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Climate Change Adaptation, Livelihoods and Resilience Interface, a Meta-analysis

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ABSTRACT

The paper explores the interface study of adaptation, resilience and livelihoods in climate and development context. Climate change is emerging as an important developmental challenge globally and in Nepal. Discourse of climate change is mostly attributed to the adverse effect to community and their livelihoods. This paper intends to explore relation among the adaptation, livelihoods and resilience in an interface. Both quantitative and qualitative approach is adapted. With the set criteria, the review of 75 papers was carried for meta-study. Codes were developed based on review. The framing and argumentation elaborated the code. The study explores that adaptation contributes to livelihoods, quality living and decreases vulnerability to climate change with increased resilience. Similarly, the increased livelihoods complement the adaptation. The resilience is the capacity for successful adaptation, ability to respond, recover and the capacity of a system to absorb disturbance and reorganize during undergoing change. The framing and argumentation of adaptation, livelihoods and resilience reviewed contribute one another. The correlation also shows that there is high degree of positive correlation between adaptation and resilience (0.433). The relation between livelihoods and adaptation is in lowest (0.133) where that of resilience and livelihoods is in between (0.300). Adaptation and livelihoods are interconnected and so is the adaptation and resilience; livelihoods and resilience. The study of climate change adaptation, livelihoods and resilience is a dynamic concept. This study has generated interface knowledge about resilience, adaptation and livelihoods approaches making the existing knowledge gap on this interface narrower.

Key words: Climate Change Adaptation, Livelihoods, Meta-study, Resilience, Theory

INTRODUCTION

The climate change is a global concern (Bush and Clayton, 2023; Guedes *et al.*, 2016; GoN 2022). It is affecting both developed and developing nations (IPCC, 2022; Chhetri *et. al*, 2023; MoFE, 2021). The adaptation to climate change is emerging as an important developmental challenge globally and in Nepal (Atube *et al.*, 2021; GoN, 2019). Nepal is among the climate vulnerable countries substantiating climate challenge hits hard to developing nations more (MoFE, 2021; World Bank, 2022; IPCC 2022). Discourse of climate change is mostly attributed to the adverse effect on community (Gautam *et al.*, 2023; Yang *et al.,* 2024). In resolving such adverse impact, adaptation approach is practised at the household and community level (Adhikari *et al.*, 2021). Climate

change is already increasing the frequency and magnitude of disaster events such as flood, drought and wild fire having multiple impacts on livelihoods. This is posing new challenges to both the environment and development of both mountain and foothill region with their own physiographic attributes (Adhikari *et al.*, 2021; Dellmuth, 2021; Kabir *et al.*, 2021). The livelihood perspectives help to strengthen resilience thinking placing greater emphasis on human needs and their agencies. It further aims to empowerment and human rights, and considers adaptive livelihood systems in the context of wider transformational changes (Tanner *et al.*, 2015; Dany *et al.*, 2015). Resilience of community or a system is manifested through practice of adaptation and approach of addressing livelihoods. This meta-analysis aims in understanding adaptation practices, livelihoods and resilience in a specific context.

The objective of this study is to explore the interrelation between climate change adaptation, livelihoods and resilience. This study further explores how three concepts are interlinked based on literature. Identifying a more holistic approach to building resilience and adaptive capacity is central to sustainable development pathways under climate change conditions and resilience is becoming a central evaluative concept for assessing climate adaptation policies both in academic literature and political practice (Keessen *et al.*, 2013; Osbahr, 2007; IPCC,1990; IPCC, 2014). The interaction of the resilience and adaptive capacity concepts in livelihoods discourse is relatively new (Gaworek-Michalczenia, 2022; Nyamwanza, 2012).

THEORY AND METHODS

Theory

The adaptation process is supposed to enhance resilience and livelihoods of community or the system (Nelson *et al.*, 2010a, 2010b). Adaptation in human systems is understood as the process of adjustment to actual or expected climate and its effects in order to moderate harm or take advantage of beneficial opportunities and plays a key role in reducing exposure and vulnerability to climate change (IPCC, 2022; Gundersen, 2000). The conventional wisdom about livelihoods revolves on the capacity and sustainable living and people use different livelihood strategies to cope the situation (Johnson, 2022; Roscher, 2022). A livelihood is sustainable when it can cope with and recover from the stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Chambers and Conway, 1992). Holing (1973) has stability view and resilient view where stability view emphasizes the equilibrium and resilience view emphasizes domains of attraction and the need for persistence. Resilience is perceived as a system to absorb disturbance and reorganize while undergoing change (Norris *et al.*, 2008; Ungar M, 2008). Resilience emphasizes the speed of recovery and is the buffer capacity or the ability of a system to absorb perturbations, or the magnitude of disturbance that can be absorbed before a system changes its structure by changing the variables and processes that control behaviour (Holling *et al.*, 1995; Adger, 2006). Resilience has become a popular research and policy concept within climate change adaptation and development context (Tanner *et al.*, 2015). The community resilience emerges from four primary sets of adaptive capacities constituting economic development, social capital, information and communication, and

community competence which collectively provide a strategy for disaster readiness (Norris *et al.*, 2008).

