

## LOCAL ADAPTATION PLAN OF ACTION FRAMEWORK AND PROCESS IN THE AGRICULTURE SECTOR IN NEPAL

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### **Abstract**

*Local Adaptation Plan of Action (LAPA) is recognized as a means to mainstream climate change adaptation into the development plans at the local level. The GoN developed NAPA and climate policy prior to LAPA and currently in the process of developing NAP. The implementation of the local adaptation plans has started in western Nepal under the NCCSP. This paper analyzes the LAPA initiatives and process focusing on agriculture including assessment of local climatic contexts, vulnerabilities, adaptations and barriers. Moreover, the paper presents the adaptation cases that has enhanced the awareness and adaptive capacity at the local level. The assessments followed the qualitative research, review and analysis using the participatory and socially inclusive approach. The adaptations were analyzed for their effectiveness in enhancing the adaptive capacity of poor and vulnerable. Furthermore, the institutional mechanism suitable for the LAPA were also assessed and analyzed. The paper concludes the appropriate procedure for LAPA design along with the potential actors and their roles. This paper also suggests the appropriate local government unit (LGU) for mainstreaming adaptation into the development process at the local level in the new governance system. Furthermore, the capacities of the communities and stakeholders need to be strengthened for effective implementation.*

**Keywords:** Climate change; Adaptation; Local; Mainstreaming; Agriculture

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### **Introduction**

Climate change is a global issue that affects all living beings in the world. The developing countries like Nepal face its impacts more than the developed countries due to the least adaptive capacities and high climate exposure and sensitivity [1]. It has also posed additional threats to the development processes due to increased temperature and variability in precipitation [2]. It is predicted that the climatic uncertainties will be more severe and alarming in future with exacerbated impacts because of higher temperature and uncertain precipitation [3]. It has impacted almost all livelihood resources and sectors; however, the impacts are observed more prominent and severe mainly in agriculture, water and forestry [4] since most of the people including the poor and vulnerable groups are highly dependent on these resources for their livelihoods and have least capacities to deal with these impacts.

The Government of Nepal (GoN) started environment-related activities since early the 1980s at the project level. Later on, the Ministry of Population and Environment (MoPE) was established in September 1995, which was combined with Ministry of Science and Technology by renaming it as the Ministry of Environment, Science and Technology in 2005. In 2009, the separate Ministry of Environment was established however, this ministry is mostly unstable

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with the changes in the government either by changing it or combining with other ministries [1]. Despite the political instability and poor economic development for decades, it is appreciative and encouraging that the GoN has led the adaptation planning in a country driven and country-owned initiative [4].

The Paris agreement emphasized on climate change adaptation based on the available climate data and climate science [5]. The GoN has already initiated the adaptation planning by the development of National Adaptation Programme of Action (NAPA) in 2010, Climate Policy and Local Adaptation Plan of Action (LAPA) in 2011 and also initiated the National Adaptation Plan (NAP) process. Nepal became a pioneer of LAPA as it was the first country to develop formal LAPA in the world [6]. The LAPA intends to implement the priorities of NAPA more effectively through public and local participation and integrating adaptation into the sectoral plans and policies. The LAPA process demonstrated the possibilities of bottom-up, inclusive and decentralized adaptation planning in Nepal [4]. The LAPA process has gained international recognition, thus, been replicated in other countries such as India, Pakistan, Mozambique, Kenya, Mali, Senegal and Tanzania [7]. Furthermore, the GoN established the climate change network as a multi-stakeholder forum and climate change council chaired by the Prime Minister [8]. The Government also established a Climate Change Division within the Ministry of Environment with a mandate to coordinate the climate agenda in Nepal [9]. For high-level political support, Nepal has Climate Change Council, chaired by honorable Prime Minister.

The GoN has initiated to develop and implement the local adaptation planning processes to address local climatic issues, build resilience, enhance adaptive capacities at the local level and mainstreaming these plans into the development plans. The government planners, policymakers as well as development partners have also emphasized on the integration of climate change into their planning, budgeting and decision-making process to ensure effective and efficient adaptation measures from the local to the national levels [10]. But there is a big gap between national and local level planning scales. This gap needs to be minimized with reach-up the planning process and draw-down the resources. It is envisaged that local adaptation planning process (LAPA) complement national planning initiatives like the NAPA and climate policy. LAPA also provides a mechanism for mainstreaming local adaptation needs and capacities into development planning for the effective implementation of the most urgent and immediate adaptation needs which were prioritized in NAPA [3].

