households in the GPUs (72%-90%) live in weak housing structures, i.e., semi-pucca and Kutcha houses, which increases their exposure to natural hazards. Among the GPUs, Sudunglakha has as high as 90% of the households (161)

living in weak housing, Rhenock Tarpin has the highest number of households living in weak housing (962).

Sl. No.	Indicators	Units	State: Sikkim			
			District: East Sikkim			
			Rhenock Development Block		Regoh Development Block	
			Rhenock Tarpin GPU	Sudunglakha GPU	Dolepchen GPU	Rolep Lamaten GPU
1.	Total Households (HH)	No.	1202	322	515	224
2.	Total Population	No.	6319	1720	2685	1284
3.	Illiteracy	%	20	24	26	23
4.	BPL HH	No.	216	122	144	136
		%	18	38	28	61
5.	Average land holding size	hectares	0.13	0.29	0.22	1.07
6.	HH dependence on agriculture	No.	301	184	222	117
		%	25	57	43	52
7.	HH living in weak housing structures (semi-pucca and Kutcha houses)	No.	962	290	453	161
		%	80	90	88	72

Table 3.4: Profiles of the GPUs selected for the study in East Sikkim
Source: (Government of Sikkim, 2010)

The techniques used to carry out the field survey in the four GPUs were Focus Group Discussion (FGD), household survey, direct observations and walk-throughs. For carrying out 4 FGDs in each of the 4 GPUs, several representatives were selected from the GPUs. For each of FGD of 10-12 representatives of the social groups in GPUs were identified who are in the age group of 25 to 60 years and have been residing in the GPUs since childhood. FGDs were planned with all male groups, all female groups and mixed groups comprising both male and female representatives (Table 3.5). It was important to carry out group discussions with all male and female groups as they bring out the gender-

specific concerns and experiences. Mixed groups were crucial as they would reflect the societal structure and the dynamics of interactions between males and females on the issues in consideration. Further each group had representatives from all the social groups to understand the dynamics of the interactions between different caste and tribes and variations in their opinions and responses. The representatives were selected who are engaged in agriculture as it is predominant economic sector of the district.

Sl. No.	Gender based composition of participants of FGD	State: Sikkim				Total FGDs
		District: East Sikkim				
		Rhenock Development Block		Regoh Development Block		
		Rhenock Tarpin GPU	Sudunglakha GPU	Dolepchen GPU	Rolep Lamaten GPU	
1	All male	1	1	1	1	4
2	All female	1	1	1	1	4
3	Mixed (male and female)	2	2	2	2	8
	Total FGDs	4	4	4	4	16

Table 3.5: Gender based composition of the participants of FGDs

A sample of 35 HH was drawn from each of the four GPU through **stratified random sampling** forming a total sample size of 140 household for household survey. Stratified random sampling was considered a suitable method of sampling as the technique is aimed to obtain a representative sample. In this sampling technique, the population is classified into sub-groups which are more homogeneous than the population (Black, 1999). These sub-groups are called strata. The **strata** for the **research** is defined in accordance with the classification of the social group based on the caste, i.e., General, ST, and OBC (Table 3.6), to ensure that there is a representation of all the major social groups of the East district.

The rationale for selecting a sample size of 35 is that a sample size of greater than and equal to 30 is considered a statistically large enough sample of a population to draw meaningful conclusion for the population. This is because a sample size of greater than and equal to 30 is approximately normally distributed, regardless of the distribution of the population one samples from (Levin and Rubin, 2007, LaMorte, 2016). In the sample of 140 households, a representative sample size for each strata of greater than 30 was selected (General-43, OBC-65, and ST-32). It is important to mention here that none of the households who were interviewed for the research belonged to SC category because the percentage of SC population were much lower in East Sikkim district (4.6%) and there were few household belonging to the SC category in the selected study locations (Government of India, 2011b).

		State: Sikkim									
Sl. No.	Caste	District: East Sikkim									
		Rhenock Development Block				Regoh Development Block				Total No. of respondents	
		Rhenock Tarpin GPU		Sudunglakha GPU		Dolepchen GPU		Rolep Lamaten GPU			
No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	General	15	42	12	34	6	17	10	29	43	31
2	OBC	10	29	15	42	20	57	20	57	65	46
3	ST	10	29	8	24	9	26	5	14	32	23
	Total no. of respondents	35	100	35	100	35	100	35	100	140	100

Table 3.6: Classification of the social group based on the caste,

The next section is on the data collection methods and techniques used in the research.

3.1.3 DATA COLLECTION METHODS AND TECHNIQUES

The qualitative data was collected through FGD and KII, while the quantitative data was collected through a household survey. The rationale of using FGD is that it engages a small number of people with similar backgrounds or experiences in an informal group

discussion (or discussions), ‘focused’ around a particular topic or set of issues which are of common interest (Wilkinson, 2004). As this research is intended to build research base on community perceptions and experiences on vulnerability to climate change, adaptation, and resilience it was important to interact with the communities FGD was found to be an appropriate method. Further, FGD provides an insight into how a group thinks about an issue, and brings out variations in the opinions and ideas, and the inconsistencies and disagreements. These discussions reflect the social dynamics of the community in terms of their beliefs, experiences, and practices. FGDs are very useful in exploring the underlying meaning of survey findings that cannot be explained quantitatively. As this research is also intended to bridge research and policy gap, FGD was found to be a useful tool in informing research based policy reforms, and planning interventions in a participatory manner. FGD were planned for the initial phase of the field survey as it is a good method to be used prior to designing questionnaires for household survey (ODI, 2009).

The FGD were intended to gain an understanding of community’s perception, experiences, and practices. A semi-structured checklist with open-ended questionnaire was designed for the FGDs comprising four focal themes (Figure 3.5). - (I) their perceptions on climate variability and change, (II) Fundamental needs, (III) Assets, exposure and equality and (IV) Capability approach. The specific sets of questions on capability approach are shown in Table 3.7. These sections dwell on individual/communities’ capabilities such as opportunities and freedoms available to the people. The checklist is detailed out in Appendix 1.

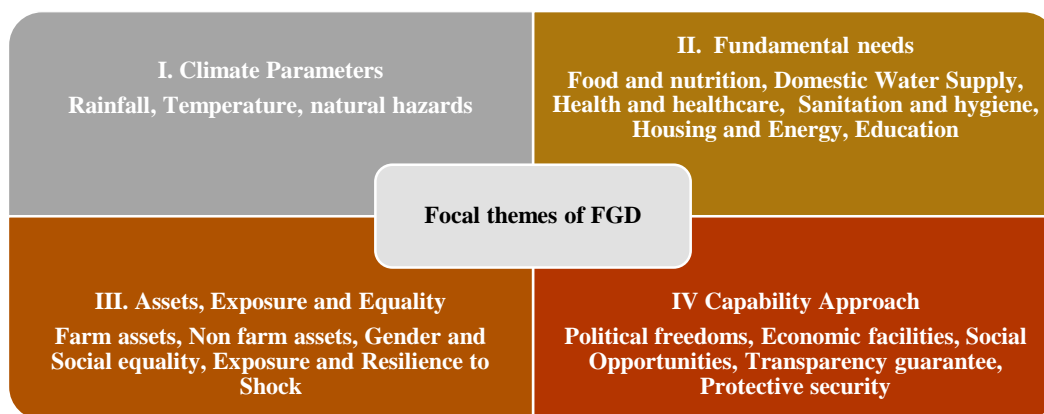


Figure 3.5: Sections covered for the FGD questionnaire

Instrumental freedoms of Capability approach to human development	Specific questions asked in the FGDs
Political freedoms	<ul style="list-style-type: none"> Do people participate in planning and implementation of interventions, schemes, policies etc.? Are you satisfied with the intervention, schemes, and policies implemented in your region?
Economic facilities	<ul style="list-style-type: none"> What are the various economic facilities provided by interventions in your region to enhance your economic opportunities (access to market, opportunities to generate income, access to credits, and knowledge and trainings etc.?)
Social opportunities	<ul style="list-style-type: none"> Do the people of different social groups and gender have equal opportunities (such as access to education, health care, sanitation, market, employment)?
Protective security	<ul style="list-style-type: none"> What are the social safety net schemes and programmes (interventions to improve fundamental needs, assets and equality) operational in your region to build resilience? Are the benefits sufficient to reduce poverty?
Transparency guarantee	<ul style="list-style-type: none"> Are you aware of various social safety net scheme implemented in your region for the welfare of the communities. Do you feel sufficient information on these social safety nets schemes (e.g. budget, implementation process, benefits) is provided. Are these schemes implemented properly?

Table 3.7: Specific questions asked in the FGDs on capability approach to human development

The interview schedules which were used to carry out household survey were based on the Multidimensional Poverty Assessment Tool (MPAT) framework which was developed by the International Fund for Agricultural Development (IFAD). It was considered as a suitable analytical framework because it was developed on the understanding that income, or economic growth, is not a sufficient measure of poverty

and poverty is multifaceted, complex and is difficult to define and measure (Streeten and Burki, 1978, Streeten *et al.*, 1981, Sen, 1999, Bourguignon and Chakravarty, 2003, Sullivan, 2006, Bossert *et al.*, 2009, Narayan *et al.*, 2009, Alkire and Santos, 2010, Alkire and Foster, 2011). The significance of assessing multidimensional poverty to determine vulnerability of individual/communities by moving beyond income, resources, and assets discussed in section 2.2.

MPAT uses broad survey questions (Appendix 2) but precise enough as quality proxy measures to understand rural poverty. It is a thematic index which gauges the multidimensional poverty in ten themes (or components) reflecting the *fundamental needs* and *rural assets, exposure, and equality* thereby emphasizing on the overall well-beings of an individual/communities (Scoones, 1998, DFID, 1999, Cohen, 2010, Cohen and Sullivan, 2010). Among the various indices on multidimensional poverty (Figure 3.6), MPAT was selected for carrying out the contextual vulnerability assessment because it moves beyond income, resources, and assets, and in particular it has included ‘exposure and resilience to shock’ and the ‘social and gender equality’ as themes to define multidimensional poverty. These are crucial themes to examine the contextual vulnerability.

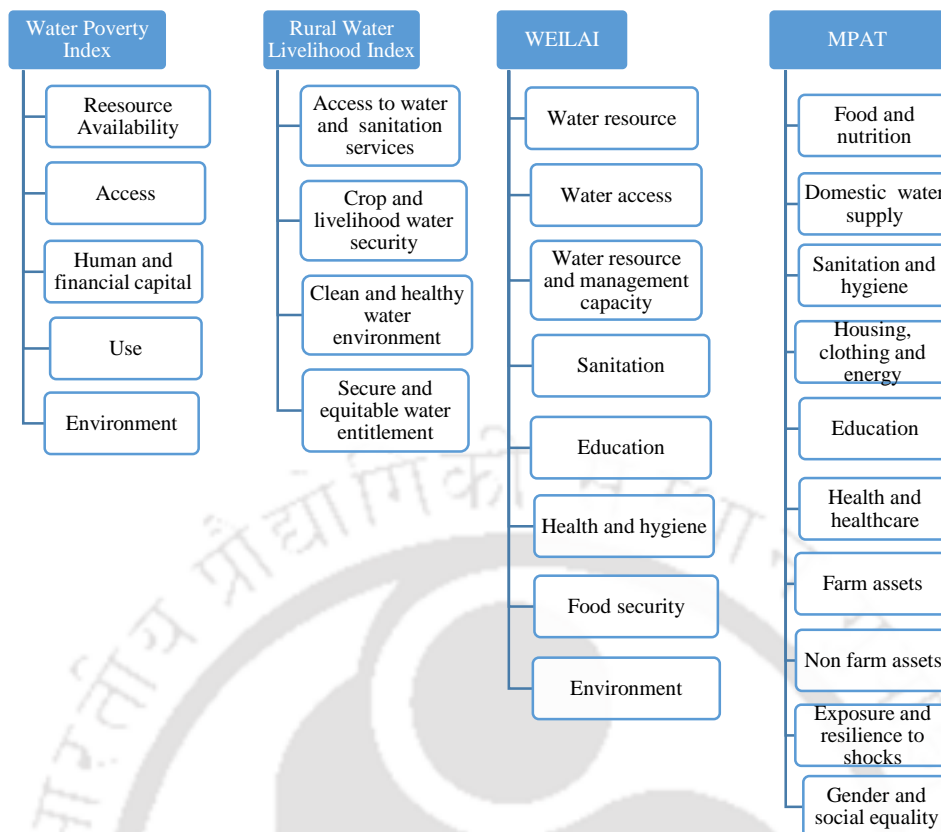


Figure 3.6: Different indices to understand Multidimensional poverty

Source:(Sullivan, 2002, Cohen, 2009, Cohen and Sullivan, 2010)

The MPAT provides a methodology and a framework for the development community to measure rural poverty in order to support poverty alleviation (Cohen, 2010). MPAT shares similarities with Sen's capabilities approach (Cohen, 2010) where it aims to move away from income/consumption based poverty measurement to a more holistic approach of multidimensional poverty. In particular, MPAT tries to capture the *circumstances* (personal, social, and environment conversion factors) in which a person is living and the *opportunities* (capabilities) and *choices* available to an individual. Factors such as gender, literacy, physical conditions (health conditions), and educational attainments of the individual were used to capture the personal conversion factors, while social conversion factors were captured through religion, norms, gender disparity, and societal hierarchies (caste system). The significance of the themes of MPAT in enlarging freedoms and building resilience of rural mountain communities to climate change is discussed in Table 3.8.

	Components	Significance of the component for building resilience to climate change	Capability approach (Freedoms)
Fundamental Needs	Food and Nutrition Security	<p>Climate change affects the water availability and food production, therefore it poses greater risks to health and life (UNFCCC, 2007a)</p> <p>Climate and global environmental change has threatened not only the current but also the future efforts to overcome food insecurity and malnutrition (Tirado <i>et al.</i>, 2010)</p>	<p>Political freedoms: Participating in planning and implementation of social safety nets scheme such as food security schemes (public distribution system, midday meal etc.)</p> <p>Economic facilities: The ability to buy nutritious food (fruits, meat, milk, etc.) for consumption.</p> <p>Social opportunities: Equal access to food and nutrition across different caste, tribes, and gender.</p> <p>Transparency guarantee: Transparency during planning, implementation, and budgeting of schemes related to food and nutrition.</p>
	Domestic Water Supply	<p>Climate change affects the availability of water in many of the regions (UNFCCC, 2007a)</p> <p>As water availability has direct relation in development of a region, a decrease in water availability would hamper the socio-economic development in the region.</p>	<p>Political freedoms: Freedoms to participate in planning and implementation of water schemes such as rural water supply, domestic water supply etc.</p> <p>Economic facilities: Ability to use the water available for production of resources such as agriculture for consumption and exchange.</p> <p>Social opportunities: The ability to equally benefit through the interventions on domestic water supply.</p> <p>Transparency guarantee: Transparency in implementation of projects on domestic water supply.</p>
	Health and Health Care	<p>Climate plays a significant role in people's health (IPCC, 2007, IPCC, 2014). There are possibility of increase in diseases if climate changes</p> <p>Individuals/communities having access to health centers are assumed to be more empowered and less vulnerable to the impacts of climate change (Liverman, 1990, McCarthy <i>et al.</i>, 2001, Brooks, 2003)</p>	<p>Political freedoms: Freedoms to participate in planning and implementation of social safety nets such as national health mission, functioning of public health centers</p> <p>Economic facilities: The ability to use the facilities of health and health care to improve economic facilities.</p> <p>Social opportunities: Equal opportunity across caste, tribes and gender to access the facilities of health and health care services.</p> <p>Transparency guarantee: Transparency in implementation of health and health care projects.</p>
	Sanitation and Hygiene	<p>Water, sanitation and hygiene (WASH) have a significant impact on health and, of particular concern (IPCC, 2007, IPCC, 2014)</p> <p>Climate change will compromise the effectiveness of a significant proportion of both existing and planned water and</p>	<p>Political freedoms: Freedoms to participate in planning and implementation of social safety nets such as total sanitation campaign</p> <p>Social opportunities: Access to sanitation and hygiene practices across different caste, tribes and gender</p>

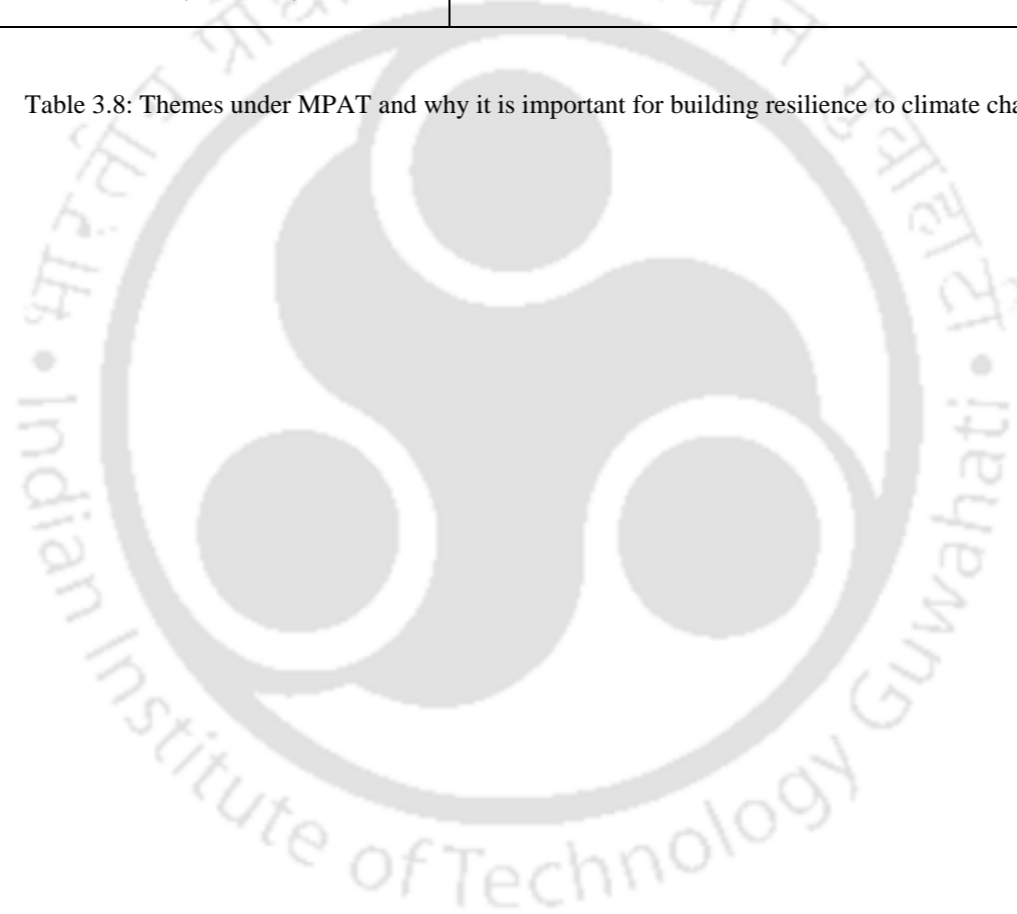
Rural Assets, Exposure, Equality		sanitation services in many parts of the world, putting at risk human lives, economic investments, and progress towards and sustaining the achievements of the related MDGs (WHO/DFID, 2009)	Economic freedoms: Ability to use economic facilities through interventions on hygiene. Transparency guarantee: Transparency in budget, design and implementation of sanitation scheme such as total sanitation campaign.
	Housing, Clothing ⁸ , and Energy	Housing quality is an important factor in evaluating vulnerability to natural calamities such as earthquake, landslides, rainfall, storm etc., (Flanagan Barry <i>et al.</i> , 2011) Poor people often live in more poorly constructed houses (Kutchha or temporary structure) that are especially vulnerable to strong storms or earthquakes.	Political freedoms: Freedoms to participate in planning and implementation of housing schemes, power supply etc. Social opportunities: Equal access to social safety nets such as housing schemes, electricity etc. Economic opportunities: Ability to use the economic facilities for the purpose of housing and energy. Transparency guarantee: Transparency in housing and energy schemes in the region.
	Education	According to Muttarak and Lutz (2014a), education plays an important role in reducing vulnerability of an individual/community as it builds knowledge, skills, and competencies of people to adapt to climate change. Education is an essential element of the global response to climate change(UNESCO, 2014) as education increases the opportunities and choices available to people.	Political freedoms: Participatory approach to planning interventions for improving availability, accessibility and quality. Economic facilities: Freedoms to use the facilities of education to enhance opportunities for employment Social opportunities: Equal access to educational facilities across caste, tribes or gender. Transparency guarantee: Transparency in the implementation of projects such as right to education act, Sarba Siksha Abhijan etc. Protective security: Access to the schemes for the vulnerable section of the society.
	Farm assets	Natural resource-dependent livelihoods of rural poor such as agriculture are likely to experience a disproportionately larger burden of the adverse impacts of climate change (Agrawal and Perrin, 2008) Agricultural systems are recognized as one of the most vulnerable due to a high sensitivity to changes in climatic parameters -temperature and rainfall (Nazari <i>et al.</i> , 2015)	Political freedoms: Participation in planning and implementations of interventions crop inputs, livestock managements, governing ownership and access to farm land Economic facilities: Freedoms to use the farm assets for economic activity such as consumption, and exchange in the market Social opportunities: Equal access to social safety nets such as distribution of crops inputs, land, and other agriculture inputs across caste, tribe and gender.

⁸ Clothing was not selected because consultation with experts reveals that it is not a relevant indicators of poverty

		Transparency in implementation of scheme related to farm assets.
Non-Farm Assets	<p>Diversification of income sources is considered to be an important aspect of enhancing resilience to climate change (Adger, 1999, Kelly and Adger, 2000, Yohe and Tol, 2002, UNDP, 2009)</p> <p>As farming is a seasonal occupation, livelihood diversification supplements farm incomes. The livelihood diversification to include less climate-sensitive occupations such as small scale business or industries is important. These livelihood activities require non-farm assets.</p>	<p>Political freedoms: Freedoms to participate in planning and implementation of non-farm schemes such as MGNREGA, self-help groups etc.</p> <p>Economic facilities: Facilities for employment and ability to use assets during the times of emergencies.</p> <p>Social opportunities: Equal opportunities of employment, equal distribution of assets across different caste, tribes and gender.</p> <p>Transparency guarantee: Transparency in implementation of employment schemes such as MGNREGA, self-help groups.</p>
Exposure and resilience to shock	<p>Exposure refers to the presence (location) of people, livelihoods, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected by physical events and which, thereby, are subject to potential future harm, loss, or damage (IPCC, 2001). For example, coastal communities will have higher exposure to sea level rise and cyclones, while communities in semi-arid areas may be most exposed to drought</p> <p>The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure. The level of exposure determines the resilience to climate change (IPCC, 2007, IPCC, 2014).</p>	<p>Political freedoms: Ability to influence implementation of schemes to build resilience to natural disasters such as earthquake, landslides, etc.</p> <p>Social opportunities: The freedoms available to build resilience across caste, tribes and gender.</p> <p>Economic facilities: Ability to recover in economic activities.</p> <p>Protective security: Implementation of schemes to protect the vulnerable section of the society such as old, children, and female members which have the least capacity to adapt to the impacts of climate change.</p>
Gender and Social Equality	<p>According to Adger (1999) resources and wealth in themselves do not constitute security since resources are mediated through property rights and access to them. Therefore, equal rights in the society are crucial in building resilience to the impacts of climate change.</p> <p>Women are more vulnerable to impacts of climate change than men—primarily as they constitute the majority of the world’s poor and are more dependent for their livelihood on</p>	The participation of different caste, tribes and gender in political, economic, and social discussion and decision-making through targeted interventions (social safety net).

