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Climate Change Adaptation in Nepal: Exploring Ways to Overcome the Barriers

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Abstract: Adaptation to climate change is emerging as an important developmental challenge in Nepal and globally. To address climate change risks and vulnerabilities, a set of mutually integrated strategies are necessary at different sectors and levels. This paper examines institutional, technological and informational barriers to designing and implementing adaptation. In particular, it combines literature review and case studies to diagnose the limitation of adaptation and its institutional environment in Nepal. The findings reveal that there are limits to adaptation, which are caused by barriers of available technology, knowledge and institutional frameworks. These barriers undermine the effectiveness of the initiatives promoted both at the national as well as local level. Effective climate change requires addressing these barriers by reworking of the ways in which institutions operate and by building on the existing knowledge, skills, and best practices. This can be facilitated by changing the design of development planning and modes of delivery.

Key words: Climate change, vulnerabilities, risks, limits to adaptation, local institutions

INTRODUCTION

Adaptation to climate change has emerged as a challenge to achieving and sustaining the development outcomes as mitigation is not taking place as needed (Eriksen 2011). However, adaptation is becoming complicated in practice as climate change and its impacts are faster than the natural process can sustain and they are interlinked with and embedded into a range of social, economic and political processes (Ayers 2011a). As the science of climate change has yet to come, out of its own limitations in addressing uncertainties and identifying technological solutions to adaptation and mitigation, social and financial issues are dominating the negotiations and actions taken on the ground. On the other hand, governments and people need to make hard choices and difficult decisions to avoid irreparable losses likely to be made by climate change. Therefore, vulnerable communities need to respond to climate change without delay to enable them and their ecosystem to keep up with the on-going and potential changes in climate system.

Adaptation is necessary to deal with adverse climatic stresses and hazards and to take the opportunities such as new innovations, which can be both to current, actual or projected conditions (Smit *et al.* 1999: p. 203). So, there are two broad components on adaptation: coping and adapting with adverse impacts happening at short and longer term and benefiting from the favourable situations. The ultimate goal of adaptation is to build long term resilience of communities so that they are capable of sustaining their livelihoods even in extreme shocks and stresses.

However, the concept of adaptation as such is not new; life has come through different adjustments biologically and behaviourally and successful struggle for existence, modifications and survival of the fittest (Charles and Wallace

1859). But now, we do not let the nature decide alone. We want action to our ends as well and there is already knowledge to begin with:

> Adaptation to climate change is not something that must start from scratch. It is an incremental process that can build upon a long history of previous adaption. What is new is the need to adapt much more rapidly because of the impact of human activities on climate (Burton 2000: p159).

The discussions on adaptation, adaptive capacity or resilience capacity, as they are interchangeably used, is often highlighted in terms of effective response. The Intergovernmental Panel on Climate Change (IPCC) defined adaptive capacity as the 'ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages to take advantage of opportunities or to cope with the consequences' (IPCC WG II 2001: p. 72). For a human community, adaptive capacity is influenced by multiple socioeconomic factors apart from physical circumstances. The socioeconomic factors include technology, resources, skills and governance. Adaptive capacity also include enabling properties of both natural and societal assets, including financial, technological and information resources and the context within which these assets are held, including infrastructure, environment, political influence, social networks, public policy and institutional governance (Ensor and Berger 2009: p. 170).

Building adaptive capacity is now becoming the centre of focus amongst adaptation and development communities. There is still no clarity on the direction to climate change adaptation, particularly on how it should happen and what the appropriate measures are. At the international negotiations, debate over the technology transfer is overshadowed by the discussion on emission target and climate change financing. In Nepal, there is hardly any discussion on adaptation technology, skills and systemic processes; acquiring technology and skills is yet far to be achieved.

Similarly, studies highlight the richness of traditional knowledge and emphasise on promoting it often without suggesting proper ways and adequate guidance on how to do in the changing situations. Studies that focus on the need of technology to solve climate change problem lack accessibility, affordability and management capacity of the communities in need. The role of policy and institutions is crucial in enabling communities to access appropriate technologies and to achieve adaptation and mitigation objectives. Similarly, policy and institutions play decisive roles in enhancing knowledge and skills for the successful use of approaches, processes and technologies.

The aim of this paper is to explore ways of building effective adaptation measures at the local level. The specific objectives are: a) to find out opportunities and constraints of adaptation responses at the local level; and b) to identify innovative ways of enhancing adaptive capacity at the local level. The diagnosis of opportunities and constraints of climate change adaptation supports mainstreaming of climate change within development and ensures effective adaptation responses at the local level.

METHODOLOGY AND STUDY FRAMEWORK

Methods

The research is mostly based on review of literature backed up by case studies in Nepal. We reviewed current literature on adaptive capacity and limits to adaptation. We looked into the opportunities and constraints of different initiatives on adaptation at the national and local level, as well as into the issues

of adaptation knowledge, technology and institutions.

We conducted content analysis of two national programmes - National Adaptation Programme of Action (NAPA) and Strategic Programme for Climate Resilience (SPCR) in terms of their focus on climate change responses. The content analysis was backed up by semi-structured interview with 17 policy makers and 26 practitioners working on climate change issues at the national and local level, which were purposively selected.

