



## Research article

# Vulnerability management practices for sustainable livelihood security in drought-prone Gamo lowlands: An empirical insight from southwest Ethiopia

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## ABSTRACT

Vulnerable people do not always absorb the occurring shocks instead they react to disasters employing multiple strategies. This study mainly aims to explore households' vulnerability management practices and their linkages with sustainable livelihood security in the drought-prone Gamo lowland setup. Through the multistage sampling technique, a total of 285 respondents were selected from the four sample *kebeles*. Primary data were collected using a survey questionnaire, key informant interviews, focus group discussions, and field observations. Secondary data were drawn from published and unpublished materials. A mix of the qualitative dominant mixed methods of data analysis was employed. The newly formulated Vulnerability Management for Survival (VMS) framework is used to schematize people's survival strategies and challenges. It was found that the Gamo lowland households pursue multiple vulnerability management practices like liquidation, adopting drought-resistant crops, livelihood diversification, destocking, engagements in off-farm activities, remittance, and reciprocity. These practices are linked with households' livelihood security wherein effective management of vulnerabilities yields secured and sustained livelihoods among the implications. To sustainably enhance rural invulnerability, strengthening people's survival strategies like reciprocity, participation in financial institutions, water harvesting, area closure, afforestation and reforestation, and access to information are recommended.

## 1. Introduction

Vulnerability is a notion that involves legions of insights and explanations relying on the branches of knowledge that maintain a linkage of descriptions at various scales. The natural hazards and their corollary disasters are unavoidable and occur increasingly. The magnitudes of the hazards vary with new heights escalating the impacts on lives, infrastructures, and economies all over the world with severe manifestations in developing countries (Manandhar and McEntire, 2014; Tsadikovich et al., 2020). Besides, the hazards greatly impede the livelihoods and livelihood security of people with disordered lives every day (Sadaka et al., 2013; Ngwa et al., 2015; Shokane and Nel, 2020). Disaster risk management policy to action-oriented overview on this concern might be best quoted as 'We cannot avoid hazards, but we can prevent them from becoming disasters' (Golnaraghi, 2008, pp. 3–4) by effectively weighting the induced losses as inputs for managerial policy narratives to enhance community resilience (Sangha et al., 2021).

The ability of the community to withstand the facing vulnerabilities in the environments they live dictates the extent of vulnerability (Lazarte-Hoyle, 2017). To reduce vulnerability at various levels such as households and communities, building societal resilience would be a top priority. It is a vital strategy for ameliorating disaster risk at any phase of smoothening community survival (Shuaibu et al., 2014; Hoffmann and Blecha, 2020). Other scholars also indicate that fostering peoples' resilience strongly and minimizing vulnerability at various scales like the individual, societal, and largely at the country level are essential approaches to circumvent socioeconomic inequality in the spheres of recent social concerns (Rakauskine and Strunz, 2016). Besides, the capacity of the public to counter risks and disorders enhances well-adjusted growth and sustainability in a dependable manner (Matlaba et al., 2021). Others also claimed that for increasingly occurring natural hazards and their associated resultants, solely depending on hazards is found to be not enough for the reduction of threats; instead, vulnerability reduction via resilience building is a better strategy (National Academy of Sciences,

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2007; Birkmann et al., 2013). In the rural context, mitigation and adaptation with their components are presently employed as “the best practice” for reducing vulnerability in light of the 2030 poverty eradication goal of Sustainable Development (Gondwe, 2019).

Households predisposed to unsafe conditions induced either by natural or anthropogenic hazards employ various strategies using local wisdom and building indigenous knowledge to survive in the localized context (Mafongoya and Ajayi, 2017; Dhraief et al., 2019; Thony AK et al., 2020). The exposure to food insecurity and other livelihood security-related shocks are widely discoursed in this regard. Incapacitated households are hit hardest by such scenarios. However, the victims simply do not absorb all the undesirable happenstances they encounter. Rather, they deploy both ex-post coping and ex-ante adaptive mechanisms that help them stand against a plethora of adversities. To manage the specific vulnerability types the people are exposed to, due survival strategies are very important. Multiple strategies such as livelihood diversification and environment-oriented practices are commonly conducted by drought-disposed people as coping strategies in Ethiopia (Mensefe, 2010; Deressa et al., 2011; Arega, 2015). The existing research findings indicate the limitations and the inevitability of investigating further strategies in line with reducing vulnerability and building capacity with a condensed duty (McEntire, 2005; Kayombo et al., 2020). So, with the vulnerability prioritizing approach of this study, it was intended and tried to cover the recommended situations by intensively exploring rural vulnerability management and the related trammels. The focus on Ethiopia as a case study particularly on the drought-prone Gamo lowland areas was to explore how the affected households survive with vulnerabilities and contribute to helping rural invulnerability building.

The vulnerability of the study districts, particularly the targeted rural sites to drought hazards and the related adverse impacts requires intensive investigation to have deeper insights. This can be accounted as an input that would enhance communities' resilience building in light of the changing climate. Also, such a duty is considerably significant and an imperatively recommended strategy to develop the strategy of building adaptation (Sarker et al., 2019). The majority of the people in the study districts are sedentary farmers. This mode of sustenance paves good ways for the future vulnerability of households to insecure livelihoods wherein their capacity against shocks is hamstrung. Previously, drought-induced community vulnerability and the interwoven socio-economic scenarios that strongly tempt society today are less documented. In a nutshell, such situations are among the triggering problems that motivated this research work. To this end, this study has aimed to 1) explore households' vulnerability management practices 2) formulate the analytical framework for schematizing the household-level survival strategies and the challenges facing 3) examine the linkages of vulnerability management practices with sustainable livelihood security in the drought-affected Gamo lowlands. In order to attain these objectives, important research questions which led to such attainments were also set. Accordingly, what practices are pursued to manage vulnerability/ease survival in the study areas? what are the challenges of vulnerability management practices in the Gamo lowlands? and how is vulnerability management linked with livelihood security in drought-prone rural Gamo lowlands? are the questions considered.

The authors believe that the insights from the study findings would help improve the activities of building rural community resilience among the inhabitants of drought-affected lowlands by identifying the underlying challenges at the grass-root level.

## 2. Theoretical underpinnings of vulnerability investigation

Several theories, models, frameworks, and approaches have been employed while examining a vulnerability in consideration of the issues under scrutiny. In this study, particularly important models and a framework that would serve as a base for the investigation of rural vulnerability per the envisioned objective are presented. The employed models/frameworks are of vital importance to divulge the state-of-the-art

comparison in the study where fundamental research processes are thematically and methodologically linked with the result indicating its originality.