Agriculture is the main source of livelihood and food security, which is identified as a major theme in the NAPA and LAPA. It is one of the central foundations of income for the rural and poor people particularly in developing countries like Nepal. Almost 40% of the global population today are dependent on it for their livelihood. But this is the most vulnerable sector from the adverse climate impacts, thus, it is very crucial to analyze and understand the adaptation in this sector in the present context [11]. This paper has focused particularly on the adaptation in agriculture sector in the LAPA process. Many studies have been already conducted by the researchers concentrating the trend analysis, assessment of the vulnerabilities in agriculture and adaptation, however, only very few researchers have concentrated on analyzing the adaptation in the agriculture particularly focusing on LAPA process. This paper analyses the LAPA initiatives, framework and process in Nepal particularly focusing on agriculture including the LAPA piloting and participatory assessment of local climatic contexts, vulnerabilities, adaptations and integration of adaptations into development processes. Moreover, the paper assesses the adaptation cases at the local level which enhance the awareness and adaptive capacities by following the review and analysis using the participatory and socially inclusive approach. Vulnerability assessment tools, pair-wise ranking, participatory vulnerability ranking, cost-benefit analysis and multi-criteria assessment were used during assessment and analysis. The adaptations were analyzed for their effectiveness in enhancing the adaptive capacity of poor and vulnerable. Furthermore, the institutional mechanism suitable for the LAPA were also assessed and analyzed.

## Methodology

The paper is based on the combination of qualitative research and scoping review of the existing publication on the climate policies particularly focusing on LAPA in Nepal. An extensive review was carried out including the case studies and documents from climate-related projects and programmes implemented in Nepal focusing on LAPA framework. The case study was concentrated in Dhading, Dang and Chitwan districts of Nepal for assessment of vulnerabilities and adaptations. Among these selected districts, Dhading is selected site for piloting of LAPA in agriculture, whereas Dang district is selected district for implementing LAPA under the Nepal Climate Change Support Programme (NCCSP). Chitwan is neither a part of LAPA piloting nor part of implementation, however, the adaptive initiatives are continuing with the support of government and non-government agencies. These districts were selected based on the review of climate change vulnerability mapping and also the prevailing climatic vulnerabilities like landslide, drought, and hailstone in consultation with key informants and District Development Committee (DDC) and district line agencies based on their organizational past experiences. Climate vulnerabilities and adaptation interventions were assessed at the community and VDC level (*Village Development Committee used to be the lowest administrative government unit earlier, which is not changed into rural municipalities (Gaun Palika) and municipalities after the declaration of Federal Democratic Republic Country of Nepal. The rural municipalities resemble the VDC in the present context.*) with the active participation of climate vulnerable communities, local stakeholders, political parties and NGOs and community-based organizations (CBOs). These organizations are categorized into public (bureaucratic administrative and elected governments), private (service and business oriented) and civic (membership and cooperative organizations) organizations based on A. Agrawal and P. Perrin [12]. Institutional mechanisms that enabled adaptations were also assessed and recommended for planning and effective implementation of adaptation interventions, process, and mechanism for mainstreaming climate change into development plans.

Number of focus group discussions (FGDs) and community workshops were organized at the local level in presence of 10-20 local actors/stakeholders representing public, private and civic organization including communities to have a common understanding on climate change, observed climatic risks and vulnerabilities, the concept of LAPA, their roles and contributions on LAPA process including the barriers in the process. Participatory approaches and tools were used to gather primary and secondary information through participatory vulnerability assessments, field observations, consultations and participatory planning and monitoring with local stakeholders including communities. Most of the information generated in the fields were verified and cross-checked with reports and publications through review of the literature through scoping review of available policies, plans, publications and unpublished reports.

## Results and Discussion

### *Observed Climatic Risks and Vulnerabilities in the sites*

Climatic risks and vulnerabilities differ across and within the district and VDC due to altitudinal and climatic variations even within the VDC. Ethnic people are comparatively more prone to the climatic risks and vulnerabilities. Chepang and Tamang ethnic people in Dhading district and Tharu ethnic people in Dang and Chitwan district have faced the climate change impacts. It is confirmed from the study that the poor and marginalized people are highly affected by the climate change impacts in the selected study sites. The study also found the poor and marginalized people especially living close to river, streams, forest and national parks are highly prone to the impacts. Chepangs are one of the deprived ethnic groups in Nepal, living in upper hills and cultivating in marginal and unproductive lands [13, 14]. Landslide, drought,

hailstone are major climatic vulnerabilities found in study sites in Dhading district, whereas, flood, riverbank erosion, and drought are found major climatic vulnerabilities in the study sites in Dang and Chitwan district. Table 1 shows the vulnerability ranking of the study districts based on the national vulnerability mapping conducted by the Ministry of Environment. However, different VDCs, municipalities and rural municipalities within these districts have different climatic risks and vulnerabilities based on exposure, sensitivity and adaptive capacities, which should be considered for future adaptation plans [15]. *J.P. Aryal et al.* [16] also confirmed the varied impacts of climate change in different regions and sectors depending on the type of exposure events related to climate change.