	<p>natural resources that are threatened by climate change. Furthermore, they face social, economic and political barriers that limit their coping capacity.</p> <p>Women and men in rural areas in developing nations are especially vulnerable when they are highly dependent on local natural resources for their livelihood (UN, 2009)</p>
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Table 3.8: Themes under MPAT and why it is important for building resilience to climate change.



The strength of MPAT is that it has relevant set of indicators for rural communities of Asia, and particularly India as it was pilot tested at a large scale in China and India in early 2009 (IFAD, 2014). The interview schedule comprised of close-ended questions on these indicators. Further, MPAT is a suitable method for the research as it gives an impression of the status and success of *interventions* on the ten thematic components which are crucial for strategizing resilience building of the vulnerable communities in consultation with representatives of these communities.

The next section describes the method followed for the field survey using the data collection instruments.

3.1.4 FIELD SURVEY

The first step of the field survey was to establish communication with the local communities. The key communicators for building rapport with the community were the BDO, field facilitators of the GPUs, the Panchayat members, and the village community elders. A capacity building workshop was organized to introduce the study objectives, concepts, the components of the interview schedule, and the process of data collection to them. This was followed by pilot testing the FGD checklist with ten representatives of the GPUs.

These preparations were for the first phase of the field survey from October to December 2013 during which FGDs were conducted (Appendix 3). The FGDs contributed to the process of selecting relevant questions for the household survey which was carried out in the second phase of the field survey from April to July 2014. Prior to carrying out the household survey, the interview schedule was pilot tested with thirty respondents to eliminate the errors in the data collection instrument.

Following an **ethical procedure** in consultation with the local communities was crucial as they were involved from the planning stage to evaluation of the findings and validation of the conclusive statements. In accordance with the ethical procedure suggested by Cinner *et al.* (2013); Balemie and Singh (2012); and Pearce *et al.* (2009), due consideration was given to the local norms, language, traditions, and confidentiality of the participants' responses during the research. Before recording the participants' responses, they were informed about the survey, its purpose, and how the data would be utilized and a Prior Informed Consent was obtained. Their contributions were acknowledged while seeking their willingness to participate in the survey and discussions. The participants were connected to the research both as contributors and as beneficiaries as they were able to discuss and generate awareness about the issues of importance.

3.1.4.1 FIRST PHASE: FGD

In total 16 FGDs were conducted in the four GPUs, each FGD was carried out with a small group of 10-12 members, guided by a moderator. The moderator was the field facilitator from the RMDD. The thematic areas described in Figure 3.5 were discussed in the FGD. The composition of the groups is detailed out in Table 3.5. The FGDs were conducted in the local language (Nepali). The study from the very beginning kept the local formal institutions into the loop so that the community's concerns can be directly heard by them; therefore, the KII were conducted with the BDO and field facilitators. While conducting the FGD protocol given in Development Pool (2010); Escalada and Heong (2009) and Krueger (2002) were followed (Table 3.9); The discussions helped in identifying the core socio-economic issues for research on resilience building.

Meeting Data: Date: Start time: Meeting location: Meeting leaders:	Participation Data: No of Participants: No of Male: No of Female: Occupations:
<ul style="list-style-type: none"> • Introduction: Introducing the researchers, moderators, welcoming the participants, giving an overview of the topic, informing the ground rules. • Discussions: Asking Questions that Yield Powerful Information Using open-ended questions Use questions that get participants involved • Ending Questions Summary question Final question (Have we missed anything?) • Observations 	

Table 3.9: Focus group discussion protocol
Source: Krueger (2002)

3.1.4.2 SECOND PHASE: HOUSEHOLD SURVEY

The household survey covering a sample of 140 households in the four GPUs was conducted with the help of the field facilitators of the RMDD, Government of Sikkim. The interview schedule consisted of the questions corresponding to the sub-components of the 10 themes of MPAT are described in the Table 3.10. The relative importance (weights) of the sub-components and the indicators were adopted from MPAT framework. Consultation were held with experts from RMDD, Government of Sikkim, academia, and local community on the relevance of the weights in the context of East Sikkim prior to data collection.

	MPAT components	Sl.No.	MPAT sub-components	Indicators of sub-components	Relative importance (weights) of indicators of sub-components (%)	Relative importance (weights) of sub-components (%)
Fundamental Needs	Food and nutrition	1.1	Consumption	The quantity and quality of the food consumed by the household which is compared with the recommended dietary allowance per person on average.	100	100
	Domestic water supply	2.1	Quality	The main source of water for drinking and cooking	70	29
				Treatment of water	30	
		2.2	Availability	Availability of water mainly during winter/dry season	70	38
				Type of storage facility	30	
		2.3	Access	Availability of piped water supply in the household premises	50	33
				Time taken to collect the water from the nearest source of water (e.g. natural spring)	50	
	Health and healthcare	3.1	Health Status	Any person with disability	45	38
				Any person suffering from chronic illness	30	
				Whether the patient is undergoing treatment	25	
		3.2	Access and affordability	Availability of doctors in the hospital	100	34
		3.3	Quality	Time taken to reach the hospital	50	28
	Whether the people find the treatment affordable			50		
	Sanitation and hygiene	4.1	Toilet facility	Type of toilet	60	60
				Practice of usage of toilet	40	

		4.2	Hygiene practice	Practice of washing hands before eating a meal, after defecating	100	40
	Housing and energy	5.1	Housing structure	Type of material used for the wall and roof of the house	70	50
				Ownership of the household premises	30	
		5.2	Energy sources	Primary source of cooking in the household	57	50
				Primary source of light in the household	43	
	Education	6.1	Quality	Teacher pupil ratio in a class	100	31
		6.2	Availability	Education level attained in school and college (school- primary and below, middle, secondary, higher secondary; college- bachelors and above)	100	33
		6.3	Access	Distance to the educational institute	100	36
rural assets, exposure, equality	Farm assets	7.1	Land tenure	Ownership of the cultivable land	65	39
				Area of cultivable land available	35	
		7.2	Land quality	Water requirement for irrigating crops	100	26
		7.3	Crops inputs	Source of the water for livestock as an indicator of the water resource requirement to meet the need for water	70	35
				Ownership of livestock and aquaculture assets	30	

Non-farm assets	8.1	Fixed assets and remittances	Employment and skills- Non-agriculture based occupations are assigned higher importance	70	50
			I. Primary		
		II. Secondary	30		
	8.2	Employment and skills	Fixed assets- type of roof material	40	50
			TV connection	20	
			Remittances- % of family members working outside the HH and send money	40	
Exposure, shock and resilience	Degree of exposure	Kinds of hazards (physical) the villages are exposed to (e.g. earthquake, drought, and landslide)	100	33	
	Coping ability	Ways of coping with the hazard/shock (e.g. local and government efforts, migration, changes in agriculture pattern)	100	34	
	Recovery ability	Whether the people are able to completely/partially recover from the incidence of hazard	100	33	
Gender and social equality	Access to education	What is the highest level of schooling the female child in your household will likely to achieve?	50	31	
		What is the highest level of schooling the male child in your household will likely achieve?	50		
	Access to healthcare	For the majority of the households in your village/area, do you think there is a better chance for a women or a man to receive healthcare when needed?	50	36	

			Do you think the healthcare centers in your village/area (within two hours distance from your home) are usually able to provide with adequate healthcare when they seek it?	50	
		Social equality	Variation in income (indicator of economic opportunities) by caste and religion category	100	33
^a Weights used for estimating arithmetic weighted average ^b Weights used for calculating the geometric weighted average					

Table 3.10: The themes with the subcomponents, the survey questions and relative weights assigned to the subcomponents

Source: (IFAD, 2014)

In the FGD and household survey, women's participation was crucial as they have significantly large contribution in food and livelihood security and are most vulnerable social group in North Eastern region of India. Women's representation in FGD was around 40 %, and in the household survey, it was approximately 30 %. To ensure their participation in the discussions and survey, the time and venue were decided keeping their convenience in mind. For instance, the survey with female respondents and discussions were held in the afternoon in the vicinity of their households so that participation in the discussion would not interfere much with their household and livelihood activities.

3.1.5 METHOD USED IN DATA ANALYSIS

Based on the responses to the survey questions on the ten dimensions of poverty, ten thematic indices were generated and represented without being aggregated into one index. This is because MPAT was developed with the intent that there needs to be balanced development in each of these ten dimensions to alleviate multidimensional poverty. The collected data were analysed using standardized procedure of MPAT manual (IFAD, 2014).

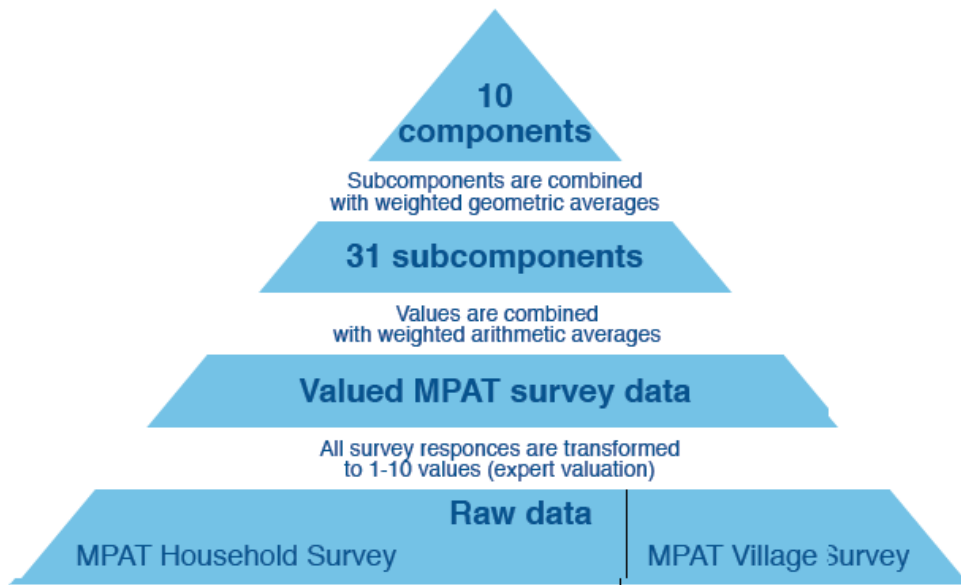


Figure 3.7: Visual summary of how MPAT data are aggregated into indicators

Source: (IFAD, 2014)

First step of processing the responses to the survey questions on indicators (Table 3.10) was to carry out valuations of each of the responses on a scale of 1-10 to obtain a scaled score x_{ijk} in Equation 1, where 1 reflects high poverty and 10 reflect no poverty. In the second step, this scaled score of the response to survey questions (indicators) of each sub-component and the weights attached to the respective survey questions w_{ik} (in %) were aggregated by estimating the weighted arithmetic average (Table 3.10 and Equation 1). In this way, a value is obtained for each sub-component and each household on a scale of 10-100 (at a higher resolution) (IFAD, 2014)

$$y_{jk} = \sum_{i=1}^L w_{ik} x_{ijk} \quad \text{Equation 1}$$

Where,

y_{jk} : arithmetically weighted average score for household j in sub-component k

w_{ik} : weight attached to survey question i in the sub-component k

x_{ijk} : scaled score for household j in question i in sub-component k (Saisana 2009).

$$\sum_i w_{ik} = 1 ; 0 \leq w_{ik} \leq 1 \quad (\text{the weights are represented in \% in Table 3.10})$$

The next step was to aggregate the sub-components of each component through geometric weighted average using ` Equation 2.

Geometric weighted average is preferred in the final step as compared to arithmetic weighted average because it pulls the index score to the lower value which needs to be emphasized; this aspect is important as the research is on multidimensional poverty and is aimed at identification of the themes which require emphasis to reduce contextual vulnerability (Saisana and Saltelli 2010).

The arithmetic weighted average from the previous step is considered as x_{ijk} , and w_{ik} are the weights attached to each sub-component (last column of Table 3.10) (Saisana and Saltelli, 2010).

$$y_{jk} = \prod_{i=1}^L x_{ijk}^{w_{ik}} \quad \text{Equation 2}$$

y_{jk} : geometrically weighted average score for household j of component k

w_{ik} : weight attached to sub-component i of component k

x_{ijk} : arithmetically weighted average score for household j in sub-component i of component k (Saisana 2009).

$$\sum_i w_{ik} = 1 ; 0 \leq w_{ik} \leq 1 \quad (\text{the weights are represented in \% in Table 3.10})$$

In this way, the multidimensional poverty thematic indices were developed at the household level and subsequently at the GPU level. The final step was to develop the thematic index at district level (y_i). It was calculated by population-weighted aggregation

technique based on population of the 4GPUs (Table 3.4) as weights (

Equation 3).

$$y_t = \frac{\sum_{i=1}^n w_i x_{it}}{\sum_{i=1}^n w_i}$$

Equation 3

Where,

y_t : population weighted average score of component (or theme) t for East district

w_i : population of GPU i as weight

x_{ij} : thematic index score of GPU i for component (or theme) t

$$\sum_i w_i = 1 ; 0 \leq w_i \leq 1$$

The thematic index is expressed in percentage with extreme poverty reflected by a score between 0-30% and no poverty by a score in the range of 80-100%.

4 CHAPTER 4: MULTIDIMENSIONAL POVERTY AND VULNERABILITY: A CASE STUDY FROM EAST SIKKIM⁹

The chapter presents multidimensional poverty assessments at district level to prioritize themes that reflect highest poverty and require immediate attention through interventions to reduce vulnerability in the district. The discussion also dwells on the pro-poor interventions from the viewpoint of capability approach to understand to what extent these interventions have contributed to enhancing the resilience of the rural mountain communities by reducing the ‘deprivation of people’s capabilities/freedoms’, in other words, the contextual vulnerability. The discussion is based on both quantitative and qualitative analysis on extent of multidimensional poverty in the selected rural mountain communities in East district of Sikkim and the influence of multidimensional poverty on the contextual vulnerability of these communities (RQ2). The analysis led to identification of the dimensions of multidimensional poverty that need to be prioritized to reduce contextual vulnerability through policy interventions, thereby contributing to building resilience of these communities to climate change (RQ3).

4.1 PRIORITY THEMES TO REDUCE VULNERABILITY: MULTIDIMENSIONAL POVERTY ASSESSMENT AT DISTRICT LEVEL

The multidimensional poverty in East district of Sikkim indicates the deprivation of the communities which makes these communities vulnerable to the impacts of climate change (Figure 4.1). It is important to mention here that the six themes reflect high poverty (30%-60%) while four themes reflect moderate poverty (60%-80%). The sub-

⁹ Presented this chapter in the annual conference of *Human Development and Capability Association (HDCA)* held at University of Cape Town, South Africa (6-8th September 2017) and at University of Georgetown , Washington DC(10-13 September 2015)

components of the ten themes fall in extreme (0-30%), high (30-60%) moderate (60-80%) and no (80-100%) poverty levels. For instance, extreme poverty is reflected in sub-component land tenure (27%) of farm assets. While no poverty is reflected in sub-component social equality (92%) of gender and social equality, toilet facility (98%) of sanitation and hygiene, and availability (82%) of domestic water supply (Table 4.1). The multidimensional poverty in the district highlights that vulnerability is not only induced by biophysical factors but also by poor socio-economic factors like poor education, healthcare, lack of employment, limited resources, poor connectivity, gender inequality etc. These poor socio-economic factors create a host of barriers that constraint the rural community's ability to withstand the impacts of climate change (Barua *et al.*, 2014).

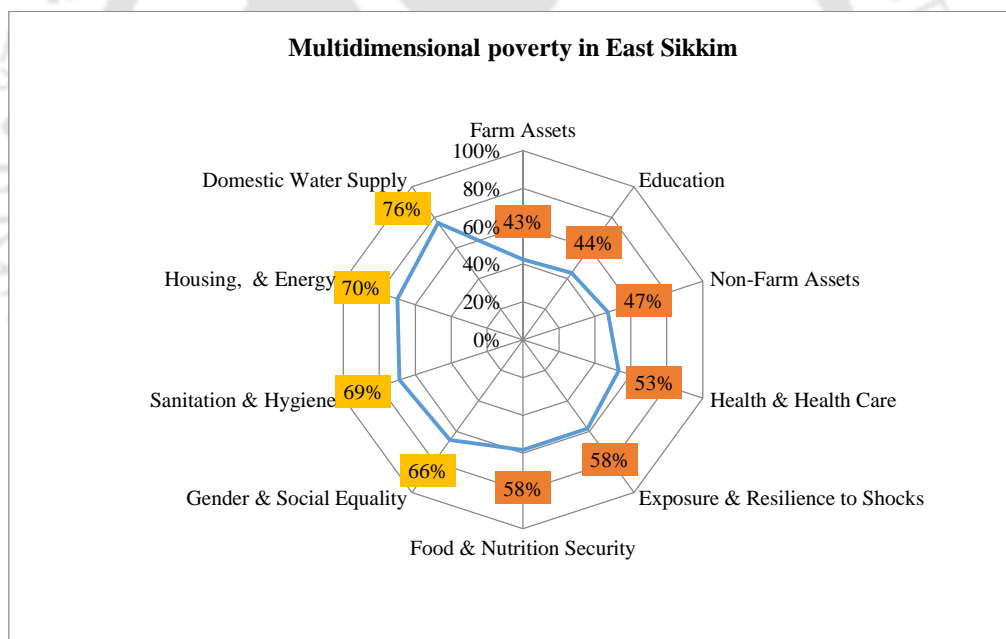


Figure 4.1: Multidimensional poverty in East Sikkim

Poverty levels (score in %)			
0%-30% Extreme	30%-60% High	60%-80% Moderate	80%-100% No

Table 4.1: Poverty levels according to the multidimensional poverty assessment scores

It is also important to know which kind of interventions have been implemented in the district to reduce poverty. Are these interventions pro poor? The interventions in these

themes is documented in table 4.2. It indicate that both physical and social interventions have been introduced. Although physical interventions such as infrastructure, technology are crucial to reduce vulnerability of the communities, they are insufficient to strengthen the resilience of people (Barua *et al.*, 2014). In contrast social interventions such as level of education and health are an essential element of the global response to climate change as they increase the opportunities and choices available to people (UNESCO, 2014).

In the subsequent sub-section, the discussion begins with the themes falling in the high poverty levels followed by the moderate poverty levels. In the discussion the intervention made for each of the themes of multidimensional poverty are discussed to understand whether these interventions have been able to address poverty adequately. It was also crucial to understand the differences in multidimensional poverty among the social groups as social group formed the basis for stratified random sampling for household survey (Table 3.6). The MPAT scores for the components and sub-components of the three social groups is presented in Table 4.3. It can be inferred that the households from the General category had comparatively lower poverty levels than households from OBC and ST category in five of ten themes- (1) non-farm assets, (2) exposure and resilience to shock, (3) food and nutrition security, (4) sanitation and hygiene, (5) housing and energy. The households from OBC category were better off than General and ST category in two themes of multidimensional poverty- (1) farm assets, and (2) gender and social equality. The households of ST category had relatively better MPAT scores for two themes- (1) education, and (2) health and healthcare. The three social groups had similar MPAT score for the theme domestic water supply.