Theoretical Framework of Study

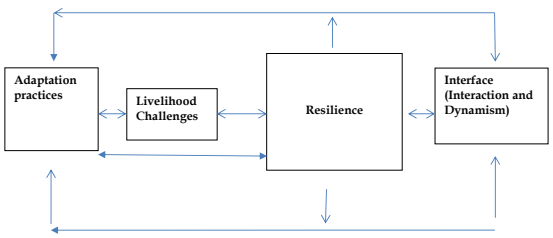

Figure 1: Conceptual Framework for study

The proposed model generates knowledge about resilience, adaptation practices and livelihoods approaches in the domain and their contribution to interface. The interface of these three domains is interlinked to contribute one another. Further, this theoretical approach provides an understanding to learn emerging concepts on resilience, climate change adaptation and livelihoods for its broader research and how they are interlinked.

Methods

Both quantitative and qualitative approach was adapted. The review of 75 papers including discussion papers and journal paper was carried out as part of meta-study. The journals papers reviewed were both theoretical papers and empirical papers focusing the principal three themes (adaptation, livelihood and resilience). Following criteria were used to select the papers to review:

(i) The discussion of these three themes (climate change adaptation, livelihoods and resilience) in the same paper was the key criteria of journal paper selection

(ii) The article should be related related to at least one theme in findings but it should discuss or capture all three themes on overall paper.

(iii) The article should represent theory, and empirical findings. In other words, articles were selected based on relevance about thery and empirical findings

(iv) The article represented 1989 to 1919 AD publications. Among them, majority of articles fall in between 2000 to 2019 (20 years). The articles before 2000 AD were selected for their relevance such as theoretical perspectives.

Table 1: Attributes of paper reviewed

Theme: Climate Change Adaptation, Livelihoods and Resilience					
Type		Representation		Aspect	
Discussion paper	6	Nepal specific	8	Agriculture specific	3
Journal paper	69	Other parts of globe	67	Community forestry specific	5
-	-	-	-	Natural resource management and others	67
Total	75	Total	75	Total	75

The objective of exploring three themes in a single paper was to analyse finding quantitatively. The essence of each of the paper was drawn through (i) specific theme, (ii) operationalizing the aspect of the study, and (iii) the common term to represent the aspect. On the basis of this essence, 10 codes in each theme were finalized.

The meta-analysis is a proven approach to extract information and analyse it to get the insights and understanding (Pagdee *et al.*, 2006; Lee *et al.*, 2013). Meta-analyses are tools in the social sciences and environmental research to generate knowledge through the systematic assessment of carefully selected literature (van Valkengoed, 2019; Pagdee *et al., 2006*). This article also adapted the meta-anaysis approach with this understanding. Based on indicators and aspect discussed about adaptation, livelihood and resilience, following 10 specific codes were developed as below:

Table 2: Codes on adaptation, livelihoods and resilience theme

Adaptation codes	**Livelihoods codes**	**Resilience codes**
1. Coping/-capacity, 2.Social adaptation-community adaptation 3. Vulnerability 4. Strategy of adaptation 5. Ecological adaptation-ecosystem based adaptation 6. Adaptive capacity, adaptability 7. Adaptive management, adaptive system 8. Institution 9. Shock, stressor 10. Local adaptation	1. Capacity 2. Wellbeing 3. Poverty 4. Strategy of livelihoods 5. Resource-asset-capital-income 6. Empowerment, economic 7. Innovation 8. Institution 9. Resource 10. Sustainable livelihood, environmental service	1. Socio-ecological system 2. Social resilience 3. Ecological resilience 4. Strategy of resilience 5. Transformation-transformability-renewable and reformation 6. Human ecology 7.Stability 8. Institution 9. Transformational change 10. Resilience capacity

In order to capture the perspective of three themes, journal paper were reviewed with the frequency of codes mentioned. As mentioned, the codes were developed to capture the essence of three themes (Climate change adaptation, Livelihoods and Resilience) through systematic study. The data (frequency of 10 codes) were finally recorded. Similarly, the framing shows the context of the code application and argumentation representation as its description. The qualitative analysis is based on the discourse review of the paper about three themes and correlation is interpreted to observe relation.