**Table 1.** Climate vulnerability ranking of study districts [14, 15]

<i>Ranking</i>	<i>Drought VI</i>	<i>Flood VI</i>	<i>Landslide VI</i>	<i>Rainfall temperature VI</i>	<i>Ecological VI</i>	<i>Overall VI</i>
Dhading	High (0.515-0.759)	Very low (0.000)	High (0.630-0.786)	Moderate (0.345-0.451)	Moderate (0.193-0.343)	High (0.601-0.786)
Dang	Low (0.181-0.331)	Very low (0.000)	Moderate (0.47-0.629)	Very low (0.000-0.218)	Low (0.079-0.192)	Low (0.181-0.355)
Chitwan	Low (0.181-0.331)	High (0.534-0.787)	Very low (0.000)	Very high (0.641-1.00)	Low (0.079-0.192)	High (0.601-0.786)

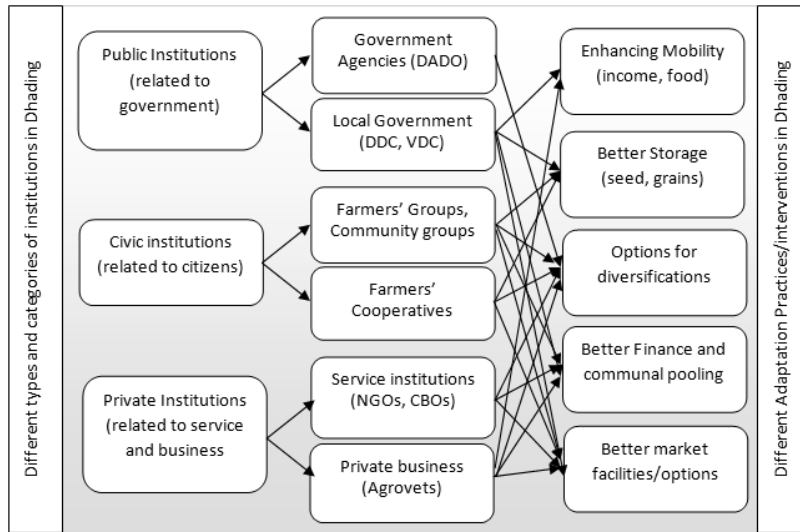
Based on the location-specific exposure, sensitivity and adaptive capacities, the communities are facing the climate change impacts differently. Agriculture is the mainstay of livelihoods in all the study sites with more than 90% population dependent on it and also highly affected sectors from climate change impacts. Agricultural lands and production have been affected by flood and flood-induced riverbank erosion in Dang and Chitwan districts and by the landslide, run off of agriculture land in Dhading district. Some areas are affected by drought due to lack of water for irrigation since most of the agricultural lands are rain-fed in nature. Farmers also observed changes in local temperature, a shift of monsoon rain, the occurrence of new diseases, and outbreaks of pest and diseases in the sites. MoE [3] also highlighted the increased climate variability and risks have impacted the agriculture and agricultural productivity across all ecological zones in Nepal. Local communities have been coping with their own initiations and both government and non-government organizations are implementing interventions to enhance their capacities and livelihood. But these efforts are sufficient enough to adjust to the changed environment and climate. The specific adaptation initiatives are required to address the location-specific climatic risks and vulnerabilities.

#### ***Adaptation interventions and strategies***

Most of the adaptation interventions and strategies that are being implemented in the study sites have enhanced the adaptive capacities of the communities including the poor and vulnerable communities. In all the study sites, the government and non-government organizations are implementing these interventions and strategies on livelihood diversification and also focusing on enhancing skills, knowledge, and capacities of the local farmers. Some of these interventions are not directly related to climate change adaptation, however, these interventions have supported in development and the integration of adaptation in their planning processes. Some of the adaptation interventions found in the study sites were water collection tank and farmers' field school in Dhading, irrigation canals, culverts in Dang, and early warning and evacuation towers, community seed and resource center in Chitwan. Local institutions are vital for effective implementation of these development and adaptation interventions. However, sustainability remained a core challenge for many of these interventions as most of the organizations involved in the implementation were focused on achieving their current and immediate goals and objectives.

Most of these interventions identified in the study sites are being implemented by the public, private and civic institutions were found in five different categories (Fig. 1) as in the case of Dhading. The public (bureaucratic administrative and elected governments), private (service and business oriented) and civic (membership and cooperative organizations)

institutions were defined by *A. Agrawal and P. Perrin* [12] in the papers, which was later contextualized by *S.K. Maharjan et al.* [2] in their paper. Similar cases are found in other study districts too. It was found that the interventions that provide a regular income and link to the markets are more sustainable. Both public and private institutions are implementing these interventions in the sites for the benefit of resource-poor and vulnerable communities.



**Fig. 1.** Linkage between local institutions and adaptation interventions in Dhading [2]

All these institutions have their own working modality and mechanism for both institutional and financial aspects. Most of the institutions have focused on development and livelihood interventions as communities highly depended on livelihood and development interventions. Most of the interventions are directly or indirectly connected to agriculture, food security, biodiversity and forestry since most of the people in the study sites are depending on these sectors for their livelihood. Many of these interventions, such as water collection ponds, riverbed farming, community seed bank, hedgerow farming, and multiple water use systems (including drip and sprinkler irrigation) also addressed climate change issues, hence relevant to adaptation as well [17], while some interventions like road construction, electricity, construction of bridges, telephone etc. contributed in building adaptive capacities of the communities through enhanced accessibility and networking. Therefore, the mainstreaming climate change into development and climate foresights in development interventions with institutional support and enhanced adaptive capacity of communities are essential.

