Descriptive Study of Community Based Disaster Management in Rural Western Nepal

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Abstract

This study inspects community-based disaster management (CBDM) in Nepal. Employing secondary and primary data, the study used descriptive statistics tool. Firstly, the study identified multiple natural risks (flood and landslide).Secondly, in the practice of CBDM, the collective action was found mainly on planning of disaster calendar, early warning, preparedness, and rehabilitation. Thirdly, there was mean salary income loss per annum (330 USD). It is one third of national per capita. Having a significant economic cost, CBDM reduced effectively humanitarian and economic cost of the community. Thus, CBDM is effective collective action to be resilient at the community. Therefore, mainstreaming CBDMG in multi-hazard risk management program, the government should improve its technical capacity and performance by training &equipment for disaster resilience. This study is expected to contribute disaster risk reduction program of the local, province and central government and also preparedness to resilient.

Keywords: Community, Collective Action, Preparedness, Disasters, Early Warning System, Nepal

1. Introduction

Community based disaster management (CBDM) is a popular approach for collective action against unpredictable natural hazards and for minimizing socio-economic losses in Nepal, particularly in the rural areas because National Adaptation Program of Action (NAPA) and Local Adaptation Program of Action (LAPA) are not being game changers yet with poor connectivity, and poor governance. At first, it was used in Nepal during the great earthquake of above 8 rector scale in 1934 (Raffety, 2023). Applying it for rescue, reconstruction, rehabilitation, and recovery in the post-disaster of the earthquake, the collective action was recalled as a successful disaster management at the community within the estimated period. After 66 years, it was reapplied in 1990 in the earthquake disaster (Raffety, 2023).

Differently, in recent years, this approach is used not only in post-disaster but also in pre-disaster because of major three reasons: growing climate change induced multiple catastrophic, increasing economic and human losses, and focusing on low-cost adaptation technology and CBDM approach at the global level. Large literatures of climate change (IPCC, 2001; Stern, 2006; Bista 2021) mention global warming at 1.50c in next 50 years. Indicating an unprecedented global threat nationally, annual multi-hazards cycle may be unstable with a high probability of extremity and economic losses. The less developed countries of Asia would be most vulnerable. Nepal may be at high exposure rank in future because of multi-hazards (MoHA, 2022). In 2020, economic loss of disaster events is accounted 190 billion USD in the world, along with 15082 deaths and 100 million people affected. Its social cost was a huge (Bevere, 2021 &

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IFRC, 2020). It is a half of the economic loss of 2016 (520 billion USD). However, the affected population is five times more than twenty-six million population affected in 2016 (WB, 2016). In the Asia-Pacific region, the rise of natural disasters is a half of the estimated cost of disasters in the world (ADB, 2013). In 2000, 150 major floods were recorded worldwide triple the number in the 1980s. Now, it is four times more likely to affect people in the region than those in Africa and 15 times more likely than those in Europe (ADB, 2013). Its cost is nearly 1 trillion USD since 1990s (ADB, 2013). The world bank (2022) reports that 750 million people in South Asia have been affected at least one natural disaster in the past two decades. IPCC (2022) mentions South Asia as particularly vulnerable to weather extremes and their economic losses in the region (Kumari, 2022). IPCC (2022) further predict climate change-induced loss and damage in South Asia by 518 billion USD by 2050. By 2070, this number could jump to USD 997 billion (Kumari, 2022). In South Asia, Bangladesh, India, Pakistan and Maldives are considered as hot spots of disasters. Similarly, Nepal is also disaster prone vulnerable country, where multi-disasters happens all over a year across the country. Ministry of Home Affairs (2020) accounts Rs.200 million and dislocating large population (MOHA, 2020). No doubt, South Asia is a most vulnerable region in the biosphere

A global discourse is whether the community can be made resilient from climatic threat. Literatures (IPCC, 2001; Stern, 2006; UNFCC, 2008, & IPCC, 2022) note a shift of global policy on low-cost adaptation technology and CBDM approach, instead of mitigation approach. Mitigation approach is a promising but may not provide an instant resilience to the community. Therefore, low-cost adaptation technology and CBDM approach have become a popular at the global community. In Nepal, early warning system (EWS) and preparedness are major strategies of Disaster Risk Reduction and Management (DRRM) and LAPA. EWS was installed in the upstream of Karnali River basin to make resilient to the downstream community, along with weather radar system in Surkhet (DHM, 2020). About 73 CBDM Groups were formed in the downstream of Karnali River Basin, Rajapur and Tikapur to disseminate and communicate the community. Similarly, CBDM Groups are active in the downstream community of Koshi river basin to minimize the economic loss of annual Koshi flood, despite the existing damin the river (Bista, 2016; Ministry of Environment, 2020)