Sl. No.	MPAT Components	MPAT Subcomponents	MPAT subcomponent score (%)	Interventions (schemes and programs)	Focus of these interventions
1.	Farm assets (43%) (<i>rural assets, exposure, and equality</i>)	Land tenure	27	1. National Food Security Mission 2007 (Government of India, 2007) 2. State Mission on Organic Farming 2003 (Government of Sikkim, 2013)	1. Aims to launch a food security mission comprising rice, wheat, and pulses to increase the production 2. Aims to protect its fragile ecosystem, ban chemical fertilizers, improve production
		Land quality	31		
		Crops inputs	43		
		Livestock/aquaculture inputs	73		
2.	Education (44%) (<i>fundamental needs</i>)	Quality	38	1. Sarva Shiksha Abhiyan (MHRD, 2017) 2. Right to education act (Government of India, 2009)	1. To provide useful and relevant elementary education for all 2. Universal enrolment of students between the ages of 6-14 in schools
		Availability	47		
		Access	48		
3.	Non-farm assets (47%) (<i>rural assets, exposure, and equality</i>)	Employment and skills	41	1. Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)(Government of India, 2015)	1. To guarantee rural employment and provide a minimum of 100 days of work
		Fixed assets and remittances	53		
4.	Health and healthcare (53%) (<i>fundamental needs</i>)	Health Status	50	1. National Health Mission 2013 (Government of India, 2013)	1. Health service beyond reproduction and child health, addresses the issues on communicable and non-communicable diseases. Also aims to improve infrastructure
		Access	67		
		Quality	44		
5.	Exposure and resilience to shocks (58%) (<i>rural assets, exposure, and equality</i>)	Degree of exposure	38	1. Reconstruction of Earthquake Damaged Rural Houses (REDRH) (Government of Sikkim, 2011b)	1. Post disaster reconstruction project after an earthquake of 6.8 magnitude on 18 th Sept 2011
		Coping ability	57		
		Recovery ability	50		
6.	Food and Nutrition Security (58%) (<i>fundamental needs</i>)	Consumption	58	1. National Food Security Mission (Government of India, 2007)	1. Aims to launch a food security mission comprising rice, wheat, and pulses to increase the production
7.		Access to education	39		

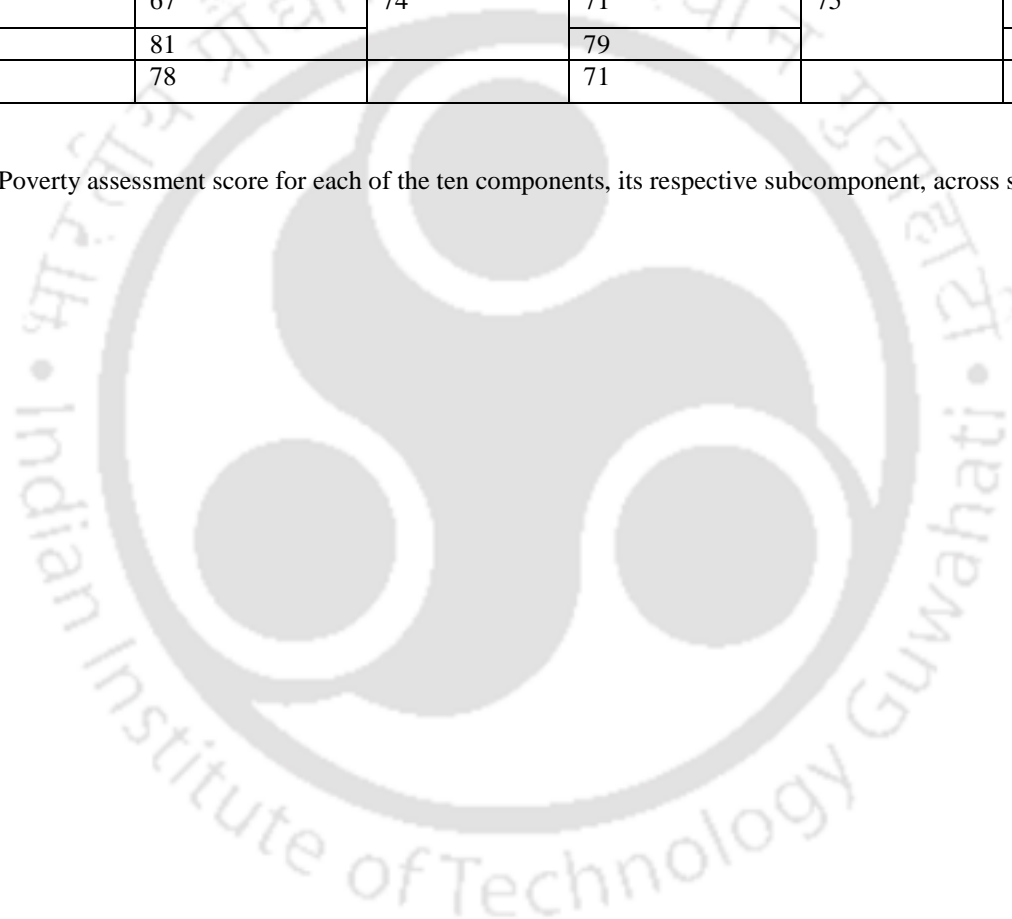
	Gender and social equality (66%) (rural assets, exposure, and equality)	Access to healthcare	59	1. Reservation in education, health, and other government schemes (Government of Sikkim, 2014)	1. To encourage equal participation in education, health, and other social sectors
		Social equality	92		
8.	Sanitation and hygiene (69%) (fundamental needs)	Toilet facility	98	1. Total Sanitation Campaign (Government of India, 2012)	1. Accelerate sanitation coverage in rural areas
		Hygiene practice	37		
9.	Housing and energy (70%) (fundamental needs)	Housing structure	71	1. Pradhan Mantri Awaas Yojana-Gramin (Government of India, 2014) 2. Chief Ministers Housing Scheme(Government of Sikkim, 2013)	1. Provides financial assistance to the rural poor living Below the Poverty Line 2. To make Sikkim the first Kutcha House-Free State in the country by 2013.
		Energy sources	68		
10.	Domestic Water Supply (76%) (fundamental needs)	Quality	69	1. Rural Water Supply Program(Government of Sikkim, 2012)	1. To enhance availability of water in the rural areas
		Availability	82		
		Access	79		

Table 4.2: Multidimensional Poverty assessment score for each of the ten components, its respective subcomponent, interventions and schemes implemented in in East Sikkim

Sl. No.	MPAT indicators	MPAT Subcomponents	State: Sikkim					
			District: East Sikkim					
			Social Group					
			General		OBC		ST	
			MPAT subcomponent score (%)	MPAT Component Score (%)	MPAT subcomponent score (%)	MPAT Component Score (%)	MPAT subcomponent score (%)	MPAT Component Score (%)
1	Farm assets	Land tenure	27	44	27	47	28	44
		Land quality	31		33		33	
		Crops inputs	44		50		37	
		Livestock/aquaculture inputs	72		77		76	
2	Education	Quality	32	38	40	37	38	43
		Availability	28		32		40	
		Access	54		40		52	
3	Non-farm assets	Employment and skills	44	51	36	44	31	42
		Fixed assets and remittances	58		51		52	
4	Health and healthcare	Health Status	53	59	62	60	76	62
		Access	73		83		76	
		Quality	51		34		33	
5	Exposure and resilience to shock	Degree of exposure	37	61	42	56	43	51
		Coping ability	77		57		56	
		Recovery ability	70		70		54	
6	Food and nutrition security	Consumption	70	70	62	62	50	50
7	Gender and social equality	Access to education	51	66	46	68	44	64
		Access to healthcare	58		64		63	

		Social equality	90		93		86	
8	Sanitation and hygiene	Toilet facility	100	71	95	62	100	67
		Hygiene practice	42		29		34	
9	Housing and energy	Housing structure	74	74	64	63	68	65
		Energy sources	73		61		62	
10	Domestic water supply	Quality	67	74	71	75	66	75
		Availability	81		79		83	
		Access	78		71		79	

Table 4.3: Multidimensional Poverty assessment score for each of the ten components, its respective subcomponent, across social groups in East Sikkim



4.1.1 HIGH POVERTY (30-60%)

The section dwells on the six themes which lie in high poverty (30%-60%) beginning with the theme with the highest poverty. Hence the order of the themes is – (1) farm assets, (2) education, (3) non-farm assets, (4) health and healthcare, (5) exposure and resilience to shock, (6) food and nutrition security. It is interesting to note that three of these themes represent *fundamental needs* while the other three are indicators of *rural assets, exposure, and equality*.

4.1.1.1 FARM ASSETS (43%)

The communities in East district are highly dependent on subsistence agriculture which is mostly rain-fed agriculture. Investments in farm sector such as the State Mission on organic farming emphasizes on the importance of subsistence agriculture, biodiversity conservation and environmental protection (Appendix 6). National Food Security Mission has also been implemented in the district, with the focus on distribution of seeds, equipment, season based trainings of farmers, seed storage facilities, public distribution system etc. Despite these investments, the result of MPAT for farm assets shows high poverty (43%) in the district. Among the four sub-components of farm assets, land tenure system lead to extreme poverty (0%-30%) reflected in a score of 27%, and quality of soil is poor (31%) and crop inputs are limited (43%) reflecting high poverty (30%-60%) (Table 4.2). Livestock and aquaculture input sub-component indicates moderate poverty with a score of 73%.

The major crops grown in the district are paddy, maize, millets, ginger, and cardamom (Appendix 6). Land tenure system suffers from extreme poverty because majority of the communities have a limited land holding size (below 1 hectare), rocky and steep terrain, decrease the fertility of the soil. Unavailability of crop inputs like assured irrigation facilities has been a barrier in achievements of the farm sector. Further,

increased incidences of crop diseases are a concern as this had led to drastic fall in agriculture production. For example, yellow leaves in cardamom and ginger, brown, circular spot in bean, grey-green water-soaked spots on tomato, yellowish leaves in oranges are some of the disease symptoms cited by the respondents. The respondents also cited increase in temperature as one of the causes of spread of diseases in crops. According to experts, climate change could be a major factor behind the uncontrollable spread of the crop disease in the State of Sikkim (Chaudhary, 2015). This has impacted the communities as most of the respondents are solely dependent on agriculture for their

“Agriculture production has decreased due to low rainfall”

“As a coping strategy we have made slight change in cropping pattern.”

“I grow vegetables to sell in the market, and I have been doing this since last three years. I have tried selling it through various means such as middle men, self-export to Siliguri, however, I have not

being able to make good profit due to high cost of transportation”

“I have not heard of any training programmes related to organic farming in the village, I am interested to undergo training”

“We sell agriculture produce if any through middlemen”

-Perceptions on farm assets from FGDs (translated from Nepali and Hindi)

livelihood with limited scope for employment diversifications.

Initiatives have been undertaken by the communities to boost the farm assets through livestock rearing such as poultry, piggery, dairy farming etc., and this is likely to act as an alternative livelihood of the rural mountain communities who are solely dependent on climate sensitive farm sectors (Government of Sikkim, 2011c). However, many of the respondent expressed that the scale of livestock rearing (poultry, piggery, dairy farming)

is small and is primarily for self-consumption and is only sold off during times of medical and education emergencies.

It is important to mention here that the communities were of the opinion that the present occupation of cultivation are mostly done under compulsion as there are no other livelihood opportunities available in the district. Some of the underlying factors cited by the communities regarding limited opportunities are poor education, low income, and poor market access. This indicates that the themes of multidimensional poverty are interconnected and influence each other. The interventions intended for one theme influences the success of other themes which are linked to it.

Further these interventions are social safety net (protective security¹⁰) but have not been made through a participatory approach as the community lack political freedom¹¹ (Table 3.7) to express their views in the planning and implementation of the interventions. The community perceives that there is a need to enhance the transparency¹² in implementation of the schemes on distribution of crop inputs. Similarly, economic facilities¹³ to use the farm assets is limited which has contributed to high poverty level. The interventions made to enhance the farm assets, such as crop inputs and livestock/aquaculture inputs have not been sufficient to reduce poverty and in turn vulnerability. A difference in the social opportunities in the farm assets has been observed with the OBC category reflecting a slightly lower poverty (47%) than the General (44%) and ST (44%) categories (Table 4.3). There needs to emphasis on enlarging the political freedom of the communities to influence decision on formulation and

¹⁰ Protective security: a component of the capability approach to human development (Section 2.3.2.4)

¹¹ Political freedom: a component of the capability approach to human development(Section 2.3.2.1)

¹² Transparency guarantee: a component of the capability approach to human development (Section 2.3.2.5)

¹³ Economic facilities: a component of capability approach to human development (Section 2.3.2.2)

implementation of interventions to make the intervention demand-driven. Secondly, increase the transparency in planning and implementing the schemes related to farm assets, increasing the investment in improving economic facilities for farming sector. Lastly, there is a need to lay emphasis on equality in opportunities for the social groups. These considerations are important for reducing contextual vulnerability of these agriculture dependent communities.

4.1.1.2 EDUCATION (44%)

Education is a crucial factor for overall human development. Government initiatives such as Sarva Shiksha Abhiyan (SSA), and Right to Education Act (RTE) in education sector have not adequately addressed the **quality of education (38%), availability (47%) and access to education (48%)**. This is evident in high dropout rates among the

“Our children are unable to go for higher education as there are no facilities for higher education in our region, and sending them to Gangtok will only be possible if we have proper income”

- Perceptions on education from FGDs (translated from Nepali and Hindi)

children. For example, distance to the nearest primary school is 1-2 km, secondary school is 3-4 km, while College/ University are located in at a distance of 60 km in Gangtok.

The communities were of the opinion that most of the children dropped out after class 10 because of long distance and high fees with very less provision of education loan. This has resulted in low educational qualification among the communities. For example, only 24% of the household respondents were graduates and they have cited poor quality of schooling, lack of affordability in terms of income, lack of accessibility to higher educational facilities as the underlying factors that have limited their educational achievements. Low educational qualification has been a challenging problem for the

district as it has led to increased rate of unemployment among the youths. For example, Human Development Report (2014) of Sikkim shows that 50% of the rural population in East district are unemployed (Government of Sikkim, 2014). Similarly, the quality (38%) of education has been impacted by high student: teacher ratio (senior secondary= 1:60; Primary school= 1:30) and this was one of the main concerns of the communities.

The *social safety net* schemes in education sector have been made through a top-down approach where the emphasis on quality of education was relatively less and this has resulted in high poverty for the sub-component (38%). The communities expressed their interest in participating in decision on the future interventions in education sector to draw attention towards improving the quality of education in the district for better employment opportunities. Their interest in participation is to also make the process of planning and implementation of interventions transparent, which contribute to *political freedom* and *transparency guarantee*.

Among the three social groups the least poverty level in education sector is of ST category (43%) while OBC has the highest poverty (37%) primarily because households from the OBC category had least access to education among the three groups (Table 4.3). This reflects a difference in *social opportunities*. Further, the current status of the *economic facilities* in the education sector such as infrastructure for improved access, and quality of education is not able to generate economic opportunities like income generating employment, skills and knowledge thereby limiting the community's capability to enhance adaptive capacity.

4.1.1.3 NON-FARM ASSETS (47%)

Non-farm assets are crucial to cope and recover from an unexpected occurrence of natural disasters. Referring to Table 4.2 it can be inferred that lack of employment and skills (41%) has limited the opportunities of the communities. Very few are engaged in

sector other than agriculture, for instance in business, labourers, and government/private jobs. Although the employment generation scheme under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) has succeeded in providing wage labour (Appendix 7), the respondents expressed that their engagement is as unskilled labourers, the scheme is designed in a way that only one member of each household is employed through it. Further, the respondents have experienced a delay in payment

“My two sons are graduate, however, they are still engaged in agriculture. They have applied for many jobs but failed to get any. There is a lack of opportunities available in the region”

“We have limited income due to lack of employment opportunities apart from agriculture. We don't have the capacity to buy assets and we owe very few assets which can be sold off”

“As a coping strategy we sell off few assets (utensils, garments, livestock etc.) which we possess during times of emergencies such as medical, education etc.”

- Perceptions on non-farm assets from FGDs (translated from Nepali and Hindi)

which has resulted in low achievements from such schemes. Similar initiatives have been undertaken by the Government to create employment through self-help groups. These groups are mostly engaged in cultivation of ginger, cardamom. The revenue generated is given as loan to the households who need it at an interest rate of 2%. However, it was observed that many of the poorer houses were not a member of any of the self-help groups and hence could not benefit from this provision. There are few money lenders (*Mahajan*) in the villages and they charge high rate of interest (10-15% per month).

Further lack of fixed assets and remittances (53%) has influenced the ability of the communities to cope and recover from natural disasters. For example, the earthquake in September 2011 led to destruction of fixed assets, houses, agricultural land, and the community largely depended on the Government to compensate for the damages caused.

The communities possess very few fixed assets (TV, Vehicle etc.), no proper market access, and also the provision for financial services are low in the region. Further lack of skills has limited the opportunities of the communities and very few members of the village go outside the village for employment. Therefore, investments are crucial in this sector as it plays an important role in reducing the vulnerability of the communities.

From the discussion above it can be inferred that the community has limited *freedom to participate* in implementation of *social safety net* schemes such as MGNREGA and SHG, this has led to a lack of awareness on the budget and other details about the schemes. There needs to be an effort in enhancing *transparency* in implementation of the schemes where the beneficiaries are made well aware of the various aspects of the schemes. The community perceives that there is a lack of adequate *economic facilities* to reduce the high unemployment rate, as the MGNREGA scheme employs only one member of the household while the average size of the household is 5. Limited amount of fixed assets and their destruction in hazards also indicates that they have very less buffer to recover from the impacts of these hazards.

A difference in the *social opportunities* can be observed from Table 4.3 as the households from General category (51%) have least poverty among the three social groups and ST category has the highest poverty (42%).

4.1.1.4 HEALTH AND HEALTHCARE (53%)

The status of health and healthcare reflects high poverty as only primary sub centres and dispensaries are located within the GPU (usually 20-30 minutes' drive from the villages). Although the respondents expressed that the access to basic health facilities with primary health centres located in almost every GPUs (67%), the health status (50%) and the quality of treatment (44%) were main concerns. The poor health status was evident in increased incidences of diseases such as fever, diarrhoea, diabetes, high blood

pressure etc. Further, poor hygiene, food habits, low consumption of recommended diets and changes in climatic parameters (rainfall and temperature) were cited as underlying causes increased incidence of diseases and of poor health status.

Quality of treatment reflects high poverty primarily because of the lack of facilities available in the region for treatment of major diseases. The facilities available are only for treatment of minor diseases such fever, diarrhoea, etc., in the sub centres and dispensaries. The treatment is generally administered by nurse. The doctors usually visit the facilities only once a month when the medical camps are organized. Efforts have been initiated by the Government with the implementation of projects under “National Health Mission 2005” where the focus is on health service beyond reproduction and child health, addressing the communicable and non-communicable diseases. Monthly medical camps are organized every month under National Rural Health Mission (NRHM) where health

“Earlier there were no disease such as diabetics in our village. This disease has increased during last 10-15 years due to changes in food habit such as consumption of food from outside the State which are grown using chemical fertilizers”

“Mostly take traditional medicines from the forest to cure diseases such as jaundice, fever, dysentery etc.”

-Perceptions on health and healthcare from FGDs (translated from Nepali and Hindi)

check-up and medicines are distributed free of cost in the sub centres and dispensaries. However, medical supplies often run out of stock. Treatments of complicated or serious illness or injuries, needs to be undergone at Gangtok, which is around two to three hours’ drive from the GPU. Affordability of medical expenses for complicated diseases seems to be low among communities. Most of them have to borrow money from the money lender/self-help groups (SHG) in case of medical emergencies to seek treatment for illness/accidents.

Communities' *involvement* in planning and functioning of *social safety net schemes* in health sector like National Health Mission is limited. This has resulted in a mismatch in the priorities of the community and the government, for instance, community's priority is accessibility to doctors for seeking timely treatment for major illnesses which is lacking in the health sector at present. Lack of awareness about the schemes among the communities emphasizes a need to strengthen the communication with them on the various aspects of the schemes to strengthen *transparency*. The *economic facilities* for healthcare sector like improving infrastructure and provisions is crucial because investment in healthcare not only contributes to improved health but also contributes to economic wellbeing as illness affect the economic productivity of people.

There is not much variation in the health and healthcare among the three social groups, i.e., it ranges from 59-62%. The households of ST group revealed slightly lower poverty in terms of health and healthcare (62%). Hence the social opportunities in the health and healthcare need to improve equally for the three social groups.

4.1.1.5 EXPOSURE AND RESILIENCE TO SHOCK (58%)

Literatures on climate change vulnerability assessments for the State of Sikkim have reported that weather has become unpredictable and erratic, snow is melting rapidly, and water sources are drying up (Sharma *et al.*, 2009, Tambe *et al.*, 2011, Sharma and Rai, 2012). When questioned about climatic parameters (rainfall and temperature), the respondents expressed that there have been incidences of erratic rainfall, and increased temperature during the last 10-15 years. They specifically pointed out that since the year 2001, there is a striking decrease in rainfall. Further, the district is highly vulnerable to the impacts of natural disasters such as earthquake and landslides resulting in destruction of houses, roads, crops etc. Occurrence of landslides during rainy season is also a cause

of concern in the district (Appendix 5). This is evident in the MPAT score of 38% for the sub-component, *degree of exposure*, of the district.

We have observed changes in rainfall and temperature pattern compared to last ten years and this has resulted in decreased agriculture production, increase of diseases on crops, human”

“Winters are becoming warmer in our region...we have made a slight shift in vegetables grown during winter seasons”

- Perceptions on exposure and resilience to shocks from FGDs (translated from Nepali and Hindi)

The communities have experienced colder winters and hotter summers. These changes in rainfall, temperature have cumulative impact on the socio economic status of the communities through impact on water resources, agriculture, and health. The respondents reported that the agriculture production in the district has decreased compared to a few years back; there have been increased incidences of crop diseases. The respondents cited an increase in price of essential commodities due to disruptions in agriculture production, and lack of proper transportation. There have been higher incidences of diseases such as jaundice, dysentery, diarrhoea, cold and fever etc., among the communities. These have limited the ability of the communities to cope and recover from the impacts of natural disasters (Table 4.2). This is evident in the MPAT score of 57% for coping ability and 50% for recovery ability. According to Barua et al. (2014) mountain communities are more vulnerable to the impacts of natural disasters such as earthquake, landslides due to limited mobility and poor infrastructure which also makes it difficult for interventions and assistance to reach on time. Therefore, to tackle the impacts of climate change and climate variability, the Government of Sikkim has been sensitive to these emerging threat of climate change and proactive steps are already

underway to mainstream climate change adaptation in the development planning of the State (Tambe and Arrawatia, 2012).

The intervention of REDRH, under which earthquake damaged households were reconstructed, was implemented as *protective security*. This has been very specific intervention for the state as Sikkim is highly vulnerable to earthquake. It has been appreciated as it was introduced on the basis of people's requirements therefore people had *political freedom* in the decision. Some of the respondents expressed that they have not benefited from the scheme and feel there needs to be *transparency* in sharing the details of the scheme to strengthen trust between the community and the government. The *economic facilities* in transportation, agriculture, health and healthcare, education are damaged during exposure to shock such as earthquake, and landslide. The recovery is slow and the respondents expressed that the losses in health care, and agriculture due to crop damage limits their overall wellbeing.

Further it can be inferred from Table 4.3 that the households from ST category have relatively higher exposure to shocks than OBC and General, and have lower ability to cope and recover from the shock (51% for ST, 56% for OBC, and 61% for General). As they have relatively lesser *social opportunities* than the other 2 groups, ST category needs to be prioritized to reduce their contextual vulnerability.

4.1.1.6. FOOD AND NUTRITION SECURITY (58%)

The food and nutrition security in the district suffers from high poverty in terms of availability, and consumption of food to meet nutritional requirements according to the recommended dietary allowance (RDA). The respondents shared that they do not go hungry; however they lag behind in terms of food self-sufficiency, as well in meeting recommended dietary allowance (RDA). The respondents expressed that the crops cultivated are insufficient to meet the food requirements of the villages despite

agriculture being the main source of livelihood. Rice, vegetables, pulses (dal) have to be purchased from the market. The food consumed did not meet the standard RDA as proposed by Indian Council of Medical Research (ICMR) for protein, carbohydrates, fats, vegetables, and fruits intake (ICMR, 2009).

The analysis of food consumed shows that even though rice, dal, meat, vegetables, milk and milk products are consumed regularly, proteins in the form of fish and meat are consumed in lesser quantity than prescribed RDA. For instance an average of 4g/day is consumed while 40g/day is recommended. Similarly, intake of fruits is around 5g/day in comparison to the recommended intake of 50g/day which is a concern. Various interventions have been implemented to fulfil the food requirements in the district. For instance, Public Distribution System (PDS) and mid-day meals are social safety net schemes to improve food and nutrition levels in the States of India and they have also been implemented in East district. PDS is targeted towards households falling Below Poverty Line¹⁴ (BPL). Beneficiary households with 5 members are provided 35kg of rice and with more than 5 members are provided 50kg of rice at Rs.2 /kg under PDS. Mid-day meals program is targeted towards school going children. The scheme is aimed to encourage school attendance along with improvement of food and nutrition levels. Other schemes have also been implemented in the district which focus on distribution of seeds, equipment, and season based trainings, and seed storage facilities to contribute to

“Although the government has introduced organic farming in the State, the food that we consumed comes from outside the State as the crops grown in our field are insufficient throughout the year. So we still eat food that is grown using chemical fertilizers”
- Perceptions on food and nutrition security from FGDs (translated from Nepali and Hindi)

14 Defined by Government of India (2014)

food and nutrition security. Despite these interventions in the district, food and nutrition security reflects high poverty; hence there is a need to enhance the focus on achieving food and nutrition security in the district.