### 2.1. The methods for the improvement of vulnerability assessment in Europe (MOVE) framework

This is an investigative, holistic, thinking tool, and multidimensional framework. The goal is for providing a conceptualization of multifaceted vulnerability features in an improved manner where risk and vulnerability are differentiated, the idea of adaptation in vulnerability assessment is integrated with natural hazards, and disaster risk reduction perspectives are enhanced with a new perception. It closely interlinks the concept of assessment techniques in the communities of disaster risk reduction and climate change adaptation. In the framework, key factors and various thematic dimensions of vulnerability are systematically operationalized with due foci on numerous reciprocated actions that model susceptibility like dynamism (changeability over time), nonlinearity, and place-specificity (Birkmann et al., 2013).

### 2.2. Holistic model

Vulnerability according to the holistic model is described by ‘physical exposure, the existence of a fragile system, and limited adaptive capacity to recover’. The issues of hard/physical risks (the capacity for damage to physical systems) and soft/social risks (the capacity for damage to social systems) are underlined here as they occur when the elements interact with hazards. According to additional suggestions of the model, risk reduction of hazard events requires the effective use of feedback structural processes to mitigate hazard impacts (Birkmann, 2006). Susceptibility of physical entities in hazard-labile areas, social and economic delicacy, and lack of capacity to recover are determinant conditions of vulnerability whereas the failure/inability of delicate socio-economic systems to cope adequately (soft risks) and physical exposure to hazards (hard risks) are considered as vulnerability factors (Cardona and Barbat, 2000).

### 2.3. Integration theory

The occurrence of disasters induced by diverse hazards has multidimensional impacts. The victims and intervening organs take different actions to relieve the adverse implications of the disasters and their resultants. As part of such duties that enhance the effective recovery from disasters, the evaluative participation of the people is found to be of great value. The effective management of individuals' actions through participatory bureaucracies yields the achievement of the intended communal goals efficiently. The integration theory, among the many disaster theories, contributes to the better performance of both the calmed political systems and the gratification of the citizens in this regard. This was reported in light of the events of natural hazards such as floods. In general, the integration theory outlines the role of people's inherent participation as an imperative approach wherein the recovery from the occurring hazard-driven disasters is effectuated (Kweit and Kweit, 2004).

## 3. Materials and methods

### 3.1. Area of the study

#### 3.1.1. Location

The study was conducted in the Gamo zone of Southwest Ethiopia (Figure 1). Presently, the Gamo zone has 14 rural districts and 4 town administrations with a zonal centre at Arba Minch, 505 km Southwest of Addis Ababa. Astronomically, the Gamo zone is situated at 5° 43' 30" N - 6° 46' 30" N and 37° 10' 30" E - 37° 52' 30" E with a total area of 667, 081.37 ha.

### 3.1.2. Climate

The agro-climate zones in the study districts are classified into three types namely, *Dega*, *Woina Dega*, and *Kolla*. Boreda district is described as 29% *Dega* (highland), 18% *Woina Dega* (mid-land), and 53% *Kolla* (lowland) (Boreda District Farming and Natural Resource Development Office, 2020). In the Mirab Abaya district, the agroecological facets are identified as *Dega* (highland, 11%), *Woina Dega* (mid-land, 27%), and *Kolla* (lowland, 62%) (Mirab Abaya District Farming and Natural Resource Development Office, 2020). For the study districts, 40 years' gridded meteorological data of the average temperature and rainfall are accessed from the database of the Climate Engine. Consequently, the mean annual temperature and precipitation records in the Mirab Abaya district were 20.11 °c and 332.89 mm respectively. In the case of Boreda district (at Zefine town), the annual average temperature was 20.56°c and meagrely 249.16 mm for the mean annual precipitation (CFSR) (Climate Engine, 2021).

### 3.1.3. Physiography

The landform of the studied districts is characterized by different physical features. In the Boreda district, the topography is categorized as hills (29%), valleys or gorges (16%), and plateaus (55%) (Boreda District Farming and Natural Resource Development Office, 2020). Meanwhile, the topographic features of the Mirab Abaya district are described as plateaus (40%), hills (25%), and plains (35%) in which the elevation ranges from 1100 m to 2900 m above sea level (Mirab Abaya District Farming and Natural Resource Development Office, 2020).

### 3.1.4. The socio-economic conditions

The total population of the Gamo zone is 1, 668, 744 of which 826, 020 were males and the remaining 842, 724 were females accounting for nearly 10% of the total population of the Southern Nations Nationalities and Peoples Region (SNNPR). The study districts, Mirab Abaya and Boreda in particular have a total population of 196, 192 with a male 98, 751 and a female 97, 441 (United Nations Office for the Coordination of Humanitarian Affairs, OCHA Ethiopia, 2020).

The livelihood of the communities across the study areas depends dominantly on subsistence mixed farming. Socioeconomic vulnerability is the main driver that causes seasonal migration of the people mainly youth in the study areas. This is to secure livelihoods by gaining better income through diverse alternatives amongst which livelihood diversification is underlined. For this purpose, young members of the respondents' families migrate to other areas with varying destinations within and outside the country. Recurrent droughts and related adversities such as human and animal health constraints, low income, and meagre productivity among others test people's survival, livelihood security, and the attainment of sustainable development across the study sites.

## 3.2. Research methodology

### 3.2.1. Research design and approach

A community-based cross-sectional survey research design was employed to carry out the study in purposively selected Gamo lowland sample *kebeles*. The decision to use this type of design was due to the fact that it/is: 1) allows inferences from the sampled subjects about the population, 2) employed with a purposive selection of representatives in which the data is used from a large number of subjects, 3) entails the data gathering at and one point time from the whole population and 4) encompasses the deployment of survey practices to acquire the required data. The mixed methods research approach was implemented to generate quantitative and qualitative data. This is because of the nature of the data required to meet the research objectives and the method is best to understand and explain the research problem properly (Creswell, 2014). More clearly, a combination of quantitative and qualitative techniques was used.