The case study was carried out in Bangesaal and Dhungedadi Village Development Committees (VDCs) of Pyuthan district in mid-western region of Nepal. These two VDCs are pilot sites for Local Adaptation Plan of Action (LAPA) and Community Adaptation Planning (CAP). We conducted interviews with 120 randomly sampled household members and held six focus group discussions with Community Forestry User Group (CFUG) members, executive members of Village Forest Coordination Committee (VFCC), project staffs and local government officials. The interviews used semi structured questionnaire to map out the perceptions of sampled household. A total of 60 households were selected in each of the VDCs, using simple random sampling, based on the list available in those VDCs. The participants for focus group were selected in coordination with the executive members of CFUG and local government office. The selection considered gender, ethnicity, status of households and distribution of users. A checklist was used during the focus group discussion. The data were analysed using descriptive statistics and NVivo[1]. It also used Social Analysis System (SAS)[2] tools and technique like stakeholder analysis, force field to map the vulnerability context and stakeholder dynamics.

Study Framework

This study used the framework proposed by Preston and Stafford-Smith (2009) to analyse the key barriers and limitations to adaptation. This framework has outlined the dimensions of adaptation where it is represented as a process driven by four sets of determinants, with each set comprised of multiple determinants with multiple dimensions. The framework states that adaptation barriers and limits disrupt the relationship between determinants and the adaptation process (Preston and Stafford-Smith 2009).

Adaptation to climate does not occur in isolation. It involves in a context and amid of complex set of socio-economic, institutional interactions (Smithers and Smit 2009: `17). Climate system encompasses both variability and extreme events in the short run and aggregate impact of uncertain future and intensity and degree of climate change in future. At the grass root level, any meaningful measurement of adaptation needs to accept climate change is contextualised with the other risks (social, economic and political as well as environmental) that shape and limit human well being and functioning of socio-ecological system (Pelling and Wisner 2009).

Adaptation history shows that both natural and human system are adapting to environmental and ecologic stresses. According to Smit (1993)

[1] NVivo is a qualitative data analysis (QDA) computer software package produced by QSR International. It has been designed for qualitative researchers working with very rich text-based and/or multimedia information, where deep levels of analysis on small or large volumes of data are required (www.qsrinternational.com).

[2] Initiated by Jacques M. Chevalier and Daniel J. Buckles at Carleton University (Ottawa, Canada) and Michelle Bourassa at the University of Ottawa, the SAS2 Dialogue approach spans ten years of creative conceptual and methodological experimentation.www.sas2.net

and Smithers and Smit (2009), adaptive responses is better explained by intent, role of government, scale, timing, duration, form and effect. It can be of different form of action ranging from technological, behavioral, financial, and institutional or informational. Adaptation happens at individual household, community, regional, national and international level and occurs in diverse system ranging from human to natural. The response also differs from actors' i.e. public, private, community and government (see Smit *et al.* 1999; Smit and Wandel 2006; Burton *et al.* 2007; Pelling 2011).

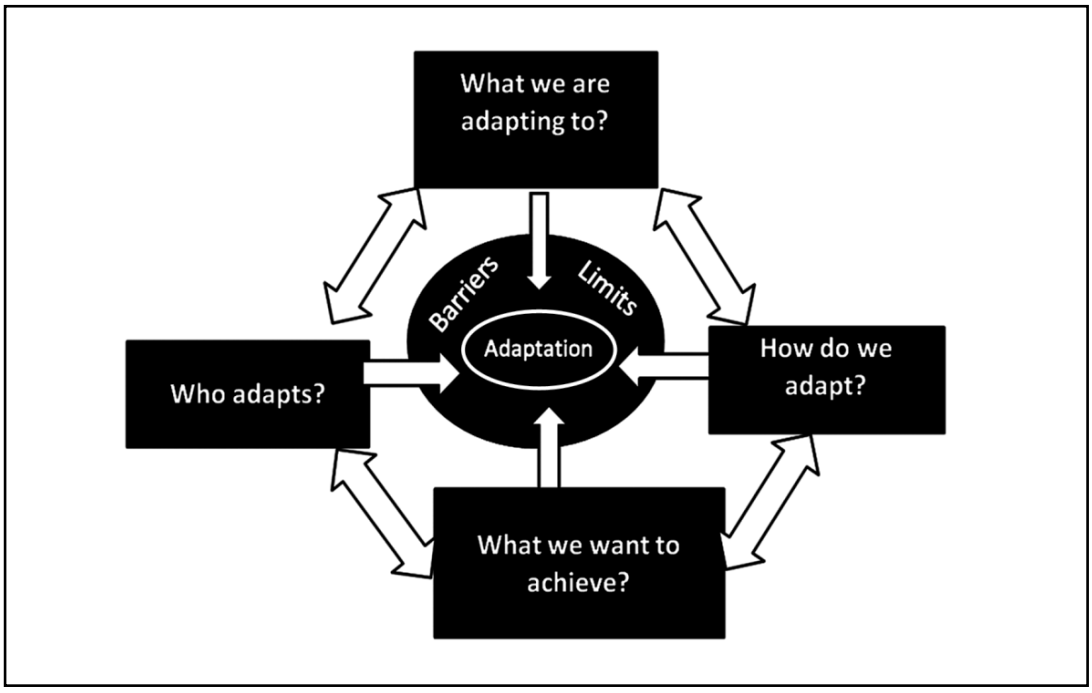

Figure 1: Different dimensions of adaptation
Source: Preston and Stafford-Smith (2009: p1)

The ultimate aim of adaptation is to build resilience of communities and natural system. Adaptive capacity is influenced by multiple factors which includes economic, social, technological, human and governance. Adger *et al.* (2006: p. 728) explain about the examples where social capital, social networks, value, perceptions, customs, traditions and level of cognition affecting the capacity of communities to adapt to climate change risk. They explain that adaptive capacity is locally specific and highly heterogeneous within a society. Lemos *et al.* (2007: p. 24) mention that the adaptive capacity can be created by investing in information and knowledge, encouraging appropriate institutions that permit evolutionary change, and increase level or resources such as income and education.

