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Improving Adaptive Capacity of Riverine Communities in Responding to Floods in Beledweyne District, Somalia

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Abstract

This study aimed at improving the adaptive capacity of riverine communities in responding to floods in Beledweyne district, Somalia. The objectives of the study were to examine the factors that determine flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia, to assess the indicators of adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia and to evaluate the adopted strategies for improving adaptive capacities to flood hazards by riverine communities of Beledweyne District, Somalia. The study employed quantitative research approach using descriptive research design to analyse the adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia. The research used data collection tools like questionnaire, interview and documentary review to collect the data. The main findings of the study were that there are many factors determining flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia like staying very close to the river increases community members' vulnerability to floods in the areas, staying near the estuary to flood, staying near the high-water mark, staying near the river defense walls, staying near the basin bridge with poor condition and many others. Secondly, the findings of the study indicate that there are indicators of adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia which they encompass: low level of emergency and preparedness plan and resources, low level of emergency and preparedness plan and resources, low improvement of livelihoods and rural economy in the flood prone areas and low improvement of livelihoods and rural economy in the flood prone areas. Furthermore, the findings of the study indicate that the recommend strategies for improving adaptive capacities to flood hazards by riverine communities of Beledweyne District, Somalia entail: continuous assessment of the sector and infrastructure vulnerability in the riverine communities, executing early actions to increase economic resilience in livelihoods, assessment of the critical infrastructure (roads, bridges, utilities, prevention of ad hoc basin defenses, favor non-structural solutions and preparation and implementation of effective early warning messages that reach marginalized groups of people. The study recommends that there should be preparation of medium-term development and spatial plans, there should be proper preparation of medium-term development and spatial plans in Beledweyne district, preparation of proper local plans and the district authority or leaders in collaboration with the national leaders should prepare proper local plans for riverine communities.

Keywords: *Floods, Riverine communities, Beledweyne, Adaptive capacity, Somalia.*

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1. INTRODUCTION

Floods are the most common and deadly natural disaster that occurs as a result of water thar submerges normally dry land. The main causes of flood entail heavy rainfall, the surge of storm from tropical cyclone, rapid snowmelt and tsunami in most coastal areas. Floods have got devastating effects such loss of life, damage of personal property, widespread devastation and destruction of the critical public health infrastructure. It has been reported by world health organization that between 1998 to 2017, floods that occurred in various parts of the world have affected over 2 billion people. The people who are most vulnerable to floods are the ones that live non-resident building or floodplains or lack effective warming systems and awareness of the occurrence of flooding hazard (WHO, 2021). The adaptive capacity of the various riverine communities to the occurrence of flood clearly reflects the process of adjustment to the real or expected consequences of floods in a given community. The facilitation of the adjustment involves human interventions (Komolafe et al., 2020). In many Sub-Saharan countries in Africa the devastating impact of floods have been increasing in frequency and intensity due to continuous occurrence of cyclones and tropical storms that produce dangerous natural disasters. Currently, over 2.3 million people are exposed to dangerous risks of floods in several countries such as Uganda, Ghana, Ethiopia and Sudan. It has been estimated that 22,000 to 26,000 people in Africa have been affected and 6,000 to 8,000 people have been displaced by floods between 2010 and 2016. According to Komolafe et al., (2020), they revealed that flood hazard has got high susceptibility rate with an average coverage area of 1269.40, 14139.50, 7188.40, 17.41 and 0.85 km2 that are occupied by 466 290, 355 542, 69 554, 231 and 54 people, respectively. In Malawi floods account for over 70% of all the hazards that occur in the country due to lack of capacity to mitigate and response to floods and socio-economic and environmental fa tors that underlie the susceptibility of floods (Kawasaki, A., Kawamura, G., & Zin, W. W.m 2020; Kamanga et al., 2009). According to Douxchamps et al. (2016), the threats being posed by floods in the future could be mitigated through improving adaptive capacity of riverine communities in responding to floods that would reduce climate vulnerability and have a positive significant impact on land productivity ensuring sustained production.