This approach is a global strategy for disaster risk reduction and management (DRRM).UNISDR (2005) endorses it as a paradigm shift to local action in DRRM policy and strategy. Similarly, the Hyogo Framework for Action (2005-2015) says the prerequisite of local and national government's commencement to accomplish calamities on calamity threat evaluation, early warning systems, communal resilient level, riskin decline and readiness (UNISDR,2005). This is self-motivated, independent, and informal groups of the local community as per disaster prone local areas with their low-cost indigenous knowledge and technology. Recently, local, regional and national network and DRRM rule and regulation consider such group as a formal stakeholder. The group basically collect early warning information and signals to the community for readiness, along with rescue, assistance, restoration, and rebuilding. Thus, it diminishes susceptibility (Ali et al., 2019; Bista, 2018; Bista, 2019; Bista, 2019a; Bista, 2019b; Bista 2020; Peng et al., 2020; Zahari & Ariffin, 2013; Zhang, et al; 2013). Likewise, Zhang et al. (2013) claim it as an indigenous people's apprehension to disaster risk reduction Peng et al. (2020) note it well-organized and operative. As a synthesis, the capacity of local community makes them proactive and

stakeholder on DRRM for their collective action and instant response to disaster risk with indigenous knowledge and technology.

Like Victoria (2002), Shaw (2012) points out its six features: a) local grassroots 'involvement, b) significance to the most susceptible clusters, and the public, c) public definite threat lessening, d) recognized capability and handling instrument, e) honesty amid development and catastrophe threat lessening, f) easing part of strangers. Otherwise, Sjostedt and Sturegard (2015) explicate its 3stakes: involvement, withstand, and possession for its reason. Therefore, involvement and possession are main dimensions for CBDM to DRRM.

Pandey and Okazaki, 2005; Sjostedt and Sturegard, 2015, Huq, 2016; Lassa et al, 2018; Azad et al., 2019 empirically assessed CBDM across the world. In Nepal, Pandey and Okazaki (2005) deliberates viable growth to avert catastrophe threats, along with actions: improving the security levels of public amenities (schools); publicizing reatest performs in DRRM at the public level; and framing combined agendas of growth and DRRM. The study mentions lesson learnt as a) public enablement & communiquétoresilience; b) public centered execution strategies and preparation for capacity development for resolving issues; c) clearness of actions and propagation of understanding and data for grassroots involvement; d) prerequisite of steady economic funds, as well as e) official role of public and business community. Similarly, Sjostedt and Sturegard (2015) found CBDM as an operative method for DRRM in the river of Vietnam and approaches & designs to catastrophes. Additionally, Huq (2016) observed events in Bangladesh: formation of community mindfulness, appropriate use of environmental data, suitable avoidance, common esteem, judicious message, and systematic base dedicated preparation, and easing events. Moreover, Ali et al. (2019) discovered irregular response of a community on disaster coercions over time. Empirically Zahari and Ariffin (2013) identified acute part of public centric catastrophe readiness actions for their adaptive capability and resilience to catastrophes and the prerequisite of strategy and investigation, the contribution of local organizations and public groups in resilience constructing. In the critical appraisal, above these literatures are expected to cover empirically on all dimensions of CBDMG. However, these literatures cover its concept, issues and lesson learnt, except Bista (2022). Regarding the impact of CBDMG in the rural areas, there are few literatures. Therefore, this study is highly relevant to fill up the research gap. This study is expected to contribute significantly as a valuable input to formulate and implement DRRM plan and actions.

A broad objective of the paper is to measure CBDM's performance in rural Nepal. Its precise aims are a) recognizing the collective action of CBDM Grelating to DRRM, b) measuring household involvement in the collective action of CBDMG, c) examining time spending and deployment of household to shared activities and cost of shared disaster adaptation activity, & d) finding issues and implication of CBDMG.

2. Methods

2.1. Analytical Framework

Figure 1: Analytical Framework
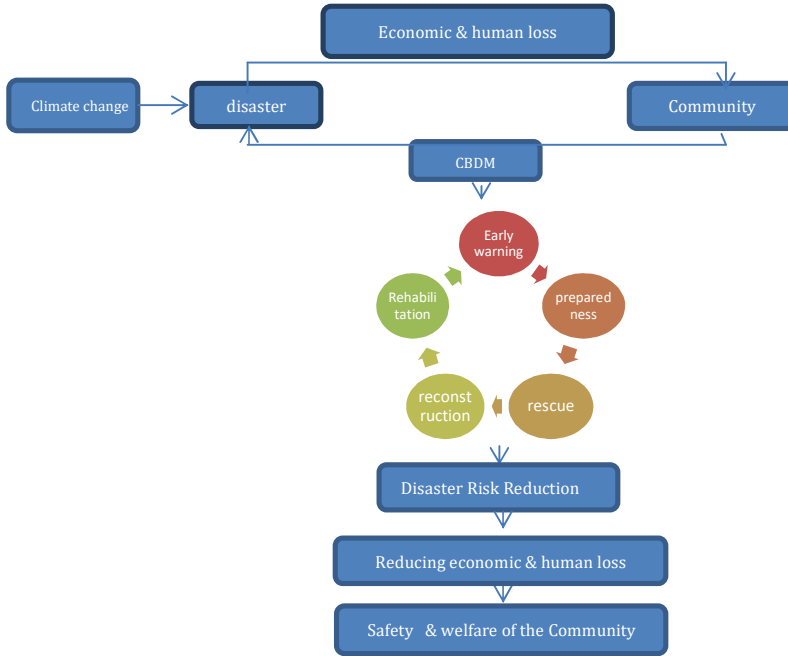
Source: Based on Hyogo framework, https://www.unisdr.org/