### 3.2.2. Sampling procedure

Both probable and non-probable sampling techniques were used in the study. Purposive (prioritizing districts with more drought-prone rural *kebeles* from the Gamo lowlands) and multistage sampling deployments

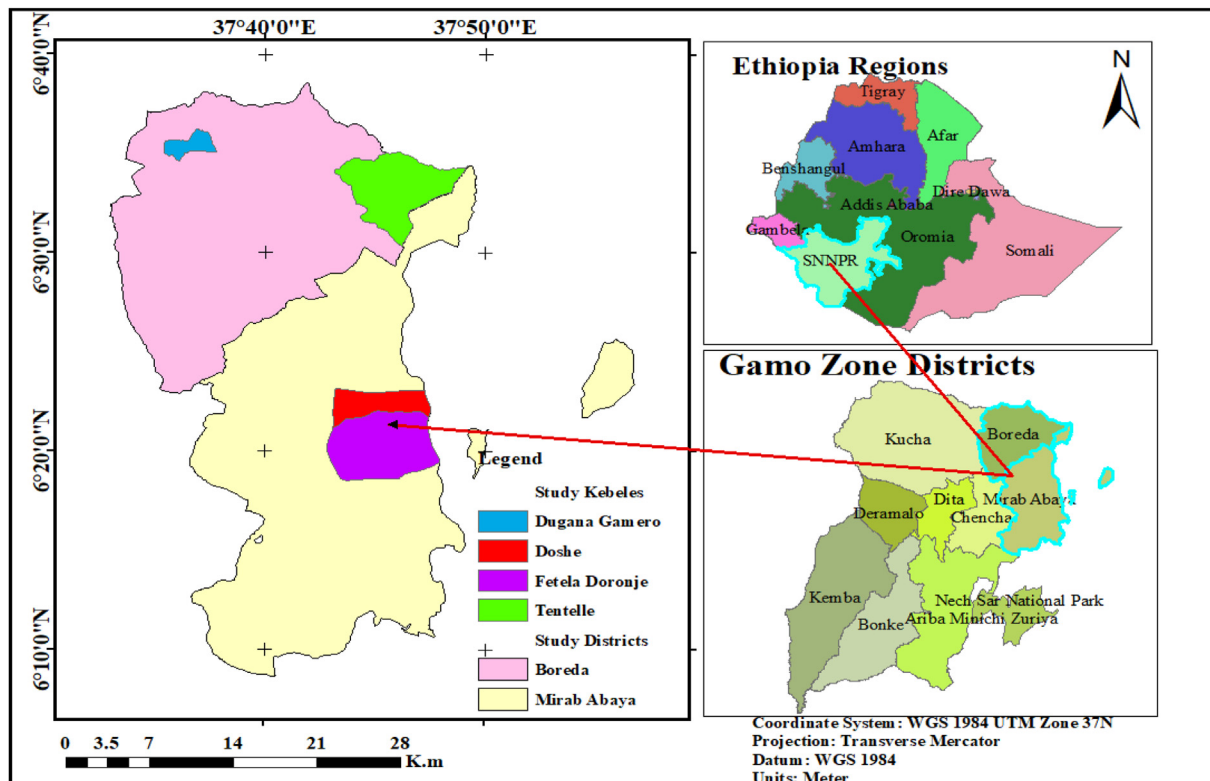


Figure 1. Map of the study site.

were the manifestations of such duties. Until selecting the final representative sample respondents, four stages of multistage sampling were employed.

The first stage was identifying districts with lowland *kebeles* from the Gamo lowland areas. There are fourteen rural districts in the Gamo zone. Nine of these districts are comprised of the lowland *kebeles* amongst which Mirab Abaya and Boreda districts were prioritized due to the presence of more drought-prone rural lowland *kebeles*. Secondly, more prone lowland rural *kebeles* namely Fetele Doronje and Doshe from Mirab Abaya district and Tentelle and Dugana Gamero from the Boreda district were selected due to the severity of drought hazard recurrence. The database in the [National Disaster Risk Management Commission \(NDRMC\) \(2019\)](#) reveals the severity of drought hazards and the other socioeconomic vulnerabilities in the selected *kebeles* for which the victims opt for seasonal migration and other strategies to survive and secure their livelihoods. In addition to this, researchers' familiarity with the study communities was valued and contacts were made with the concerned professionals and gatekeepers which *kebeles* to prioritize per the intended objectives. Also, these *kebeles* were among the primarily focused sites to address drought-affected students in disaster responding strategies like school feeding programs (Gamo Zone Education Department, 2019). In the third stage, the total targeted households were identified from the list of households available in the *kebeles* which was used as the sample frame. The households identified at this stage are the total targeted household heads per the availability in the list of the study areas' administrative documents (used as a sample frame) ahead of the formula-based determination of the respondent households from the four targeted study sites ([Table 1](#)). Lastly, determining the sample size was carried out. The sample household heads were selected from each study *kebele* and proportionally allocated following the formula applied to determine the sample size. The sample size determining formula of [Yamane \(1967\)](#), explicitly,

$$n = \frac{N}{1 + N(e^2)}$$

was used to compute representative households from the known finite population in which 'n' is the response/sample size while 'N' is the total household population size. 'e<sup>2</sup>' is the level of precision (0.5%) signifying the maximum variability, and '1' is the probability of the event to occur. This formula is preferred for applications with a 5% error margin and 95% confidence level as there was no earlier research conducted for consideration as a benchmark for the study ([Rose et al., 2015](#)). Additionally, this formula is opted for it is better as it assumes the normal distribution and is suitable for determining an appropriate sample size (50%) with the biggest possible rate of response in consideration of no previous research data on both conceptual and geographical scopes of the study. On the other hand, this formula is employed to determine the sample size where the population is known ([Mackenzie, 2017](#)). Accordingly, 285 respondent household heads were selected from a total of 989 households as presented in [Table 1](#). The lottery method was used to nominate the calculated and proportionally allocated household survey respondents.

The selection of the representative focus group discussants, key interviewees, and agricultural office experts was also conducted as part of the sampling process. The FGD attendees were the non-sampled households who did not take part in the household survey. The selection was done with the considered gatekeepers. The gatekeepers in the research context are the recruiters or facilitators of the research respondents and the study areas. The *kebele* health extension workers, school directors, and cluster supervisors, development agents, and *kebele* administrative bodies are the gatekeepers with whom the selection of the FGD participants was carried out. In each group, 6–8 gender-inclusive members have participated. Consequently, a total of 29 (20 males, 9 females) FGD participants were carefully taken and participated in the four study sites. While selecting the focus group discussion attendees and the key

interview informants, participants' long-living experiences in the *kebeles*, ability to describe the local areas, and household situations following the guiding checklist were emphasized as the selection criteria. The non-household key informants namely the two officers of the Farming and Natural Resource Development Offices were selected based on the availability criterion as they were available during the survey time being politically assigned. The agricultural experts were selected per the criteria of their professional backgrounds (disaster risk management and food and livelihood security experts at the zone level) and availability for the development agents in the study *kebeles*.

### 3.2.3. Data types, sources, and collection tools

Both primary and secondary data types and sources were used. Accordingly, the primary data were obtained from 285 survey respondents, agriculture professionals, and key informants. Besides, the focus group attendees, and the field observation inputs were the other sources of the first-hand data required to attain the objectives by substantiating the findings of the household survey data. Secondary data were acquired from the relevant published and unpublished materials and databases of the *Wereda* Disaster Risk Profile (WDRP), the Climate Engine, UN/OCHA, and official reports among others. The authors' familiarity with the study areas and communities also had a significant contribution in generating additional inputs in line with exploring the links between vulnerability management practices and people's secured livelihoods.

