

STRENGTHENING THE CONTRIBUTION OF LOCAL ACTORS FOR A CLIMATE RESILIENT SOCIETY IN ZANZIBAR

BASELINE REPORT



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Climate Action Network Tanzania, (2023); *Baseline study and Knowledge, Attitudes and Practice (KAP) on climate change and the contribution of climate services for a climate-resilient society in Chuni Shehia, Zanzibar*



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Acknowledgement

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Executive Summary

Zanzibar islands have complex and dynamic systems in terms of both human activity and biophysical conditions with a substantial proportion of the national population and support several community livelihood options. Unfortunately, in Zanzibar, the economy, and the livelihood sectors are under threat from climate change due to being climate sensitive with high levels of vulnerability and face environmental degradation. Chuini Shehia found in Zanzibar's West A district is no exception to this. This comprehensive baseline study was conducted in Chuini, a pilot Shehia, as an integral part of the project's implementation. The study aimed to collect, analyze, and report information related to project objectives and indicators as a benchmark to inform project interventions. Furthermore, this study intends to provide a thorough understanding of the context of the climate change era concerning the aspects targeted by this project. These aspects include livelihood activities, climate knowledge, attitude, and practice, as well as need and access to weather and climate services, gender equity and equality, knowledge, decision-making, plans, agenda, and strategies in place with the general practices and linkages.

Key Findings:

The study found that people engage in a variety of livelihood activities specifically to get income and food to cater for their households' basic needs. A good percentage of livelihood activities found in the study area are climate-sensitive, and hence face threats from changing climate and its challenges, thereby increasing their susceptibility. Subsistence farming, artisanal fishing, animal husbandry, and petty business, are among the key activities together with non-agricultural salary activities, short-term labor/workers, pension, and remittances. Subsistence farming and fishing, as well as petty business, are the common and integrated livelihoods in the study area. The study also discovered an increase in women's engagement in undertaking and participating in household livelihoods. For climate-sensitive livelihoods which are subsistence farming, artisanal fishing, and animal husbandry have experienced a trend in decrease in productivity or fluctuations in productivity as a result of many factors among which is climate change. In contrast, livelihoods that are least directly climate sensitive such as non-agricultural salary activities, pension, and remittance had the least changes in 5 years, meanwhile petty business showed diverse changes from decreasing, fluctuating, and smaller percentages reporting an increase. The overall performance of other livelihoods directly impacts the socio-economic conditions in the community affecting trades thus petty business and even contributing to a decrease in job opportunities for casual/short-term laborers.

Concerning the awareness of climate change, respondents showed inadequate awareness though the effects have posed significant challenges to smallholder's livelihoods, leading to a vicious cycle of poverty while expanding vulnerable groups in the study area. The unpredictability of rain onset rain cessation, prolonged droughts, coastal erosion from sea level rise, inundation of low-lying agricultural lands, saltwater intrusion in freshwater aquifers, increasing sea surface temperatures, sea storms, and flooding were frequently reported as major climatic challenges affecting Chuini Shehia.

There are different coping mechanisms implemented in the community across the different livelihoods. In agriculture, the major mechanism included adopting irrigation, use of pesticides, and the following expert suggestions in the use of drought-resilient seeds. Meanwhile, in animal husbandry and fishing, there has been the least adaptation except for shifting to alternative livelihood options mostly being petty business and agriculture together with waiting for calm weather to go fishing. The community response to floods consists of migration to other areas together with staying on rooftops to give way to floods. The adequacy and comprehensiveness of adaptation are still low, not coordinated, and effective in the long term.

In terms of the availability, and utilization of weather and climate information and services, the study discovered that the majority of respondents primarily rely on information from TMA, with fewer relying on traditional forecasters. Weather information from traditional forecasters, which is recognized as Indigenous knowledge (IK), has been ignored in the study area due to its association with witchcraft belief and enhanced technology has improved the preference for scientific weather information including early warning.

In terms of access, TMA-generated and disseminated weather and information services were received by respondents in the study communities via Television (TV), radio, newspapers social gatherings, and word of mouth. Nevertheless, because of the rural character of the setting, some of the community members have no or limited access to services.

Recommendations:

Based on the study findings and the specific objective of the project, it is of great relevance to continue strengthening the community's knowledge and capacity for enhanced resilience during the climate change era. The study recommends a multi-stakeholder approach to address climate change in Zanzibar whereby.

Ministries, Departments, and Agencies, the Revolutionary Government of Zanzibar (RGoZ) are to invest in Tanzania's meteorological authority to improve data collection and interpretation and promote institutional capacity for climate change coordination mainstreamed mechanisms in all strategic sectors including non-state actors for resilience society in Zanzibar. Furthermore, the government to establish frameworks for evaluating areas affected by climate change, involving all stakeholders in the process.