In Somalia, there are two major types of floods being experienced: river flood and flash floods. River floods occur river Juba and river Shabelle which are located in the Southern part of Somalia; whereas, flash floods occur along the intermittent streams located in the northern part of the country. In the recent past, Somalia has experienced increased in severity and frequency of floods. The most dangerous historical floods in Somalia took place in 1961,

1977, 1997, and 2006 and the floods of Gu that occurred in 1981 and 2005. The occurrence of continuous floods in Somalia are creating serious economic damage and human casualties. Even though the main cause of river floods in Somalia being localised rains that lead to severe flooding in river Juba and river Shabelle; another main cause of flooding in some parts of Somalia is as a result of the drainage from the catchment area that are located the Ethiopia's highlands which experience severe and frequent rainfall resulting into floods in many areas in Somalia. The continuous floodings along riverine communities are being worsened due to illegal openings the river embarkments (built to create outlets for water irrigation during the dry season in Somalia). The water that comes out of the openings cause serious and devastating havoc on the adjacent land (FAO, 2019).

The different places in Somalia that are faced with enormous threat to disasters culminating from both man-made and natural causes. Floods pose one of the commonest types of natural disasters. The most recent devastating floods were experienced in October 2019. Here, more than 300,000 people were displaced. Of these, 90% were from Beledweyne district of Hirshabele State. Given threats posed by floods in the future with an estimated thousands of people projected to be exposed to greater risk of water stress by 2020 (IPCC, 2007). Overcrowded Internally Displaced Persons (IDP) settlements and displacing more people along riverine areas due to flooding. In Baidoa, half of the estimated more than 246,000 IDPs, are at the risk of flash flooding. In Galgadud region, heavy rains resulted in flash floods in low lying land in Abudwaq town. Approximately, 9,300 displaced people in Danwadaag, Kulmiye and Wadajir. In Jubaland, an estimated 28,200 people have been displaced by flash flooding. This includes 8,000 in Saakow; 6,000 in Bu'ale; 6,000 in Luuq; 6,000 in Afmadow; 1,200 in Ceel Waaq villages and some 7,000 people in Jilib and Jamaame riverine areas who have been temporarily displaced to nearby highland areas. In Middle Shabelle, the Shabelle River burst its banks displacing people in Horseed area. Farms and IDP shelter were washed away. Some 7,000-affected people have moved to Hantiwadaag village in Beledweyne (UN. Office for Coordination of Humanitarian Affairs: OCHA, 2018).

According to OCHA (2021) report, the flooding that took place across various areas in Somalia in the year 2021 affected over 400,000 and displaced 101,300 people in 14 districts in Somalia. Flooding that was caused as a result of heavy rainfall that occurred on 7th May 2021 in Mogadishu, Somalia caused severe flash flooding in the city and it led to the collapse of several building in Wadijir district and dead of nine people. Floods caused the breakages along the banks of river Shabelle abreast to Beledweyne district that led to serious flooding and affected thousands of the people in the district. By mid-May 2021 breakages along the

banks of the Shabelle river near Beledweyne caused severe flooding affecting thousands in the district. According to the report by OCHA (2021), the floods in Beledweyne district have displaced about 66,000 people from their twenty-seven villages, destroyed about 40,000 hectares of farmlands in the district, disrupted the learning of students in twelve schools in the district and have damaged 82 percent of the WASH infrastructure in the district, destroyed over 1,235 hectares of farmland and displaced over 22000 people from their village. The other areas affected by severe floods in Somalia encompass: Afgooye, Jilib, Bu'aale, Hakaba,Banadir and Marka. In the Northern parts of the country such as Hargeysa and Ceerigaabo districts, hundreds of people were displaced by floods (OCHA, 2021). Additionally, it has been reported that Juba River broke its bank in Doolow whereby it reached 4.70 meters above the moderate level of flooding in three villages (OCHA, 2021). The continuing economic and social effects of floods in Somalia are much greater in Somalia. Hence it is imperative to gain a detailed understanding about how areas at risk can adapt and the vulnerabilities, resilience and adaptive capacity of these communities. Thus, it is against this background that this paper aims to examine the factors that determine flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia, to assess the indicators of adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia and to evaluate the adopted strategies for improving adaptive capacity of riverine communities in Beledweyne district, Somalia.

2. LITERATURE REVIEW

Flood vulnerability has attracted significant attentions from various researchers who provided its diverse definitions. According (Pathak et al., 2020), defines flood vulnerability as means the extent in which a particular system is highly susceptible to floods owing to its exposure, perturbation in relation to inability or ability to either cope, cover or adapt floods in a given duration and area. Flood vulnerability also refers to level of harm which is expected or anticipated during the conditions of susceptibility and exposure to floods as well as resilience to flood (UNESCO-Institute for water education, 2020). Flood vulnerability are measured by various tools such as cluster analysis, multi criteria decision analysis, hydrodynamic modelling, geospatial analysis and integrated approach (Hong et al., 2018; Seenath et al., 2016). However, the Flood Vulnerability Index (FVI) is another effective tool that has been used to determine the resources, identification of areas with flood vulnerability and effective decision making (Salazar-Briones et al., 2020; Pathak et al., 2020; Nasiri et al., 2016). Flood vulnerability index (FVI) varies with different areas however riverine flood are a major

weather-related disaster affecting both production and physical infrastructures (Pathak et al., 2020).