Multiple instruments of data collection were deployed. The structured survey questionnaire, structured questionnaire, FGD, KII, and field observations through transect walk were the tools used. In detail, the structured survey questionnaire was prepared for the household survey respondents and administered by the trained enumerators (diploma and degree holders with relevant qualifications) and close supervision of the first author in the field. Approximately, 45 min were intended to complete a survey questionnaire. This was per the lessons of the pilot-testing conducted by the first author at a non-sampled *kebele* (Fura) in the Mirab Abaya district with a similar profile. The observed time consumption of a survey enumeration ranged from 35–50 min. The time allotment and the differential consumption were because the questionnaire contained not only the issues of this manuscript (objective) of the Ph.D. dissertation but also the other specific objective questions that were incorporated. At the beginning of the enumeration, some lengthy minutes were consumed and at later times, lower or relatively shorter minutes were used per the increasing familiarity of the enumerators with the questions. Such issues were among the boldly underlined scenarios while training the enumerators.

The structured questionnaire was organized for the agricultural office technocrats who filled and returned the questionnaire with the required professional inputs. The questionnaires prepared for these sources were comprised of both open and close-ended questions embracing objective-oriented components such as socio-demography, capital assets, and their access status, survival strategies employed by the people and the challenges facing, the status of livelihood security, the interlinkages of vulnerability management and livelihood security among others. Concerning the FGDs, four group discussions were conducted in the study

**Table 1.** Sample sites and study population.

Sample <i>Kebeles</i>	Total households			Sample households		
	M	F	T	M	F	T
Fetele Doronje	138	20	158	39	6	45
Doshe	201	36	237	58	10	68
Tentelle	102	11	113	30	3	33
Dugana Gamero	454	27	481	131	8	139
Total	895	94	989	258	27	285

Source: Authors (2020)



sites from 07-November-2019 to 07-December-2019. The socio-economic and environmental conditions of the areas, vulnerability management practices (survival strategies) pursued by the households and the challenges facing, people's livelihood sources, vulnerability perceptions and extent, constraints of livelihood security, vulnerability to drought hazard and food shortfalls, the interlinkages of vulnerability management strategies and secure livelihoods, and capital assets and the access status were the components of the FGD checklist and the interview guides. The inputs gathered were used to substantiate the findings of the household survey data. The field observations and transect walks conducted across the study sites were meaningfully helpful to procure the supplementary data by taking the necessary and objective-related photos used for supplementing the data accessed by the other tools. The photos were taken per the prior consent of the concerned participants and placed in due places in the manuscript.

### 3.2.4. Data analysis methods

Data analysis was done with a mix of the qualitative dominant mixed methods of analysis in which verbal descriptions, narrations, annotations, and triangulation were widely employed by summarizing the data into themes. Grounded theory analysis of qualitative data analysis technique was deployed in the study. This was because this technique is preferable to closely examine the data with an open-ended approach. Also, it is a better fitting strategy as it depends on what is observed in and inferred from the data incorporating researchers' knowledge and experiences brought to the data. Furthermore, scholars like Li et al. (2020) conveniently used this analytical method in the rural setup to explore the drivers of smallholders' poverty.

To ease the analytical duties, a relatively new approach, termed as Vulnerability Management for Survival (VMS) framework was formulated by the authors and put into practice for its significance. The framework is a heuristic and analytical tool. It attempts to fill the existing theoretical lacuna, schematizes the practically employed vulnerability management or survival strategies and their challenges, and adds vital inputs for the resilience building of at-risk communities in the lowland context.

### 3.2.5. Ethical consideration

The manuscript is original and the data represent the real situation of the study areas. The resubmitted work is a revised, original, and has not been published elsewhere in any form or language (partially or in full), and the figures are original. The results were presented clearly, honestly, and without fabrication, falsification, or inappropriate data manipulation. No data, text, or theories by others are presented as if they were the authors' own wherein proper acknowledgments of others' works were considered. Ahead of conducting the survey questionnaire administration, the official letters from Arba Minch University and the study district were collected through which the survey respondents at the study sites were contacted. The household survey questionnaire data collection was done in accordance with the ethical issues. The ethics approval from Arba Minch University Institutional Research Ethics Board was received as part of the preliminary data collection duty by the first author. Also, the prior informed consent of the study participants was obtained ahead of conducting the data collection clearly explaining that the required data were only for the research purpose and the data would be handled confidentially.

## 4. Results and discussion

### 4.1. The characteristics of survey respondents

The maximum and minimum ages of the studied households were 20 and 90 where the average was 46 years. In the category, the age groups between 44 to 54 years absorbed the majority of the households (56%). Nearly, the households were characterized by an average size of 7 family members. The female-headed respondents accounted for 9.5% whereas

the remaining large share (90.5%) goes to the male-headed counterparts. Besides, the households possessed farmland with a varying size from the lowest 0.125 ha to the highest 19 ha (Table 2).

The findings of the survey households were found conformal to the report indicating the resettled households' situations in terms of the minimum and mean ages which were 20 and 46.6 years, respectively. On the contrary, the level of literacy and average landholding size were found to be relatively better where more than 68% of the households were identified with a low educational level (unable to read and write, attended only grade 1–4, as well as functional adult literacy) possessing 3.43 ha of an average landholding were compared with the illiteracy of nearly 72% of the households and only 1.43 ha of the average farmland possessed. These convergent and divergent characteristics were in comparison with the survey results indicating the Chewaka district resettlers reported by Alemayehu et al. (2021). The other recent study also divulges a contradicting status of households' profile wherein the respondents exceeding 50% were found with a secondary level education (Okaka and Odhiambo, 2019). Furthermore, the respondents were described with a differential status in the case of livestock owned that on the other hand yielded the unequal capacity of the survey respondents to stand against the facing vulnerabilities. A subsistent mixed-farming and migration of the family members to different destinations for survival were among the socioeconomic attributes of the households.

### 4.2. The what of vulnerability management: lessons from the rural Gamo lowlands

In line with investigating climate-induced hazard impacts, varieties of terminologies and phrases are preferably and situationally used. Risk, risk analysis, risk management, vulnerability assessment, and disaster risk management are among such concerns in diverse fields as per the intended objectives. In the case of this study, the phrase *vulnerability management* is opted and duly focused. This is because managing vulnerability is a demanding scenario for resilience building of the studied communities characterized by a legion of socioeconomic challenges in the face of changing climate. Hence, management of vulnerability has a prime role in proactively taking actions on hazards and their resultant disasters before they happen as vulnerability is a predictive measure and a precondition for the hazard and disaster occurrences. So, vulnerability management with its imperative definition per the study areas' context is reasonably emphasized in this work.