Secondly, the integration of scientific weather forecasts and traditional weather forecasts should be put into consideration to enable the downscaling of weather forecasts, making them more useful, accurate, and reliable for enhanced climate resilience. The study also recommends that TMA cooperates with local government authorities and community members (traditional weather forecasts) to undertake the integration process at the district level, where development plans and budgets are prepared to inform the regional and national decision-making processes.

Local Government Authorities are advised to enhance the capacity of district and ward extension officers to support smallholders in interpreting weather and climatic information. The local government should also safeguard traditional weather forecasting knowledge and facilitate clear data flow between the community and district-level leadership. Measures should be taken to perpetuate this knowledge and counteract negative impressions associated with Indigenous Knowledge (IK).

Lastly, for the Chuini community and its stakeholders, the study recommends the development of a comprehensive, community-led adaptation plan to build resilience against the effects of climate change. This involves a participatory assessment of climate and disaster risks, in collaboration with civil society organizations. In all these strategies, mainstreaming gender in climate change policies and programs is emphasized to ensure the integration of women's issues, needs, and contributions.

Methodology and Data Collection

Different data collection and analysis methodologies were applied to capture all required information fulfilling the requirements of the study objectives. Both primary and secondary information were collected. For the secondary data, in-depth documentary reviews for the districts on related topics were done to inform the understanding of the situation. For the primary data and information, interviews were conducted with 115 heads of households, Key Informant Interviews (KII) to the people in Shehia of Chuini and district technical officers, 2 Focus Group Discussions (FGDs), and physical observation. The data management tools were the Statistical Package for Social Sciences (IBM

SPSS 24) and Excel for analysis while for qualitative data analysis, conceptualization, reflections, reflexivity, examining relationships of issues, and authentication of conclusions were made for an informed baseline report.