RESULTS

Adaptation

The continuum of adaptation frame ranges from national to local level. The implementation is mostly specific to area to address the niche gap. The study explores that adaptation strategies of individual or farmer differs with the adaptation options and the knowledge they perceive about the specific adaptation options. Such adaptation options are helpful to them to cope from the changing climate. In general, the adaptation has been portrayed as an activity that contributes to the livelihoods. In substantiating this, the findings refer that it ultimately helps to augment quality living through different forms of adaptation strategies. Such strategies were found in a range from agricultural innovation to institutional aspect. It was explored that adaptation activities aim to decrease vulnerability to climate change and increase the resilience. The study found that different types of adaptation practices exist based on ecological regions. Different factors influence the climate change adaptation practices. In an effort to adaptation, different interventions such as plantation, water source conservation, trees and grasses plantation in the farm land, crop diversifications are practiced by local people. The study further explored that adaptation concepts are linked to reduce vulnerability. The adaptation research is in practice among policy and practitioner engaging global environmental change science, climate change, sustainability

science among others.

Livelihoods

The specific forms of livelihoods strategies have been captured based on the regions but the essence of all forms of livelihoods was to enhance the quality of life. Similarly, the demographics, asset, location, and ethnicity were found influencing the livelihood strategy adapted by the households. The diversification of livelihoods was also common attribute in all regions studied. In the South Asian context, ethnicity was also one of the determinant of the livelihoods strategies and such strategies differ in rural and urban set up. The study further finds that livelihood has been portrayed as an activity that contributes to enhance better living and ultimately helps to augment the capacity. Livelihood comprises materials and social resources. More specifically, the capabilities, and assets realize the activities required for a means of living.

Resilience

Resilience has been portrayed as situation of amelioration. Resilience has been defined in different settings. The majority of definitions emphasize capacity for successful adaptation. In addition, it aims to respond, recover and the capacity of a system. Resilience proposes a systems approach to human-environment relations to absorb disturbance and re-orient after tackling challenge. The study also found that resilience is an attempt to predict or model social-ecological change. As a result, resilience thinking offers a dynamic and forward looking approach to human-environment change. Its holistic perspective and the emphasis on unpredictability, change and complexity across scales create situation for better integrated work. The resilience has been discussed diversely among scientific and epistemology aspects. The concept of resilience needs to be linked to other concepts such as social and ecological resilience. In the course of time, resilience has been has been carried conceptualized as positive adaptation. Similarly, the perspective of resilience has been applied in wide continuum from social and philosophical aspect to science and policy arena. Some of the scholars opined that the domains of resilience such as systems, agents, institution and exposure are critical to evaluate the resilience framework. Such an evaluation need to develop a frame for integrated study where three domains climate adaptation, livelihoods and resilence need to discussed.

Adaptation and livelihood

Adaptation provides approaches, strategies and opportunities to cope with the adverse effect of climate change and support better livelihoods. The adaptation option practised infer that these targets aim to boost farmers livelihoods reduce vulnerability. The adaptation approaches provide an opportunity for improved neighbourhoods and livelihood options. Based on the findings, studies have shown that adaptation approach is directly related to livelihoods enhancement of the community. Adaptation capacity and practices were found varying among communities and in the household level based on the specific location.