The adaptation measures have to be sector and location-specific based on the climate change impacts and induced disasters. The institutional supports to these adaptations are dependent on the thematic and sectoral focus of the particular institutions. However, agriculture in Nepalese context is very common theme for most of the institutions working at the community level. In addition to several adaptation interventions implemented by local and national institutions, farmers and vulnerable households themselves are coping with the ongoing climatic hazards through community adaptation plans, which provide the strong basis for LAPA in addressing the adaptation needs [18]. These coping practices were introduced as a response to the altered environment in the local context, tested and adopted through generations. LAPA process, therefore, focused on assessing the local adaptation and coping practices, strengthening and mainstreaming them. At the same time, it is very important to consider the contexts and clients before attempting to replicate them.

Considering the local context, the case of reserve fund for livestock compensation mechanism in Jogimara VDC of Dhading was effective which was implemented in collaboration with AKO cooperative with separate regulation with the incentives to poor and vulnerable households as communities have been attracted towards livestock rearing due to observed crop failures. The mechanism was mainstreaming by the VDC by allocating NRs. 25000 to operate the mechanism in addition to cooperative shares and CADP-N support [2]. Agriculture and livestock insurance support the poor and marginalized farmers to face the risks and vulnerabilities and enhance the access to the financial sources to improve their livelihoods [19]. It is necessary to analyze the long-term impacts of this mechanism, but farmers are enthusiastic about its implementation and plan to expand to cover crops as well. Despite institutional, technical, operational and financial challenges, crop and livestock insurance scheme provide relief to the farmers from local climatic risks [20]. The government has decided to provide 50-75% subsidy on insurance premium [19, 21] for crop and livestock insurance, which has further raised the scope of livestock and crop insurance in future.

#### ***LAPA unit for planning and mainstreaming LAPA into development plans***

The whole government structure and the local government unit (LGU) needs to be revised and reframed based on new governance system under the Federal Democratic Republic of Nepal. In the earlier studies, VDC was identified as the most appropriate local government unit which used to be the main local unit for development planning before the federal governance system in Nepal. It was recognized as LAPA unit for adaptation planning, intervention and mainstreaming. But the political scenario has changed after the declaration of the Federal Democratic Republic of Nepal and successful elections at central, regional and local levels. The rural municipalities and municipalities and their respective wards are the most appropriate and applicable local government units in the changing political context. The Ward, which is the lowest unit of governance, could be the LGU for LAPA process. However, lots of consultations at different levels, planning and preparatory works are yet to be done as it has to be the most applicable scale for the integration of climate change into development and planning process from local to national levels. It is more important to build the adaptive capacities, climate resilience of the communities and local government officials to address the climatic issues at the community levels.

The 100 LAPAs have been prepared by the government in mid and far-western development regions under the NCCSP that also need to be discussed and revised in line with changing political context. All of those LAPAs were prepared considering VDC as the LGU which has now changed into rural municipalities and municipalities. The VDCs are combined either to form rural municipalities or municipalities in the new political scenario. Additionally, the district and regional level adaptation planning and executing body are also required to address the issues. Thus, the former LAPA framework needs to be revised and changed as per the new governance system. In addition to national and local level adaptation programmes/plans, the state-level action plans and governing body on climate change are required to deal with climate risks and vulnerabilities and effectively adapt to these impacts. The environment ministry at the state-level should be the responsible body to coordinate and effectively implement the adaptation. The state-level plan has integrated the LAPAs to effectively implement the national and state-level plans in India [16]. The LAPA process still needs to take initiatives to integrate adaptation interventions into their planning processes by strengthening Agriculture, Environment and Forest Committee (AEFC) formed under Local Self Government Act 2055 B. S. (*Bikram Sambhat is Official Nepali Calendar, 57 years earlier than the AD*) within the VDC. The district and village level energy, environment and climate change committee (DEECCC and VEECCC) may be the appropriate unit for LAPA process.

It is realized that the community-led adaptation responses are effective to deal with localized and specific climate change impacts. A. Sharma *et al.* [7] also confirmed the effectiveness of community-driven responses in local development and adaptation process. Some of the VDCs have already started to integrate the adaptation plans into development plans. Adaptation plans and priorities prepared at community and ward level in support of

NGOs working in the VDC were integrated into VDC annual plan. The District Development Committee (DDC) has restructured the guidelines and working modality of the Agriculture, Environment, Forestry and Industry Committee within the DDC to address climate-sensitive issues in the planning process and enable communities to reach up and draw down resources and services. There is evidence of adaptation programmes, projects, and strategies for agriculture either supported by the NGOs or government at the local levels [22]. This ensures reach-up the plans and draw-down of the resources through the LGU. The roles of LGUs are instrumental of mainstreaming climate change adaptation into development plans and climate foresights in development plans, as these organizations are implementing development activities under local self-government act in Nepal.