However, there are literatures which identify the limits and barriers to adaptation (Figure 1). Some argue that any limit to adaptation depends on the ultimate goals, uncertainties associated with foresight of future climate change,

adaptation and social and individual factors (Hulme *et al.* 2007). Similarly, Adger *et al.* (2004) contends that limits to adaptation are endogenous to society and hence contingent on ethics, knowledge, attitudes to risk and culture. This paper argues that barriers to technology and governance limit the success of climate change adaptation initiatives in Nepal. The limitation on governance, knowledge on climate change and technology, impacts the effectiveness of adaptation interventions.

In order to effectively address the impact of climate change, there is a need to overcome the barriers to adaptation. This can be done by overcoming information, knowledge, technological, institutional, structural and policy barriers. This paper argues that different levels of institutions and communities need to collaborate and act in order to address the key challenges to adaptation. The effective way of making adaptation work is to devise right policy and local level practices which mobilises the national and local level stakeholders.

CLIMATE CHANGE ADAPTATION AND ITS LIMITS

Adaptation defined: Flexibility is crucial

Adaptive action has been defined by autonomous (automatic, spontaneous and passive) and planned (active, structured and strategic). Adaptation actions are diverse and largely depend on the context and resources required and available. Therefore, adaptation needs to be innovative and flexible to improve and incorporate new technologies, approaches, skills and resources warranted by the changing context brought about by the uncertain level and timing of climate change. Adger *et al.* (2005) argue that adaptation to climate change involves various decisions across a landscape made up on agents from individuals' firms and civil society, to public bodies and international agencies. The authors also argue that unintentional adaptation has implications to the effectiveness of purposeful adaptation, so integration of adaptation into actions and policies is a challenge. Burton (1994) argues on purposeful adaptation which involves reducing the sensitivity, altering the exposure and increasing the resilience. Mertz *et al.* (2009: p. 750) further argue that uncertainty in climate change leads to the need of robust, innovative, flexible, institutional, policy, governance and inclusive structure that can be of significance for developing country populations to better adapt and reduce the adaptation deficit. However, these concepts have yet to go through practical tests on the ground such as to test the degree of flexibility required for adaptation in particular circumstance and in specific context.

Limits to adaptation

Uncertainties and complexities

There are limits to coping strategies adapted by communities to deal with climate extremes. The coping range and thresholds are determined by the extent of climate variability and capacity of vulnerable communities to respond individually and collectively to the adverse impact of climate change (Adger 2003a). For example, there is little chance of success to adaptation once the atmospheric Green House Gas (GHG) concentration exceeds 450 ppm CO_2eq (IPCC 2007). Thresholds mark the tipping points that vary from one systems state to another. Critical thresholds will be those that set the broad scope for what is possible through purposeful adaptation (Adger 2003b).

According to Pelling (2011), actions of adaptation are stimulated by the crossing of risk, hazard or vulnerability thresholds. Each threshold is socially constructed. The level of risk that is accepted by society determines the first threshold and is shaped by whose values and vision for the future (Adger *et al.* 2009). The

traditional adaptation is driven by perceptions and local knowledge from the past experiences of weather, climate and the associated disaster trends. Climate change adaptation is largely local and contextual in nature. However, the communities and their resources on which their livelihoods depend on are linked to larger intricate network of ecosystems and the changing climate including its uncertainty makes the adaptation at local level challenging and difficult (Adger *et al.* 2009; Dessai and Hulme 2004).

Focusing on socioeconomic factors determining adaptation, Adger *et al.* (2006) explain that limits to adaptation are endogenous to society and hence are contingent on power structure, ethics, attitude, culture and knowledge. The authors argue that the limits depend on the ultimate goal of adaptation underpinned by diverse values, uncertainty around climate foresight, social and individual actions and systematic undervaluation of loss of place and culture.

Ayers (2011a) explains that the uncertainty and climate change risk depend on both science and international processes. The uncertainty in adaptation is underpinned by uncertainty around United Nations Framework Conventionn on Climate Change (UNFCCC) meaning of 'dangerous climate change' and what thresholds of dangerous climate change need to be avoided. The second uncertainty is around the science of climate change projection, particularly on identifying and quantifying impacts. The third uncertainty is around the complex interaction between climate change and development. This argument explains that international climate assessment and negotiation discourse could be a barrier to the adaptation if they fail to proceed in a desired pace.

Policy and institutions

Institutions play vital roles in initiating, promoting, improving and sustaining adaptation practices (Osman-Elasha *et al.* 2006). However, existing institutions need to change their traditional practices to address the new and additional issues of climate change and need capacities to perform in innovative ways. There are barriers and constraints in promoting adaptation in developing countries due either to lack of modifiable institutions or lack of institutions for various reasons around governance. These barriers are driven from international and national level policy making; translating policy into effective action, institutional structure to manage sustainable adaptation and financial resources and capacity needed to promote adaptation at different scales.

The international and national policy on adaptation is in an infant stage. Global community has recently given attention to adaptation through providing space in the UNFCCC negotiations and devising strategies and action plans to guide it. At the national level, governments have developed climate change policy, strategies, and action plans to deal with the problem. National Adaptation Programme (NAPAs) have been prepared by least developed countries[3]. But national level work on policy harmonisation and mainstreaming is lagging behind and translation of these policies into practice is likely to become a distant task. There are limiting factors and barriers such as lack of political stability, understanding of the problem and its drivers, coordination between different ministries and departments, bureaucratic hurdles and so forth.