Food and nutrition security is lacking in the district because respondents of the survey expressed that they have not been able *participate* in making *social safety net* schemes suitable to the context of the district. The food habit and consumptions patterns of these mountain communities are different and to achieve food and nutrition security the components of diet which are lacking in meeting the RDA need to be focused through these social safety net schemes on food and nutrition security. There is a good level of awareness about the provisions they receive as beneficiaries and this is because of *transparency* in implementation of the PDS system. *Economic facilities* which is the like the ability to buy nutritious food (fruits, meat, milk, etc.) for consumption is limited due to lack of economic capacity.

There is a significant variation in the food and nutrition security status based on social groups in the state, with ST having an MPAT score of 50%, while that of General is 70%. Therefore, it is essential to bridge this inequality in *social opportunity* food and nutrition security.

4.1.2. MODERATE POVERTY (60-80%)

The section dwells on the four themes which lie in moderate poverty (60%-80%) beginning with the theme with the highest poverty. Hence the order of the themes is – (1) gender and social equality, (2) housing and energy, (3) sanitation and hygiene, and (4) domestic water supply.

4.1.2.1. GENDER AND SOCIAL EQUALITY (66%)

The district also lags behind in gender and social equality as it reflects a high poverty; among the sub-components, access to education (39%) should be prioritized as there is

high gender inequality in it. Gender inequality in access to health care services reflects high poverty (59%). According to Hou and Ma (2012) women with more decision-making power are more likely to use the health care services. Female members with higher educational qualifications have greater say in the household decision-making process. The findings from the MPAT shows that gender and social inequality in education and health has resulted from socio-cultural context of the communities where female have lower access to education, and health care. For example, it is the female members who are likely to drop out of schools during the times of emergency as compared to the male members of the household. Further, it is observed that it is the female members who perform most of the household activities such as collection of water, taking care of the child, food etc., along with the agriculture activities. Gender inequality also exist in the form of property inheritance, domestic violence, engagement of majority of the female members in agriculture, limited participation in political activities, under representation in bureaucracy, early marriage etc. Efforts have been undertaken by the Government of Sikkim to bring about a gender equal society. There is a mandatory rule of 50% representation of women in local institutions, i.e., Panchayat. Further, there are reservation for women, and people of different social groups in Government jobs to strengthen social and gender equality. This has resulted in MPAT score is 92% for the sub-component social equality. A score of 92% reflect no deprivation resulting from difference in social group (caste and tribe) in economic opportunities.

The *participation* of women and different social groups has been encouraged in *political, economic, and social* discussion and decision-making through targeted interventions (*social safety net*). As a result of these interventions, the respondents expressed, that there is not much variation (64%-68%) among the social groups in the

“Although I have job card to work under MGNREGA schemes I have not yet worked under the schemes, as I have a young child to take care and my husband who is a driver mostly remains busy and there is no one to take care of the baby”

“I have married at the age of 16 since most of girls get married early in our villages. Although I had attended schools, I discontinued after marriage as married women don't attend schools in our villages”

“The initiatives are self-help groups to empower women, reservation under Government for female members in panchayat”

- *Perceptions on social and gender equality from FGDs (translated from Nepali and Hindi)*

component of social and gender equality, where 64% is for ST, and 68% is for OBC. Due to good governance and *transparency*, the beneficiaries are well aware of their rights and entitlements. However, social and cultural factors are still limiting the efforts toward gender equality; this is evident in early marriage, and early motherhood, higher dropout rate of female students, and inability to benefit from economic opportunities for women.

4.1.2.2. SANITATION AND HYGIENE (69%)

Sikkim has been declared as the first State with 100% sanitation coverage in India (Tambe and Arrawatia, 2012). Sanitation facilities with enclosed pit are constructed in accordance with the guidelines of World Health Organization (WHO, 2013). These toilet facilities are constructed under total sanitation campaign (TSC)/Nirmal Bharat Abhiyan sponsored by Ministry of Drinking Water and Sanitation (MDWS), Government of India. However, despite these initiatives and claim by the Government of Sikkim, many household are yet to have toilet facilities which are reflected by the MPAT score of 98%. Further, many respondents expressed lack of practice of washing hand after defecation and before consuming food (hygiene practice has a MPAT score of 37%). Poor sanitation habits influence the health conditions (poor sanitation causes diarrhoea) of the communities. According to Narayan *et al.* (2009) "Improved sanitation contributes

enormously to human health and well-being, especially for girls and women”. Hygiene practices are also likely to be influenced by the educational attainments among the

“Although we have toilets in our houses, we did not get any support from the Government. Most of the toilets are self-built”
- Perceptions on sanitation and hygiene from FGDs (translated from Nepali and Hindi)

communities (WHO, 2016). Therefore there is a need to create awareness and bring about behavioural change to improve the hygiene practices in the district.

People have limited freedom to participate in planning of the interventions (social safety nets) on sanitation and hygiene and this reflected in a low emphasis on awareness generations on hygiene practices. In additions the respondent expressed that there are lack of interventions on hygiene practices and this has resulted in poor health and diseases related to poor hygiene practices. The respondent also made a link between poor hygiene and economic losses in treatments. Hence there is a need to invest in *economic facilities* through interventions on hygiene. There is a variation in hygiene practices of the households from different social groups with extreme poverty among the OBC households (29%), followed by ST (34%) and General category households (42%) (Table 4.3). Therefore, emphasise need to be laid on improving the hygiene practices of the three social groups, particularly of OBC households.

4.1.2.3. HOUSING AND ENERGY (70%)

Various initiatives have been taken by the Government in the form of housing schemes such as the Chief Minister's rural housing mission, and Reconstruction of Earthquake Damaged Rural Houses (REDRH). These aim to replace the temporary (Kutchha) houses with that of pucca structure; this is because "Kutchha houses" are vulnerable to extreme weather events and susceptible to collapse during earthquake. Houses damaged in earthquake are compensated a sum of Rupees 30000-500000 depending upon the nature of damage and type of housing. The respondents mentioned that 51 houses (in Rolep Lamaten, Rhenock Tarpin, Dolepchen, and Sudunglakha GPU) were completely destroyed during the September 2011 earthquake that occurred in the State. The fully damaged houses were provided a sum of rupees 4.8 lacs to rebuild their houses while the mildly damaged houses were compensated depending upon the extent of damage. However, the communities are yet to benefit from such schemes and most of the communities live in weak housing structure (Kutch and Semi Pucca houses) (Appendix 5) as reflected from the MPAT score (71%).

"Although my house was damaged during the 2011 earthquake, I did not benefit from the schemes provided to rebuild the damaged house"

"The money provided under housing schemes are insufficient to build houses room 5-6 members of a household"

"Repair the houses every year to make it strong enough to resist earthquake, strong etc."

- Perceptions on housing and energy from FGDs (translated from Nepali and Hindi)

The main source of energy for light is electricity with connection for every household in the district. Electricity connection is provide free of cost to the BPL household with nominal charges for the electricity usage. However there are reports of regular power

cuts especially during the summer season. Fuel wood collected from the forest is the main source of energy for cooking. The fuel wood is collected with the permission of the forest Department, Government of Sikkim. Overall, the status of energy source in the district falls under moderate poverty (68%) and require improvements.

The housing schemes implemented by the state government are *demand-driven* and therefore respondents are well *aware* of the benefits from the *social safety net schemes*.

The schemes have *benefitted people across social groups*, and there is not much variation among the social groups in the housing and energy theme. The social group with relatively higher poverty is OBC (63%) and the group with least poverty is General (74%). There has been emphasis on the *economic facilities* as the scheme intends to provide permanent houses to the households living in temporary houses. This is an important aspect to reduce vulnerability.

4.1.2.4. DOMESTIC WATER SUPPLY (76%)

Although, interventions in water sector have improved the availability (82%) of water in the district, desired improvements are yet to be achieved in quality (69%), and accessibility (79%) to domestic water supply, amounting to moderate poverty in domestic water supply component (76%). Most of the household have piped connection for drinking water under Rural Water Supply Programme (RWSP), Government of Sikkim. However, few households still collect water from springs, with approximately 15-30 minutes as the time taken for collection of water.

We don't have problem of drinking water in our village. However, water for agriculture is insufficient during the winter months due to less rainfall"

"The water in the springs has drastically reduced especially during winters compared to 10-15 years back"

*"Water storage tanks build under rural water supply scheme has helped in storing water"
- perceptions on domestic water supply from FGDs (translated from Nepali and Hindi)*

Decrease in availability of water in the springs have been observed during winters (Sharma *et al.*, 2009, Tambe *et al.*, 2011). This decrease in water sources in the district is a cause of concern for the communities as most of the communities are dependent on springs water and rainfall for their agriculture activities. Some of the springs located in the selected study sites are *Thuola Dhara, Devithan Kholcha, Jhor Dhara, Durga Devi Mandir Dhara, Laxuman Dhara, Rizal Dhara, and Guruji Dhara*. An interesting observation was that most of the springs are named and linked to names of God and Goddess as people of Sikkim, considers the air, soil, water and the biota all sacred and any human-induced perturbation is considered to spell disaster for Sikkim as a whole (Ramakrishnan, 1998). To revive and maintain the drying up of springs, the Government of Sikkim under “Dhara Vikas” programme has undertaken various initiatives such as digging trenches to collect the runoff water. Water storage facilities are available in almost every household with the tanks built under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). MGNREGA schemes along with water related initiatives such as building of water tanks, digging trenches has resulted in employment generation in the region. Although the quality of water is constantly monitored by the Government, communities mostly drink water after boiling as this has been practice since generations due to its cold weather.

4.2 SUMMING UP

From the above discussions, it can be inferred that efforts and investments has been made in the selected study regions to improve the socio economic aspects e.g., human capital (health and education), or economic resources (livelihood opportunities and market linkage), which are needed for enhancing resilience and overall development of the region through breaking the poverty trap. However, the poor communities in remote and marginalized mountain regions tend to be more seriously affected by climate change

due to **low education, poor health, limited assets (both farm and non-farm assets), and due to gender discrimination.** Deprivation in these sectors has further enhanced the vulnerability of the communities. Recent studies illustrate that people's educational level enhance their ability to adapt to natural disasters including climate change (Striessing *et al.*, 2013, Muttarak and Lutz, 2014b) and this has also been reflected in East Sikkim district of Sikkim. For example, low educational attainments among the communities had limited their participation in schemes and projects. Many of respondent in the region were unable to recall the name and budget allocated for schemes and projects implemented in the region. Lack of participation in schemes and projects has limited their opportunities to benefit from such schemes, which would have boosted their capacity to withstand the impact of such natural disasters. Similarly, the poor status of health and healthcare services are a concern in the region as it influences the vulnerability to the impacts of climate change (Hahn *et al.*, 2009) and also reduces the opportunities available among the communities (Robeyns, 2013). Further, natural resource-dependent rural poor households are likely to ensure a disproportionate burden of the adverse impacts of climate change (Agrawal and Perrin, 2008). The findings from the field shows that majority of the household (80%) are dependent on agriculture for their livelihood and this is despite the fact that agriculture production remaining stagnant due to difficult topography, small and fragmented holdings, limited irrigation, and lack of farm mechanization and frequent occurrence of natural calamities like landslides, floods and earthquakes (Government of Sikkim, 2011a, Government of Sikkim, 2014) resulting in low and uncertain earnings among the communities. Further lack of non-farm assets, lack of access to market, small land holding size, low educational qualification, poor health, and limited opportunities and choices, has increased the vulnerability of the communities to climate change. Subsistence agriculture as the sole source of livelihood in the study

region seems inadequate, specifically with the lack of access to market, limited landholding size and reduced availability of water due to climate change.

Another concerns of the communities were related to non-farm assets (47%) as there are reports of lack of employment opportunities, skills, and as well limited assets which can be sold off during the time of emergencies. Further the communities were of the opinion that despite few opportunities available in the region, the communities did not have the skills to utilize benefits from such opportunities. For example, the national flagship programme, Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) under non-farm sector can be become an important source of climate-proof cash income in the rural areas (Government of Sikkim, 2011c). However, as mentioned elsewhere, under MGNREGA schemes, the communities are mostly involved in unskilled works with lower pay as compared to skilled labourers. Most of the skilled workers are hired from outside the villages. Similarly, the very few household with higher agricultural productions have failed to sell the agriculture products due to lack of proper access to market.

Due to mismatch of skills and opportunities, people in the selected areas have failed to convert the existing opportunities (agriculture, MGNREGA, self-help group etc.) into actual achievements, thereby limiting their *economic facilities* available to the communities. Similarly, the opportunities of vocational training under livelihood mission although are important and much needed, it have failed to benefit the large section of the people, as only few of them have attended such trainings. These lack of skills along with the mismatch in opportunities are likely influence the vulnerability among the communities. It is important to understand the underlying causes leading to lack of skills and go for a long term interventions that are crucial to improve the skills as well the opportunities available among the communities.

Another important sector that require special attentions are concerns related to gender equality. Gender equality are crucial for climate change adaptation as it is the female who are more vulnerable to the impacts of climate change. The respondents were of the perception that the rate of school dropouts were higher among female child, poor access to health, and there are fewer employment opportunities for women apart from agriculture as compared to man. For example, in the employment generation schemes such as MGNREGA, it is the mostly the male members who holds the job cards to work under such schemes. Only a few female respondent that participated in the FGDs hold job cards. Although they hold the job cards many of them failed to work under such schemes as they are mostly engaged in managing the household chores which is reflected from the opinion of the participants below. Similarly, the culture of early marriages has limited the achievements of the female child in the region. It is observed that social setup such as early marriage, and as well the traditions of married women not going to schools have limited the freedom to attain school. Further, participation of female members in public discussion were low and it is likely to overlook the concerns of the female during designing of interventions. For instance, in one of the FGD conducted with the female members, many of the respondent in the FGD were of the opinion that they were not aware of the budgets, schemes, and policies that are implemented in the villages while most of the male respondent were aware of such schemes. This has further marginalize the female members in the society by limiting the **social opportunities** and **transparency** in the system of Governance. Similarly, most of the respondent were of the opinion that decision making power mostly lies among the male members of the household. This lack of decision making powers are likely to limit the capabilities by overlooking the concerns of the female during the implementation of projects related to education, health, housings, etc.

Therefore, it is crucial to focus on how these rural communities can derive maximum benefits from the present interventions to avoid the impacts of hazard and climatic variability and simultaneously enhance their ability to adapt to long term climate change.

To identify the GPUs which are relatively more vulnerable and need to be prioritized for reducing the vulnerability of the district, the multidimensional poverty assessment at GPU level is discussed in the next chapter.



5 CHAPTER 5: MULTIDIMENSIONAL POVERTY ASSESSMENT: A SUB-DISTRICT ANALYSIS TO IDENTIFY PRIORITY AREAS FOR REDUCING CONTEXTUAL VULNERABILITY¹⁵

This chapter discusses the status of multidimensional poverty at sub-district level (GPU) in East district. It is interesting to note that there is a variation in the multidimensional poverty across the four GPUs, i.e. Rhenock Tarpin, Sudunglakha, Dolepchen and Rolep Lamaten, from Rhenock and Regoh development blocks. The MPAT scores reflect that the themes fall in high (30-60%) and moderate (60-80%) poverty levels (Figure 5.1 and Table 5.1). The discussion in the chapter is aimed to identify the most vulnerable GPUs theme-wise to prioritize the areas for reducing vulnerability.

5.1 PRIORITY THEMES TO REDUCE VULNERABILITY: MULTIDIMENSIONAL POVERTY ASSESSMENT AT DISTRICT LEVEL

From the MPAT assessment presented in Figure 5.1, it was found that ***Dolepchen GPU is the most vulnerable in five themes*** of multidimensional poverty themes- (1) education, (2) non-farm assets, (3) exposure and resilience to shocks, (4) housing and energy, (5) domestic water supply. ***Rhenock Tarpin was the most vulnerable GPU in the four themes*** of multidimensional poverty - (1) farm assets, (2) health and healthcare, (3) food and nutrition security, (4) gender and social equality. ***Sudunglakha GPU is the most vulnerable in one theme*** of multidimensional poverty- sanitation and hygiene.

¹⁵ Presented this chapter in the annual conference of *Human Development and Capability Association (HDCA)* held at University of Cape Town, South Africa (6-8th September 2017) and at University of Georgetown , Washington DC(10-13 September 2015)

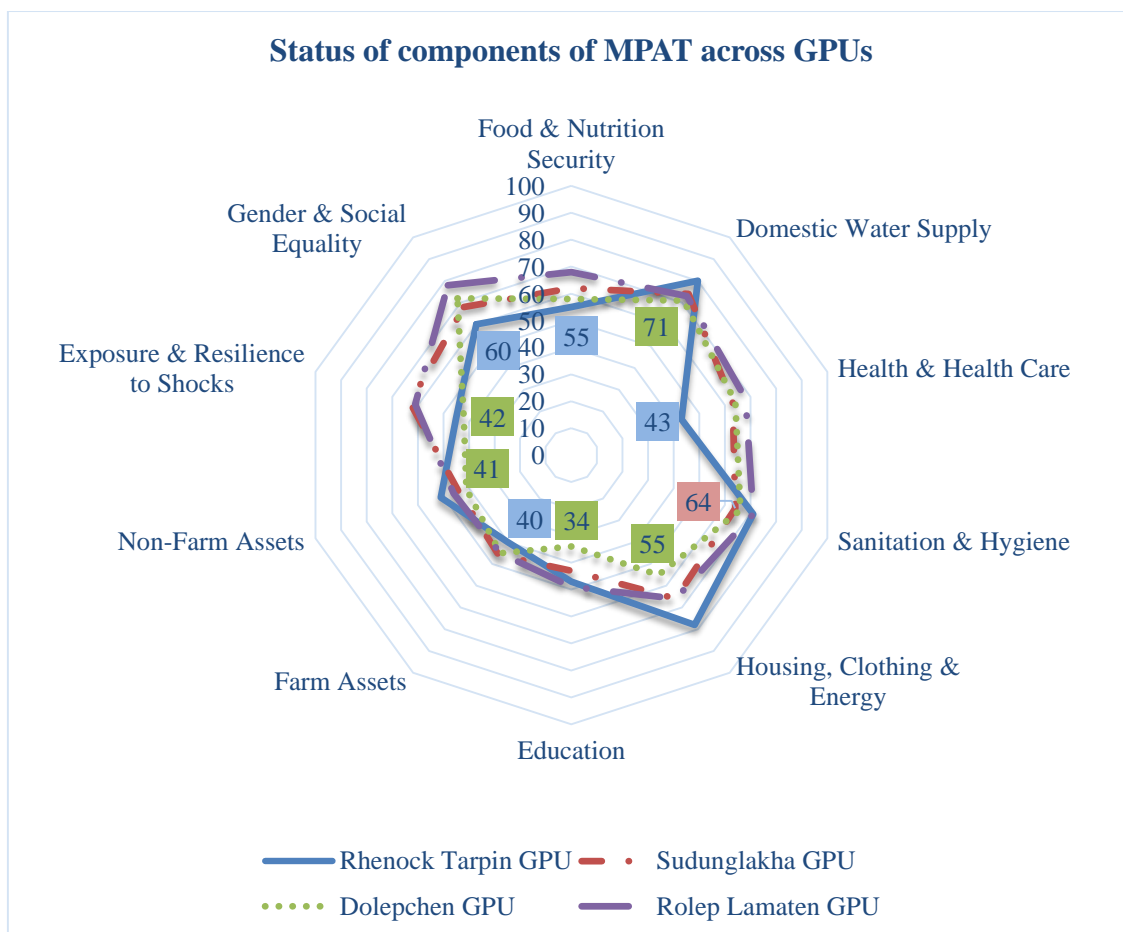


Figure 5.1: MPAT score across four GPUs in East Sikkim District

Sl. No.	MPAT indicators (score for the district) <i>category</i>	MPAT Subcomponents	State: Sikkim							
			District: East District							
			Rhenock Development Block				Regoh Development Block			
			Rhenock Tarpin GPU		Sudunglakha GPU		Dolepchen GPU		Rolep Lamaten GPU	
			MPAT subcomponent score (%)	MPAT Score (%)	MPAT subcomponent score (%)	MPAT Score (%)	MPAT subcomponent score (%)	MPAT Score (%)	MPAT subcomponent score (%)	MPAT Score (%)
1.	Farm assets (43%) (<i>rural assets, exposure, and equality</i>)	Land tenure	27	40	28	46	27	45	26	45
		Land quality	30		34		32		32	
		Crops inputs	35		51		54		46	
		Livestock/aquaculture inputs	70		80		75		76	
2.	Education (44%) (<i>Fundamental needs</i>)	Quality	38	47	64	43	21	34	39	49
		Availability	52		29		49		42	
		Access	56		36		27		65	
3.	Non-farm assets (47%) (<i>rural assets, exposure, and equality</i>)	Employment and skills	47	51	35	44	36	41	33	46
		Fixed assets and remittances	55		53		47		58	
4.	Health and healthcare (53%) (<i>Fundamental needs</i>)	Health Status	33	43	72	63	62	64	77	68
		Access	55		83		79		81	
		Quality	41		42		52		47	
5.	Exposure, and resilience to shock (58%) (<i>rural assets, exposure, and equality</i>)	Degree of exposure	35	45	50	63	39	42	35	61
		Coping ability	58		65		42		75	
		Recovery ability	42		75		47		66	
6.	Food and nutrition security (58%) (<i>Fundamental needs</i>)	Consumption	55	55	62	62	58	58	68	68
7.	Gender and social equality (66%)	Access to education	30	60	38	68	43	72	78	78
		Access to healthcare	54		65		66		64	
		Social equality	95		92		85		93	

	<i>(rural assets, exposure, and equality)</i>									
8.	Sanitation and hygiene (69%) <i>(Fundamental needs)</i>	Toilet facility	100	71	100	64	90	66	100	71
		Hygiene practice	43		29		23		43	
9.	Housing and energy (70%) <i>(Fundamental needs)</i>	Housing structure	79	78	65	66	61	55	65	66
		Energy sources	76		68		49		66	
10.	Domestic water supply (76%) <i>(Fundamental needs)</i>	Quality	66	80	73	74	74	71	65	73
		Availability	86		79		75		80	
		Access	89		69		65		74	

Table 5.1: Multidimensional Poverty assessment score for each of the ten components, and its respective subcomponent across four GPUs of East Sikkim

5.1.1 HIGH POVERTY (30-60%)

The discussion on GPUs in this section dwells on the six themes which lie in high poverty (30-60%) beginning with the theme with the highest poverty. Hence the order of the themes is – (1) farm assets, (2) education, (3) non-farm assets, (4) health and healthcare, (5) exposure and resilience to shock, (6) food and nutrition security.