In the context of Gamo lowlands, survey households view (conceptualize) *vulnerability management* in various ways. While responding, there had been a mixing of issues by households for vulnerability management and the pursued practices that help manage the vulnerabilities. Further explanations were needed to manage such a mix-up to turn respondents to the *what of vulnerability management* track and additional inputs were also considered from supplementary tools like key and informal interviews and focus group discussions. The existing conditions dictate communities to come with their own but with common characteristics based on household, village, or community level contexts while expressing the phrase "*vulnerability management*" as interrogated in their local language. Accordingly, households' open views on the matter are themed into three categories as presented in Table 3.

These views are clear indications of multiple vulnerability constructs and their management difficulties that necessitate differential approaches to survive with multiple vulnerabilities across drought-disposed rural Gamo lowlands. Besides, experts in agricultural offices described the *vulnerability management* concept in various ways. Amongst, the mechanism of minimizing/controlling hazard effects, identifying the root causes of environmental and social problems, planned strategies to reduce hazard vulnerability, and soil and water conservation to enhance soil fertility were added by the professionals. In a nutshell, mixes of households' responses and further inputs from office technocrats, key informants, FGD discussants as well as authors' familiarity with the study areas were duly considered to put the operationalized clear cut of

**Table 2.** Major attributes of the respondent households.

Attribute	Category	N	%	Min	Max	Mean	SD
Age	20–24	3	1.1	20	90	46	11.322
	25–29	12	4.2				
	30–34	16	5.6				
	35–39	38	13.3				
	40–44	66	23.3				
	45–49	47	16.5				
	50–54	46	16.1				
	55–59	17	6				
	60–64	23	8.1				
	≥65	17	6				
Family size	1-3 members	24	8.4	1	17	6.76	2.375
	4-6 members	109	38.2				
	7-17 members	152	53.3				
Farmland size (ha)	0.125–1.00	3	1.1	0.125	19	3.43	2.605
	1.01–2.00	132	46.3				
	2.01–5.00	109	38.2				
	5.01–10.00	34	11.9				
	>10	7	2.5				
Educational status in grade level	Unable to read and write	94	33				1.461
	Functional adult literacy	29	10.2				
	Grade 1-4	71	24.9				
	Grade 5-8	59	20.7				
	Grade 9–10/12	28	9.8				
	Certificate/TVET	1	0.4				
Current marital status	Married	254	89.1				
	Unmarried	1	0.4				
	Widowed	22	7.7				
	Divorced	8	2.8				
Sex	Male	258	90.5				0.293
	Female	27	9.5				

Source: Modified from Thomas et al. (2021).

vulnerability management concept. Hence, the study areas’ situation indicative notion of the phrase is “methods employed by vulnerable communities to address the impacts of a climatic shock”.

**4.3. Undergoing vulnerability management practices and challenges: the vulnerability management for survival (VMS) framework**

The communities of Gamo lowlands were found susceptible to diverse types of vulnerabilities, namely, exposure to drought hazards, insecure livelihood, food situations, human and animal health constraints, and others that have interrelated consequences. To live with such inconveniences, multiple interventions have been pursued by households. These undertakings help people live with varied categories of vulnerabilities. In the context of the study areas, survey households employ multiple survival methods with varying magnitudes. Hence, based on the practical employment extent, people’s vulnerability management or survival strategies are structured in which a framework is reasonably formulated with the VMS nomenclature.

The naming instance is tied with the practices on which the people were engaged to live with the facing shocks across drought-vulnerable low-lying agroecological areas. VMS stands for “Vulnerability Management for Survival” in short with the nomenclature imperatively conceived as per the existing context across the study communities. This context necessitated exploring the strategies of how lowland households survive with vulnerabilities. The key goal of formulating the framework was to contribute and work in reversing/transforming drought-prone risky lowland communities into resilient and adaptive people acting

continuously beginning from the cradles of the problem. The VMS framework is an analytical framework that accredits exploring vulnerability reduction strategies contextually in low-lying drought-prone areas. The strategies are survey-based, lowland-friendly, and differentially pursued by the people as per their varying extents of predisposition to the shocks. Hence, the framework seeks to analyze vulnerability management practices the people locally deploy, and the facing challenges.

**Table 3.** Themed views of vulnerability management.

Counteracting capacity-related views	Environment and natural resource-related views	Livelihood asset and welfare-related views
<ul style="list-style-type: none"> <li>Adapting challenges to elapse bad times</li> <li>Minimizing hazard vulnerability</li> <li>Controlling vulnerability driving factors</li> <li>Tolerating prolonged scarcity (adversity)</li> <li>Developing self-reliance capacity</li> <li>Finding solutions for existing problems (drought and its corollaries)</li> <li>Developing knowledge via information access</li> </ul>	<ul style="list-style-type: none"> <li>Practicing environmental protection</li> <li>Soil and water conservation</li> <li>The wise use of natural resources</li> <li>Early ploughing and water harvesting</li> <li>Sustainable farm management</li> </ul>	<ul style="list-style-type: none"> <li>Using income appropriately</li> <li>Usual treatment (in line with animal diseases)</li> <li>Selling household assets to pass bad periods</li> <li>Increasing income sources</li> <li>Saving economy</li> <li>Getting rid of dependence</li> <li>Improving/changing livelihoods through hard work</li> <li>Assuring food security</li> </ul>

Source: Field survey (2020)

Formulating the VMS framework eases the analytical duties in a framed manner. Henceforth, it is placed under the results and discussion part.

The framework addresses the existing theoretical instances from which the best inputs were drawn. The theoretical and analytical gaps found in existing studies were attempted to be filled. This is in line with what is missed by the vulnerability assessment model, namely, the Pressure and Release (PAR) or Disaster Crunch model. Among the deficiencies of the model, *failure to participate in vulnerability alleviation strategies* is openly critiqued. Furthermore, the formulated framework efficiently accommodates the basic questions posed in consideration with vulnerability assessment viz “*how do households respond to shocks?*” (Moret, 2017, p. 7); “*how vulnerability can be reduced?*” (Orru et al., 2021). These questions were among the intentions of this study to be filled as a missing part in the literature mentioned. As a result, the framework addressed due responses or mechanisms concerning the studied lowland communities’ survival practices pursued to live with diverse socioeconomic irregularities. Qualitative data sourced from key informants and field observations were also deployed to substantiate the practical ingredients of the framework. Such a duty is thought of as fair to harness important lessons and scale-up to other geographies with a similar context.