Table 3: The Framing and argumentation

Adaptation			**Livelihoods**			**Resilience**		
Adaptation Codes	Framing	Argumentation	Livelihoods Codes	Framing	Argumentation	Resilience codes	Framing	Argumentation
Coping/-capacity	Addressing adverse impact	Has ability to cope the process	Capacity	Existing capacity to address crisis	Determinant of situation	Socio-ecological system	Community-environment interrelation	Socio-environment perspective
Social adaptation-community adaptation	Community led approach	Economical and sustainable to society	Wellbeing	Measurement of status	Economic and social aspect	Social resilience	Community led /focussed resilience approach	Useful tool for social assessment / Economical and sustainable
Vulnerability	The risk existing	Useful tool for assessment	Poverty	Existing economic condition below threshold	Living standard, income	Ecological resilience	Ecology focus resilience approach	Useful tool for ecological assessment/ Ecology and sustainability
Strategy of adaptation	Way to address climate change impact	More than one strategies exist	Strategy of livelihoods	Way to address livelihoods	More than one strategies are exisiting	Strategy of resilience	Way to gain resilience	More than one strategies are exist
Ecological adaptation ecosystem based adaptation	Nature based solutions	Sustained solution	Resource-asset-capital-income	Capacity in terms of financial leverage	Means, Affluence	Transformation-transformability-renewable and reformation	Betterment from reformation	Sustained solution
Adaptive capacity, adaptability	Extent of adaptation skills	Assessing the situation	Empowerment, economic	Skills	Enhancement of situation	Human ecology	Overall ecological aspect of sustainability	Balance in the system
Adaptive management adaptive system	Community led process	Economical, adaptive	Innovation	New approach	Better solution	Stability	Relative expected position	Stable position
Institution	Established role, institutions	Has norms, practices	Institution	Established role, institutions	Has norms, practices	Institution	Established role, institutions	Has norms, practices
Shock, stressor	Cause of climate change	Existing situation exploration	Resource	Means of solution	Captures the overall ability	Transformational change	Building back better	Enhanced situation
Local adaptation	Indigenous and local solutions	Economical and easily available	Sustainable livelihood, environmental service	Perpetuity	Appropriate from economic, ecological and social standpoint	Resilience capacity	Ability of betterment and withstand shock	Betterment

(Acharya 2022, Meta analysis)

Adaptation and resilience

Adaptation approaches are linked with resilience. Adaptation plan has objective of resilience enhancement reducing vulnerability to climate change. Adaptation is in wider use and its applicability ranges from livelihoods enhancement to resilience of any system. Both in academic literature and in political practice, resilience is becoming a central evaluative concept for assessing climate adaptation policies. The resilience provides ability of groups or communities to cope with external stresses and disturbances. The study has explored that social, political and environmental change provides opportunity of learning and development during this resilience process. Resilience of community or a system is manifested through practice of adaptation and approach of addressing livelihoods. Adaptive capacity is described as system robustness to changes in resilience. The discussion on adaptation, adaptive capacity or resilience capacity is used interchangeably to depict the response for change.

Livelihood and resilience

The loss of resilience is linked to adverse impact on livelihoods. In the context of the institutions of common property management, collective institutional resilience is an area of discussion. As community or individual adapts more diverse strategies to address livelihoods, the resilience is expected to be more. The community resilience is perceived through adaptive capacity, economic empowerment, information access and social capital but not limited to. As a result, such comprehensive community resilience provides a strategy to tackle adverse impact of disaster where coping mechanism preparedness in place.

Adaptation, livelihoods and resilience interface

Adaptation contributes to livelihoods and resilience. Resilience, livelihoods and adaptation process are interrelated. Similarly, the resilience, Climate Change Adaptation, and livelihoods concepts are interconnected. The adaptation process is mainstreamed to enhance resilience and livelihoods of community or the system. The concept of community based intervention such as community forestry has engaged people to address these three themes resilience, livelihood and climate change adaptation in an integrated way. This interaction further addresses challenges to meet the emerging need of community people. Adaptation approaches provide an opportunity for improved neighbourhoods and livelihood options. The relation among resilience and adaptation has been studied in different settings. It ranges from sociology and human behaviour to livelihoods, natural resource management and forestry. A livelihood resilience approach helps to minimize harm and loss addressing key issues of common people such as their access to the resources, rights, justice, and well-being. In accomplishing such issues, it demands greater attention on the vulnerability and resilience exploring their root causes. The literatures have mentioned that, the inclusion of the resilience and adaptive capacity concepts in livelihoods is relatively new. The study of resilience theory particularly focussing the ecological, social-ecological, and social systems has been a common concern. Its linkage to the livelihoods and adaptation concurrently is a new approach. In addition, resilience and adaptation perspectives has been applied in natural and social sciences.

In South Asian context, community based livelihoods has been an emerging area of study and exploration. The adaptive strategies show that adaptation is not a new to the local communities and has been practised in different parts of the globe. They have always had to develop and implement individual

and collective strategies to adapt to climate variability and environmental change.

Correlation

The correlation is based on the data generated from 75 articles gathered under 10 codes under each theme (Climate change adaptation, livelihoods and resilience). Each of the codes under theme were counted and collective data was generated. The correlation among three variables adaptation, livelihoods and resilience based on the data of codes has been presented in the table below.