5.1.1.1 FARM ASSETS

Among the four GPUs Rhenock Tarpin has the highest poverty in farm assets (40%) while Rolep Lamaten has the least poverty (46%) (Table 5.1). One of the main concerns across the four GPUs was the *extreme poverty* (0-30%) in the sub-component land tenure (land holdings, type of ownership) (Figure 5.2). Limited land holding size among the communities has resulted in low agricultural production. The average landholding size varies across the four GPUs with lowest in Rhenock Tarpin (0.13 hectares) and highest in Rolep Lamaten (1.07 hectares) (Table 3.4). Majority of the household in the four GPUs are engaged in agriculture as their primary occupation. Rhenock Tarpin GPU has the highest number of households dependent on agriculture (301 households) and least in Rolep Lamaten (117 household) (Table 3.4).

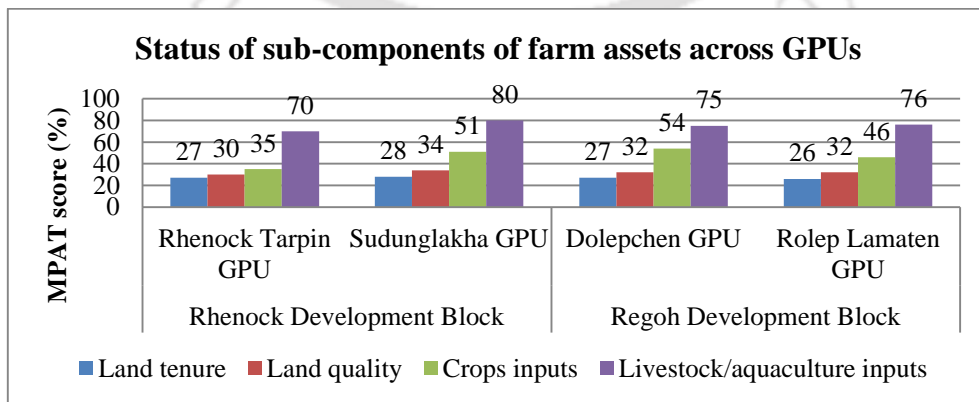


Figure 5.2: Status of sub-components of farm assets across GPUs

Many of the household did not have access to land for cultivation and therefore were dependent on shared cropping. Further the quality of land is poor; it ranges from 30% in Rhenock Tarpin to 34% in Sudunglakha GPU (Figure 5.2). It is important to mention here that Sikkim being a hilly State, has mostly steep land. The organic mission initiatives by the Government distribute crops inputs across the four GPUs. However, very few people have benefitted from such schemes due to limited land holding size; this is reflected in high poverty for the sub-component of crop inputs (Figure 5.2). Rhenock Tarpin also has highest poverty in the sub-component ‘crop inputs’, i.e., 35% while Dolepchen has the least poverty (54%). Further the crops produced are largely for self-consumption (Table 5.2).

	State: Sikkim			
	District: East Sikkim			
	Rhenock Development Block		Regoh Development Block	
	Rhenock Tarpin GPU	Sudunglakha GPU	Dolepchen GPU	Rolep Lamaten GPU
Crops for self-consumption	Rice, maize, millet, wheat, urd, potato lemon, ginger	Rice, maize, millet, wheat, potato, ginger	Rice, maize, millet, potato lemon, ginger	Maize, rice, finger millet, wheat, ginger
Crops for sell	Nil	Nil	Nil	large cardamom
Livestock for self-consumption	goats, pigs, poultry, ducks, cattle and sheep	goats, pigs, poultry, ducks, cattle and sheep	goats, pigs, poultry, ducks, cattle and sheep	goats, pigs, poultry, ducks, cattle and sheep

Table 5.2: Crops grown, and sold and livestock

The subcomponent of ‘livestock/ aquaculture inputs’ which is the only sub-component reflecting moderate poverty (60-80%), is perceived to play an important role in income generation. In the present context, livestock rearing (goat, pig, poultry, dairy etc.) is primarily done for self-consumption and is sold off in times of emergency like natural calamities, medical needs, and for supporting education. Among the four GPUs, Rhenock Tarpin emerges as the most vulnerable for the ‘farm assets’ component, therefore needs to be prioritized.

5.1.1.2 EDUCATION

Dolepchen GPU has highest poverty in education (34%), while Rolep Lamaten GPU has least among the 4 GPUs (49%). This is also evident in a highest illiteracy rate in Dolepchen (26%) (Table 3.4). Dolepchen has extreme poverty in terms of quality (21%), the quality is hampered due to high teacher student ratio (1:40) in the primary schools. Dolepchen GPU also has extreme poverty in access to educational facilities (27%), while there is high poverty in availability (49%) (Figure 5.3). Therefore, there is a need for improvement in all the three sub-components of education.

Sudunglakha GPU has extreme poverty in availability of education (29%) and has second highest poverty in education (43%). This is mainly due to the lack of availability of facilities for higher education as there are only primary schools in the GPU.

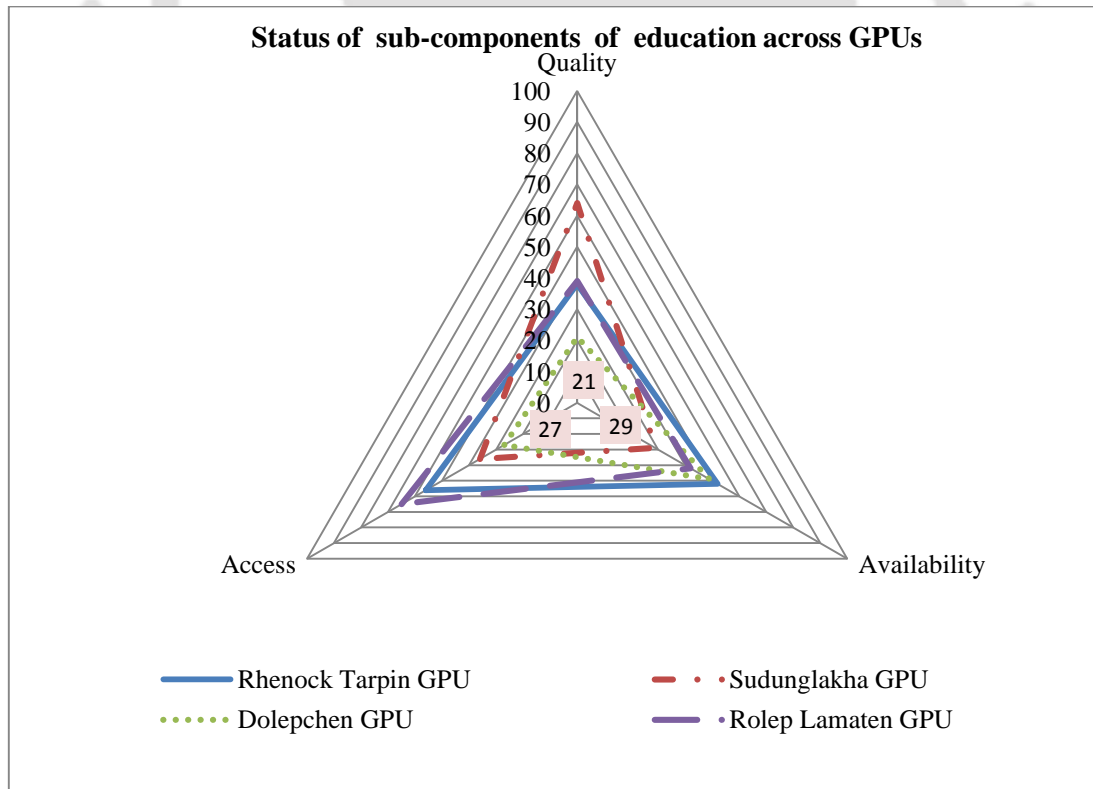


Figure 5.3: Status of sub-components of education across GPUs

The respondents perceive private schools to be better than public schools in terms of education facilities, and expressed that the private schools are largely affiliated with Christian missionary. The main reason for not being able to send their children to private school is high fees (Rupees 250-450 per month) which make it unaffordable due to limited income. While the difficulty in attaining higher education, i.e., senior secondary school and college is long distance (approximately 15 km).

Rhenock Tarpin (47%) and Rolep Lamaten (49%) GPUs have relatively lower poverty; among the three sub-components, quality reflects highest poverty in both the GPUs, i.e., 38% and 39%, respectively. The respondents from the two GPUs revealed that they have access to primary, secondary and tertiary (college), however, due to long distance there is high school dropouts rates which has resulted in only a few attaining higher education.

There is an urgent attention needed to improve the status of education in all the four GPUs considering these underlying causes of low achievements in education for overall human development and enhancing their adaptive capacity.

5.1.1.3 NON-FARM ASSETS

All the four GPUs lack non-farm assets which are crucial during times of emergencies such as natural calamities, medical conditions etc., (Figure 5.4). The underlying factors for high poverty in the non-farm assets is lack of diversified employment opportunities, and lack of professional skills required for occupation other than traditional agriculture. The respondents expressed that they are engaged in non-agriculture sector are mostly unskilled laborers under the employment generation scheme of MGNREGA. This is reflected in the

MPAT score for employment and skills sub-component lying in high poverty range (30-60%), with the highest poverty in Rolep Lamaten (33%), and least in Rhenock Tarpin (47%).

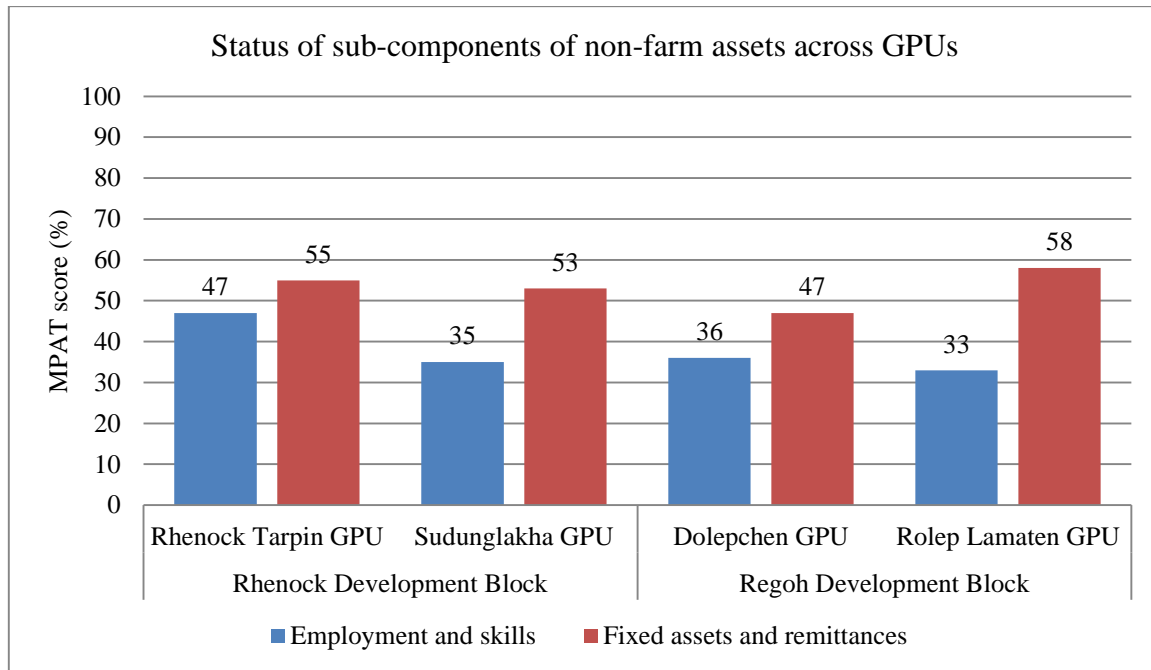


Figure 5.4: Status of sub-components of non-farm across GPUs

The subcomponent ‘fixed assets and remittances’ reflects lesser poverty than ‘employment and skills’ however it still has high poverty levels. The highest poverty is in Dolepchen (47%) and least in Rolep Lamaten (58%). The remittances are low as people who migrate are employed in unskilled or semi-skilled jobs. For the component of non-farm assets, Dolepchen has the highest poverty (41%) and Rhenock Tarpin has least (51%).

5.1.1.4 HEALTH AND HEALTH CARE

Achievements in the status of health and healthcare in the four GPUs suffers from moderate to high poverty (Figure 5.5). Rhenock Tarpin has the highest poverty with MPAT score of (43%) and least in Rolep Lamaten (68%) (Table 5.1). Rhenock Tarpin has highest poverty in all the three sub-components, i.e., poor health status with reports of chronic illness

(33%), poor quality of treatment (41%), and limited access to health facilities (55%) (Figure 5.5). The respondents shared that the nearest primary health center is 15kms away which is difficult to cover in short time in hilly terrain. Further, there is only a provision of dispensaries in the GPU which have limited medical supplies for treating minor illnesses such as cold, fever, diarrhea, etc.

Among the sub-components of healthcare, quality of treatment is a major concern in other three GPUs. It lies in high poverty (30-60%), - Sudunglakha (42%), Rolep Lamaten (47%), and Dolepchen (52%) (Table 5.1). The quality of healthcare suffers due to unavailability of doctors in the primary health centers. For better health status, accessibility to medical facilities (primary health centers) needs to be prioritized as these medical facilities are distantly located in the three GPUs (5-10 km). In addition, the respondents expressed that they prefer to seek treatment in Government medical facilities as the treatment in private medical facilities is highly expensive and unaffordable for larger section of the society.

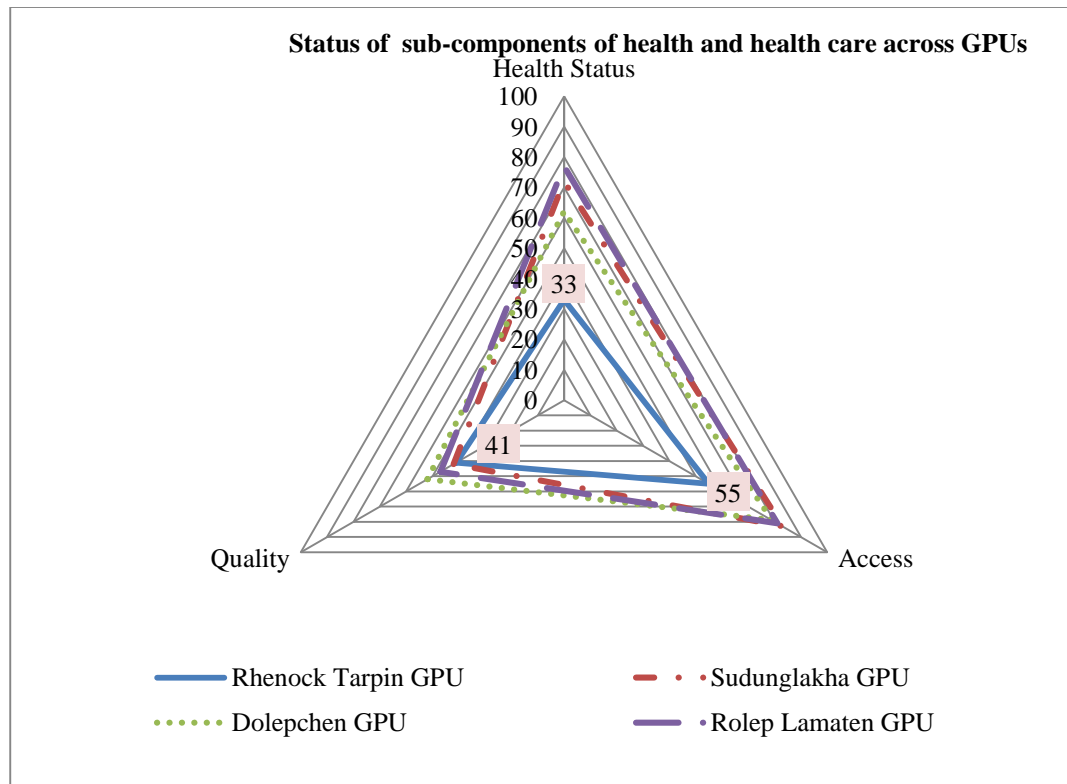


Figure 5.5: Status of health and health care services across four GPUs

5.1.1.5 EXPOSURE, AND RESILIENCE TO SHOCKS

Dolepchen GPU has the highest poverty in the theme of exposure, and resilience to shocks (42%) while Sudunglakha has the least (63%) (Table 5.1). It is observed that Rhenock Tarpin (35%), Rolep Lamaten (35%) have relatively higher exposure to shocks, and Sudunglakha (57%) has least (Figure 5.6). The respondents cited that the degree of exposure to shocks like earthquakes and landslides in 2011 was very high which led to large scale destruction of infrastructure, which affected agriculture, healthcare, education and others. Among the GPUs, Dolepchen has highest poverty in coping ability (42%) and Rhenock Tarpin in recovery ability (42%). The ability to cope and recover from the impacts of these shocks are determined by the assets owned, level of education, status of health, and other resources. Therefore, pro-poor policy interventions and improvements in these sectors are

crucial to enhance the ability to cope and recover from these shocks and reduce the vulnerability of the rural mountain communities.

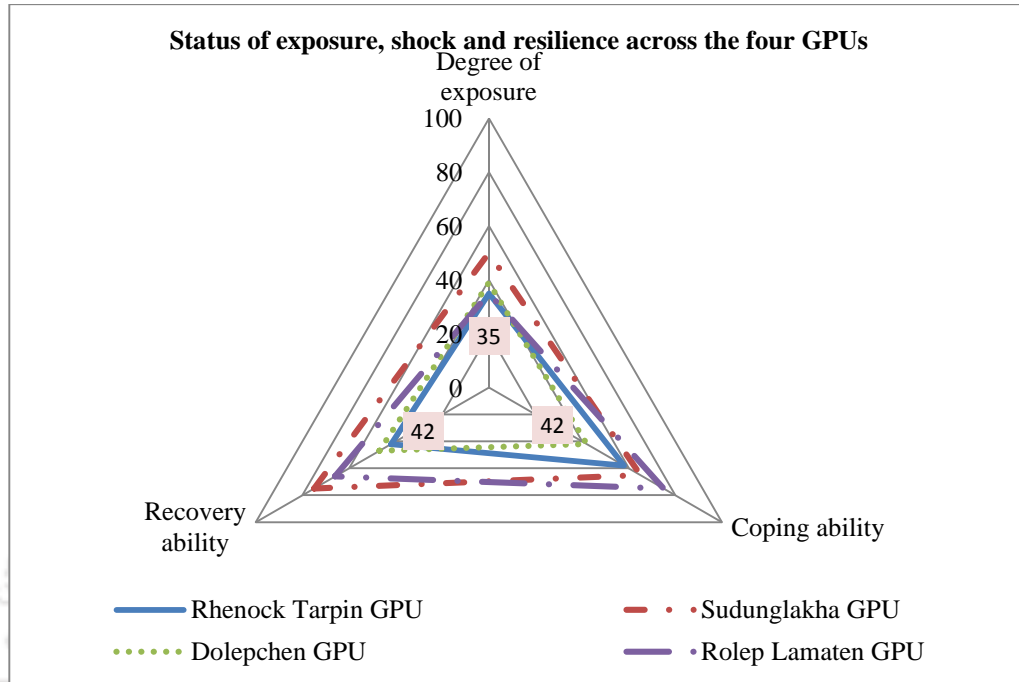


Figure 5.6: Status of exposure, shock and resilience across the four GPUs

5.1.1.6 FOOD AND NUTRITION SECURITY

The consumption level in the four GPUs fall under high (30-60%) and moderate poverty (60-80%) levels with highest poverty in Rhenock Tarpin (55%) followed by Dolepchen (58%), Sudunglakha (62%), and Rolep Lamaten (68%) (Table 5.1). It is interesting to observe that the GPUs where majority of the population are engaged in agriculture are worse off in terms of achievements in food and nutrition security. For instance, Rhenock Tarpin has 301 households dependent on agriculture followed by Dolepchen (222 HH), Sudunglakha (184 HH) and Rolep Lamaten (117 HH) (Table 3.4). It can be inferred from the results that agriculture does not provide substantial income to purchase food to meet the basic needs (RDA) for achieving food and nutrition security. Hence, it is crucial to supplement their

income by engaging in non-farm sector such as daily wage laborers, small business (poultry, dairy) etc., to meet the basic needs for food and nutrition security.

Another interesting finding was based on the number of BPL households in the GPU and their food and nutritional security status. It is observed that the GPUs with higher number of BPL household had comparatively better food and nutritional level, for instance, Rhenock Tarpin had the highest number of BPL HH (216) followed by Dolepchen (144 HH) have higher poverty in terms of food and nutrition security than Sudunglakha (122 HH) and Rolep Lamaten (136). PDS is the *social safety net* scheme for providing cheap essential commodities to BPL HHs to reduce their poverty in food and nutrition security. For example, every BPL household is provided with 35 kg of rice at Rs. 4/kg, wheat flour at Rs.9/kg, and sugar at Rs.13.50/kg under PDS.

Food and nutrition security (Consumption level across the four GPUs per day)					
Food categories	RDA per day (ICMR, 2009)	State: Sikkim			
		District: East Sikkim			
		Rhenock Development Block		Regoh Development Block	
		Rhenock Tarpin GPU	Sudunglakha GPU	Dolepchen GPU	Rolep Lamaten GPU
Grains and cereals (rice, maize, wheat and other cereals) (gm)	460	1000	850	650	1200
Pulses (gm)	40	15	30	30	60
Vegetables (gm)	100	120	160	150	140
Fruits (gm)	50	6	5	5	4
Milk and milk products / egg (gm)	150	70	110	80	70
Fish and meat (gm)	40	3	5	5	4
Edible oils (gm)	20	100	80	90	70
Sugar (gm)	30	50	60	78	60
Salt (gm)	30	50	20	70	30

Table 5.3: Status of food consumed

Despite these variations, interventions are needed in all the four GPUs, as the communities in all the GPU has not been able to meet the RDA as recommendation by ICMR

(2009). The findings from the field shows food such as fruits, milk and milk product, egg, fish and meat, pulses are consumed in less quantity than the prescribed dietary allowance by ICMR (2009) (Table 5.3). The respondents expressed that high cost of transportation increases the price of essential foods such as fruits, milk, meat, fish, soybeans, pulses etc. And a lack of financial capacity to purchase these essential commodities has resulted in low nutritional level.

5.1.2 MODERATE POVERTY (60-80%)

The discussion on GPUs in this section dwells on the four themes which lie in moderate poverty (60-80%) beginning with the theme with the highest poverty. Hence the order of the themes is – (1) gender and social equality, (2) sanitation and hygiene, (3) housing and energy, and (4) domestic water supply.