This analytical framework is an interactive framework between disaster and the community standing on two approaches: collective action and disaster management cycle basically based on the literatures of Bratman (1993), Gilbert (2006a), and Searle (1990). These literatures defined "we- intention" for collective action and objective. Similarly, disaster management cycle is the idea of International Red Cross (IRC, 2020). In the cycle, there are mostly five stages: early warning, preparedness, rescue, rehabilitation, and reconstruction. Thus, in this framework, CBDM functions formally and informally with we-intention and disaster risk management for reducing economic and human loss for safety of the community. Its assumption is that CBDM reduces socio-economic impact of the disaster and increase safety of the community. Therefore, CBDM is expected effective low cost stabilizer to risk and loss of climate induced disaster over time.

2.2 Research Design
This study is intended to use explorative research design. Under this design, the quantitative method was engaged to gather computable data about CBDM and its practices. Quantitative and Qualitative Primary data was gathered from household survey.

As supplementary, the quantitative secondary data about climate catastrophes and household vulnerability from 2014 to 2015 were collected from publications of a) the District Development Committee (DDC), b) MoH, c) Nepal Red Cross, and d) Metrological and hydrological departments.

2.3. Data Collection Method and Tools

As supplementary to the secondary data and information, primary data related to household socio economic information and CBDM was collected. In the primary data collection, the follow-up questionnaire method was conducted to gather about climatic events and its vulnerability to install hydrological monitoring system, alert system, infrastructure and building adaptation capacity. In the survey, questionnaire was employed as a tool. In the questionnaire, there were three major sections: a) socio-economic information, b) disaster, and c) CBDM.

Besides, validity and reliability of the collected primary data were tested in three micro workshops, where stakeholders of CDRM (households, schools, Nepal Red Cross, District Administration office, Disaster Management cells, Municipality of three river basin villages) verified it and were employed to find new data about CBDM and its roles through the open question.

2.3.1. Sampling and Sample Size

Two step random sample technique: bunch and chance sampler technique were planned to decide sample size. At first, bunch method was used to divide 9 bunches to the study region (Gadhi, Lekhagaon and Kunathari) constructed on elevation, site and habitation layering 3310 households. Similarly, at second, 642 household samples (19.3%) were arbitrarily designated from these bunches.
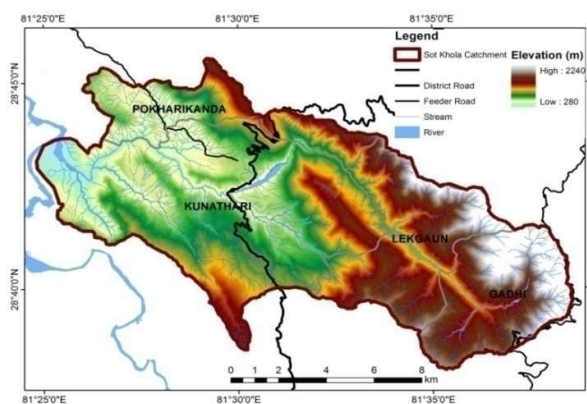
In the study, an operational form was a key tool to collect about socio-economic data (land-living, wages level, basis of wages, extent of household, sex, age, caste, etc.), climatic actions, susceptibility and CBDMG and their resilient measures.

2.3.2. Study Area

The study was commenced in 30 kms long Sotkhola water basin (Figure 2) located in the north of Surkhet, district. Spreading widely to the downstream, Rakseni, Kunathari VDC from the upstream, Chandane, Gadhi VDC (Figure 2), this

Figure 2: the study area-Sotkhola

glacier feeding river floods in monsoon and silent in winter season. Since three villages of the study area: Gadhi, Lekhagaon, and Kunathari were in different altitudes from 198 meter to 2369 meter (DDC, 2015), wildlife eco system, and communities were diverse and heterogeneously rich. Besides, this basin was a major source of clean drinking and irrigation in these villages. Out of which a) Gadhi with 28 km2 area lies at 1200 meters' high altitude (Figure-2). CBS (2021) reported 3369 populations. Similarly, b) Lekhgaonis of 2451 km2

Source: Geographic Information System mapping, 2015

(249016 hectare) spreading from 198-meter (Tata pani) to 2369-meter (Matela gurase) altitude (Figure 2). Only 16 % landmass was valley. Population was of 3999 (DDC, 2015). c) Kunathari lies between 600 meter and 1200 meter (Figure 2). Population was of 3413 (CBS, 1991).