The main factors that influence flood vulnerability in a particular area encompass: adaptive capacity, household sensitivity and exposure to flooding as an integrated vulnerability index (Pathak et al., 2020). According to the qualitative study conducted in Nepal, the study revealed that factors such as migration and credit access positively influenced flood vulnerability; and socio-demographic factors such as livestock owned, gender, livestock owned, adaption measures, per capita, adaption measures, and distance to water bodies had a negative influence on the FVI (Pathak et al., 2020). The diverse nature of flood vulnerability entails physical environment and socio-economic component.

According to Cardona et al. (2012), the most common factors that influence flood vulnerability include: social, economic, geographic, demographic, cultural, institutional, governance, and environmental factors. These factors can be grouped or varied as temporary and spatial in nature based on the rationale that floods vulnerability, exposure, resilience is vastly dynamic and changes over time and has to be assessed over a space of time. Furthermore, the factors determine flood vulnerability also vary over time; hence, there should be consideration of updated information when assessing these determinants or factors that influence flood vulnerability. For instance, the economic characteristics of a particular area do not remain the same every year, they are always subject to change. Flood vulnerability is defined or known when all the factors that determine vulnerability to floods are identified and assessed. The components of vulnerability are combined to determine overall vulnerability to flood (Karmaka et al., 2010).

The indicators of adaptative capacity of riverine communities are basically the existing factors in a given society that that determine whether the communities can adapt or cope with the floods. However, it is quite difficult to identify the indicators factors that determine the adaptive capacity of riverine communities as they are not directly measurable in nature. According to UNDP-GEF (2003) the use of scorecard (subjective) approach can assess the attributes of the adaptive capacity of the riverine communities to floods. Therefore, the capacity development projects should consider the role of contextual or external factors that affect systems but are outside of their control; and the internal factors operating within systems that may be directly addressed through effective interventions to enhance adaptive capacity. Whether a factor is internal or external depends on the scale of the system in question. For example, the use of national-level data to develop adaptive capacity indicators could represent internal factors if the scale of analysis is national and external factors if the

scale is local. In the project context, the team needs to make a judgment as to whether the factors are internal or external to the system boundary (UNDP-GEF, 2003). The main indicators of adaptive capacity at national level encompass: literacy, health status and governance (Brooks et al., 2004). Therefore, these majorly relate to the level of economic development in the society, even though the nature of the relationships is highly complexed and subject to serious debate. The essential factors such as literacy, health economic wealth as well as governance demonstrate the country's overall development status; they are largely determined by the national development context and they contribute to the level in which the sub-national scale systems must adapt. Therefore, it can be above the scope of most adaptive capacity development projects that affect national governance, national economic development and the investment of central government in health and literacy.

3. RESEARCH METHODOLOGY

The researcher used quantitative approach to collect and analyze text and numeric data in relation to improving adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia respectively. The study used descriptive research design to assess the improving adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia. The study population was drawn from the population of Beledweyne district through different categories of respondents in the selected communities to test the adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia. Researcher "envelops" his or her own experiences in order to understand those of the participants in the study. This research design helped the researcher in examining the objectives of the study that found out the factors that determine flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia, assess the indicators of adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia and to recommend strategies for improving adaptive capacities to flood hazards by riverine communities of Beledweyne District, Somalia. The study has been conducted in four communities in Beledweyne district namely: Kooshin, Hawo tako, Howlwadag and Bundoweyn. The target population that has met the inclusion criterion that have been used for the study was 183. The target population included community residents, community leaders as well district leaders. The sample size of the study was 12

Table 1.

Research Population and Sample Size

Category	Target population	Sample size	Sampling techniques
District Leaders	20	15	Stratified purposive sampling
Community leaders	33	20	Stratified purposive sampling
Community residents	150	91	Snowballing and purposive sampling
Total			

Source: Primary Data, May, 2023

The quantitative data involved information from the questionnaires only. Data from the field was raw for proper interpretation. It was therefore vital to put it into order and structure it, so as to drive meaning and information from it. The raw data obtained from questionnaires was cleaned, sorted and coded. The coded data was entered into the computer, checked and statistically analyzed using the statistical package for social scientists (SPSS) software package to generate descriptive and inferential statistics.