5.1.2.1 GENDER AND SOCIAL EQUALITY

Among the GPUs, Rhenock Tarpin has the highest poverty in gender and social equality with an MPAT score of 60%. One of the main concerns of the GPU is equal access to education for female members where the MPAT score is 30%. The MPAT score of this sub-component at the border of extreme and high poverty. The poverty level is evident in a high school dropout rate of females due to domestic responsibilities of cooking, washing, taking care of younger siblings, engagement in agriculture, and long distances to the schools and other education facilities. Sudunglakha and Dolepchen GPU also have high poverty in access to education for female members with a score of 38% and 43%, respectively (Figure 5.7 and Table 5.1). In Rolep Lamaten, access to education for female members has moderate poverty level (60-80%) with a score of 78%, it is very close to the no poverty level of 80-100%

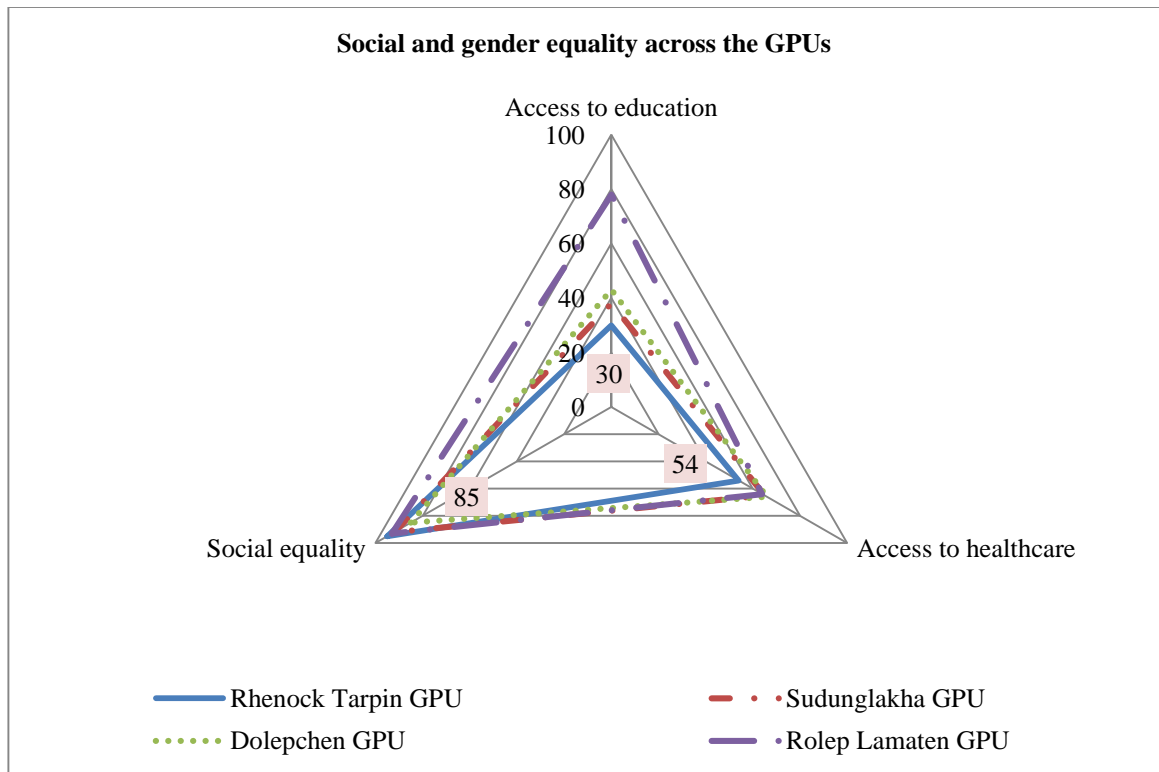


Figure 5.7: Status of gender and social equality across the four GPUs

Further access to health and health care services among the female members were a concern for all the four GPUs fall under high poverty Rhenock Tarpin (54%), followed by Rolep Lamaten (64%), Sudunglakha (65%) and Dolepchen (66%). There are reports of chronic illness among the female members and they also expressed the difficulties faced during pregnancy. Many of the pregnant women from the GPUs have to travel to Gangtok for seeking medical assistance in case of emergency during pregnancy.

The sub-component of social equality reflects that there is no poverty (80-100%) as the MPAT scores ranges from 85% in Dolepchen to 95% in Rhenock Tarpin. The respondents have not experienced discrimination based on their religious beliefs, and social affiliations.

5.1.2.2 SANITATION AND HYGIENE

The score for sanitation and hygiene practices in all the four GPUs fall under moderate poverty. Among the GPUs the highest poverty was in Sudunglakha (64%) while the least poverty was in Rhenock Tarpin (71%) and Rolep Lamaten (71%). As discussed in section 4.1.2.2, Sikkim has a 100 % total sanitation Coverage, and almost every household in the four GPUs has toilet facilities (Figure 5.8).

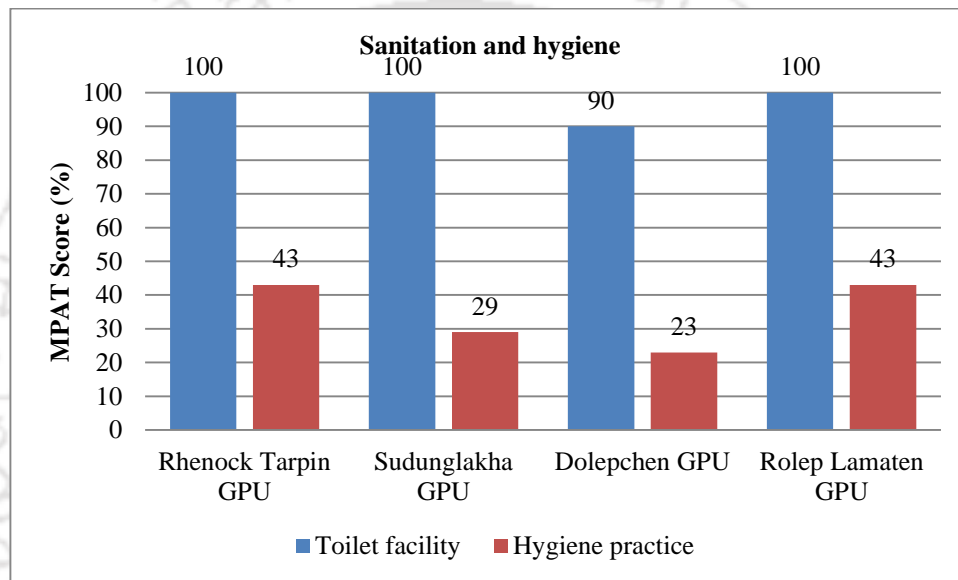


Figure 5.8: Status of sanitation and hygiene across GPUs

The concerns were mostly in the sub-component of ‘hygiene practices’ across the four GPUs in the context of washing hand after defecation and before food. It was worst in Dolepchen (23%) and Sudunglakha (29%) as they both lie in the extreme poverty level (0-30%), and Rhenock Tarpin (43%) and Rolep Lamaten (43%) falls in high poverty level. Efforts to improve the hygiene practices have been undertaken by the Government through various policy interventions under health and healthcare services, such as Accredited Social Health Activist (ASHA), Integrated Child Development Services (ICDS).

5.1.2.3 HOUSING AND ENERGY

Among the GPUs, Dolepchen (55%) has the highest poverty in housing and energy and least in Rhenock Tarpin (78%). Except Dolepchen all the other three GPUs experience moderate poverty (60-80%) (Figure 5.1 and Table 5.1). Despite high exposure of the district to hazards (earthquake and landslides), most of the communities' live in weak housing structure only 20% in Rhenock Tarpin lives in pucca house, 10% in Sudunglakha, 12% in Dolepchen, while comparatively higher percentage (28%) in Rolep Lamaten lives in Pucca houses (Figure 5.9). This is reflected in the MPAT score of all the GPUs (Figure 5.1). The communities were of the opinion that the present income is insufficient to incur the expenditure for building pucca houses. There are initiatives undertaken by the Government to provide permanent housing structures to the earthquake affected households (Table 4.2).

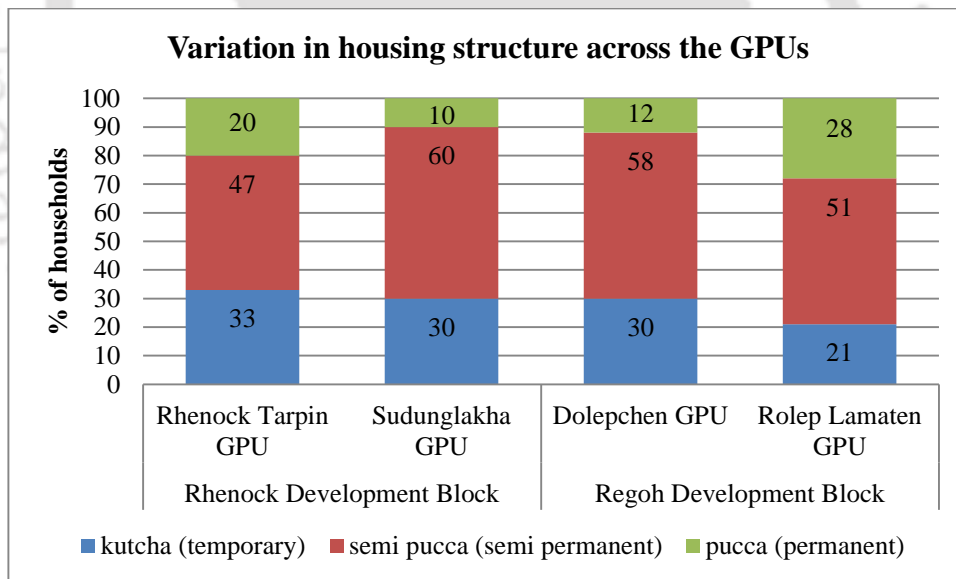


Figure 5.9: Variation in housing structure across the GPUs

Further, there is a variation in the source of energy for light and cooking in the GPUs. While the provision of electricity and LPG connections were available in all the four GPUs, household having electricity and LPG connections were comparatively lower in Dolepchen

and most of the households used kerosene as a source of light and firewood for cooking. Fire woods are collected from the forest with the permission from the forest department, Government of Sikkim. The MPAT score indicates that Dolepchen (49%) falls in high poverty levels (30-60%) while the other 3 GPUs lie in the moderate poverty levels (60-80%) (Table 5.1).

5.1.2.4 DOMESTIC WATER SUPPLY

Dolepchen GPU has the highest poverty in domestic water supply among the GPUs (71%), while Rhenock Tarpin has the least (80%) (Figure 5.1). The implementation of water schemes (Table 4.2) has resulted in improving the status of overall domestic water supply across the four GPUs (Figure 5.1). Further, large numbers of springs have improved the domestic water supply in the GPUs. There are eight springs in Rhenock Tarpin (*Thulo Dhara, Devithan Kholcha, Devithan Dhara, and Jhor Dhara*) and Sudunglakha (*Durga Devi Mandir, Laxuman Dhara, Rizal Dhara, and Guruji Dhara*).

Among the sub-components, the respondents from Rolep Lamaten expressed that the GPU has the poorest quality of domestic water supply (65%), Dolepchen GPU has the lowest availability (75%) and access (65%) (Figure 5.10).

Further, improvements are needed in all the sub-components to alleviate poverty. For instance, Rhenock Tarpin and Rolep Lamaten, lag behind in **quality of water** (66% and 65% respectively). In Sudunglakha and Dolepchen, **access to water** is a concern, in the winter season they experience water scarcity. Lack of access to water throughout the year is likely to influence the agriculture dependent communities in Sudunglakha and Dolepchen. More than 80% of the respondent from the GPUs were agriculture dependent and it is important

to mention here that domestic water supply is also used for agriculture in rural areas of Sikkim.

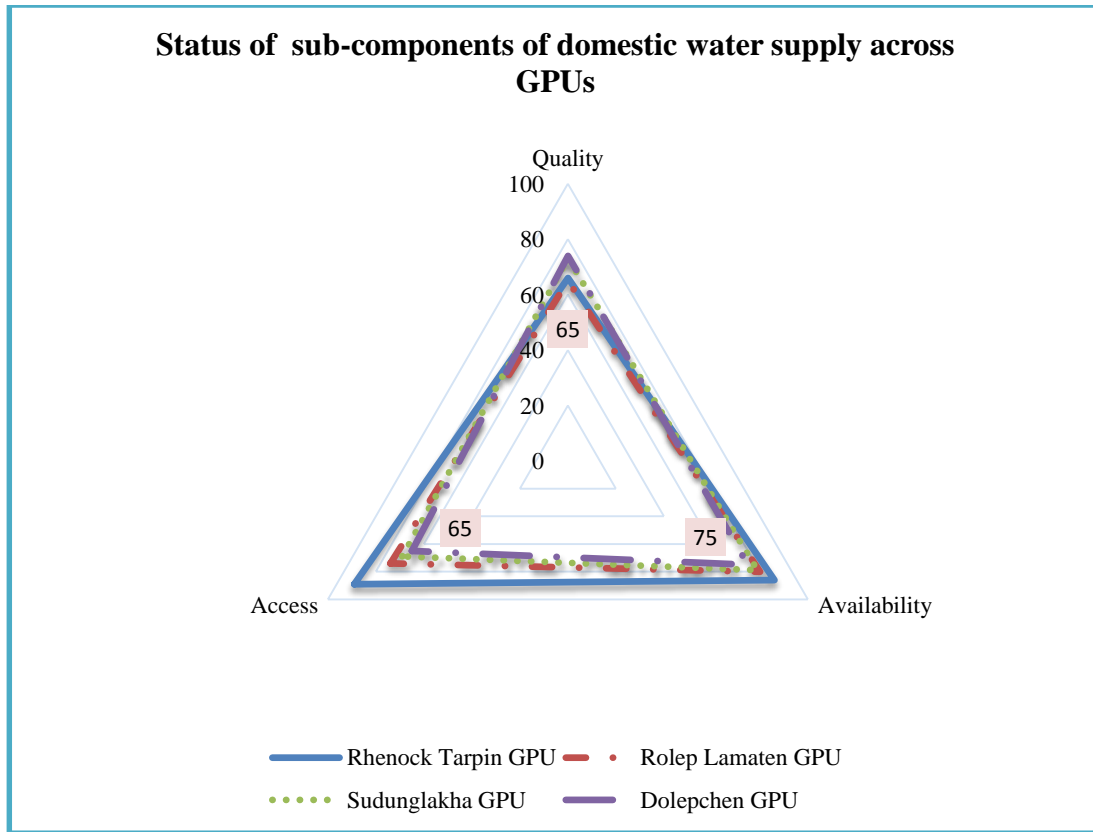


Figure 5.10: Status of domestic water supply across four GPUs

5.2 SUMMING UP

Identification of the weaknesses of the GPUs is crucial to adequately addressing the contextual vulnerability of the communities and building their resilience in a targeted manner. From the above discussions it can be inferred that poverty across the four GPUs ranges from extreme to no poverty. Relatively Dolepchen GPU suffers from higher poverty in five themes of the MPAT followed by Rhenock Tarpin (four themes of MPAT). Some of the sectors which require urgent interventions and investments across the four GPUs are farm assets, education, non-farm assets, health and healthcare, exposure and resilience to shock, and food and nutrition security. For instance, Rhenock Tarpin GPU relatively has

lowest achievements in farm assets. However, the main concerns across the four GPUs was the *extreme poverty* (0-30%) in the sub-component land tenure (land holdings, type of ownership). This is mainly due to limited land holding size among the communities, sloppy mountains resulting in limited agricultural production. This has further limited achievements from interventions such as the organic mission initiated by the Government of Sikkim. Another concern area where all the four GPUs suffer from extreme and high poverty is on education sector. Here, Dolepchen suffers from extreme poverty in terms quality of education and educational facilities, while Sudunglakha suffers from extreme poverty in terms of availability of educational facilities, thereby limiting higher education. Further, low educational achievements has led to low employment opportunities across the four GPUs. Similarly, quality of treatment under health and healthcare theme is a major concern in all the four GPUs. The quality of healthcare suffers due to unavailability of doctors in the primary health centers. Low achievements in the above MPAT themes (*lack of farm and non-farm assets, low level of education, poor status of health, and other resources that are crucial for adaptation*) has resulted in low the ability to cope and recover to any unexpected occurrence of natural calamities across the four GPUs. Therefore, it is important prioritize these themes during the designing of policies and interventions in the selected GPUs for successful adaptation to the impacts of climate change.

Based on these findings and discussions, the next chapter put forward some of the key outcomes and recommendations based on this research.

6 CHAPTER 6: CONCLUSION

The chapter is broadly divided into two sections. The first section revisits the research questions of this thesis, where key outcome and recommendations are made on the basis of findings from the discussions in the thesis. The second section highlights the scope of future research.

6.1 REVISITING THE RESEARCH QUESTIONS

(Key outcomes and recommendations)

The thesis aimed to examine the *link between poverty and vulnerability* of natural resource dependent rural mountain communities in East district of Sikkim, through capability approach to human development. The research was intended to contribute to formulation of well-informed pro-poor interventions on multiple dimensions of poverty in the region for strengthening community's resilience.

6.1.1 UNDERSTANDING ON POVERTY-VULNERABILITY LINKAGE (RQ 1)

(Does the capability approach to human development provides a holistic view to assess contextual vulnerability and the poverty-vulnerability linkage?)

The research builds an understanding on contextual vulnerability which is also known as social vulnerability as it focuses on the capacity of individuals and social groups to respond to, cope with, recover from, or adapt to, any external stress placed on their well-being and livelihoods (Kelly and Adger, 2000). The external stress is in the form of short term climate variability, social and environmental changes, unexpected changes and disruption to livelihoods.

Understanding on contextual vulnerability has evolved to acknowledge the complexity of climate-society interactions and its multidimensional nature. The physical and social

impacts of climate change are not homogenous as the magnitude and direction of climate change varies with space and time (O'Brien *et al.*, 2004, Pearson *et al.*, 2008). Therefore, it is crucial to understand and investigate the underlying causes of variation in **vulnerability** among communities and individuals through examining 'who is vulnerable', 'what is leading to vulnerability' and 'what is the existing capacity to adapt to changes' (Ford and Smith, 2004)

There is an intrinsic link between poverty and vulnerability, which is not only context-specific but is complex and multi-faceted (Cohen, 2009, Barua *et al.*, 2014, Leichenko and Silva, 2014). To acknowledge this, there has been an expansion in the understanding on poverty and vulnerability from a narrow focus on 'lack of economic resources' to an **inclusive** view encompassing 'lack of social and political/institutional factors, in addition to, economic resources'. This recognition came with the view that vulnerability is an inherent property of a society determined by factors such as poverty, inequality, gender patterns, access to basic need such as health care and housing (Brooks, 2003). The developing countries are relatively more vulnerable as they are already burdened by various problems such as poverty, high rate of population growth, and high dependence on natural resources. Adaptation to climate change plays a crucial role in these economies as the poor and the marginalized in these economies are at higher risk of impacts of climate change.

Multidimensional nature of poverty increases the vulnerability of the poor community to change, and makes it very difficult for them to break the poverty trap and 'bounce back' from impacts of climate variability in the short term and climate change in the long term. The poor are highly vulnerable due to lack of choices and opportunities. Therefore, there is

an urgent need to build adaptive capacity to reduce vulnerability among the individual/communities.

According to Seath (2010), climate change has the potential to undermine human development across countries. Therefore it is important to mainstream climate change interventions into development policies which along with human development, would lead to better adaptive capacity among local communities. Mainstreaming of climate change policies are crucial tool to ensure the **climate change adaptation and human development** are implemented hand in hand (UNDP, 2011). Mainstreaming involves the assessments and incorporating information and measures related to climate risks and vulnerabilities into development policies, plans, institutions, programs and projects (OECD, 2009). It would lead to cost effective mechanism of promoting adaptation through development projects. Further mainstreaming climate change policies in future projects and strategies would help in reducing vulnerability by including priorities that are contextual (Klein *et al.*, 2007). Therefore, there was a need to identify a suitable approach to human development which considers multidimensional nature of poverty, and would make meaningful contribution to ***pro-poor interventions***.

Human development approach for understanding the multidimensional poverty-contextual linkage draws attention to Sen's capability approach to human development discussed in 'Development as Freedom'. The focus is on human capabilities, i.e., *what people are effectively able to be (beings) and to do (accomplishments)*, in other words, 'ability' or 'inherent capacity' to convert resources into sets of capabilities. In the context of multidimensional poverty-contextual linkage, the capability approach indicates that vulnerability can be viewed as 'deprivation of human capabilities or freedoms', as

uncertainty posed by climate variability and climate change threatens to ‘erode human freedoms’ and limits the choice of an individual (UNDP, 2007). For reducing vulnerability through ‘expansion of the adaptive capacity and building resilience’ there is a need for ‘expansion of the freedoms people have and enjoy’ (Sen, 1999).

6.1.2 EXAMINING THE EXTENT OF MULTIDIMENSIONAL POVERTY IN EASTERN HIMALAYA (SIKKIM) (RQ 2)

(What are the factors leading to multidimensional poverty in the rural mountain communities and how does it influence the contextual vulnerability of these communities to climate change?)

Sikkim was selected for carrying out the multidimensional poverty assessment of rural mountain communities because it is characterized by a multitude of ethnic minorities, tribes and clans, where the dependence on natural resources is high, and impacts of climate change is likely to magnify the risk they face. Sikkim faces physical isolation, limited mobility, poor infrastructure, limited production & livelihood opportunities, poor access to resources, exposure to natural hazards (like earthquake, landslide, snow, storm) resulting in poor socio-economic development.

Through **purposive sampling method** four GPUs, (1) Rhenock Tarpin, (2) Sudunglakha, (3) Dolepchen, and (4) Rolep Lamaten were selected from Rhenock and Regoh development blocks of East district of Sikkim to carry out field survey on establishing the multidimensional poverty-contextual vulnerability linkage (Ongoro and Ogara, 2012, Sovacool *et al.*, 2012). As this research is intended to build research base on community perceptions and experiences on vulnerability to climate change, adaptation, and resilience it was important to interact with the communities and FGD was found to be an appropriate method. FGD reflected the social dynamics of the community in terms of their beliefs, experiences, and practices and were useful in exploring the underlying meaning of survey

findings which could not be captured quantitatively. As this research is also intended to bridge research and policy gap, FGD was found to be a useful tool in informing research based policy reforms, and planning interventions in a participatory manner. The sample of respondents for FGD was selected through purposive sampling method to collect *qualitative data*.

Multidimensional Poverty Assessment Tool (MPAT) was identified as suitable analytical framework for establishing the link between multidimensional poverty-contextual vulnerability. This is because it shares similarities with Sen's capabilities approach (Cohen, 2010) on viewing rural poverty as multifaceted, and complex. In particular, MPAT tries to capture the circumstances (personal, social, and environment conversion factors) in which a person is living and the opportunities (capabilities) and choices available to the person.