[3] Such as UNFCCC has received NAPAs from 47 Least Developed Countries as of December 2011. http://unfccc.int/cooperation_support/least_developed_countries_portal/submitted_napas/items/4585.php

There are institutional issues around integrating climate change adaptation. There are traditional institutional structures that are too fragmented, sectoral and isolated. These structures are also constrained by capacity and resources. As climate change is a multifaceted problem, it demands coordinated actions and strong institutional collaboration. These could be built on traditional sectoral approaches and practices but the persisting lack of commitment for coordination stand as a barrier to adaptation. Adaptation actions have to be localised and built up nationwide. So, the challenge is to ensure governance structure that can address the institutional gaps and barriers (Ayers and Dodman 2010).

Another issue is around financing which is mostly limited and curtailed by the poor governance in the countries as well as in the international processes. Financial resources are critical to facilitate planned adaptation as it demands massive financial resources in developing countries. The country governments have to rely on international support in order to meet the cost of adaptation which has to overcome project based approach. Unless and until resources are available adequately and regularly, promoting meaningful and purposeful adaptation is remote. The governance issues in Nepal, as highlighted by many report and papers, are mostly related to financial management, capacity to delivery, knowledge management, institutional mechanisms and aid transparency (Oxfam 2011; Regmi 2011; Regmi and Bhandari 2012).

FINDINGS[4]

Local adaptation and its limitations (Case study at local level)

Adaptation dimensions in the study site

This case study was conducted in Dhungegadi and Bangesaal VDCs in Pyuthan district of mid western region of Nepal. The population of Dhugegadi and Bangesaal is 3,938 and 5,407 respectively[5]. Both the VDCs have sub-tropical and temperate climate change with elevation of 100 to 1000 msl. Dhungegadi VDC was one of the pioneers in terms of working on climate change adaptation initiative as it was one of the pilot VDC of LAPA.

What farmers are adapting to?

Although the vulnerability mapping carried out under NAPA shows that Pyuthan is relatively less vulnerable district, the local vulnerability of climate change is high (Rupantaran 2012). Climate change issue was also evident in both of the VDCs. Communities during interview and discussion shared their perception on the increased warming trend and rainfall variability. The interaction with communities in the research sites revealed that due to changes in the climatic patterns, there are major shifts and changes in the production system and resource use. The impact has been severe in agriculture, water resources and health sector. Although there is slight variation in the scale of impact, the challenges in both the VDCs are enormous. The consequences of the impact has decreased agriculture production, increased risk of human exposure to disasters and disrupted access to drinking water.

[4] The data used in this paper is partly from the PhD research of the principal author and serves as one of its output.

[5] Source: District Profile Pyuthan, DDC Report 2004.

The group discussion, historical trend of crop priority and calendar revealed that farmers in the study VDCs attempted to respond to the negative impacts of climate change. The communities changed crops and cropping calendar over the last three decades. Major driving factors to do so were the introduction of new crop species, varieties, traditional crops failing to do well and uncertainty in rainfall. Some natural resource management skills and practices coupled with better access to markets, seeds and technical advices enhanced adaptive capacity. However, these local practices remained ineffective due to scale and magnitude of impact.

Who adapts?

The findings reveal that mostly the poor, women and marginalised communities face the impact of climate change. The population who rely on agriculture as their main source of livelihood are impacted the most by climate change. In some aspects, the climate change impacts across all segments of the society. For example, the drying of spring and water sources has not only impacted the poor but also the rich families and households. However, the discussion with communities reveals that poor households are more vulnerable because they lack resources to effectively respond to the adverse impact.

But the communities have also been traditionally responding to the climate extremes. The type of responses is varied based on the risk and impact observed both at the household and community level. The focus group discussions show that the level of response is also varied among different socio-economic groups. For example, in Bangesaal VDC, the richer households, compared to the poor households, afforded to quickly switch from cereal crops to short term cash crops during drought. This implies that economically resourceful households tend to adapt quickly than poor households.

How adaptation occurs?

Communities in the two VDCs have traditionally responded to climate change based on their existing capacity. The response in the past was *ad hoc* and not well organised. Communities only responded when the disasters happened. The early preparedness was lacking in the past. Majority of the consulted communities felt that due to lack of preparedness, they had more losses. Recently the communities and the VDC as part of local government have been involved in adaptation activities. Similarly, in both the VDCs, the communities and local stakeholders have formed the Village Forest Coordination Committee (VFCC) to coordinate the VDC level adaptation responses. These VFCCs are formed with the representation of local government, political parties, Non Governmental Organizations (NGOs) and CFUG. The adaptation planning process has just started and is yet to show its result.

However, the findings in both the study sites show that real adaptation has not yet happened. The coping strategy in the past has not helped them to deal with extreme events. Even with the preparation of adaptation plans, communities seem to be planning to respond to the short term variability of climate change. There are other external factors that determine communities' capacity to respond well and systematically. The socio-economic status of the household revealed that the social capital and existing resources is not enough to respond well to the impact of climate change. As majority of the population are below poverty line and facing problem of acute shortage of food and access to services, the capacity to adapt is very limited. The analysis also shows that the adaptive capacity of communities to deal with extreme events is very low due to lack of knowledge and technology.

What we want to achieve?