This study area was purposively selected because of: i) climatic variation and disasters in 2014, ii) risk and vulnerability, iii) morphological change, iv) environmental damage, v) plot& grain damage and vi) CBDM.

2.3.3. Data Analytical Tools

Descriptive statistics was a major analytical tool to analyze above three major objectives: a) identifying the collective action of CBDM to manage disaster, b) evaluating household sharing and priority of CBDMG, and c) spending time and deployment on shared action and cost of shared disaster adaptation activity. In the descriptive statistics, average, ratio, percentage and graph were used.

3. Results

Result I: Collective Action of CBDMG

In the result, six CBDM groups were found in the study areas regarding DRRM. In the group, household representation to caste, gender, and geographical location for was proportional. It was a mandatory to disaster victim household.

Table 1: Activities of CBDMG

Intervention	Events	Particulars
Intervention I	Public Cluster	LG & NGO molded 25 members CBDMG to lessen catastrophe threat and to make the local public as shareholder.
Intervention II	Consciousness & make conscious	LG & NGO delivered consciousness and sensitization activities to the CBDMG for different actions.
Intervention III	Capability constructing	Preparation events was piloted to recover capability of the local public to evaluate threats and to change resilience design.
Intervention IV	Instruments and Skills	These institutions delivered liberate instruments and skills to the CBDMG.

Table 1 displays details of CBDMG's activities in which Local government (LG) and non-Government Organization (NGO) aided CBDMG to execute four interventions: a) formation of CBDMG, b) consciousness & make conscious, c) capability constructing, and d) instruments and Skills. Such technical assistance was to build institution to the community for participatory disaster management and stakeholder. Thus, the community was made the stakeholders with ownership, and participation. Thus, CBDMG made disaster resilient to the local community. Therefore, CBDMG may be an alternative for effective DRRM with low-cost indigenous knowledge, skill, and technique.

Collective action of CBSMG

CBDMG adopts collective action in DRRM. The context raised a query whether CBDMG had collective action in the study area. Table 2 shows CBDMG collective actions in which about the members of 6 CBDMG participated six major collective actions: a) vulnerability chart, b) preparation, c) aware structure, d) protective building, e) consciousness events, f) backup shareholder (table 2).

Table 2: CBDMG action

CBDMG's Event	Events	Details	Result	Impact
Event I	Vulnerability Chart	CBDMG prepared vulnerability chart.	Main and insignificant vulnerabilities chart at ward level.	Consciousness, Possession and Aware
Event II	Formation	The involved formation was framed.	Program was articulated.	Consciousness and Readiness
Event III	Aware Structure	Precipitation dimension proposal was implemented. Mobile and FM radio aware structure was prepared.	Aware structure	Material and message among the public
Event IV	Protective Building	Barrage and Re-plantation activities were deliberated as protective events.	Avoidance to catastrophe	Hurdle for tidal wave and mudslides
Event V	Consciousness Events	Consciousness event was started at public level through literal competition, theatre and leaflet.	Consciousness to all	Refining possession and huge involvement in CBDM
Event VI	Backup and Habitation	Backup scheme was conveyed.	Dynamic involvement and aid	Wild salvage, liberation, and reclamation

Source: Field Survey, 2018

These six major activities were key phases of disaster cycle. About 100 percent members of CBDMG were proactive to collective action for awareness and alert about disaster. Therefore, the collective action of CBDMG was effective not only minor disaster but also major disaster.

Capacity of CBDMG

The capacity of CBDMG is most vital in disaster management cycle. Above tables provided its evidence. In this context, the study undertook three major assessments to understand disaster management cycle: a) identification of natural hazards and impacts, b) intensity level of disasters and c) disaster cycle.

a) Identification of vulnerabilities and effects: CBDMG performs complementary collective actions on vulnerabilities and effects of catastrophes identified through discussion method. Eight sub-categorical catastrophes are identified as a) flood, b) landslide, c) hail & storm, d) insects, e) animals, f) drought, g) cold wave, and h) snakes (Table 3). Holistically, these catastrophes are cross tabulated with six economic agents: people, plot, yields, seeds, domestic animals, and physical structure as per their effects (Table 3).