4. FINDINGS OF THE STUDY

4.1. Demographic background of the respondents

4.1.1. Category of the respondents

The respondents were asked to indicate the category they belong. The study findings are illustrated in the table and graph below:

Table 2.

The category of respondents

Category	Number	Percentage
District leaders	15	11.9%
Community Leaders	20	15.8%
Community residents	91	72%
Total	126	100%

Source: Primary Data, May 2023

4.1.2. Age Bracket of the respondents

The respondents were asked to indicate their age bracket. The study findings are illustrated in the table below.

Table 3.

Age range of the respondents

NO	Age group	Frequency	Percent	Valid Percent	Cumulative Percent
1	18-25	46	36.4	36.4	36.4

2	26-33	44	35	35	71.4
3	34-41	14	11.1	11.1	82.5
4	42-49	08	6.4	6.4	88.9
5	50-57	08	6.4	6.4	95.3
6	58 & above	06	4.7	4.7	100.0
	TOTAL	**126**	**100.0**	**100.0**	

Source: Primary Data, May 2023

The study findings indicated that 36.4% of the respondents were 18-25 years, 35% were 26-33years, 11.1% were 34-41, 6.4% were 42-49, 6.4% were 50-57 and 4.7% were over 58 and above years old. This indicates that respondents were mature enough to answer questions in the questionnaires**.**

4.1.3. Educational background of the respondents

Under table 4, below the study shows the level of education of different categories of respondents who participated in the study.

Table 4.

The education level of respondents

NO	Education level	Frequency	Percent	Valid	Cumulative Percent
1	Diploma	08	6.4	6.4	6.4
2	Degree	82	65.1	65.1	71.5
3	Master	32	25.3	25.3	96.8
4	PhD	04	3.2	3.2	100.0
	TOTAL	126	100.0	100.0	

Source: Primary data, May 2023.

The above table 4 shows the academic level of the respondents. They respondents had different education levels of which according to the research, 82 (65.1%) of the respondents had completed university degree level, about 8 (6.4%) had diploma, 32(25.3%) had masters and at least 4 (3.2%) of the respondents had PhD. Therefore, the respondents in this research all went through education but at different levels.

4.2. Factors that determine flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia.

The quantitative results of the examination of the factors that determine flood vulnerability of riverine communities in responding to floods in Beledweyne district, Somalia are presented in table 5 below:

Table 5:

Factors that determine flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia.

NO	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
F1	Staying very close to the river increases community members' vulnerability to floods in the areas.	12 (9.5%)	17 (13.5%)	00 (0.0%)	87 (69.1)	10 (7.9%
F2	Staying near the estuary to flood increases community members' vulnerability to floods in the areas.	24 (19.1%)	03 (2.3%)	00 (00.0%)	75 (59.5%)	24 (19.1%)
F3	Staying near the high-water mark increases community members' vulnerability to flood in the areas.	17 (13.5%)	24 (19.1%)	00 (00.0%)	73 (57.9%)	12 (9.6%)
F4	Staying near the river defence walls increases community members' vulnerability to flood in the areas.	17 (13.5%)	12 (9.5%)	00 (00.0%)	73 (57.9%)	24 (19.1%)
F5	Staying near the basin bridge with poor condition increases the community members' vulnerability to the flood in the areas.	05 (3.9%)	12 (9.5%)	00 (0.00%)	97 (76.9%)	12 (9.5%)
F6	Staying near high flood risks increases community members' vulnerability to the flood in the areas.	16 (12.7%)	13 (10.3%)	00 (00.0%)	73 (57.9%)	24 (19.1%)
F7	Staying near the areas with a history of basin erosion increases members' vulnerability to floods in the areas.	24 (19.1%)	05 (3.9%)	00 (0.00%)	73 (57.9%)	24 (19.1%)
F8	Staying near wetland increases community members' vulnerability to flood in the areas.	12 (9.5%)	24 (19.1%)	00 (0.00%)	73 (57.9%)	17 (13.5%)

F9	Staying near the dynamic basin features along the bank in the increase's community members' vulnerability to flood in the areas.	16 (12.7%)	20 (15.9%)	00 (0.00%)	69 (54.7%)	21 (16.7%)

Source: Primary Data, May 2023.