The findings show that strategic visioning of climate change is well advanced in the study sites. The communities, with assistance from the donors and NGOs, have prepared community and local level adaptation plans. The adaptation plans have prioritised and strategised action plans to deal with climate change. Analysis of the existing plan reveals that communities are more interested in the short term nature of adaptation interventions. For example, the communities have identified activities that can solve their immediate problems like drinking water. The action plans aim at reducing the vulnerability than addressing risk. The VDC level LAPA of Dhugegadi shows that more than 80 percent of the priorities in adaptation are related to address livelihood concerns rather than risk reduction.

Similarly, the government, donors and NGOs have considered the aspects of adaptation responses linked with integration in the development planning process. The heavy reliance on the planned adaptation process only undermines the potential of autonomous adaptation and flexibility needed to respond to the climate extremes. Adaptation with little or no consideration of political economy of climate change risks the danger of mal-adaptation. This can result in negative effects that are as serious as the climate-induced effects that are avoided (or managed). So the effects of climate change must be considered in the context of multiple actors, multiple stressors and factors, which may be as important to the design of adaptive responses as the sensitivity of the change.

Limits and barriers to adaptation

Technological barriers

The interview with communities in Dhungegadi and Bangesaal showed that there are some traditional practices to cope with climate change impacts. As show in table 1, the perception on existence of traditional practices is higher in Dhungegadi (62.5%) compared to Bangesaal (54.7%). There was also higher number of respondents who did not adapt any kind of traditional practices. According to the non-adopters, they didn't adapt because they were not aware about the suitable technology that works better in the extreme situations. Similar findings were reported in other reports as well (SAGUN 2009).

Table 1 : Household perception on the existence of traditional practices

		Village Development Committee (Location)					
		Dhungegadi VDC		Bangesaal VDC		Total	
		Count	Column N %	Count	Column N %	Count	Column N %
Existence of Traditional Practices	Yes	40	62.5%	35	54.7%	70	58.6%
	No	24	37.5%	29	45.3%	53	41.4%

The traditional practices are location specific and adapted by communities since generations to gradually adjust their livelihood in light to the adversities in weather and climate. At the research sites, the traditional practices adapted at the household level were mostly related to efficient water management, plantation and local bioengineering practices. Around 23 percent of the respondents used kitchen waste for irrigating their vegetable crops. Communities also practiced plantation and bio-engineering to protect the land from landslide and flooding. Some adopted the local irrigation practices to reduce the risk and impact of climate

change (see Figure 2). There were also other national level studies which have documented local knowledge in relation to climate change. These studies have provided examples of some of the practices adopted by communities (Chapagain *et al.* 2009; Regmi *et al.* 2009a; Devkota *et al.* 2011; Maharjan *et al.* 2011; Manandhar *et al.* 2011).

The relevance and significance of local practices become important in areas where the government and other agencies support do not reach. The significance of local technologies in adaptation has been documented in Nepal. Regmi *et al.* (2009) show that, innovative technologies currently practiced by some hill farmers are helping to build resilience of communities. Others also reveal that farmers and their supporting institutions are evolving and co-producing climate sensitive technologies on demand in Nepal (Chhetri *et al.* 2011).

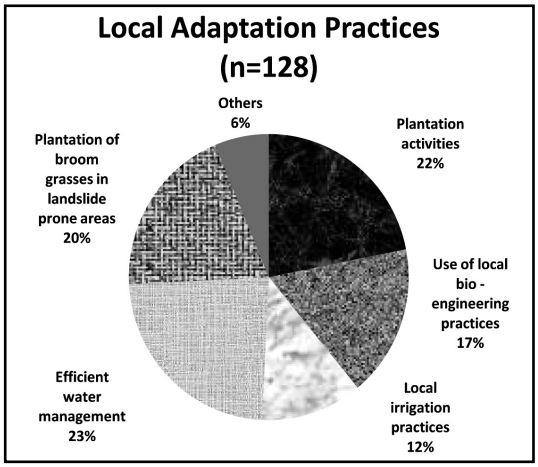

Figure 2. Household perception of the adoption of local adaptation practices

But, there are limits to these coping strategies adapted by communities to deal with climate extremes. The coping range and thresholds are determined by the extent of climate variability and capacity and resources of communities to respond individually to the adverse impact of climate change (Adger *et al.* 2009). The uncertainties of climate change impact and the scale of devastation makes the local practices ineffective.

Most of the local practices respond to the current climate variability and are short term responses. The focus group discussion with the communities revealed that communities regard their responses as coping and temporary adjustment. Respondents, during household survey, reported that many of the adopted traditional practices were ineffective. Almost 89.1 percent of the respondents in both the VDCs perceived that the existing adaptation options were ineffective and could not address the climate risk and impact (see table 2). Only around 11 percent of the respondents felt that the traditional practices are effective to deal with some of the disasters. The effectiveness differed in household responses because of the factor governing the type of technology and experiences of its impact.

Table 2 : Perception of communities on the effectiveness of adaptation options.

		Village Development Committee (Location)					
		Dhungegadi VDC		Bangesaal VDC		Total	
		Count	Column N %	Count	Column N %	Count	Column N %
Existence of traditional practices	not effective at all	22	34.4%	31	48.4%	53	41.4%
	less effective	32	50.0%	29	45.3%	61	47.7%
	effective	10	15.6%	4	6.3%	14	10.9%
	very effective	0	0%	0	0%	0	0%

About half of the respondents (64) perceived that the traditional practices were ineffective because of the lack of information, knowledge and technology. Many felt that they had limited access to modern and advance technology that can deal with community responses. Some respondents (13) felt that the traditional technologies could only work in normal situation and proved ineffective in massive damages caused by climate change. There were some respondents who felt that even the exported technologies were ineffective. Similarly, there were few individuals who blamed the traditional extension and service system of the government as cause of the ineffectiveness.