**LAPA Framework and Planning Process**

The concept of LAPA originated in the multi-stakeholder’s consultation processes during NAPA in order to address local climatic variabilities. The LAPA framework is important for integrating the local climate responses in the development plans which is replicable in other developing countries [23]. *G.D. Awasthi and K.D. Joshi* [24] proposed the hybridized planning process by the combination of bottom-up and top-down approaches. Later, LAPA pilot framework was conducted under the Climate Adaptation Design and Piloting-Nepal (CADP-N) with different thematic areas across Nepal in 2010/11 with the support of DFID [6, 9]. Agriculture and food security are one of the main themes as guided by the NAPA. Under CADPN-N, livestock insurance, farmers’ field school, community resource center and water conservation pond were pilot in Dhading district [2]. The lessons from this pilot are taken forward in the full-fledged implementation of NCCSP which is also replicable to the other areas. The main purpose was to integrate climate change into development and planning processes through decentralized, bottom-up, inclusive and flexible approaches based on local contexts. The main features mainly LAPA objectives and steps of LAPA framework adopted in the CADP-N and afterwards are presented hereunder (Table 2).

**Table 2.** LAPA objectives and steps

LAPA objectives	LAPA steps
<ul style="list-style-type: none"> <li>• Identify and prioritize the most vulnerable areas, communities, household and individuals including their adaptation needs and priorities</li> <li>• Develop and integrate local adaptation plans into the local and national planning process</li> <li>• Identify the support and service delivery agencies and mechanisms</li> <li>• Assess, monitor and evaluate LAPA planning and delivery processes and mechanisms including the cost-effectiveness and benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Sensitization and awareness building</li> <li>• Assessment and prioritization of the climate variabilities, vulnerabilities, and adaptation possibilities, needs and existing adaptation options</li> <li>• Development and integration of local adaptation plans into the development and planning process</li> <li>• Implementation of local adaptation plans for action</li> <li>• Assessment of the progress of local adaptation plans for action</li> </ul>

It is very fundamental to develop and execute LAPA for the climate change adaptation [16]. Each of these objectives and steps has equal importance in the LAPA framework. Sensitization, awareness, and capacity building are very crucial for the communities to understand the importance of LAPAs, develop and prioritize the local adaptation plans at the local level (Figs. 2 and 3). During LAPA pilots and implementation under the NCCSP, the communities and stakeholders emphasized on the sensitization and awareness-raising activities in the study sites. The communities in Chitwan district also revealed such awareness raising events from the government and non-government organizations in the areas. Local impacts and adaptation are location specific and adaptation should fulfill the location-specific community needs [25]. *H. Reid et al.* [26] underlined the effectiveness of the community-led adaptation at the community level.

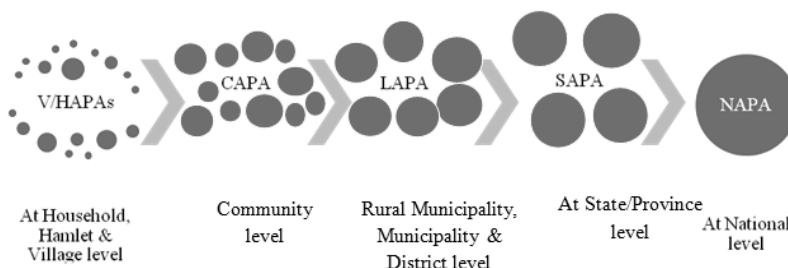


Fig. 2. Adaptation plans at different levels (size represents area of coverage in different levels)