From the table above table 5 above, 87 (69.1%) respondents agreed and 10 (7.9%) strongly agreed that the staying very close to the river increases community members' vulnerability to floods in the areas, 75 (59.5%) respondents agree and 24 (19.1%) strongly agreed that staying near the estuary to flood increases community members' vulnerability to floods in the areas, 73 (57.9%) respondents agreed and 12 (9.6%) respondents strongly agreed that staying near the high water mark increases community members' vulnerability to flood in the areas, 73 (57.9%) respondents agreed and 24 (19.61%) strongly agreed that staying near the river defense walls increases community members' vulnerability to flood in the areas, 97 (76.9%) respondents agreed and 12 (9.6%) strongly agreed that there that staying near the basin bridge with poor condition increases the community members' vulnerability to the flood in the areas, 73 (57.9%) respondents agreed and 24 (19.1%) strongly agreed that staying near high flood risks increases community members' vulnerability to the flood in the areas, 73 (57.9%) respondents agreed and 24 (19.1%) strongly agreed that staying near the areas with a history of basin erosion increases members' vulnerability to floods in the areas, 73 (57.9%) respondents agreed and 17 (13.5%) strongly agreed that staying near wetland increases community members' vulnerability to flood in the areas and lastly, 69 (54.7%) respondents agreed and 21 (16.7%) respondents strongly agreed that there is presence of of dynamic basin features along the bank in the riverine communities.

4.3. The indicators of adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia.

The quantitative assessment of the indicators of adaptive capacity of riverine communities in responding to floods in Beledweyne is presented in table 6.2 below:

Table 6:

The indicators of adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia

NO	Statement	Very High	High	Medium	Low	Very Low
I1	There are emergency and preparedness plan and resources that increase the level of adaptive capacity of riverine communities in the flood prone areas.	14 (11.1%)	30 (23.8%)	05 (3.9%)	65 (51.6%)	12 (9.5%)
I2	There is improvement of livelihoods and rural economy in the flood prone areas that increases the level of adaptive capacity of riverine communities.	22 (17.5%)	05 (3.9%)	00 (0.00%)	82 (65.1%)	17 (13.5%)
I3	There is improvement of the condition of basin resources in the flood prone areas that increases the level of	05 (3.9%)	08 (6.4%)	03 (2.4%)	75 (59.5%)	35 (27.8%)

	adaptive capacity of riverine communities in the flood prone areas.					
I4	There is land use decision and planning taking place in the flood prone areas to that increases the level of adaptive capacity of riverine communities in the flood prone areas.	08 (6.4%)	08 (6.4%)	00 (0.00%)	87 (69.1%)	23 (18.3%)
I5	There is attention to the need of marginalized groups in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas.	15 (11.9%)	15 (11.9%)	00 (0.00%)	78 (61.9%)	18 (14.4%)
I6	There is public awareness of local conditions such as erosion, shifting or river course delta in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas.	18 (12.6%)	19 (15.1%)	00 (0.00%)	75 (59.5%)	14 (11.2%)
I7	There is effective leadership through local mobilisation in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas.	16 (13.5%)	17 (13.4%)	05 (3.96%)	62 (49.2%)	26 (20.6%)
I8	There are effective security, law and order in the flood prone areas that increase the level of adaptive capacity of riverine communities in the flood's prone areas.	20 (15.8%)	22 (17.5%)	08 (6.4%)	70 (55.6%)	6 (4.7%)

Source: Primary Data, May, 2023.

From the table 6 above, 65 (51.6%) respondents agreed that there is low level of emergency and preparedness plan and resources that increase the level of adaptive capacity of riverine communities in the flood prone areas and 12 (9.5%) agreed that there is very low level of emergency and preparedness plan and resources that increase the level of adaptive capacity of riverine communities in the flood prone areas, 82 (65.1%) of the respondents agreed that there is level of low improvement of livelihoods and rural economy in the flood prone areas that increases the level of adaptive capacity of riverine communities and 17 (13.5%) agreed that there is very low improvement of livelihoods and rural economy in the flood prone areas that increases the level of adaptive capacity of riverine communities, 75 (59.5%) respondents agreed that there is low level of improvement of the condition of basin resources in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas and 35 (27.8%) of the respondents agreed that there is very low level of improvement of the condition of basin resources in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas, 87 (69.1%) of the respondents agreed that there is low level of land use decision and planning taking place in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas. Furthermore 23 (18.3%) respondents agreed that there is very low