Table 4: Correlation among adaptation, livelihoods and resilience

Variables	Adaptation	Livelihoods	Resilience
Adaptation	-	0.133	0.433
Livelihoods	0.133	-	0.300
Resilience	0.433	0.300	-

(N=75)

The findings among three variables suggest there is high degree of positive correlation between adaptation and resilience (0.433).The high level of correlation is attributed to the transformation that adaptation results to the community or household in the resilience process. Similarly, the high level of resiliency of developed nation in terms of the resource access, knowledge and alternative arrangement make them in better position than others. The poor nations which have relatively weak institutions, knowledge gap and other priorities face more challenges. The relation between livelihoods and adaptation is in lowest (0.133) where that of resilience and livelihoods is in medium stage (0.300). The relation between livelihood and resilience was observed in household and community level to respond the external shocks. Adaptation and livelihoods are interconnected and so is the adaptation and resilience; and livelihoods and resilience. The finding is interesting in the sense that correlation exists among the three variables substantiating the proposed theory that adaptation, livelihoods and resilience are interlinked. Based on the finding, the study explores that 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.

DISCUSSION

Adaptation has been discussed complementing livelihoods and vice versa on several studies (Karki *et al.*, 2021; Bisui *et al.,* 2022; Chhetri *et al.*, 2023). The adaptation process generally aim to decrease vulnerability to climate change and increase resilience (Folke, 2006; Taylor, 2022; Timalsina *et al.* 2022). Both livelihoods and climate change adaptation are linked and this linkage has been discussed in community forest management as well (Roshani *et al.*, 2022). Adaptation policies and plans of countries like Nepal has to emphasize generating science-based climate information, knowledge, and services to enhance the resilience of climate-sensitive sectors and vulnerable households (Wester *et al.*, 2019).

Similarly, the resilience and adaptation has been discussed closely linked (Taylor, 2022; Nofal and van de Lindt, 2022). The adaptation is perceived in wider use and its applicability ranging from livelihoods enhancement to resilience of any system. The relation among resilience and adaptation has been studied in different settings (Nor Diana *et al.*, 2022) including sociology and human behavior to livelihoods, natural resource management and forestry. Enhancing livelihood opportunities contributes resilience (Sharma *et al.*, 2015, Adhikari *et al.* 2021). The introduction of cardamom in mid-hills of Nepal and other forms of intervention has increased resilience and livelihoods is an evidence to support the claim (KC and Upreti, 2017; Karki *et al.* 2021).

Several studies have indicated how adaptation contributes livelihoods and resilience (Scheffran *et al.*, 2011; Tschakert and Dietrich, 2010). The discussion on adaptation, adaptive capacity or resilience capacity, as they are interchangeably used, is often highlighted in terms of effective response. The climate change adaptation, resilience and nature based solutions are interrelated (Turner *et al.*, 2022). Theoretically, the integrated study of resilience led adaptation and livelihoods can be linked to sustainable livelihoods of the community (Carmen *et al.*, 2022; Fierros-González and Mora-Rivera, 2022). As a result, the experience supports that climate change adaptation, livelihood and resilience is interrelated.

The study of interaction of adaptation, resilience and livelihoods is a dynamic concept where enhancement of these attributes is linked (Gaworek-Michalczenia, 2022; Nyamwanza, 2012). Similarly the empirical research to support this theory is also a need. However, the discourse where all of these three attributes resilience, adaptation and livelihoods and its theory based interface study has not been found adequately (Keessen *et al.*, 2013; IPCC, 2014; Folke 2006, Walker *et al.*, 2005). So far, in the regional context, study of such contribution and integrated analysis of resilience led adaptation to contribute livelihoods on a theoretical model has not been studied comprehensively. Based on empirical evidence, the findings also support this idea (IPCC, 2014; Osbahr, 2007; Timilsina *et al.* 2022; GoN 2022; Roshani *et al*. 2008).

CONCLUSIONS

The study of climate change adaptation, livelihoods and resilience is a dynamic concept. Only one setting does not provide the comprehensive picture all these attributes. Nevertheless, it provides the clue to understand their interrelation. The enhancement of resilience is linked with adaptation and livelihoods. Both the developed and developing nations have adaptation practices in priority but availability of resource makes their priorities and tasks different. The study of climate change adaptation, livelihoods and resilient is a subject of integrated domain. This study has generated knowledge about resilience, adaptation practices and livelihoods approaches in theoretical domain backed by secondary findings. This study further contributes to livelihoods of rural poor making the existing knowledge gap on this interface narrower. The discussion on adaptation, adaptive capacity or resilience capacity, as they are interchangeably used, is often highlighted in terms of effective response. The gap on the study of resilience, adaptation and livelihoods with their theory based interface study is still in need. This interface meta- study is important to understand holistic concept of resilience. The theoretical relation among climate change adaptation, livelihoods and resilience has been proposed as a model to undertake further research on this interface.

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