When the contribution is considered, this framework is believed to add inputs (generate knowledge) for disaster risk management operations that are firmly dependent on vulnerability-related scenarios in the face of an impermanent climate. Besides, the framework enhances both the resilience and adaptation capacities of the communities where two central concerns would be outlined. Firstly, communities’ resilience through the capacity of absorbing climate-induced hazards is ascertained in which the sustainability of livelihoods is maintained. Secondly, the framework also articulates the adaptive capability of the people to adjust themselves to the negative impacts of climate taking advantage of their own and locality-specific innovations. For this study, the former case was given more emphasis. Thereby, onuses might be shared among stakeholders and practitioners as a remedy to tackle the lowland-oriented drivers of vulnerability in the areas under investigation and others with similar socio-economic characteristics. Wide-ranging sorts of strategies are put into practice by stakeholders and victims to respond to the occurring risks. Survival, adaptive, accumulative (materialistic), and coping (fine-tuning) are the recommended types of strategies in the literature (Moret, 2017). In the study areas, the practically used vulnerability management mechanisms had the characteristics of both survival and adaptive components of the strategies.

The schema in Figure 2 illustrates the newborn VMS framework with vulnerability management practices in the nucleus surrounded by varyingly pursued strategies and their extents. This means that since households are differentially disposed to vulnerabilities, they employ diverse survival mechanisms at the household, village, and community levels. Liquidation, adoption of drought-tolerant crops, income diversification, participation in social protection strategies, destocking, engagement in off-farm activities, improving land management, and reciprocity are amongst the diverse vulnerability management practices deployed by the households to varying extents.

In the schema, the vast majority of households employ liquidation while the least iteration goes to membership in financial institutions. This clear-cut of households’ differentials in vulnerability alleviation mechanisms and extents is synchronized based on the empirical findings for what the framework is investigative. The strategies identified are classed as ex-ante adaptive and ex-post coping typically. Temporally, these coping and adaptive strategies are households’ interim and lasting interventions respectively (Arega, 2015). Bajwa (2015) on the other hand opts for the term offensive for coping and defensive for adaptation to describe the strategies that are used by the households to respond to the occurring crisis. From the perspective of climate change, vulnerability is well-thought-out to be a function of three factors, namely, exposure, sensitivity, and adaptive capacity. Referring to diverse literature, Islam and Mamun (2020) claim the difficulty of detaching sensitivity and

exposure at a household level for what there is no sensitivity unless exposure takes place first. Furthermore, the authors assert that climatic episodes are manifested remarkably at a macro-level. With this regard, the adaptive capacity corner of households’ vulnerability is given more attention in this study.

Two routeways with differential origins delineate the nuts and bolts of the framework in which extremities of implementation extents are presented. Routeway one commences from the vulnerability management practice widely implemented by the lowland communities. It leads to the less frequently opted strategies as can be seen from the numbers assigned in front of each strategy indicating the implementation extent. In this regard, liquidation takes the highest iteration. On the contrary, the second routeway originates from the least pursued survival option namely membership in financial institutions. This demands a coordinated and determined action of creating opportunities that foster vulnerable people’s participation in income-generating financial institutions. Routeway two mainly signals people’s survival strategies that seek especial focus by stakeholders or decision-makers as the practices singled out were not widely and appropriately pursued as expected. Low participation in financial institutions, declining reciprocity, poor water harvesting experience during rainy periods, lack of employment opportunities in various organizations, and area closure were among such sorts of strategies. If properly implemented, these strategies would help the resilience of the risky people more across the sites.

The arrows at the progressing ends of both routeways indicate the courses taken by each routeway to understand the strategies implemented practically and their extents by contouring around the framework. Due lessons are drawn from the framework. In the context of lowland drought-prone communities, thereby, there is no single utter method to manage rural vulnerability, vulnerability management demands the employment of multiple strategies, vulnerability management by itself is exposed to shackles of efficiency, and differentially vulnerable people employ differential strategies to survive with shocks. In addition to these, the framework also shows the possibility of developing easily understandable and area-specific frameworks that help enhance the resilience building of at-risk communities. This per se is among the pros of the framework for drought-prone rural lowlands in light of the changing climate.

Managing or reducing vulnerability is not an easy task from a disaster risk management perspective. It is widely hamstrung by diverse determinants mainly in rural areas. In rural Malawi, farming households employ diverse mechanisms of coping with shocks induced by climate. Even though, large sections of the households (32%) do not pursue any adaptive strategy. This was due to information access limitations during climatic shock periods and financial capacity problems (Abid et al., 2020). Likewise, the Gamo lowland communities survive with multiple sorts of vulnerabilities that restrain their capacities to stand against the sorting pressures. In the framework, empirically identified challenges to people’s survival are embraced around the external boundaries. These are numerically indicated to show the extent of impediment against communities’ survival mechanisms in percent. Dependence on limited resources of sustenance, animal diseases, and literacy-related fetters were the leading barriers to households’ survival strategies. Beyond these key survival setbacks reiteratively prioritized by the respondents, other challenges were additionally recognized to a relatively lesser extent as can be seen in Figure 2. In consideration of this, Lazarte-Hoyle (2017) asserts multidimensionality and complexity of vulnerability minimization and resilience fostering in the rural context due to diverse factors.

Agricultural professionals with their long experiences and exposure to the study population on the other hand reflected their views on households’ vulnerability management practices and the deterring factors. Communities’ low economic capacity, low educational level, large family size, lack of awareness, shortage of diversified income sources, low agricultural outputs, backward agriculture, lack of information for hazard occurrence seasons, lack of skilled manpower and awareness creation opportunities, as well as water stress and poverty were commonly