The focus group discussions in Dhungegadi and Bangessal revealed that they had received adaptation support. The support was provided in implementing the LAPA prepared at the VDC level. There were some technologies identified and promoted at the local level[6]. But many of the technologies were based on communities' knowledge without getting technical input from other agencies. When communities were asked about the effectiveness of these technologies, they admitted that it did not actually address the risk. They expressed that they lack technological backstopping from the government agencies due to which, their proposed technologies failed. The informal discussion with the NGO staffs providing facilitation support in the VDC also realised the limitation of technological information and knowledge.

The study carried out by Manandhar *et al.* (2011: pp. 346-347) found that the farmers in Nepal are capable of quickly responding to climate change, but their adaptation measures are for short term and may be inadequate to cope with the long-term effects of climate change. Similarly, Regmi *et al.* (2009b) argue that although there are innovative local practices to cope with climate change, there are limits to it and have to be accompanied with external support.

The study carried out by Lebel (2012) in Asia Pacific also shows that there are few evidences showing the direct contribution of local knowledge on reducing vulnerability. Most of the contributions were based on responses to existing climate variability or particular events as opposed to longer-term changes in climate. In another study carried out by Macchi *et al.* (2011), it was noted that despite the repertoire of response strategies to the changes in climate, these responses may not keep up with the fast pace of change that the communities are facing.

The technology transfer debate is very strong at international level but outcomes were not satisfactory at the local level. The household survey also emphasised on the need to enhance technological cooperation among countries to help the vulnerable household to better adapt. Blending traditional practices and modern technologies might prove effective in adaptation responses. Some of the respondents also pointed out the need to revive the extension services and to make it efficient. The service delivery and technology transfer need to be tied up in the future to make development and adaptation more sustainable.

Institutional barriers at local level

The LAPA and CAP were piloted by in all the CFUGs in Dhugegadi and Bangasaal VDCs. TheCFUGs were organised and formed VFCC for coordinating the climate change adaptation work at the VDC level. VFCC is a loose informal organisation which is functional at

[6]These include plantation activities, construction of check dams, drinking water source protection, awareness campaign.

the VDC level since 2009. This study looked into the opportunities and constraints of CFUG and VFCC in relation to management of adaptation responses at the local level.

The exposure, resources and leadership play an important role in the institutional development. The analysis of existing community based institutions revealed that CFUG appear to be most potential and viable institution at the local level compared to agriculture group, cooperative, mothers group and local clubs. CFUF was perceived to be strong because of its legal status, coverage, leadership, resources available and linkages with other agencies. Other groups were not much functional. Many of the communities and local agencies however realised the limitation of CFUGs. They mentioned that CFUG is too forestry focused, only limited to areas where forest is present and often faced with internal governance problems. The internal governance of CFUGs , particularly gender role, elite dominance and management of funds was also reported by other papers (Agarwal 2001; Buchy and Subba 2003; Pokharel 2008; Thoms 2008).

Similarly, the analysis of the VFCC revealed that there are many issues with the current institutional mechanism. Although actively functional in Bangesaal and Dhungegadi, these institutions were not legalised, had less experience and exposure, and their institutional resources were limited. There were both positive and negative perception of communities and local stakeholders with regards to the existence of VFCC (Table 3). Many felt that it is necessary and has to take the lead at VDC level.

Table 3 : Perception of stakeholders on the strength and weaknesses of VFCC

Mechanism	Strength	Weaknesses
Village Forest Development Committee (VFCC)	• Includes all the CFUG of the VDC • The composition of VFCC is inclusive (includes government, political parties and user groups) • Strong leadership and management will • Linked with government local agencies • Strong local level ownership • Strong technical background and institutional support • Functional and effective in terms of coordinating and delivery	• Not legally recognized • Only represents forest user group • Excludes others group at community level • Lack political buy in

The research also analysed the power, interest and legitimacy of some local and government institutions in Dhugegadi VDC of Pyuthan district. This was done by involving representatives from the communities, political parties, government stakeholders and the civil society. They were asked to rate the power, interest and legitimacy[7] of some of the organizations. The institutions analysed were: VFCC, VDC, Local Agriculture Cooperative,

[7] For interest and Legitimacy, rating was done using high, medium and low. In case of interest, it was rated according to High gain, gain, medium, loss and high loss (www.sas2.net).

Agriculture Group, Livestock Group, Mothers Group, and Local Clubs. The result showed that the VDC had high power, medium interest and medium legitimacy. The VFCC had low power, high interest and low legitimacy. While rest of the groups (such as mothers group, agriculture group) had low power, high interest and low legitimacy (Figure 3).

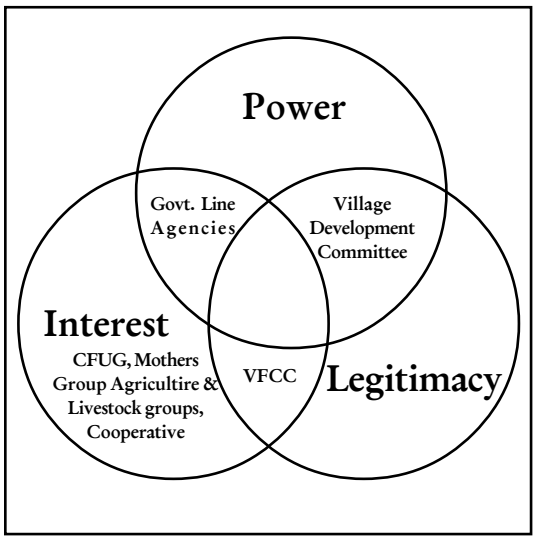

Fig 3: Power, interest and legitimacy analysis in Dhugegadi VDC.