Table 3: Vulnerabilities and Effects

Particulars	Flood	Landslide	Hail & Storm	Insect	Animals	Drought	Cold wave	Snakes
people	extreme	extreme	slight	slight	slight	slight	slight	slight
Plot	extreme	extreme						
Yields	extreme	extreme		extreme	extreme	extreme	extreme	
Seeds	extreme	extreme						
Domestic animals	extreme	extreme				slight	slight	slight
Physical Structure	extreme	extreme						

Source: Field Survey, 2018

The cross effect is measured by rank method of two ranks: extreme (highest) and slight (least). In the catastrophes, effects of flood and landside are ranked into extreme on all economic agents: people, plot, yields, seed, domestic animals, and physical structure (canals, drinking pipelines, etc.). Similarly, the effects of insect, animal, drought & cold wave on yield are also extreme. However, the effects of multiple-hazardson the people is slight, like as the effect of drought, cold wave and snakes on domestic animals from production and health. Besides, flood and landslide are categorized most tragic with a huge socio-economic loss.

b) Concentration level of vulnerabilities is rank from two dimensions: extremity and rate through four ranks: a) acute, b) medium, c) little and d) insignificant. Table 4 shows the result of vulnerability analysis of eight catastrophes in the cross-tabulation below.

Table 4: Vulnerability Analysis

Rank	Flood	Landslides	Hail & Storm	Insect	Animals	Drought	Cold wave	Snakes
Extremity	Acute	Acute	Insignificant	Insignificant	Little	Little	Little	Insignificant
Rate	more	more	Insignificant	Insignificant	Little	Little	Little	Insignificant

Source: Field Survey, 2018

Extremity level of flood and landslides are acute in the comparison with six catastrophes. Hail, Insect and snakes are insignificant due to high altitude factor. But animal, drought and cold wave are little but significant.

Likewise, rate of catastrophes is similar in Gadhi, Kunathari, and Lekhagaon clusters. As a result, rate of landslide (29) per annum are more than all six multiple-hazards. Unlikely, rate of hail & storm, insect and snakes are insignificant. Therefore, landslide is a major catastrophe in Gadhi, Kunathari and Lekhagaon.

c) Catastrophe calendar that is major instrument widely used at the grass root level to implement resilient plan and policy for readiness is understood a dynamism of catastrophe monthly in a year. Table 5 displays annual catastrophe calendar. In the catastrophe calendar, the events of tidal wave, mudslides, insects, animals, famine, fire, icy movement and snakes are found during10 months long, except October & November.

Table 5: Catastrophe Cycle

Explanation	January	February	March	April	May	June	July	August	September	October	November	December
Tidal wave						▓	▓	▓				
Mudslides						▓	▓	▓				
Insects		▓	▓	▓				▓	▓			
Animals		▓	▓	▓				▓	▓			
Famine	▓	▓	▓	▓	▓							
Fire			▓	▓	▓							
Icy Movement	▓	▓										▓
Snakes			▓	▓	▓							

Source: Field Survey, 2018

In this calendar, flood and landslides are recorded from July to September. Insects and animals are intense from February to April and from August to September. As a follow up, the event of drought starts from

January to May and the event of fire occupy from March to May. Similarly, the event of cold wave starts from December to February. Snakes are also found from March to July. Therefore, multiple catastrophes are major threats to the people in the study area, where rapid resilient and readiness are needed as soon as soon as possible.

Result-2: Household Involvement and Priority of CBDMG in Collective Action

Household involvement and priority of CBDMG are two major factors to its result oriented collective action. In the survey, the respondents were asked four questions a) whether the collective action of CBDMG occurs in the disaster-prone areas, b) whether household's involvement in CBDMG is active, c) whether household's involvement is full or not, and d) whether CBDMG has priority on resilience in the pre-and post-disaster. Table 6

Table 6: Collective Action of CBDMG

Choice	Action of CBDMG (%)
Yes	97
No	3
Total	100

Source: *Field Survey, 2018*

presents the collective action of CBDMG in DRMC (Disaster Risk Management Cycle). Out of 640 sample respondents, about 97 percent validates the collective action of CBDMG in Gadhi, Kunathari and Lekhagaon, where CBDMG were six.

Similarly, since CBDMG is a group of catastrophe victim households representing three clusters: Gadhi, Kunathari and Lekhagaon, household's involvement as member is mandatory. Table 7 reveals nature of household's involvement in CBDMG.

Table 7: Family's Involvement

Choices	Family's Involvement in CBDMG Group for Collective action (%)
Active	99
Passive	1
Total	100

Out of 640 respondents, 99 percent ranks their active involvement for collective action of the group. Only 1 percent is passive. These respondents own the group and its activities. Despite illiteracy, they are highly aware and concern with it. Thus, these indicators are determinants to make effective readiness, and resilient program.

Likewise, household's involvement level in the collective action of CBDMG is a vital measure to execute effectively DRRM. This is captured by two ranks: full involvement and partial involvement. Table 8 reveals level of household's involvement in CBDMG. This is a key in DRMC to sustain DRRM.