level of land use decision and planning taking place in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas, 78 (61.29%) respondents agreed that there is low level of attention to the need of marginalized groups in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas and 18 (14.4%) agreed that is very low level of attention to the need of marginalized groups in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas, 75 (59.5%) respondents agreed that there is low level of public awareness of local conditions such as erosion, shifting or river course delta in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas and 14 (11.2%) respondents agreed that there is very low level of public awareness of local conditions such as erosion, shifting or river course delta in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas, 62 (49.2%) respondents agreed that there is low level of effective leadership through local mobilisation in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas and 26 (20.6%) agreed that there is very low level of effective leadership through local mobilisation in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas and lastly 70 (55.6%) respondents agreed that there is low level of effective security, law and order in the flood prone areas that increase the level of adaptive capacity of riverine communities in the floods prone areas and 6 (4.7%) of the respondents agreed that there is very low level of effective security, law and order in the flood prone areas that increase the level of adaptive capacity of riverine communities in the floods prone areas.

4.4. The strategies for improving adaptive capacities to flood hazards by riverine communities of Beledweyne District, Somalia.

The quantitative results of the recommended strategies for improving adaptive capacities to flood hazards by riverine communities are presented in table 6.3 below:

Table 7:

The strategies for improving adaptive capacities to flood hazards by riverine communities of Beledweyne District, Somalia

NO	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
S1	Incorporation of climate and hazards elements into economic development programs in the flood prone areas improves the adaptive capacities to flood hazards by riverine communities.	13 (10.3%)	17 (13.5%)	00 (00.0%)	88 (69.8)	08 (6.4%)
S2	Continuous assessment of the sector and infrastructure vulnerability in the flood prone areas improves the adaptive capacities to flood hazards by riverine communities.	02 (1.6%)	03 (2.3%)	00 (00.0%)	97 (76.9%)	24 (19.3%)
S3	Executing early actions to	02	03	00	97	24

	increase economic resilience in livelihoods in the flood prone areas improves the adaptive capacities to flood hazards by riverine communities.	(1.6%)	(2.3%)	(00.0%)	(76.9%)	(19.3%)
S4	Assessment of the critical infrastructure (roads, bridges, utilities) in the flood prone areas improves the adaptive capacities to flood hazards by riverine communities.	11 (8.7%)	08 (6.4%)	00 (00.0%)	86 (68.2%)	21 (16.7%)
S5	Prevention of ad hoc basin defenses, favor non-structural solutions in in the flood prone areas improves the adaptive capacities to flood hazards by riverine communities.	14 (11.2%)	10 (7.9%)	00 (00.0%)	97 (76.9%)	05 (3.9%)
S6	Preparation and implementation of effective early warning messages that reach marginalized groups of people in the flood prone areas improve the adaptive capacities to flood hazards by riverine communities	10 (7.9%)	10 (7.9%)	10 (7.9%)	70 (55.7%)	26 (20.6%)
S7	Developing and implementation of evacuation and recovery plans that meet the needs of children, elderly and the sick people in the flood prone areas improve the adaptive capacities to flood hazards by riverine communities.	28 (22.3%)	10 (7.9%)	10 (7.9%)	62 (49.2%)	16 (12.7%)
S8	Executing early actions to increase economic resilience of poor people through diversified livelihood opportunities, especially for women, elderly people, people with disabilities and many others in the flood prone areas improve the adaptive capacities to flood hazards by riverine communities.	22 (12.7%)	14 (11.2%)	08 (6.4%)	70 (55.6%)	12 (9.5%)
S9	Adaptation of policies that recognize basin features and discourage construction in hazardous zones in the in the flood prone areas improve the	11 (8.7%)	11 (8.7%)	09 (7.2%)	84 (66.7%)	11 (8.7%)