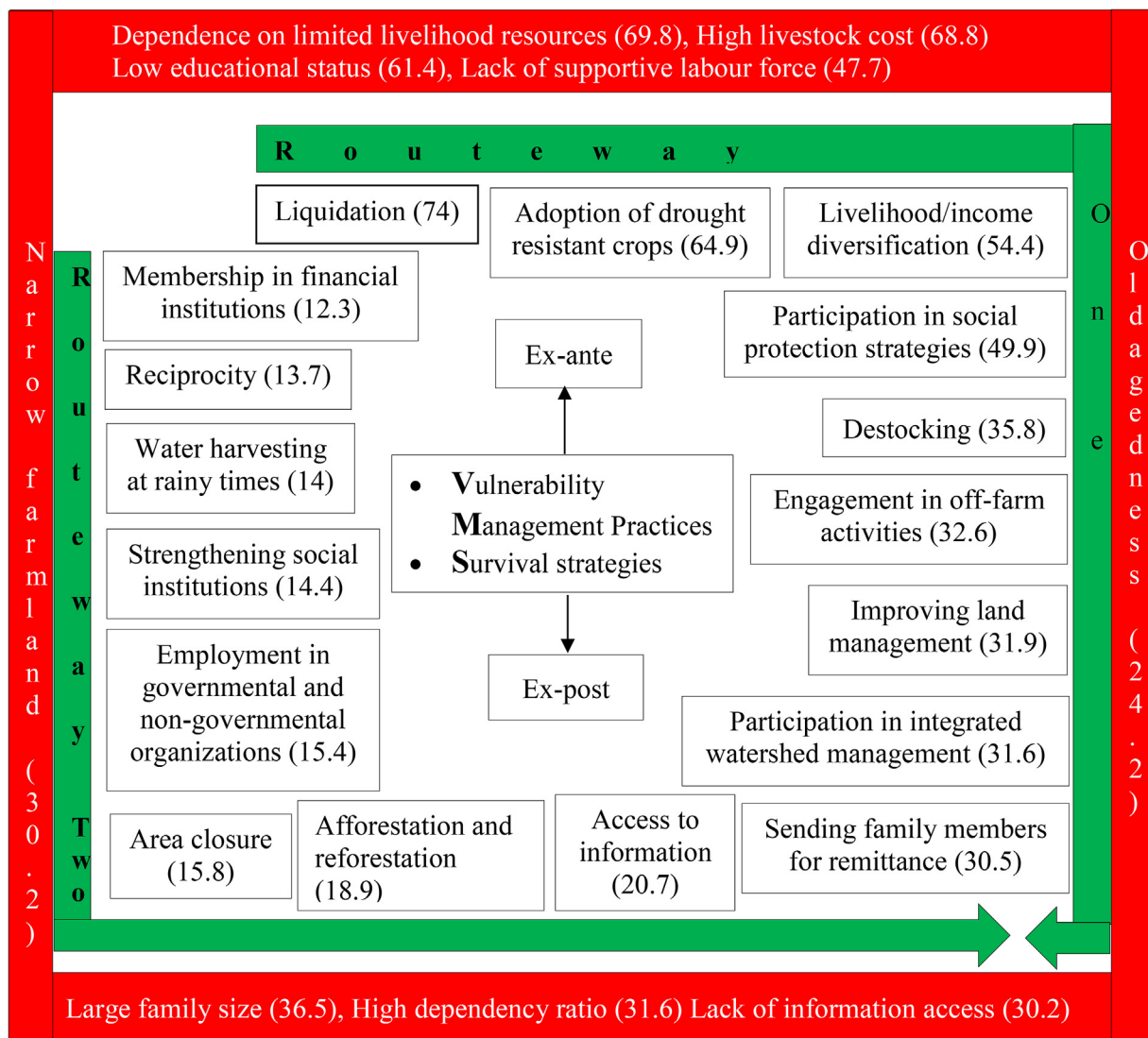


Figure 2. The VMS framework Source: Survey-based own construction (2020).

acknowledged by the experts in this regard. The investigated vulnerability management strategies were not in the position of enabling some sections of the community like the aged, female-headed, and those dependent on others and direct beneficiaries of the safety net program. These groups were disproportionately disposed to the effects of socio-economic problems. Such conditions are common currently and getting escalated in extent over time. For instance, crop failure induced by natural hazards (drought recurrence, crop pests like fall armyworm, swarming locust infestation, etc.), and animal disease onsets still seriously challenge people's survival. As a result of these, single agriculture-dependent economies, as well as food access modalities are impacted in which familial and communal health status is threatened while livelihoods in their entirety become eroded (Figure 2). Congruously, this finding is consistent with the report of Tafesse (2020) that unveils the problem of such undiversified living systems which fetter the drought-affected rural households' adaptive capability in the face of the changing climate.

The theories reasonably embraced in this study have strong implications and linkages with the Gamo lowland context. Consequently, the MOVE Framework was used to understand the multifaceted nature of vulnerability, the Holistic Model was deployed to enhance the how of reducing hazard impacts, and the Integration Theory on the other hand was incorporated to outline how different stakeholders take remedial actions against various disaster occurrences. Since these theories are

crucial to elaborate vulnerability and how to cope with it in the setup of the targeted drought-prone households, it was found demanding to address and accordingly link them with the study situations.

In Sub-Saharan Africa, prone to climate change impacts, rural households pursue multiple adaptation strategies with both on-farm and off-farm modalities (Antwi-Agyei et al., 2014) to survive with challenging encounters. A review of households' coping mechanisms to climate change by Shuaibu et al. (2014) also goes with these activities embracing planting drought-resistant crops, moving to other places, and off-farm engagements among others. Besides, the sale of livestock mainly small ruminants to fulfil household items, changing feeding patterns, migration to near and far destinations, harvesting water, engagement in off-farm practices, and looking for remittance are the ameliorative coping mechanisms deployed by Awi zone potato farmers and Central Rift Valley households of Ethiopia (Chalachew et al., 2014; Getachew and Aune, 2019). These mechanisms are consistent with the aforementioned survival and livelihood-securing practices of drought-vulnerable Gamo lowland communities schematized in the framework. Furthermore, the drought-prone farming households of northern Ethiopia deploy varieties of adaptation approaches against the changing climate. In such drought-recurrent areas, diversifying crops, income sources, and livestock were among the many survival stratagems (Fikre and Muluken, 2021) which diverges from the adaptation alternatives of the Gamo lowland households in the case of livestock for what destocking and





**Figure 3.** Vulnerability management practices across the study areas: a) Local grain storage, b) Collecting grass from distant areas, c) Harvesting water (Field photo, 2020).

restocking were pursued instead of diversification. Besides, destocking is identified as the last ranked option among the adaptive approaches employed by Kenyan smallholders against climatic shocks which further confirms the divergence of the finding (Simotwo et al., 2018). In general, the scholastic perusals affirm the advancement of differently recognizable strategies to counteract vulnerability (Orru et al., 2021). Generally, the households' employment of diverse vulnerability management practices is cognately converged with the recent report of Nassor and Makame (2021) that states the varied household-level adaptation mechanisms pursued in the natural hazard (flood) recurring areas.

**Figure 2.** The VMS Framework Source: Own formulation (2020).

The qualitative data sourced from key informants, office experts, and field observation also showed that migration as a survival strategy or means of income generation is opted for by some household heads or members of households in the study areas. In general, 20.4% of the respondents stated the presence of migrant family members. For 16.8% and 8.8% of the households, there were 1–3 male and 1–4 female migrant family members respectively. Uniquely with this regard, seasonal migration to other near and distant areas is pursued by livestock-dependent households in Tentelle county of Boreda district to elapse the difficult months. Even though, this strategy has been hindered by other challenges at one of the destinations namely Lake Abaya shore to where the mentioned sections of the community go regularly from December–April every year until summer rain starts. A livestock dependent key informant describes the encounters as follows:

*“Migration of dominantly animal raisers from Tentelle kebele to Shinkiko (adjacent kebele of Mirab Abaya district) and Lake Abaya shore is a common activity. The main driver of this phenomenon is the lack of water. Due to recurrent drought hazard boldly and ineffective governmental endeavours (digging water wells and distributing from the nearby kebeles) to pave the way for water access, still the stress continued. Every year, since the end of November, we, the pastoral households move to Lake Abaya shore and stay there until the summer rain launches. After the un/dependable summer rain makes the availability of our necessities (water and pasture) possible, we come back to our kebele along with our animals and children. Like the earlier times, the conditions are not easy to get what our animals and their dependents require. This is as a result of the narrowing grazing lands around the lake due to traditional and small mechanized irrigation schemes that also are causes of disagreements with the people of Mirab Abaya district who live on irrigating around the lake. So, even to go to the lake shores as usual, it is unsafe and not comfortable like yesteryear”* (Key informant, personal communication, 04-January- 2020).