The analysis revealed that although VDCs had the potential to coordinate climate change adaptation responses at the local level, they were not much interested and their legitimacy was questioned due to lack of experience, expertise and resources. The VFCC proved to be the potential institution in Dhugegadi VDC for climate change coordination. VFCC was rated with low power/influence but with higher interest. This institution had high legitimacy in terms of their coordination capacity and mobilisation. They were considered legitimate by the local stakeholders.

Local institutions have role in facilitating adaptation. Institutions can motivate actors to start adapting, even though actors might not be intrinsically motivated (Biesbroek *et al.* 2009). Agrawal (2008) also found out that 'institutions are critical leverage points which determine the direction and magnitude of flows of resources to different social groups'. In our case, the newly formed institution has both potential as well as challenges. Although it might be the best coordinating mechanism, but question remains on whether it can respond to the uncertainties and the scale of climate change impact.

There is also an issue of power and control over decision making on adaptation responses. The figure above clearly shows that the power of local communities is weak in terms of influencing the decision making process. The institutional dynamics within the group also harbours exclusionary environment that may undermine the benefit to the most vulnerable population. The current institutional structure and mechanism like VFCC treats household in a general way and does not consider the specific inclusionary policies and approaches to target the most vulnerable household and communities. It is therefore necessary to devise and institutional mechanism that favours inclusionary structure and decision making system.

NATIONAL LEVEL POLICY AND STRATEGIC DILEMMA: NAPA AND SPCR

This section looks into the policy and strategic dilemma at the national level with regard to promoting climate change adaptation. It specifically analyses the case of NAPA and SPCR. The information presented here came from literature review and interview and consultation with policy makers and practitioners.

There are conceptual and strategic issues around adaptation responses. The scientific community advocates for risk reduction perspective of adaptation where the technological solution is the only means to achieve adaptation objectives (Klein and Maciver 1999; Klein *et al.* 2007). The technology driven adaptation is oriented towards identifying technologies to reduce the climate risk. The central level government in many developing countries also argue for sectoral and technology based solution to address climate risk. The national and sectoral plans on climate change adaptation reflect technology dominated planned adaptation responses to tackle the problem. Similarly, there are others who argue for vulnerability-first approach to adaptation. They argue that communities should be at the centre of climate change responses (Cannon and Muller-Mahn 2010; Ayers 2011b). The following paragraphs will highlight the national perspective of adaptation responses in Nepal.

Climate change adaptation was understood as risk reduction responses during early years of climate change discussion in Nepal. The government of Nepal along with donors invested to drain out water from Tsho Rolpa Glacier Lake in order to prevent the potential danger of glacier outburst floods. But there are more than 20 dangerous glacier lakes and many other forming and advancing in Nepal and there is an urgency to drain them all. It requires billions of dollars to address the problems to which the government are not able to invest in. Even the technological solutions need community participation and stakeholder cooperation for handling the technologies. Thus, technological solutions alone do not solve the problems generated or aggravated by climate change.

In countries like Nepal, adaptation planning has been a marginal activity and often thought from a sectoral risk reduction perspective. The NAPA is a technical document which outlines adaptation priorities. According to the policy makers interviewed in this research, the urgent and immediate adaptation actions proposed in thematic sectors under NAPA mostly focus on technological solutions to address climate change risk. For example, the combined profile number two in NAPA document outlines improving agriculture system and services. Although NAPA was praised for participatory and inclusive process (Helvitas 2011), it however ignores the local knowledge, practices, and innovations by communities.

The SPCR support granted to Nepal under Climate Investment Fund (CIF) for climate resilience piloting in Nepal took the risk reduction approach from the beginning. Box 1 below shows some of the technological focus of the Government of Nepal and the project on climate change adaptation.

Box 1. Focus on technological solution to adaptation

National Adaptation Programme of Action (NAPA). NAPA has identified 7 urgent and immediate adaptation thematic priorities for Nepal. The activities outlined are mostly technology driven aimed at reducing the climatic risk. Government of Nepal is also approaching Least Developed Countries Fund and bilateral funding to get support in implementing adaptation priorities related to agriculture, natural resource management and disaster risk reduction. One of the projects it is aiming is to address the issue of glacier lake outburst Flood in Nepal and strengthening the forecasting system.

Strategic Programme for Climate Resilience (SPCR): the project memorandum of SPCR has mostly focused on risk reduction strategies and actions to support adaptation in Nepal. Most of the interventions are focused on risk reduction strategies through technological interventions.

Source: GoN (2010), GoN (2011)

The national approach to respond to climate change is also oriented towards risk reduction. The Climate Change Policy (2011) has given more emphasis to low carbon development and less on adaptation. Although government of Nepal has developed the LAPA framework, there is still a challenge of institutionalising adaptation. Government action is more influenced by donor interests. Recently the government is developing low emission development strategy. One of the practitioners interviewed in this research argued that government do not have clear vision on climate change so it is dragged and deviated by the agenda and interests of development agencies.

The issue of strategic vision and orientation depend on who is involved in the policy making and how decisions are made. The process of climate change policy formulation in Nepal is largely dominated by few consultants and organisations. The civil society and communities are ignored in the policy making process.