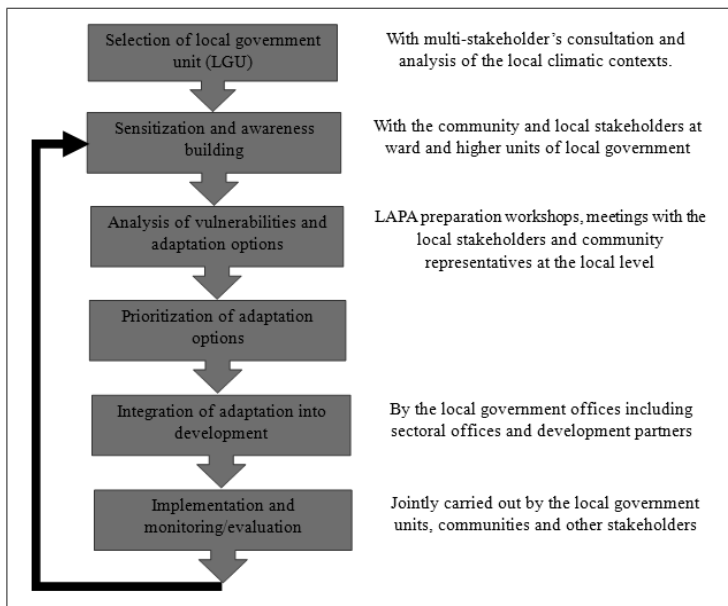


Fig. 3. LAPA Formulation process

It was also found that the LAPAs are also supported by the CAPA (community adaptation plan for actions), which are developed at the community level based on the principles of inclusiveness, responsiveness, flexibility, and iteration. In addition, the village level adaptation plans for action (VAPAs) and hamlets or household level adaptation plans for action (HAPAs) are necessary. However, the LAPA piloting has emphasized up to CAPA level as it was effective in raising awareness and building adaptive capacities at the local and community level and also in mobilizing the available local resources and institutions [6]. He further emphasized the leadership and ownership of the community in the local adaptation process. Numbers of farmers’ groups, women’s groups, micro-credits and agricultural/farmers’ cooperatives, irrigation groups are active in the mobilization and contribution in adaptation and development related interventions at the local level. The government still has to discuss, decide and develop the state-level body in the adaptation framework, especially after the formation of the new state-level government. The state or provincial level government could develop state-level adaptation plan for action (SAPA), which could focus on assessment, planning, capacity building and identifying opportunities for adaptation based on state-level priorities [16].

**Prioritization of Adaptation interventions in the process**

Wide varieties of tools and methods have been applied for identification, assessment, and prioritization of adaptation interventions in the planning process. These tools might require modifications based on local contexts. The participatory tools are used for vulnerability



assessment, climate hazard mapping and participatory vulnerability ranking were easy, quick and efficient at the community levels. In fact, single tool or method fulfils the multiple objectives. At the same time, multiple tools and methods can be applied to achieve the single objective. The example is provided in Table 3. These tools and methods were adopted and refined in the LAPA piloting process and other participatory exercises. Vulnerability assessment at community level supported on mainstreaming adaptation plans in the planning process. The integrated vulnerability assessment is an operational entry point for the LAPA planning process, which is also affirmed by *B.A. Peniston* [6]. In this process at the community level, poor and vulnerable people, women and ethnic people are encouraged to participate in the planning process that contributed to gender equity and social inclusive VDC plans. Use of these tools at different stages of LAPA development, directly and indirectly raised awareness of climate change adaptation [27].

**Table 3.** Tools and their uses in different activities [6, 9] (adapted)

Tools	Awareness Raising	Capacity Building	Vulnerability assessment	Prioritization of options	Preparation of adaptation plan
Cause and effect analysis	√	√	√	√	√
Climate hazard mapping	√	-	√	-	√
Climatic hazard trend analysis	√	-	√	-	√
Climate incorporated participatory well-being ranking	√	√	√	-	-
Forced field analysis	√	√	√	√	√
Hazard ranking	√	-	√	-	-
Livelihood impacts analysis	√	√	√	√	√
Logical framework	-	-	-	√	√
Meeting/workshop	√	√	√	√	√
Multi-criteria assessment	√	√	-	√	√
Pair-wise ranking	√	√	√	√	√
Participatory cost-benefit Analysis	√	√	-	√	√
Participatory vulnerability ranking	-	-	-	-	√
Seasonal calendars	√	√	√	-	-
Shared learning dialogue	√	√	√	-	√

Each of the tools has specific importance and applicability. Some of these tools are effective in the prioritization of adaptation interventions. Participatory cost-benefit analysis and multi-criteria assessment were useful for analyzing the effectiveness and prioritizing options with the participation of different stakeholders. *B.A. Peniston* [6] also affirmed the effective application of participatory cost-benefit analysis and multi-criteria assessment. It also helped to make interventions transparent, but the valuation of non-market goods was not easy since people’s perceptions created difficulty for agreeing on common result. Further the benefit: cost ratio alone could not give an accurate result. Thus, the multi-criteria assessment matrix was used, in which facilitators’ role is crucial to reduce chances of biased results. *S.K. Maharjan et al.* [2] confirmed the effectiveness of climate hazard mapping and climate incorporated participatory well-being ranking in identifying the poor and vulnerable households in the process.

***Adaptation plans at the community level***

The communities are unceasingly dealing with the changing environment and climatic contexts based on their local/indigenous knowledge and practices with or without the support of public, private and civic organizations/institutions. But the effectiveness of these coping and adaptation strategies are drastically enhanced with the support of these organizations/institutions at the community level. The communities are continuously adapting to the climate change impacts through their own initiatives or with the support of these

organizations even in the study sites without LAPA implementation, for example in Chitwan district. However, the number of adaptation interventions and intensive supports are comparatively higher in the areas with LAPA pilots and implementation. These adaptation interventions are not assessed and analyzed in terms of its appropriateness, effectiveness, replicability, benefits to the victims and sustainability in the study sites.