Table 8: Family's Involvement

Choices	Family's involvement in Collective deed (%)
Complete Involvement	80
Fractional Involvement	20
Aggregate	100

Source: Field Survey, 2018

In Table 8, 80 percent respondents rank full involvement in the collective action of the group, whereas 20 percent respondents are partial involvement. Such involvement is volunteer.

In the study, the respondent was asked a question whether preference and choice of CBDMG are highly relevant. Table 9 illustrates priority of CBDMG in three periods: a) Pre-Catastrophe Period, b) Catastrophe Period, & c) Upright-Catastrophe Period. In the First-Catastrophe Period, priority is a) Establish EWS and circulating warnings, b) Move to safe location, and c) Increase consciousness about catastrophe. In the Catastrophe Period, options are a) Contribute in rescue action, b) Help in evacuation, c) Form and deliver supplies at rehabilitation place, d) Help in assistance action, e) Tracking condition. In the Post-Catastrophe Period, options are a) Collective action to clean up the environment, b) Renovation /rebuild smashed families, c) Delivery of aid parcels d) Drive goods/catastrophe aid to the victim people, e) Activate aid to people.

Table 9: Primacy of CBDMG

Period	Primacy on Collective Action	%
I Pre-Catastrophe Period	Establish early warning system (EWS) and circulating warnings	55
	Move to safe location	25
	Increase consciousness about catastrophe	20
II Catastrophe Period	Contribute in rescue action	41
	Help evacuation	21
	Form and deliver supplies at rehabilitation centers	21
	Help in relief action	11
	Tracking the condition	6
III Post-Catastrophe Period	Collective action to clean up the environment	48
	Renovation /rebuilds mashed families	33
	Delivery of aid parcels	14
	Activate goods and aid to the people	4
	Drive goods/catastrophe aid to the victim people	

Source: Field Survey, 2018

In Table 9, primacy of CBDMG on collective action can be observed into three time periods: a) Pre-catastrophe period, b) Catastrophe period, and Post-Catastrophe period. The collection action of CBDMG focuses to establish early warning and circulating warnings in the pre-catastrophe period more than collective action to clean up the environment and contribute in rescue action. In the pre-catastrophe period, CBDMG involves more move to safe location than increase consciousness about catastrophe. During catastrophe period, CBDMG prefer helping in evacuation and form and deliver supplies at rehabilitation centers. Similarly, in the post-catastrophe, CNDMG focuses renovation/rebuild smashed families more than others.

Every household spends 78 days annually on activities of CBDMG. Its nominal wage value is 105000 Nepali Rupees equivalent to 889.83 USD out of 1071 USD per capita income. This opportunity cost is accounted for their safety and livelihood.

Result-3: Spending Time and Deployment Shared Activities and Its Economic Cost

Table 10 shows Spending time and Deployment on shared activities in three phases: a) Pre-Catastrophe Period, b) Catastrophe Period, and c) Post-Catastrophe Period. Household can allocate time on a) circulating warnings, and b) Increase consciousness in first phase, a) Assist evacuation and b) Tracking the condition in second phase and a) clean up the environment, b) Delivery of aid parcels, c) Renovation /rebuild smashed families and d) Activate help in third phase.

Table 10: Spending time and Deployment

Period	Shared Actions of CBDMG	Average man hours /week	Average man-hours/year	Average days /year	Average wage loss / HH /year
I Pre-Catastrophe Period	circulating warnings	2.5	120	15	7500
	Increase consciousness	1.5	72	9	4500
II Catastrophe Period	Assist evacuation	1.5	72	9	4500
	Tracking the condition	0.5	24	3	1500
III Post-Catastrophe Period	clean up the environment	2.5	120	15	7500
	Delivery of aid parcels	1	48	6	3000
	Renovation /rebuild smashed families	3	144	18	9000
	Activate help	0.5	24	3	1500
	Total			78	39000
	In US ($) if 1$=118				330.5

Source: Field Survey, 2018

In table 10, every household spends 78 days annually on activities of CBDMG. Its nominal wage value is 105000 Nepali Rupees equivalent to 889.83 USD out of 1071 USD per capita income. This opportunity cost is accounted for their safety and livelihood.

4. Discussion

Positioning at 4th climate vulnerable, 11th multiple disaster risks and 30th flood risk, Nepal is a multiple disaster-prone country (Bista, 2019). Out of 8 catastrophes(a) flood, b) landslide, c) hail & storm, d) insects, e) animals, f) drought, g) cold wave, and h)snakes), landslides and flood are most terrible risk with their extremity and time to all. Annually, 10 months are extremely risk to households. It is similar with results of Ministry of Home (MoH, 2022) and also of OXFAM and UNDRR (2023).