Zone, district, and kebele level agricultural technocrats on the other side added various practices employed by the studied households to manage and live with vulnerabilities. Storing grains, collecting grasses for livestock from distant areas, harvesting water (community water pool), and on-farm nurseries were among the commonly raised strategies by the professionals reminding differential implementation degrees.

The field observation and transect walk inputs across the study sites also show how the households employ diverse survival strategies that help them to withstand the facing shocks. Among others, the inhabitants practice food storage on their homesteads, collect or buy grasses for their animals from distant areas, and participate in water harvesting though not effective as wished due to rainfall inconsistency and implementation problems (Figure 3 a-c). The Gamo lowland households' deployment of varied survival practices in a combined manner is found conformal to the micro-level households' adoptions in the semi-arid district of Nakasongola in Uganda where climate change adversely impacts food security (Egeru et al., 2022).

#### 4.4. Vulnerability management practices and livelihood security nexus

As detailed earlier, communities of the study districts undergo various survival strategies. Directly and indirectly, these survival interventions have implications on/linkages with the status of people's livelihood security which is conceived as households' capability to meet basic needs or ascertain basic rights. In tenet, effective management of vulnerability yields secured livelihoods.

The respondents described the existing links between vulnerability management and livelihood security in a way that signals the cause-effect association and co-existence of the issues under investigation. Most commonly, people's livelihood and well-being-related issues are raised in multidimensional ways. As a result, the reiterated survey responses concerning the nexus between vulnerability management practices and livelihood security or social well-being components in the context of the study areas are depicted in Table 4.

In a way that strengthens the responses of households, agricultural experts' inputs showed that if the vulnerability is managed effectively, agricultural productivity is boosted, risk exposure is reduced, more income is generated, livelihood income sources are diversified for rural poor, community asset is sustainably built, and food and livelihood insecurities are reduced. There is a direct relationship between the issues as they have a cause-effect tie in which managing vulnerabilities appropriately secures livelihoods and yields safe well-being. Subsequently, it is to claim that “without vulnerability management, no livelihood security” and “a person with secured livelihood can adapt vulnerabilities” are the big pictures of conclusive claims on the links under scrutiny. Generally, the vulnerability management practices employed by the studied households were found conformal to the earlier investigation results in the commencement of the 21<sup>st</sup> century. In the rural context, the management interventions against dubiousness deployed by the households were advanced as a remedy to tackle livelihood insecurity in the views of a crucially reappearing developmental topic. Both the adaptation and coping approaches have been pursued by the rural victims to manage the facing risks in the literature (Devereux, 2001). Others also claimed that the implementation of social protection as one of the vulnerability management approaches has interactions with the economies to be grown entirely (Ginneken, 2005).

**Table 4.** Nexus of vulnerability management practices and livelihood (well-being) security.

S. No	Effective vulnerability management practices	Frequency	Percent
1	Lessen hazard exposure	83	29
2	Make living safe	37	13
3	Solve food insecurity	35	12.2
4	Reduce livelihood insecurity	26	9
5	Yield better living, transformation, and prosperity	26	9
6	Alleviate poverty and backwardness	26	9
7	Enhance self-sufficiency	22	8
8	Secure income	22	8
9	Relieve constraints of livelihood asset access	4	1.4
10	Make working capacity strong	4	1.4
	Sum	285	100

Source: Survey result (2020)

## 5. Conclusion and recommendation

This study has tried to investigate the survival strategies, explicitly, the vulnerability management practices employed by the local people, the existing challenges that test the strategies via the VMS framework, and how these strategies are linked with livelihood security. The households of the Gamo lowlands are exposed to various sorts of vulnerabilities with what they have been struggling with to survive. The households conceptualize vulnerability management in multidimensional ways regarding the existing socioeconomic and environmental contexts. Accordingly, three views of vulnerability management, namely, counteracting capacity, environment, and natural resources as well as livelihood asset and welfare-related views are identified and duly summarized. The management of vulnerability and livelihood security are strongly linked to one another. This is basically because effective vulnerability management practices result in secured livelihoods with capacitated households that sustainably develop resilience.

Lots of lowland-friendly vulnerability management practices are pursued by the people to reduce vulnerabilities and secure their sustenance in the study sites. These include liquidation, adoption of crops that resist drought, livelihood diversification, searching for remittance by sending family members to other areas, water harvesting, reciprocity, environmental protection, and destocking. Such survival strategies are challenged by factors like dependence on limited livelihood sources, old agedness, female-headship, low educational status, large and small-sized families, lack of information access, the prevalence of animal diseases and high treatment cost, and lack of good governance.

The VMS framework is found to be crucial to foster rural people's resilience-building by pursuing multiple interventions against vulnerabilities. The framework is analytical and enhances households' invulnerability-building in drought-vulnerable lowlands with effective implementation of survival strategies. Furthermore, it fills the gap in the existing vulnerability/disaster risk management theory of the PAR model. The study contributes to the insights into reducing rural vulnerabilities and capacity building of the lowland communities in the face of the changing climate. It also impels the policy debates to revisit the development interventions undertaken across the drought-prone lowland areas by the concerned stakeholders.

To sustainably build communities' resilience, it is imperative to suggest strengthening strategies for household capacity building. Enhancing awareness of the community on vulnerability and appropriate use of resources, strengthening social affinities like the declining status of reciprocity, and wider participation of the community in financial institutions seek due attention. Besides, water harvesting and proper management to stand against drought impacts are required to be implemented by the victimized community and other stakeholders in a planned and organized manner. These instances, which remained uncovered in this work, also demand further examination in the urban and

non-lowland agroecological contexts of the study districts and other geographies with a similar setup that are considered as the limitations of this study. By and large, the study results are reminders for the policy and decision-makers to revisit the lowland-appropriate strategies that help build the invulnerability of the lowland communities in light of a transient climate.

## Declarations

### Author contribution statement

Thomas Toma Tora: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Degefa Tolossa Degaga: Conceived and designed the experiments; Performed the experiments; Contributed reagents, materials, analysis tools or data.

Abera Uncha Utallo: Conceived and designed the experiments; Performed the experiments; Contributed reagents, materials, analysis tools or data.

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### Data availability statement

Data will be made available on request.

### Declaration of interest's statement

The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

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