	adaptive capacities to flood hazards by riverine communities.					
S10	Setting priority uses matched to sensitivity of basin areas in the flood prone areas improve the adaptive capacities to flood hazards by riverine communities.	10 (9.6%)	11 (8.7%)	06 (4.7%)	84 (66.7%)	05 (3.9%)
S11	Organizing district wide awareness and education coupled with settlement or ecosystem specific vulnerability assessments and adaptation plans in the flood prone areas improve the adaptive capacities to flood hazards by riverine communities.	05 (3.9%)	06 (4.7%)	14 (11.2%)	80 (63.5%)	21 (16.7%)
S12	Providing training for engineers, architects, planners and contractors on hazardous sites and best planning, design and construction practices in in the flood prone areas improve the adaptive capacities to flood hazards by riverine communities.	08 (6.4%)	07 (5.6%)	07 (5.6%)	95 (75%)	09 (7.2%)
S13	Organizing vulnerability assessments and adaption plans for selected communities in the flood prone areas improve the adaptive capacities to flood hazards by riverine communities.	05 (3.9%)	07 (5.6%)	04 (3.8%)	100 (82.7%)	10 (7.9%)
S14	Creating dialogue platforms to facilitate engagement between community people and their leaders on issues of common interest in the flood prone areas improve the adaptive capacities to flood hazards by riverine communities.	06 (4.8%)	05 (3.9%)	10 (7.9%)	98 (77.8%)	07 (5.6%)
S15	Developing and implementing programs to build trust, improve communications and relationships between the local government and frontline communities in the flood prone	06 (4.8%)	08 (6.4%)	00 (00.0%)	104 (82.5%)	08 (6.4%)

areas improve the adaptive capacities to flood hazards by riverine communities.	

Source: Primary Data, May 2023.

From the table 7 above, 88 (69.8) respondents agreed and 08 (6.4%) strongly agreed incorporation of climate and hazards elements into economic development programs in the flood prone areas improves the adaptive capacities to flood hazards by riverine communities in Beledweyne District, Somalia, 97 (76.9%) respondents agreed and 24 (19.3%) respondents strongly agreed that continuous assessment of the sector and infrastructure vulnerability in the riverine communities in improves the adaptive capacities to flood hazards by riverine communities , 97 (76.9%) respondents agreed and 24 (19.3%) strongly agreed that executing early actions to increase economic resilience in livelihoods improves the adaptive capacities to flood hazards by riverine communities, 86 (68.2%) respondents agreed and 21 (16.7%) strongly agreed that assessment of the critical infrastructure (roads, bridges, utilities) improves the adaptive capacities to flood hazards by riverine communities, 97 (76.9%) respondents agreed and 5 (3.9%) strongly agreed that prevention of ad hoc basin defences, favour non-structural solutions improves the adaptive capacities to flood hazards by riverine communities, 70 (55.7%) respondents agreed and 26 (20.36%) respondents strongly agreed that preparation and implementation of effective early warning messages that reach marginalized groups of people can improve the adaptive capacities to flood hazards by riverine communities.

5. DISCUSSION OF THE FINDINGS

The findings on the factors determining flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia clearly indicate that over 60% of the respondents agreed that there are many factors that determine flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia**.** The findings revealed that there are many factors that determine flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia based on the findings in the previous chapter, the study discovered that the majority of the respondents 87 (69.1) respondents agreed that staying very close to the river increases community members' vulnerability to floods in the areas, as noted in the problem statement by (OCHA, 2018), that floods are vastly common in areas which are located near the river bank in Somalia. River flooding has affected 630,000 people, with more than 214,800 displaced persons as of 2018 data and further estimates also shows that about 772,500 people and 229,000 are displaced annually due to floods in Somalia. Furthermore, majority of the respondents 73 (57.9%) respondents agreed that staying near high flood risks increases community members' vulnerability to the flood in the areas.

The findings on the indicators of adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia revealed that majority of the respondents 65 (51.6%) respondents agreed that there is low level of emergency and preparedness plan and resources that increase the level of adaptive capacity of riverine communities in the flood prone areas, 82 (65.1%) of the respondents agreed that there is level of low improvement of livelihoods and rural economy in the flood prone areas that increases the level of adaptive capacity of riverine communities , 75 (59.5%) respondents agreed that there is low level of improvement of the condition of basin resources in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas , 87 (69.1%) of the respondents agreed that there is low level of land use decision and planning taking place in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas, 78 (61.29%) respondents agreed that there is low level of attention to the need of marginalized groups in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas, 75 (59.5%) respondents agreed that there is low level of public awareness of local conditions such as erosion, shifting or river course delta in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas, 62 (49.2%) respondents agreed that there is low level of effective leadership through local mobilisation in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas and lastly 70 (55.6%) respondents agreed that there is low level of effective security, law and order in the flood prone areas that increase the level of adaptive capacity of riverine communities in the floods prone areas and 70 (55.6%) of the respondents agreed that there is very low level of effective security, law and order in the flood prone areas that increase the level of adaptive capacity of riverine communities in the floods prone areas.