Since catastrophe is undesired risk with adverse externality and enormous collective price to homes, CBDMG might remain alternate extent to handle out catastrophe& its negative externality. Almost respondents verify collective action of CBDMG for DRRM, instead of LAPA of the local government. Its reason may be ineffective LAPA to improve stakeholder ship of local people. In the group, almost all respondents involve actively in the group. Its reason is their awareness and ownership on CBDMG as an alternative anti-disaster coping measure. It is their intuition about potential threat of climatic catastrophe in future. The vulnerable people feels it as their life with a terrible experiences and losses. To some

extent, they consider their bitter fact that a struggle for their survival. So, they own the group with their involvement in the collective action to DRRM.

Since catastrophe is an exogenous threat with a wider impact, the local people cannot mitigate its causes for their safety and survival, except collective action because of a trade off between their indigenous capacity and mitigation or a trade off between resilient and catastrophe. In this paradox, the people is dilemma to choose options: either accept catastrophe and resilient or reject catastrophe and resilient. They intuitively accept catastrophe and resilient in the study area as life. As a result, most of local people (80%) fully involve in CBDMG. Only 20 percent partially involve in CBDMG. It is justified with 100 percent endorsement to the need of CBDM and CBDMG for DRRM because of highly exposed, extremely sensitive, and vulnerable community.

Since the collective action as CBDM of CBDMG is a symbol of common issue, common ownership and common participation, cost of CBDM and its sharing is accounted so least one that the vulnerable people can share it for preparedness and resilient activities. Besides, the CBDMG is transparent on equal participation, equal ownership, and equal cost sharing. As an inquiry about the primacy of CBDMG on shared actions is asked to vulnerable households. In rural areas, labor endowment of the local people is farm intensive because of a higher rate of labor and leisure time in the absence of off-farm activities. Both are unlimited in the study areas: Gadhi, Lekhagaon and Kunathari with their instinct and ethnic understanding. Notwithstanding alleviation and adjustment concepts, the people consider shared action for short & long term. Regarding by CBDMG's collective action, there are varieties of choices in these periods: a) homework in the pre-catastrophe, b) extricate and assistance during catastrophe and c) repossession and restoration in the post catastrophe. In the pre-catastrophe, there are a) Establish EWS & circulating warnings, b) Move at safe location, and c) Increase consciousness about catastrophe. In the catastrophe Period, options are a) Contribute in rescue action, b) Help in evacuation, c) Form and deliver supplies at rehabilitation places, d) Help in repose action, e) Tracking the condition. In the post-catastrophe period, options are a) Collective action to clean up the environment, b) Renovation /rebuild smashed families, c) Delivery of aid parcels d) Drive goods/catastrophe aid to the victim people, e) Activate goods and aid to the people. These actions and activities are similar with adaptation actions of UNDP (UNDP, 2022) and IOM (2011)

The pre catastrophe period is the preparation period during which the vulnerable people could be prepared because of the principle that adaptation cost is four time less than loss cost of catastrophe. So, it is called an important period in DRMC to reduce DRRM. Therefore, the government of Nepal has started to execute NAPA and LAPA

Above results provide a strong evidence to the first priority of CBDMG on option of establish early warning system (EWS) and circulating warnings with 55%, the second priority on to help household to empty to safe location with 25 % and third priority on increasing consciousness about catastrophe with 20%.Such priority raises a query, why? In its reasons, there are a) early warning: the local people know the value of warning information in the catastrophe prone areas for time for saving life and asset. Besides, they practice their indigenous knowledge, skill and tools that is to ring metal plats in the community as well as in the downstream areas because they know a positive correlation between rainfall and disaster practically. Generally, heavy rainfall in the upstream catchment areas, Gadhi is used as early warning to

the downstream areas, Lekhagaon and Kunathari for their evacuation. In addition, the local people rang a plate for alerting the periphery settlements. Therefore, EWS as groundwork activity is preferred in the disaster homework. b) evacuation plan in which it saves life and asset. Almost people allocates weekly four hours' holiday time on preparedness. c) generating consciousness in which almost households contribute weekly five hours on mean more than on prompt notice and info interchange meeting, staying and exercise. Since rural households are far from alternative opportunities, their time is assumed a surplus without monetary value. However, such engagement may be a huge cost to them, if it is calculated.

During the catastrophe period is second and important period in DRMC. In this period, catastrophe event happens with a risk and life threat. In the DRRM, every minute is an important emergency period in which the people cannot manage sufficient time to think, prepare and plan to minimize the effect of catastrophe, except prompt action to save life, and assets. So, prompt collective action is only in DRRM. In general, landslides and flood in the mid-night may be so extreme that the collective action may be an effective measure. In 2015, the involvement of almost all respondents in the collective action of CBDMG are found in the emergency activities (rescue, evacuation, and relief). Above descriptive statistics complements it with the people's involvement in the rescue operation of CBDMG (40.8%) followed by in assist evacuation (20.8%), organize, and in supplies at the rehabilitation center (20.8%), in relief operation (10.9%) and in tracking the condition (6.6%). In this period, rescue collective action is most important of the rest of all and then, evacuation and relief goods & services are also. Besides, flood and landslides events in Raksin, Kunathari are cases in which flood entered in Raksin, Kunathari at the midnight and landslides happened in Gadhi and Lakhagaon at the same time. Let's think about what the collective active of CBDMG happened. Almost all households involved in the emergency work for 48 hours. It is complemented by their time allocation on rescue (10 hours per week) and on tracking (3 hours per week). Therefore, this time is very important for minimizing human causalities and economic losses.