MPAT is a thematic index which gauges the multidimensional poverty in ten themes reflecting the *fundamental needs* and *rural assets, exposure, and equality* thereby emphasizing on the overall well beings of an individual/communities (Scoones, 1998, DFID, 1999, Cohen, 2009, Cohen and Sullivan, 2010). Particularly it includes 'exposure and resilience to shock' and the 'social and gender equality' as themes to define multidimensional poverty which are crucial for examining contextual vulnerability. Further, MPAT gave an impression of the status and success of *interventions* on the ten thematic components which are crucial for strategizing resilience building of the vulnerable communities in consultation with representatives of these communities. The sample of households for the survey was selected through **stratified random sampling**, for carrying out household survey to collect *quantitative data*. The **strata** for the **research** is defined in accordance with the classification of the social group based on the caste, i.e., General, ST,

and OBC to ensure that there is a representation of all the major social groups of the East district of Sikkim.

The multidimensional poverty assessment of East district of Sikkim reveals that the thematic poverty is concentrated in high (30-60%) and moderate (60-80%) poverty levels in the selected study region. Six of the themes of MPAT reflect high poverty (30-60%) – farm assets (43%), education (44%), non-farm assets (47%), health and health care (53%), exposure and resilience to shocks (58%), and food and nutrition security (58%). Four themes reflect moderate poverty (60-80%) – gender and social equality (66%), sanitation and hygiene (69%), housing and energy (70%), and domestic water supply (76%). High level of thematic poverty reflects deprivation in these sectors and has enhanced vulnerability of the communities. Similarly, there was a significant difference in multidimensional poverty among the social groups. The households from the General category had comparatively lower poverty levels than households from OBC and ST category in five of ten themes- (1) non-farm assets, (2) exposure and resilience to shock, (3) food and nutrition security, (4) sanitation and hygiene, (5) housing and energy.

The analysis of the data from the FGDs on instrumental freedoms, reveals that there is lack of freedoms among the communities. As interventions have not been made through a participatory approach, the community lacks political freedom to express their views in the planning and implementation of these interventions. The community also perceived that there is a need to enhance the transparency in implementation of interventions (social safety net schemes) as there is a lack of awareness about these interventions (social safety net schemes) among the communities. Similarly, current status of economic facilities to use the resources (such as farm assets, access to education) is limited in terms of achievements

(generate economic opportunities like income generating employment, skills and knowledge) thereby limiting the community's capability to enhance adaptive capacity.

6.1.3 POLICY INTERVENTIONS TO REDUCE CONTEXTUAL VULNERABILITY (RQ 3)

(How can policy interventions be improved to reduce contextual vulnerability of these communities and build their resilience to climate change?)

It is observed that various interventions have been made in the selected study regions with the focus on making improvements in sectors such as schools, health centers, sanitation, hygiene, housing, electricity, food and nutrition, domestic water supply, farm and non-farms etc. These interventions made in the district aims to improve the socio-economic well-being e.g., human capital (health and education), economic resources (livelihood opportunities and market linkage), or social safety net schemes (protective security). The communities perceive that these interventions are beneficial to some extent. However, as discussed multidimensional poverty do exist despite these interventions. The underlying factors observed in the region are mainly due to lack of instrumental freedoms such as political freedom, economic facilities, social opportunities, transparency guarantees and protective security revealed through the FDG. For example, social and gendered norms have limited the achievements of female in converting the facilities of school to attain higher education, compared to men. Similarly, lack of economic facilities have limited the benefits from interventions made in farm and non-farm sectors. The findings from the field shows that the interventions has not been made through a participatory approach, as such the community has been denied the freedom to express their views in the planning and implementation of these interventions. This has resulted in a mismatch in the priorities of the government and the communities. For instance, in education sector people want to participate in decision-

making to draw attention towards improving the quality of education in the district for better employment opportunities. Similarly, in farm sectors, despite limited land holding size, emphasizes is still on the crop inputs. In this case although the communities wanted more investment in employment diversification sectors such as livestock rearing, not much investment have been made in the region. This could be mainly due to the top down approach during framing of schemes for farm assets, where many of the concerns of the communities gets overlooked. Further, the community perceived that there is a need to enhance the transparency in implementation of interventions (social safety net schemes) as there is a lack of awareness about these interventions (social safety net schemes) among the beneficiaries. Many of respondent in the study sites were unable to recall the name and budget allocated for schemes and projects implemented. This resulted from lack of access to sufficient information on the schemes. Due to lack of awareness and access to sufficient information about the schemes, the respondent felt that the schemes are not implemented properly in some themes such as farm assets, education, non-farm assets, health and healthcare, exposure and resilience to shock, food and nutrition security. Further, people's participation in planning and implementation of interventions (political freedom) is to also make the process transparent. Current status of economic facilities to use the resources (such as farm assets, access to education) is limited in terms of achievements (generate economic opportunities like income generating employment, skills and knowledge) thereby limiting the community's capability to enhance adaptive capacity.

As a results of lack of freedoms, there are reports of low achievements in education (high dropouts), poor health and incidences of chronic diseases, lack of choices, low empowerment, lack of employment, skills, low income etc. These factors according to

literatures on climate change (Adger and Kelly, 1999a, IPCC, 2007, UNFCCC, 2007a, Norris et al., 2008a, American Meteorological Society, 2012, IPCC, 2014) are important determinants of vulnerability. As such the communities in the study regions are highly vulnerable due to low achievements from the interventions made in the selected study regions.

Sikkim among the Himalayan states, is one of the most proactive state in mainstreaming climate change adaptation strategies in their development policies. The state is making several interventions in the field of climate change through its State Action plan on Climate Change. However, in order to see a transformative change from these interventions, there is a need to adopt a human development approach, so that these interventions have a long term effect and leads to expansion of choices and freedom across communities.

The findings of this thesis can also be useful for other Indian Himalayan states who faces similar multi-dimensional nature of poverty and climate change acts as an additional stress, a human development approach in framing adaptation policies, will help in enlarging the enlarging the capabilities/freedoms of the people, which will lead to overall development and make community resilient to climate risk.



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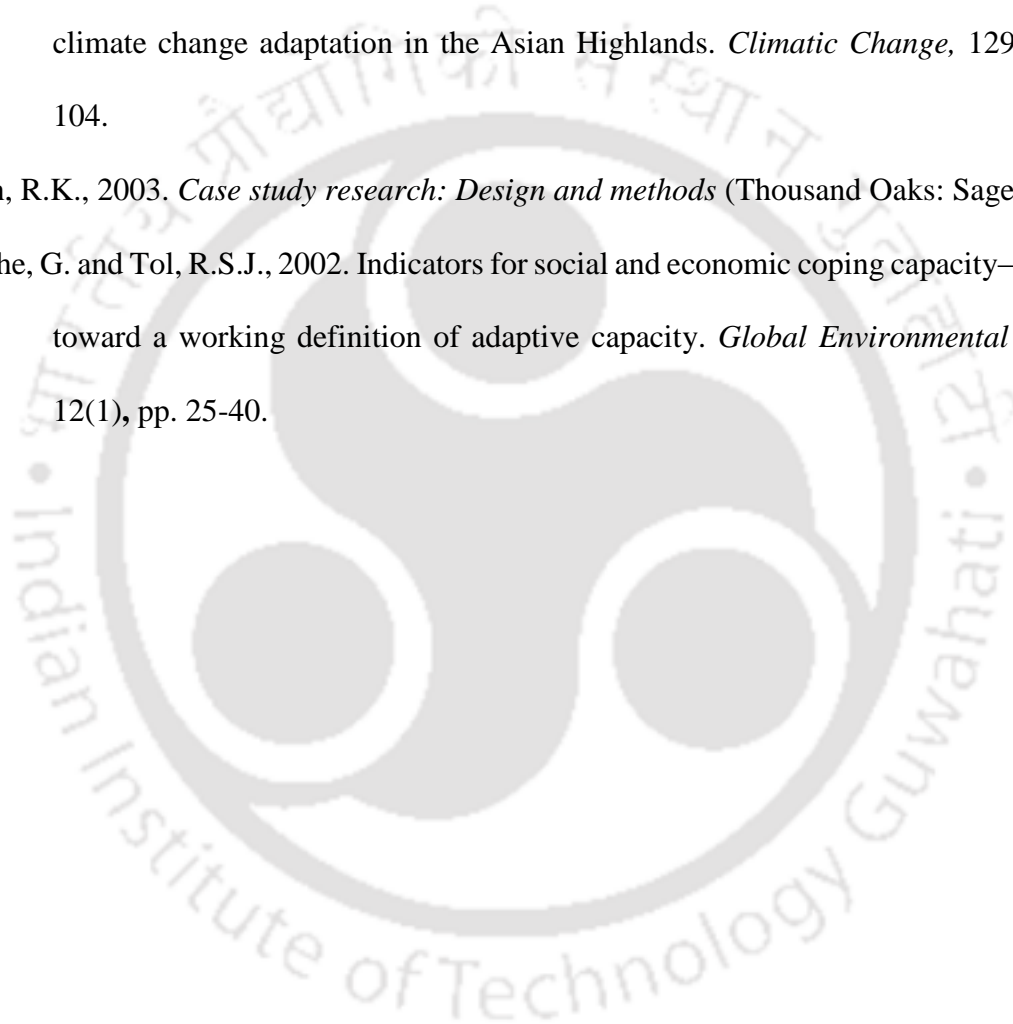
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LIST OF APPENDIX

Appendix 1: Focus Group Discussion questionnaire

Climate change, water and livelihood

We are from Guwahati, Assam and we are doing a study on poverty, vulnerability and human development. We would like to thank you for participating in this discussion and helping us in this research.

FGD Questionnaire	
District:	
Block (GPU):	
Composition of participants (GPW) represented	
Social classification: Caste/ tribe	
Occupation of the Participants:	
Venue of FGD:	
Date of FGD:	
Duration of FGD:	
Number of Participants:	
Facilitator and Moderator of the Discussion	

I. Climate Parameters:

Your perception on:

Infrequent and erratic rains:	Rising temperature and heat waves:
Illness (human)	Food prices: Increased
Drought (severity and frequency) Yes. (1968,2008,2009)	Wind change: No
Decline agriculture produce Yes, 50% decreasing production	Additional comments: Water is decreasing, Problem in water, Management of water needed.
What are the various natural disasters that occur in your region? 1. Strong winds, (July) 2. Severe rain (Sept) 3. snow, 4. Earthquake , Landslides 5. hail without significant damages Others	
What is the extent of damages, e.g. Houses/crops/roads etc	
Do the people receive support from the government during the times of natural disasters? (Food, Water, Health, Housing)	

II. Fundamental need, assets, Assets, Exposure and Equality

Questions	Responses
Housing and infrastructure	
What is common housing structure in the GPWs 1. Pucca: Permanent 2. Semi Pucca: Semi permanent 3. Kutch: Temporary 4. Serviceable temporary 5. Non-serviceable temporary	

What are the materials used for roof and wall?	
Do you feel the houses are strong enough to withstand strong winds, severe rain, snow, earthquake, and hail without significant damages?	
Do people have sufficient income to build their own house without the support of the government?	
Approximately how many household are able to build their own houses without the support of the government?	
What are the various government schemes on housing through which houses are built in your GPU/GPW? 1. Indira Awas Yojna, 2. Rural Housing Scheme 3. Mukhya Mantri Awaas Yojana (MMAY) 4. Others	
Roads Network	
As we are talking about accessibility and connectivity, what kind of road connects the GPW to nearest urban centre? 1. Pucca (Concrete/Bituminous) 2. Semi-pucca (Gravel) 3. Kutcha (Earthen) 4. No roads	
Livelihoods	
What are the main sources of occupation? (%)	
What are the secondary sources of occupation? (%)	
Is the primary occupation selected by choice or by compulsion?	
Would you want the future generations to have a different livelihood activity than yours? If yes, then why?	
Do you feel that there is a mismatch in the skills and the opportunities in the GPU/GPW?	
Have these issues regarding skills and opportunities been discussed before?	
What are the major barriers to livelihood diversifications in your wards? 1. Low income and assets to take risk which is involve in livelihood diversification 2. Poor market access	

3. Poor education 4. Poor health 5. Others	
What are the various unemployment benefits available to the people? (MGNREGA, SHG)	
Nonfarm assets financial capital/resources	
What the various financial services available? (Provision for borrowing from private or government sources for livelihood diversification, education loan, loan for health treatment)	
Which source do people prefer for borrowing?	
What is the average income of the people in your GPU/GPW?	
What is the average amount of saving do people have? E.g. % of income saved.	
What the various non-farm assets people possess in your GPW/GPU?	
Farm Assets	
What is the type of ownership do people have over land? (Share-cropping, rented, lease, illegal access)	
Do people have access to land for agriculture, livestock, or aquaculture?	
What is the average landholding size	
Land Type 1. Flat 2. Gently sloping 3. Steep	
What are the various types of crops do people cultivate? [agriculture calendar]	
Do people have the capacity to buy the crops inputs for each growing seasons?	
Do people have access to natural resources like forest products, water and aquatic resources, access to land and produce biodiversity etc?	

What are the various livestock people have?	
Do people have the enough money to buy fodder for the livestock?	
Are the livestock sold in the market?	
Market Access	
How is the connectivity of your GPW to the market? What is the distance from the GPW to the market? 1. 500m to 1 km 2. 1-5 km 3. Above 5 km	
What is the mode of transportation to the market/urban centre?	
Education	
Now we would like to talk about the access to education, distance to the nearest 1. Primary (Class I-VIII) 2. Secondary (Class XI-X) 3. Senior secondary(Class XI-XII) 4. College (Graduation) 5. University (Post Graduation)	
Highest level of education attained by most of the inhabitants of the Ward/GPU?	
How many private and government schools are there where the children of the wards study? 1. Private (P/S/SS/C/U) 2. Semi-Government(P/S/SS/C/U) 3. Government(P/S/SS/C/U)	
What is the average ratio of student -teacher ?	
Can the people afford the school fees and school supplies? 1. Private (P/S/SS/C/U) 2. Semi-Government(P/S/SS/C/U) 3. Government(P/S/SS/C/U)	

Do you feel there is equality in school among the children from different religion/ethnic/minority group?	
Do you feel there is equal access to educational facilities for various sections of the population?	
Health	
I would like to talk about the access to health care , What is kind of nearest health centre and what is the distance from the ward? 1. Dispensary 2. ICDS 3. PHC 4. Hospitals 5. Others	
Are the doctors available in the health centre?	
Are the any private doctors from whom treatment is taken?	
Do you feel that people from different sections are treated equally in the health centre?	
Are the health and health care services affordable for each section of population? 1. Government 2. Private Is the health centre clean and hygienic?	
Sanitation	
Perception on sanitation among people.	
What are the arrangement of toilet available to people? 1. Owned 2. Shared/ community/ public 3. Open defecation	

<p>What are the types of sanitation facilities available in your GPU?</p> <ol style="list-style-type: none"> 1. Open pit 2. Enclosed pit 3. Enclosed pour flush 4. Enclosed improved – ventilation pit 5. Others 	
<p>What are the government schemes on sanitation implemented in your GPU/GPW?</p> <ol style="list-style-type: none"> 1. TSC 2. Others 	
Approximately how many houses made the toilets with the help of the government schemes?	
Do people have the practice of hand washing after defecating and before eating?	
Are the sanitation facilities affordable?	
Are sanitation facilities available to each sections of population?	
Consumption pattern (Food and nutrition)	
Food that people generally consume?	
Do people in your GPU/GPW go hungry any day?	
Do you feel that because of lack of consumption of certain food there is an incidence of poor health in the GPW?	
Are people aware of the PDS, mid day meal, etc?	
Do people have access to the above schemes, if any?	
Energy	

What are the primary sources of fuel people use for cooking? 1. Wood 2. LPG 3. Others	
What proportion of the fuel is purchased?	
Is it affordable?	
What are the primary sources of light people generally use when it is dark?	
Do people have the capacity to access/afford electricity?	

III. Capability Approach

Instrumental freedoms of Capability approach to human development	Specific questions asked in the FGDs
Political freedoms	Do people participate in the implementation of interventions, schemes, policies etc.? Are you satisfied with the intervention, schemes, and policies?
Economic facilities	What are the various economic facilities provided by interventions in your region to enhance your economic opportunities (access to market, opportunities to generate income, access to credits, and knowledge and trainings etc.?)
Social opportunities	Do the people of different social groups and gender have equal opportunities (such as access to education, health care, sanitation, market, employment)?
Protective security	What are the social safety net schemes and programmes (interventions to improve fundamental needs, assets and equality) operational in your region to build resilience?
Transparency guarantee	Are you aware of various social safety net scheme implemented in your region for the welfare of the communities. Do you feel sufficient information on social safety nets schemes (e.g. budget, implementation process, benefits) is provided and are these schemes implemented properly?

Appendix 2: Household Survey Questionnaire

Household survey questionnaire for “Water, Climate Change and Rural Livelihood: Assessing Socio- Economic Vulnerability and Potential Adaptive Strategies in Sikkim and Darjeeling”

Codes for the responses

1. Identification:

	Name	Code			Name
1.1	State			1.7	Investigator Name
1.2	District			1.8	Supervisor Name
1.3	Block			1.9	Respondent Name
1.4	GPU			1.10	Date of the Survey
1.5	GPW			1.11	Start Time
1.6	Household number			1.12	End Time

2. Household Basic Information

2.1	Name of the Household head		2.6	Marital Status	<i>Married/Single/Divorced/Widowed</i>
2.2	Father's Name of the head		2.7	Occupation of the Participants:	<i>Cultivation/Govt. service/Unemployed/</i>
2.3	Name of the Respondent		2.8	Name of the Caste/Tribe	<i>General/OBC/MOBC/ST/SC</i>
2.4	Gender Individual Number (female and male respondent)		2.9	Religion	<i>Hindu/Christian/Muslim/Buddist/Others</i>
2.5	Age				

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3.Housing, infrastructure, connectivity and Energy

3.1.	What is the primary construction material of the housing unit's main wall?					
	Stone & mortar(1)	Tiles or Shingles (2)	Reinforced concrete (3)	Bricks (4)	Logs (5)	Earth (6)
	Mud or earth bricks (7)	Mud & straw (8)	Thin Wood (9)	Bamboo (10)	Thick plastic (11)	Thin Plastic (12)
	Reeds (13)	Thick fabric (14)	Thin fabric (15)	Others, specify (16)		
3.2.	What is the primary construction material of the housing unit's main roof?					
	Stone & mortar (1)	Tiles or Shingles (2)	Synthetic roofing material (3)	Metal sheeting (4)	Reinforced concrete (5)	Thick wood (6)
	Thin Wood (7)	Bamboo (8)	Thick plastic (9)	Thin Plastic (10)	Straw or Reeds (11)	Others, specify (12)
3.3.	Can your house withstand strong winds, severe rain, snow or hail without significant damage?					
	Yes(1)	No(2)	Yes, with minor damage (3)	Perhaps, but with significant damage likely (4)	Little to no extreme whether in this region(5)	Don't Know (6)
3.4.	Do you have sufficient income to build their own house without the support of the government?					
	Yes(1)	No(2)	Don't Know (3)			
3.5.	Are you a beneficiary of any of the following housing schemes?					
	Indira Awas Yojna (1)	Rural Housing Scheme (2)	Mukhya Mantri Awaas Yojana (MMAY) (3)	Others, specify (4)		

3.6	What kind of road connects your household to nearest urban centre?			
	Pucca (Concrete/Bituminous) (1)	Semi-pucca (Gravel) (2)	Kutchra (Earthen) (3)	No roads (4)
3.7	What is the primary source of light your home uses when it is dark?			
	<input type="text"/> None= 1; Low-voltage electricity = 2; Medium or high –voltage electricity from grid=3 ; Electricity from a generator= 4; Electricity from solar cells, wind turbine or small, hydroelectric dam= 5; Liquid fuel (petrol, kerosene) =6 ; Gas fuel=7; Coal or charcoal= 8; Grass, wood or other natural material			
3.8	What is the primary fuel source your household uses for cooking?			
	<input type="text"/> None= 1; Low-voltage electricity = 2; Medium or high –voltage electricity from grid=3 ; Electricity from a generator= 4; Electricity from solar cells, wind turbine or small, hydroelectric dam= 5; Liquid fuel (petrol, kerosene) =6 ; Gas fuel=7; Coal or charcoal= 8; Grass, wood or other natural material			
3.9	What is the primary fuel source your household uses for heat?			
	<input type="text"/> None= 1; Low-voltage electricity = 2; Medium or high –voltage electricity from grid=3 ; Electricity from a generator= 4; Electricity from solar cells, wind turbine or small, hydroelectric dam= 5; Liquid fuel (petrol, kerosene) =6 ; Gas fuel=7; Coal or charcoal= 8; Grass, wood or other natural material			
4. Livelihood: Occupation, Farm and Non Farm				

4.1.	What are the primary occupations of your household?					
	Agriculture (1)	Daily Wage laborer (2)	Private jobs (3)	Government service (4)	Unemployed (5)	Others, specify (6)
4.2.	What are the secondary occupations of your household?					
	Agriculture (1)	Daily Wage laborer (2)	Private jobs (3)	Government service (4)	Unemployed (5)	Others, specify (6)
4.3.	Is the primary occupation selected by choice or by compulsion?					
	Choice (1)	Compulsion (2)	Don't Know (3)			
4.4.	Would you want the future generations to have a different livelihood activity than yours? If yes, then why?					
	Yes (1)	No (2)	Don't Know (3)			
4.5	What are the major barriers to livelihood diversifications in your wards?					
	Low income (1)	Poor market access (2)	Poor education (3)	Poor health (4)	Others (5)	
4.6	Do you have access to various unemployment benefits like MGNREGA, SHG?					
	Yes (1)	No (2)	Don't Know (3)			

4.7	What are the various crops cultivated in your agricultural field for consumption?					
	Rice (1)	Millets (2)	Maize (3)	Vegetables (4)	Cardamom (5)	Zinger (6)
	Others, specify (7)					
4.8	What are the various crops cultivated for sale in the market in your agricultural field?					
	Rice (1)	Millets (2)	Maize (3)	Vegetables (4)	Cardamom (5)	Zinger (6)
	Broom stick (7)	Others, specify (8)				
4.9	Are there any changes in agricultural pattern during the last 10-15 years?					
	Yes (1), if yes go to 4.10	No (2)	Don't Know (3)			
4.10	What were the crops cultivated 10-15 years ago?					
	Rice (1)	Millets (2)	Maize (3)	Vegetables (4)	Cardamom (5)	Zinger (6)
	Broom stick (7)	Others, specify (8)				
4.11	What are the crops cultivated at present?					
	Rice (1)	Millets (2)	Maize (3)	Vegetables (4)	Cardamom (5)	Zinger (6)
	Broom stick (7)	Others, specify (8)				

4.12	Does your household have access to land for agriculture, livestock or aquaculture?								
	Yes (1)		No (2)		Don't Know(3)				
4.13	Extend of ownership and operational land holdings based upon local unit of land								
	Sl No	Land Type	Soil Type	Ownership holdings	Leased in	Leased out	Mortgaged in	Mortgaged out	Total area cultivated
<u>Codes for land type :</u> 01= cultivated; 02=Uncultivated; 03=Forest Land; 04= Orchard land ; 04= community land; 05=Others, (specify)									
<u>Codes for soil type:</u> 01=Don't Know; 02= Stony-gravelly; 03=Clay; 04=Loamy (mixed clay, sand or slit); 05=Sandy; 06=Wet; 07= Droughty; 08= Mixed, specify; 09=Others, specify									