Another issue is the lack of knowledge and information on climate change. Most of the policy makers and practitioners interviewed in this research raised the issue of knowledge gap in their sectors. The knowledge gap has implications to the decision making process. Many of the respondents argued that response on climate change is absent because the officials in the ministry and department are not much aware on the issues and remedies. The NAPA and SPCR have recognised the need to strengthen information and knowledge on climate change. The NAPA project has, established a Knowledge Management Centre and a web portal. Similarly, SPCR also proposed the research and knowledge generation work. However, the government has to take initiative and lead this. Without the government initiation, the project based approach will not be successful.

DISCUSSION: REDEFINING INSTITUTIONS' ROLES AND RESPONSIBILITIES

As it is evident that climate change is demanding urgent response at the local level, there is pressure on the institutions to work more efficiently and effectively at all levels of governance. Our case studies indicate that, although there are potentials at local level, existing institutions need to be reformed to address the new and complicated situation brought and aggravated by the climate change. Current traditional mind-set of the planners, policy makers and practitioners need to change drastically to incorporate multi-stakeholder efforts in practices. The transformation is challenging and difficult but it might be one among the many options for long-term, driving climate change adaptation agenda.

The case study also suggested that national level focus on technological solution to risk reduction mismatches with community's aspirations of vulnerability-first approach to adaptation. The radical shift in knowledge and technology generation is needed. Armitage and Plummer (2010: p. 287)also argue that in system where the ecological, social, and economic conditions are untenable, there will be limits to adaptation and a need for more fundamental shift in strategy that requires new ideas and practices. In addition, adaptation to climate change presents a complex methodological challenge due to traits of adaptation challenge (Claycomb 2009) such as uncertainty, complexity, irreversibility and urgency. This makes adaptation a wicked problem and requires innovative approach and perspective of analysis (Brown 2011: p. 19). It will be far more beneficial if we opt for even small changes in the current system of delivery (Dixit 2003).

We now need to push for more discussion around the need for society to radically transform its institution, technology, system and practices to adjust to climate change. The transformational change is not just required at the community level but applied to institutional and policy making process and its governance and implementation. Adger (2003b: p. 388) reveal that adaptation process involve the diverse nature of stakeholders and their relationships with the institutions they reside and resource base they depend. This understanding of relationship is central to the approaches needed to foster collective actions in adaptation.

In Nepalese context, the policy and practices have to be corrected in order to promote collective and inclusive action on climate change adaptation. There have been some efforts in putting the agenda into national and sectoral discussion, but it inadequate. It is very likely that efforts end up into mess as the resources are not adequately allocated and available resources are not reaching the communities and ecosystems in need. There is limited access of communities and other stakeholders in the policy, strategy and planning process as only few dominant agencies are involved. Another important issue is related to power and control over planning and decision making. Clearly, the excessive focus on knowledge alone is not sufficient to address diverse problems of development. Issues of power are more often central than the issue of knowledge.

Our findings show that there are limits to local adaptation and institutional capacity to respond effectively. But this should not undermine the value of communities and their institutions. The national framework on LAPA is an attempt to recognise the role of local agencies in adaptation. Agrawal (2008: p. 16) emphasised the significance of local institutional role by stating:

> Without greater attention to local institutions and their role in adaptation efforts of different kinds, and the ways in which local and external

institutions can be articulated in the context of adaptation, it is unlikely that adaptation interventions and investments will achieve much success.

Communities do have knowledge, skills, wealth and leverage to draw upon. Building on these experiences will help in lessening the dependency of financing and technology. It will further facilitate in implementation of adaptation priorities identified both at local as well as national level.

It may be a right time for stakeholders to advocate for inclusive governance structure and new roles and responsibilities for institutions. Agrawal and Perrin (2008) also agree that, for effective adaptation, there is a need to strengthen and take advantage of already existing strategies that many households and social groups use. We might also think of radical transformation with the existing institutions at both central and local level to become more accountable, inclusive and responsive.

CONCLUSION AND WAY FORWARD

This paper has analysed the limits and barriers to adaptation based on the two case studies carried out at national and local level. The case studies show that although Nepal has been progressive in climate change agenda, there are challenges of promoting climate change adaptation at the local level. The local case studies have provided good insights into the diagnosis of existing institutional and technological structures around climate change adaptation in Nepal.

The findings show that climate change adaptation advancement in Nepal at both national and local level is constrained due to lack of strategic clarity and policy visioning. There is a huge gap in information and knowledge base on climate change which impacts decision making at the local level. A major constraint for promoting adaptation is technology. The technologies are based on existing knowledge and limited information. They are short term in nature and rely on climatic variability, but ignore the uncertainties and scale of climate change impact. It is found out that these barriers undermine the effectiveness of the initiatives promoted both at the national as well as local level.

The complexity of climate change adaptation has to be understood in terms of its political economy of how agenda is shaped, debated and influenced at national level and how institutions play a role in facilitating adaptation at the local level. As there is lack of sufficient information on impacts and the issues, adaptation has to build on the experiences to deal with climatic variability and extreme climatic events. The options and strategies may vary but each should be benefiting both the environment and community livelihoods. The transformation is challenging and difficult but not impossible. So, the strategies should be flexible, innovative and context specific with the provision of contingency. There are differentiated roles for stakeholders that need to be piloted and then up scaled. But, it demands transformational changes in the mindset and working approaches.

Adaptation in practice needs building on the existing knowledge, skills, and best practices. For this, change in mindset and conventional way of development planning and delivery is necessary. Facilitation for the gradual change with support from state and international community can be an important entry point.

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