Post-catastrophe period follows the during catastrophe. It is the final period of DRMC in which rebuilding, repossession, and restoration. In another words, it is the period of normalization to the trauma, losses and damages of the catastrophe. In principle, the cost of post catastrophe period is multi-times more than the cost of pre catastrophe period. If the pre catastrophe period is effective, its cost will be least. In the pre catastrophe period, alert and consciousness program of CBDMG are found. How much it was effective is still a query. In the post-catastrophe period, the collective action of CBDMG are found as a) cleaning residuals dumped in the location (48%), b) maintenance /renovate buildings (33%), c) delivery of help parcels (14%), and d) activate aid to people (4%).People allocates weekly five hours only first collective action of CBDMG managing the residuals from the environment. Similarly, they give weekly two hours on distribution of relief packages. Further, they volunteer weekly six hours on rebuilds mashed houses and one hour to activate aid to the people. Despite a huge cost in the post catastrophe, the CBDMG administers CBDM successfully within a time frame. Above results are evidence of mixed CBDM including collective action not only in the pre-catastrophe but also in the during catastrophe and the post-catastrophe. Therefore, the collective action of CBDMG is effective and efficient module because CBDMG follows the principle of equal participation and equal cost sharing. It is found in the UNDP Nepal's community based disaster management practices, 2006-2008 (UNDP, 2013).

No doubt, above results illustrates the relevancy of CBDMG to manage multiple catastrophes and their vulnerabilities. It raises a question of its sustainability in the cost sharing mechanism in the future because

the marginal cost of CBDMG is invisibly higher, if we estimate value of opportunity cost of leisure time of household labor. However, in general, the people assume zero opportunity cost because of small and informal farm labor market, lack of alternative opportunity, and unlimited leisure time of household. Further, these households have no choice to join CBDMG because of lack of physical connectivity. This assumption makes zero cost of CBDMG. If we include real and nominal wage rate, the collective action of CBDMG is accounted a huge cost. Table 10 provides a mean hour per week on the collective action of the group. In the result, each household allocates 78 days on average per annum (21.1% of annual days). Assume that wage rate per day is Rs 500 (4.23 USD). Let's estimate it. Its result may be Rs. 39,000 per year (330.1 US per year). Its share in per capita income (1,071 USD)is a 30.1%. Thus, this may be significant worth of household budget to the people. However, this small cost can result a big benefit from multi-catastrophe. Its outcomes may be positive to their income & welfare. The economic cost may demotivate to them for their contribution to CBDMG. In this way, the issue of sustainability would be a big challenge to this.

5. Conclusion

This study examines the collective action of CBDMG and household's involvement in the Western Nepal. As a result, the collective action of CBDMG is effective to minimize the effect of multi-catastrophe in 10 months of a year. CBDMG focus more on preparedness in the pre-catastrophe period. Secondly, the collective action of CBDMG in three periods: pre- and post-catastrophe is mixed one. Almost all involves in the collective action with full time. Thirdly, flood and landslide are extreme on economic agents mostly on people, plot, seed, domestic animals, assets, and physical infrastructure more than other catastrophes. Time of landslide is more than flood, insect, fire, animals, drought, etc. over a year. Fourthly, the priority of CBDMG is on early warning, empty to safe place and raising consciousness in the pre-catastrophe period, on rescue, help to evacuation, aid to relief and tracking during the catastrophe and on clean up the environment, rebuilding and rehabilitation in the post-catastrophe. Fifthly, households allocate 2 to 4 hours per week in the pre catastrophe, 1.5 to 7.5 hours per week during the catastrophe and 3.5 to 7 hours per week in the post catastrophe. On average, it is accounted 78 days per year (21% of a year). In sum, per household cost is Rs 39000 (330 USD) per annum that is 30% of 1071USD per capita income. Thus, it is costlier affair but least of total economic loss. Therefore, CBDMG is effective cost effective participatory module for collective action for DRRM and for minimizing the effects of multi-catastrophe. This is expected to contribute the effective implementation of LAPA and NAPA one side and another side the importance of CBDMG for DRRM. This is expected further to build the replicative model to materialize a spirit of IPCC (2020) and sustainable development goals related to sustainable cities and communities and climate action.

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