The community-led adaptation options based on communities' priorities, needs, knowledge, practices, and capacities are efficient and sustainable at the local level. The ability to adapt mainly depends on the livelihood systems [28]. The identification, analysis, and prioritization of adaptation options and plans are done based on the local contexts and priorities at the community level. At the community level, agriculture is a cross-cutting sector relying on other multiple resources including forestry and biodiversity, water resources for irrigation, livestock, roads, and marketing etc. It is crucial to identify the highly vulnerable farming communities within the VDC/municipality and develop appropriate coping and adaptation measures. Rupantaran Nepal [18] also highlighted it as the major issue in the LAPA process to identify and target the most vulnerable households. The LAPA process has identified the participatory process to identify and prioritize such communities and households. The roles of VDC level Energy, Environment, and Climate Change Coordination Committee was crucial in the process. In the new governance structure, the active roles and contributions of similar committees for coordination and effective adaptation plans and implementation at the community level. An example of community adaptation plan prepared in Jogimara VDC is presented in Table 4 [2].

**Table 4.** Community adaptation plan to address the climate change impacts [2]

Village/Tole	Impacts/Hazards	Adaptation plan	Purpose	Resource contribution
Kami Tole, Majh Gaun, Wangrung	Drought leading to declined food productivity.	Water harvesting and storage tanks	Collect the rainwater and store to be used during drought	25% (Community), 50% (LGU) and 25% (others)
Majh Gaun and Lamangdung	Landslides	Gabions, Retention wall, Plantation of trees, Napier, Amriso, Ipil-Ipil, Nigalo and Hedgerow plantation on sloping land (SALT)	Retaining unstable land, Soil conservation, stop landslide by increasing land stability	20% (Community), 60% (LGU) and 30% (others)
Mathillo Laitaak	Landslide in drinking water source	Water source maintenance and protection	Increase drinking water availability and save the time needed to fetch water from greater distances.	10% (Community), 65% (LGU) and 25% (others)
Majh Gaun, Kami Gaun, Gairi Gaun, Aamptar, Kharka Gaun	Increased pest and diseases in agricultural crops	Integration of livestock and shed improvement, Implementation of integrated pest management (IPM) conducting Farmers Field School	Manage and use livestock's urine and reduce the use of chemical fertilizers, promote biological pesticide and insecticide	20% (Community), 50% (LGU) and 20% (Others)

The community decided to contribute certain resources by themselves and seek for technical and financial support from public, private and civic organizations. These community adaptation plans were compiled, analyzed and prioritized based on cost-effectiveness, feasibility, addressing vulnerabilities, community contributions, sustainability.

Among adaptation plans/options prepared by communities; awareness raising interventions, crop/livestock insurance, micro-irrigation interventions and sustainable agriculture practices were ranked as top prioritized adaptation interventions with multi-stakeholder consultation through cost-benefit and multi-criteria assessment and pair-wise ranking. These interventions were mainstreamed into VDC plans, which was approved by VDC council from multi-stakeholders and multi-party consultation at VDC level and forwarded to DDC for approval. For sectoral plans, district line agencies and non-governmental organizations

were planning and implementing adaptation and development plans with their own priorities. That's why, public-private partnership (PPP) modality is important for effective integration of climate change adaptation into development plans with effective monitoring and evaluation framework [2] with the defined indicators correlated with district planning, monitoring and analysis system [24].

***Analysis of key actors/stakeholders and their roles in LAPA process***

Adapting to the impacts of climate change is one of the key concerns in Nepal that need joint and collaborative efforts of all actors and stakeholders. The roles and contributions of key actors in agriculture are identified and analyzed for better synergy and collaboration and effective mainstreaming at the different level. More or less the key actors are same in all the study sites. However, the capacity and level of resources are somehow different in these sites. The sites with LAPA pilot and implementation have additional resources from the government and civil society organizations. At the same time, the communities and actors/stakeholders have received the opportunities to be involved in different capacity building and networking activities at different levels. Furthermore, the access to the information and resources in these sites are comparatively higher than Chitwan district. However, the capacity strengthening of the stakeholders and regular supervision and monitoring are required to ensure the effective implementation of adaptation intervention at the local, regional and national level. The LAPA framework and process need to guarantee the multi-stakeholders participation in LAPA planning, implementation and monitoring and evaluation of locally appropriate adaptation interventions. The participatory local planning support in exploring the economic, social and environmental contributions to the adaptation [16]. The inclusive participatory and bottom-up planning process include the issues and concerns of most vulnerable and affected communities [24]. Top down and bottom up monitoring frameworks are developed with tools and approaches. A socially inclusive and participatory planning process is one that ensures participation of the most vulnerable communities. However, it is equally important to include the other stakeholders as well to accumulate technical and financial support.