The findings on the strategies for improving adaptive capacities to flood hazards by riverine communities of Beledweyne District, Somalia revealed that majority of the respondents 97 (76.9%) respondents agreed that continuous assessment of the sector and infrastructure vulnerability in the riverine communities in Beledweyne district improves the adaptive capacities to flood hazards by riverine communities, 97 (76.9%) respondents agreed that executing early actions to increase economic resilience in livelihoods improves the adaptive capacities to flood hazards by riverine communities in Beledweyne District, 86 (68.2%) respondents agreed that assessment of the critical infrastructure (roads, bridges, utilities) improves the adaptive capacities to flood hazards by riverine communities in Beledweyne District, 97 (76.9%) agreed that prevention of ad hoc basin defences, favour non-structural solutions improves the adaptive capacities to flood hazards by riverine communities in

Beledweyne District, 70 (55.7%) agreed that preparation and implementation of effective early warning messages that reach marginalized groups of people can improve the adaptive capacities to flood hazards by riverine communities in Beledweyne district.

6. CONCLUSION

Based on the findings of the study, the study concluded the findings of the study on the factors that determine flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia clearly indicate that there are many factors that determine flood vulnerability of riverine communities in responding to floods in Beledweyne District, Somalia such as staying very close to the river increases community members' vulnerability to floods in the areas and staying near high flood risks increases community members' vulnerability to the flood in the areas.

The findings of the study on the indicators of adaptive capacity of riverine communities in responding to floods in Beledweyne District, Somalia indicate that the majority of the respondents agreed that there is low level of emergency and preparedness plan and resources that increase the level of adaptive capacity of riverine communities in the flood prone areas, there is level of low improvement of livelihoods and rural economy in the flood prone areas that increases the level of adaptive capacity of riverine communities , there is low level of improvement of the condition of basin resources in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas , there is low level of land use decision and planning taking place in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas, that there is low level of attention to the need of marginalized groups in the flood prone areas that increases the level of adaptive capacity of riverine communities in the flood prone areas and so forth.

Lastly, the findings of the study on the strategies for improving adaptive capacities to flood hazards by riverine communities of Beledweyne District, Somalia revealed that majority of the respondents agreed that continuous assessment of the sector and infrastructure vulnerability in the riverine communities in Beledweyne district improves the adaptive capacities to flood hazards by riverine communities, respondents agreed that executing early actions to increase economic resilience in livelihoods improves the adaptive capacities to flood hazards by riverine communities in Beledweyne District, respondents agreed that assessment of the critical infrastructure (roads, bridges, utilities) improves the adaptive capacities to flood hazards by riverine communities in Beledweyne District, respondents agreed that prevention of ad hoc basin defences, favour non-structural solutions improves the adaptive capacities to flood hazards by

riverine communities in Beledweyne District, respondents agreed that preparation and implementation of effective early warning messages that reach marginalized groups of people can improve the adaptive capacities to flood hazards by riverine communities in Beledweyne district.

7. RECOMMENDATIONS

The various recommendations derived from the findings of the study encompass the following:

Preparation of medium-term development and spatial plans. The district leaders should be proper preparation of medium-term development and spatial plans in Beledweyne district-wide covering basin or bank resources, wetlands and river protection and development in hazardous areas in the next round of structure plan and mid-term development plans.

Preparation of proper local plans. The district authority or leaders in collaboration with the national leaders should prepare proper local plans for riverine communities being affected by floods in order to generate additional understanding and appropriate responses to the physical impacts of erosion, flooding and physical hazards which may increase due to climate change impacts as well as address ways to increase resilience, using participatory techniques enhanced with technical information and studies where possible.

Early issuing of flood warning. There should be issuing of flood early warning by the National Disaster Management Authority of Somalia in collaboration with Beledweyne district environmental management authority through timely gathering of information on rainfall forecast for the area and in conjunction with local radio stations, disseminate flood warning information in advance to communities vulnerable to flood risks.

Continuous assessment of the community level of vulnerability. There should be continuous assessment of the community level of vulnerability and adaptation prepared strategy to demonstrate low cost, low technology methods for vulnerability assessment and adaptation planning; share experiences and best practices across communities with district government and find local champions for hazard and climate change adaptation actions.

Public awareness on local conditions in the district. There should be organisation of public awareness of local conditions in the district through carrying out district wide awareness and education coupled with settlement or ecosystem specific vulnerability assessments and adaptation plans; training for engineers, architects, planners and contractors on hazardous

sites and best planning, design and construction practices, vulnerability assessments and adaption plans for selected communities.

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