4.14	Crop Calendar and diseases							
	Sl No	Crop name	HYV	Local	Month of sowing	Month of harvesting	Diseases, If any?	Steps taken to control diseases?
4.15	During the last one year, was your household able to make or buy enough manure/compost or artificial fertilizers for each growing season?							
	Household does not think that they need to use compost/manure or fertilizers (1)							
	No (2)	Rarely (3)	Sometimes (4)	Often (5)	Always(6)	Others, specify (7)		
4.16	During the last one year, was your household able to afford enough seeds for each growing season?							
	Household save seeds (1)							
	No (2)	Rarely (3)	Sometimes (4)	Often (5)	Always(6)	Others, specify (7)		

4.17	Irrigation details of cultivated land					
	SI No	Land Type	Source of irrigation	No of Months	Comments	
Block codes for source of Irrigation:01=River; 02=Tanks/Ponds; 03=Canals; 04 Rain fed; 05= Natural springs; 06=Others (specify)						
4.18	What are the various indigenous knowledge used in cultivation of crop?					
	Zhum Cultivation (1)	Settled agriculture (2)	Intercropping* (3)	Crop rotation (4)	Cattle (5)	Others, specify (6)
*Intercropping: Ginger –Maize, Maize-Mustard, Maize-vegetables, Cardamom- Vegetables, any other combination of crops						
8.19	What are the various technology your household use for cultivation?					
	Does not used (1)	Power tiller (2)	Sprinkler irrigation system (3)	Power operated thresher (4)	Drip irrigation (5)	Poly pipes (6)
	Others, specify (7)					

4.20	What are the various livestock does your household possess?					
	Poultry (1)	Dairy (2)	Goat (3)	Pig (4)	Sheep (5)	Cattle (6)
	Others, specify (7)					
4.21	Does your household sell livestock in the market?					
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)		
4.22	For how many months your own production (from own agri field) is sufficient for the household?					
	One year (1)	Six months (2)	Less than six months (3)	Does not have crops (4)		
4.23	Has any member of your household moved outside the village in search of employment?					
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)		
4.24	If Yes, what is the amount of money they send home?					
	Less than Rs. 500 (1)	Rs . 501-1000 (2)	Rs. 1001 - 1500 (3)	Rs. 1501- 2000 (4)	Above Rs 2001	
5. Accessibility to market						
5.1	Do you sell your produce in the market?					
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)		
5.2	If Yes, where do you sell your produce?					
	Local (1)	Outside your locality (2)	Outside State (3)			

5.3	How far is the nearest market? (kms)					
	Below 0.50 km (1)	0.051-1.00 km (2)	1.10-3km (3)	3.00-5.00km	Above 5.00km	
5.4	Mode of conveyance?					
	By foot (1)	Bicycle (2)	Scooter (3)	Bus (4)	Motors (5)	Others, specify (6)
5.5	Is there any middlemen involved?					
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)		
5.6	If Yes, how much do they pay?					
6. Education						
6.1	How long does it take in minutes for the school-age children (ages 5-14) in your household to go to school (by any means, for example walking, bicycle, scooter, bus)?					
	0.00-30 Mins	31.00- 59 Mins	Above 60 Mins			
	Children in the household are not school age (1)	Children usually live in the school (2)	Household has no school children (3)	The school age children does not attend school regularly (4)	Don't Know (5)	
6.2	Can you household afford your children's school fees and school supplies?					
	Yes (1)	No (2)	Rarely (3)	Sometimes (3)	Don't Know(4)	Household does not pay fees or supply cost (5)

6.3	What is the highest level of schooling the female children in your household will likely achieve?			Codes for 6.3 and 6.4 1. No formal education 2. Primary education (age 5 or 6 until age 11 or 12) 3. Junior school (age 11 or 12 until age 14 or 15) 4. High school (age 14 or 15 until age 18 or 19) 5. Technical or vocational school (post junior school or high school, usually 2 years) 6. College or university 7. Advanced degree (Masters, MBA, PhD etc)
	No female children (1)	Don't Know (2)	Highest likely level =	
6.4	What is the highest level of schooling the male children in your household will likely achieve?			
	No female children (1)	Don't Know (2)	Highest likely level =	
7. Social opportunities and public programs				
7.1	Do the members of your household have equal economic or political opportunities?			
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
7.2	Is there any improvement in the situation in the last few years?			
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
7.3	Does the members of your household have equal access to market?			
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
7.4	Does members of your household have equal access to employment opportunities in the society?			
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)

7.5	Does member of your household have access to the various public and private services available in the GPU/GPW?			
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
7.6	Does member of your household have equal access to natural resources like forest, water, environment, etc?			
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
7.7	Does member of your household participate in common discussion (Gram sabha)?			
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
7.8	Do you have ration card?			
	Yes (1)	No (2)	Don't Know(3)	
7.9	Type of ration card?			
	Antodaya (1)	BPL (2)	APL (3)	Others, specify (4)
7.10	Does any member of your household have job cards under MGNREGA?			
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
7.11	Does any member of your household receive pension?			
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
8. Governance, voting Rights and freedoms of speech				

8.1	Does any member of your household participate in the implementation of interventions, schemes, policies etc?		
Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
8.2	Has your household benefitted with the government intervention, schemes, and policies?		
Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
8.3	Does the member of the household have the freedoms to participate in the process of selecting their representative?		
Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
8.4	Does the member of the household have the equal voting rights to select their leaders?		
Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
8.5	Do members of the household have the freedom of speech, and freedom to criticize the leaders?		
Yes (1)	No (2)	Sometimes (3)	Don't Know(4)
9. Transparency guarantees: Deals with the need for openness that people can expect from the government			
9.1	What are the various welfare schemes does your household has access to?	<ol style="list-style-type: none"> 1. Food (PDS, Mid day meal) 2. Water (RWSP) 3. Health (NRHM, Aganwardi, ASHA) 4. Education (SSA) 5. Sanitation (TSC) 6. Housing (IAY) 	

		7. Electricity (RGGVY)				
9.2	Does the member of the household have the access to information regarding the schemes (e.g. budget, implementation process, benefits)? (RTI)?					
	Yes (1)	No (2)	Sometimes (3)	Don't Know(4)		
10. Health and Health care						
10.1	In the last 12 months, how often has someone in your household been ill?					
	Never (1)	Once or twice (2)	Once a month (3)	A few times a month (4)	About once a week (5)	A few times a week (6)
	Every Day (7)	Don't Know (8)				
10.2	How many times does it take to reach the nearest health center?					
	Household self-diagnoses, self- medicates of simple illness (1)		No health center in the area (2)	Health centre is too far to travel to (3)		
	Minutes =	<input type="text"/>				
10.3	Does the health care have enough medical supplies to provide adequate healthcare?					
	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	Don't Know (6)

10.4	How much times does it take for members of your household to reach the nearest health center which can diagnosis and treat complicated or serious illness or injuries (can perform surgery)?					
	No health center in area (1)	Health center too far to travel to (2)	Don't Know (3)	Minutes=	<input type="text"/>	<input type="text"/>
10.5	Can your household afford professional treatment for serious illness or injury?					
	No (1)	Yes, If money is borrowed (2)	Yes, with much difficulty (3)	Yes, with some difficulty (3)	Yes, because government or employer helps pay for treatment (4)	
	Yes, household can afford it (6)					
10.6	For majority of the households in your villages/area, do you think there is a better chance for a woman or a man to receive when needed?					
	Woman (1)	Men (2)	About the same (3)	Don't Know (4)		
10.7	Do you think the healthcare centers in your village/area are usually able to provide women with adequate healthcare when they seek it?					
	There are no healthcare centers in our villages area (1)	No (2)	Rarely (3)	Sometimes (4)	Often (5)	Always (6)
	Yes, but since the doctors is made, women prefer not to go (7)					

11. Sanitation

11.1	What type of sanitation facilities does your household generally use?					
	Open defecation (1)	Open pit (2)	Enclosed pit (3)	Enclosed pour flush (4)	Enclosed improved – ventilation pit (5)	Others (6)
11.2	How often is the toilet useable?					
	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	Don't know (6)
11.3	What are the government schemes on sanitation implemented in your GPU/GPW?					
	Total sanitation campaign (1)	Others, specify (2)	Don't Know (3)			
11.4	Does your household have the practice of hand washing after defecating and before eating?					
	Yes (1)	No (2)	Sometimes (3)			
12. Water						
12.1	What is the main source (meaning, the source water comes from immediately before being used) of the water your household uses for drinking, cooking, bathing and cleaning inside the home?			Codes for 12.1 1. Spring 2. Stream 3. Pond 4. Piped water from treatment plant 5. Rainwater harvesting container 6. Supply water from government department 7. Irrigational canal 8. Others, specify		
	During the rainy season					
	During the dry season					
	During most of the year					

	<table border="1"> <tr> <td>No rainy season in our area</td> <td></td> </tr> <tr> <td>No dry season in our area</td> <td></td> </tr> <tr> <td>Don't Know</td> <td></td> </tr> </table>	No rainy season in our area		No dry season in our area		Don't Know								
No rainy season in our area														
No dry season in our area														
Don't Know														
12.2	<p>Source of water for</p> <table border="1"> <tr> <td>Domestic</td> <td></td> </tr> <tr> <td>Drinking</td> <td></td> </tr> <tr> <td>Agriculture</td> <td></td> </tr> </table>	Domestic		Drinking		Agriculture		<ol style="list-style-type: none"> 1. Household Owned water source 2. Community Owned water source 3. Water supply (public (government) and private (trucks or any other)) 4. Rainfed/monsoon 5. Spring 6. Stream/ river 7. Combination of the above (ratio) 						
Domestic														
Drinking														
Agriculture														
12.3	<p>Approximately how much time (in minutes) does it take a member of your household to collect enough water for your household's drinking, cooking, bathing and cleaning needs for a normal day?</p> <table border="1"> <tr> <td>During the rainy season</td> <td></td> </tr> <tr> <td>During the dry season</td> <td></td> </tr> <tr> <td>During most of the year</td> <td></td> </tr> <tr> <td>No rainy seasons in our area</td> <td></td> </tr> <tr> <td>No dry season in our area</td> <td></td> </tr> <tr> <td>Don't Know</td> <td></td> </tr> </table>	During the rainy season		During the dry season		During most of the year		No rainy seasons in our area		No dry season in our area		Don't Know		
During the rainy season														
During the dry season														
During most of the year														
No rainy seasons in our area														
No dry season in our area														
Don't Know														

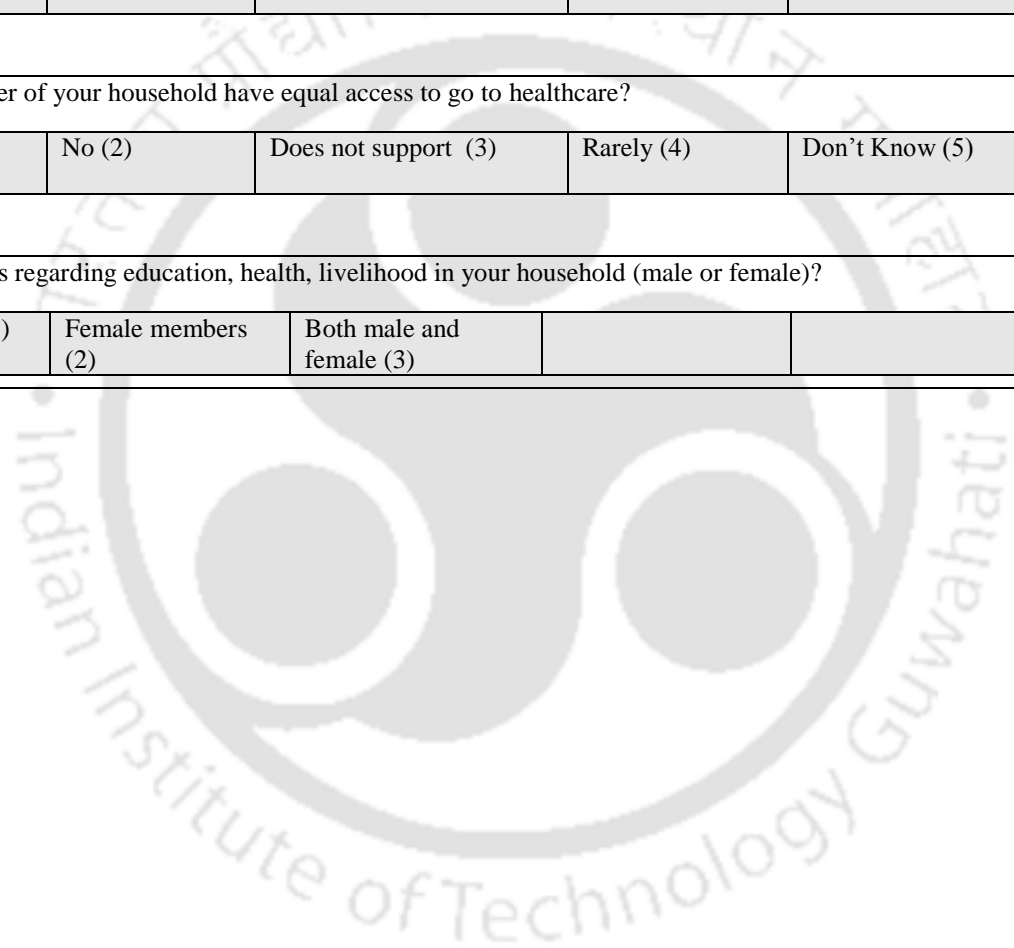
12.4	Does your household treat water before drinking (any treatment methods: boiling, allowing to settle, and filtering, chemical treatment)?					
	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	No treatment necessary (6)
12.5	How often do you worry there will not be enough water from your household's main water source to satisfy your household's drinking, bathing, and cleaning needs?					
	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	
12.6	Can your household afford to pay the fees for using water from your household's main water source?					
	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	They don't need to pay for water (6)
12.7	Generally, what do you think the quality of your households' water is?					
	Don't know (1)	Very bad (2)	Poor (3)	Fair (4)	Satisfactory (5)	Good (6)
	Very good (7)					
12.8	Does your household have usually enough water for your household crops?					
	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	They don't need to pay for water (6)
12.9	Does your household have usually enough water for your household livelihoods?					
	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)	They don't need to pay for water (6)
12.10	Who collects water in the household?					
	Male (1)	Female (2)	Both male and female (3)	Don't Know (4)		

12.11	Has the distance of the nearest water source increased in the last 10-15 years?					
	Yes (1)	No (2)	Increased slightly (3)	Decreased (4)	Don't know (5)	
13. Climate Change, Natural disasters and resilience to changes.						
13.1	Your perception on Infrequent and erratic rains:					
	Decrease (1)	Increase (2)	No change (3)			
13.2	Your perception on temperature and heat waves:					
	Decrease (1)	Increase (2)	No change (3)			
13.3	Your perception on Illness (human):					
	Decrease (1)	Increase (2)	No change (3)			
13.4	Your perception drought (severity and frequency):					
	Decrease (1)	Increase (2)	No change (3)			
13.5	Your perception agriculture produce:					
	Decrease (1)	Increase (2)	No change (3)			
13.6	Do you feel that agricultural production has changed due to changes in temperature and rainfall?					
	Yes (1)	No (2)	Don't Know (3)			

13.7	Have your household introduced any crops due to changes in temperature and rainfall?					
	Yes (1)	No (2)	Don't Know (3)			
	If Yes, Name of crops introduced:					
13.8	Does your household have any idea of crops, which is resilient to extreme events (like drought, high temperature, rainfall etc)?					
	Yes (1)	No (2)	Don't Know (3)			
13.9	Has your household faced any instances of crop failure due to extreme climate events?					
	Yes (1)	No (2)	Don't Know (3)			
13.10	What kind of Hazards they feel they are exposed to?					
	Strong winds (1)	Severe rain (2)	Snow (3)	Earthquake (4)	Landslides (5)	Hail (6)
	Others, Specify (7)	Don't Know (8)				
13.11	How does your household cope during the time of natural disasters?					
	Don't Know (1)	Primary strategy []	Secondary strategy []	Tertiary strategy []		
	Codes: 1. Seek of farm work, 2. Children help more than usual with household work, 3. Ask friends to help with farm labor or business, 4. Ask family to help with farm labor or business. 5. Reduce healthcare spending, 6. Reduce alcohol consumption, 7. Reduce meat consumption, 8. Reduce fuel consumption, 9. Plant fewer crops next growing seasons, 10. Sell livestock, Sell stored grain, 12. Sell durable goods, 13. Use savings or sell jewelry, 14. Postpone payments of debts, 15. Borrow money from relatives, 16. Borrow money from friends, 17. Send children to work outside the household, 18. Borrow money from bank or other financial service provider, 19. Borrow money from cooperative or village fund, 20. Take children out of school so that they can work, 21. Lease farmland, 22. Sell farmland, 23. Rely on government, 24. Others specify.					

13.12	Does your household have the capacity to recover from these shocks?					
	Yes (1)	No (2)	Sometimes (3)	Rarely (4)	Don't Know (5)	
13.13	How long does it take to cope after a natural disaster has occurred?					
	Don't know (1)	Less than a month (2)	Months []	Our household could not recover (3)		
13.14	Do you feel that the parameters of climate change like rainfall, temperature, etc is likely to change in the next 10-15 years from now?					
	Yes (1)	No (2)	Maybe (3)	Likely to remain same (4)	Slight changes (5)	Don't Know (6)
14. Gender and equality						
14.1	Who controls the agriculture produce, which is sold?					
	Male members (1)	Female members (2)	Both male and female (3)			
14.2	Who controls the agriculture produce for own use (female)					
	Male members (1)	Female members (2)	Both male and female (3)			
14.3	Nature of agriculture which is under control of males and females (org/inorg)					
	Male members (1)	Female members (2)	Both male and female (3)			

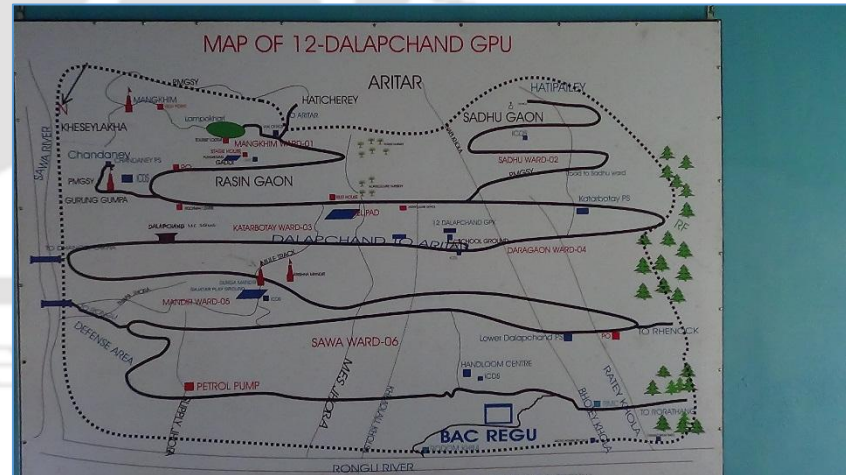
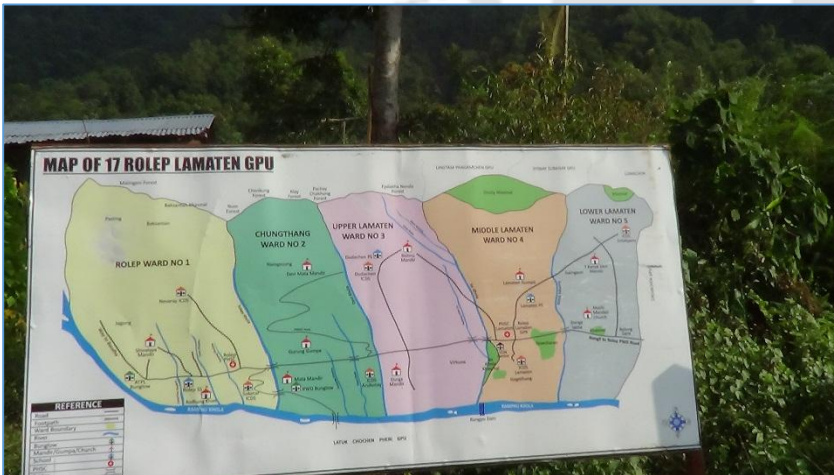
14.4	Does the female member of your household have equal access to go to school?					
	Yes (1)	No (2)	Does not support (3)	Rarely (4)	Don't Know (5)	
14.5	Does the female member of your household have equal access to go to healthcare?					
	Yes (1)	No (2)	Does not support (3)	Rarely (4)	Don't Know (5)	
14.6	Who takes the decisions regarding education, health, livelihood in your household (male or female)?					
	Male members (1)	Female members (2)	Both male and female (3)			



Appendix 3: Photos of participants in FGD (Mixed and female groups) conducted in East District, Sikkim



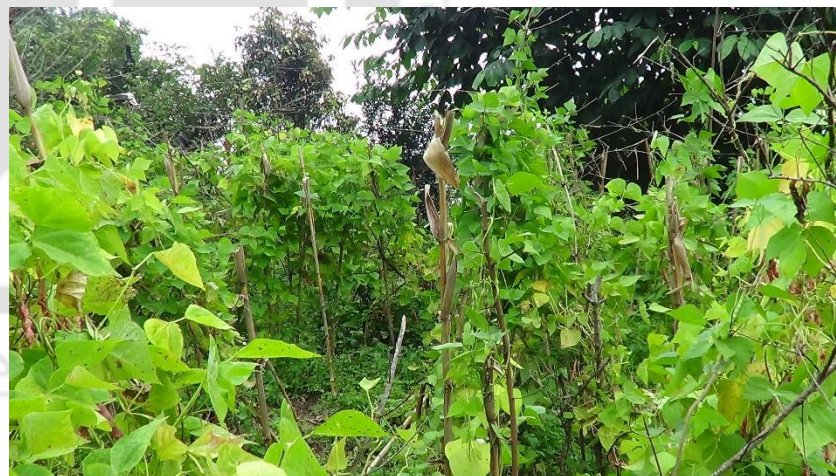
Appendix 4: Photos depicting the map of Rolep Lamaten and Dolepchen GPU in East District, Sikkim



Appendix 5: Photos depicting landslides, poor connectivity, and weak housing structure in East District, Sikkim



Appendix 6: Photos of organic manure prepared for use in agriculture, and vegetables grown using organic manures in East District of Sikkim



Appendix 7: Photos of water Tank build under MGNREGA schemes, female members engaged in wage labors under MGNREGA and Veterinary center in Sudunglakha, East District, Sikkim