At the community level, farmers groups, forest user groups, irrigation groups, community organizations are supporting in vulnerability assessment, identifying climatic hotspots, poor and marginalized households including community adaptation planning, and integration of development plans. The public, private and civic institutions are playing crucial roles and contributions in the formulation, implementation and monitoring and evaluation of local adaptation plans at wards, rural municipalities and municipalities level. Among the stakeholders, the agriculture, environment and forestry committee are crucial in identifying and prioritizing vulnerable hotspots and households, planning and integrating LAPAs in the development process. The cooperatives, NGOs, community-based organizations (CBOs) are effective in sensitization, awareness and capacity building on local climatic issues and adaptation interventions. The local political parties are influential in making decisions for the mainstreaming of those plans at the local level.

***Barriers and Constraints in LAPA development process***

Though it is important to design local adaptation plans and mainstream in development plans and sectoral institutional mechanisms, there were some barriers and constraints for mainstreaming LAPAs, which were discussed and analyzed in the process. The major barriers and constraints found are common and scattered in all study sites. Regmi et al. [23] also highlighted the barriers in LAPA implementation process mainly in terms of governance, planning, and capacity. The foremost and important barrier observed was the high political influences in the adaptation and development plans at the local level. The political parties and their representatives were also sensitized and involved in the process to minimize the political interferences and successful implementation, development and mainstreaming of LAPAs into the planning process. Most of the political parties are interested, thus, prioritized on the visible development interventions like road and constructions in the process. However, these development interventions are somehow supporting climate change adaptation. It is important to understand the concept and interlinkages between development and climate change adaptation. These two concepts support each other in the positive sense, however, sometimes,

mainstreaming climate adaptation conflicts with development interventions and vice-versa. Thus, the development interventions need to consider the existing and potential climate change impacts and prioritized the climate proofed development, though it is challenging to make the development action more climate resilient and adaptive to the changes. Development of appropriate and conducive climate policies/plans and transforming policies into practice may support mainstreaming climate change into development process [18].

Another important barrier identified in the study sites is not being able to utilize the available resources wisely and sustainably. The financial requirement of adaptation is quite high, but the available resources are limited [18]. It is quite difficult to estimate the exact cost required for the climate change adaptation [16, 29]. In most of the cases, lack the financial resources and technical knowhow at the community level became the barrier for effective implementation of adaptation plans at the ground. The delayed release of the national budget impacts on the timely planning at the local levels, which in turn affects the implementation of community-level plans. The public, private and civic organizations are contributing to minimize this gap to some extent based on their capacities. The most potential source of finance is the government and some non-government and private sector as well. The most important aspect is the effective and wise use of the available resources. The technologies and capacities need to be strengthened either by training and skill enhancement interventions and also improving the community-based innovations, techniques and also introducing community-friendly and adaptable technologies.

The whole process of adaptation planning, implementation, mainstreaming and monitoring/evaluation require time for in-depth feedback. *B.R. Regmi et al.* [23] emphasized on the reforming the planning approach and institutional structure at national, district and local level. The institutional structure has changed recently after formation of new government in 2017/18. In the present context of changing the political scenario in Nepal, this process will take more time since the systems and infrastructures for the newly elected local governments are yet to be set up. The local governments have more power and authority in the decentralized and federal system, however, the capacities of the elected government officials and governance systems are yet to be strengthened. The previous local governments lack the proper periodic plans at the VDC level. Mostly the development plans focused more on infrastructure development rather than activities in sectors such as agriculture and climate change. Still, lack of climatic data at the local level, thus, vulnerability assessments were done based on experience and assumptions of the community members and key informants in most of the cases.

## **Conclusion**

The experiences and learning from the LAPA framework and process in Dhading, Dang and Chitwan districts are relevant and useful for designing and implementing climate change adaptation in other parts of the country and also to other developing countries. The whole process provides ways to assess vulnerabilities, adaptations, develop adaptation strategies, use the information and resources for adaptation planning to address current climate variability. Available information is also relevant for the discussion on how climate adaptation can be addressed future climate change impacts and can be used for the development of local adaptation plans for action in other localities of the country as well.

Climate change impacts are widespread, and it is projected that climatic uncertainty will increase in the future with unpredictable precipitation and increased temperature. The adaptation plan has to be innovative and flexible enough to respond these uncertainties in future as well. Therefore, while designing the HAPA, CAPA, LAPA, SAPA, it is important to analyze the appropriateness of adaptation options to the local contexts and the clients. Climate change impacts have created additional challenges to the development and climate change adaptation requires additional resources to overcome the devastating vulnerabilities and poverty. In this situation, climate change adaptations need to be mainstreamed into development planning processes. Individual institutional periodic plans in order for the adaptive capacity of local

people to be strengthened to deal with climate change impacts and also to reduce poverty in more efficient ways. In the present context of political change in the country, it is very crucial to consider the climate change in the development agenda including sectoral plans and policies. Since it is the beginning of new governance system in the country, the government has both opportunities and challenges to adopt the lessons on adaptation and development. The detailed analysis of the success of NCCSP in far and mid-western Nepal needs to be carried out for planning the next phase. The author has been conducting research on it.

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