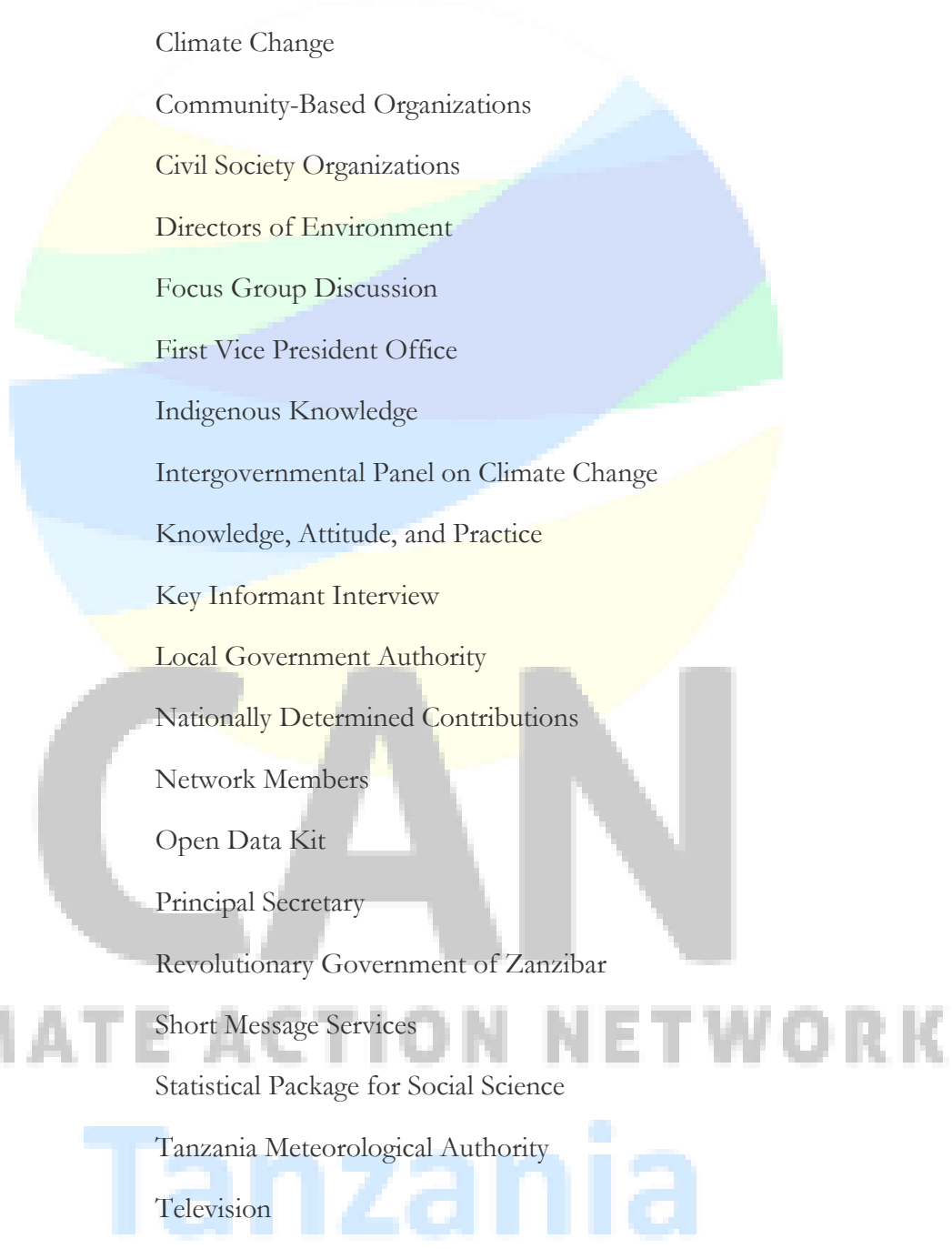


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Abbreviation

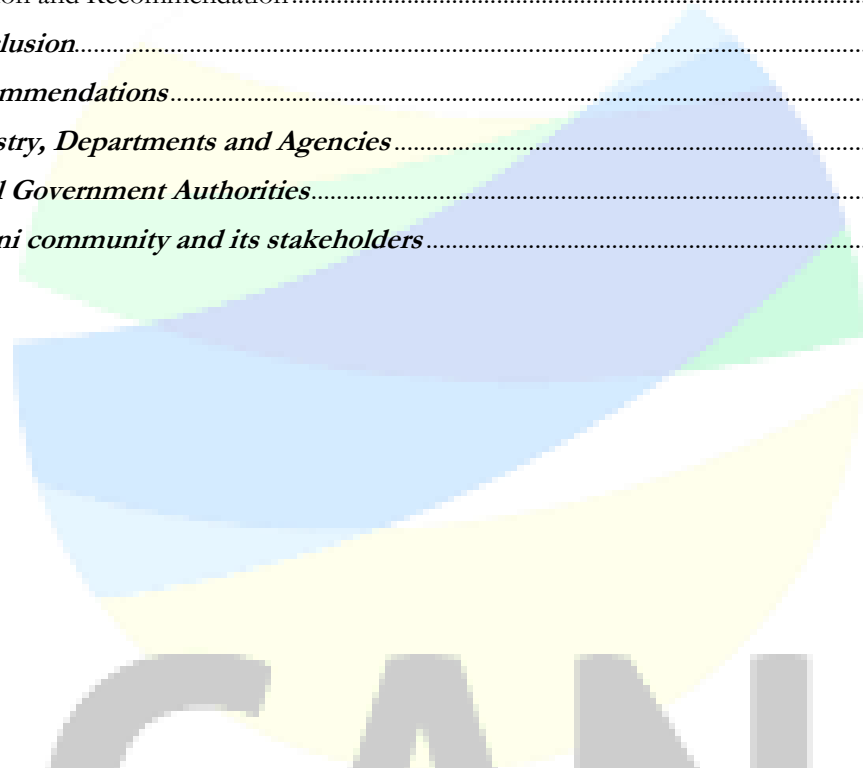


BftW	Bread for the World
CANTZ	Climate Action Network Tanzania
CC	Climate Change
CBOs	Community-Based Organizations
CSOs	Civil Society Organizations
DoE	Directors of Environment
FGD	Focus Group Discussion
FVPO	First Vice President Office
IK	Indigenous Knowledge
IPCC	Intergovernmental Panel on Climate Change
KAP	Knowledge, Attitude, and Practice
KII	Key Informant Interview
LGA	Local Government Authority
NDCs	Nationally Determined Contributions
NMs	Network Members
ODK	Open Data Kit
PS	Principal Secretary
RGoZ	Revolutionary Government of Zanzibar
SMS	Short Message Services
SPSS	Statistical Package for Social Science
TMA	Tanzania Meteorological Authority
TV	Television
UNFCCC	United Nations Framework Convention on Climate Change
URT	United Republic of Tanzania

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CHAPTER 1

1.0 Introduction

1.1. Background

The coastal areas and related ecosystems support several communities and their livelihoods. However, in recent decades, coastal areas found in the global south, are increasingly becoming impacted by climate change posing challenges to sustainable livelihoods and economic development. Future climate projections and impact models, show an increase in intensity and frequency of climate change impacts which will continue to hamper coastal community livelihoods, food security and access to essential services such as water and energy (IPCC, 2018;2019). Already climate change is leading to higher temperatures, irregular precipitation patterns, and more climate extreme events such as droughts and floods.

The coasts of East Africa and Tanzania is increasingly facing climate change challenges including rising temperatures, coral breaching, prolonged dry spells and droughts, invasive species, peculiarly heavy rains, and severe sea level rise. ND-Gain country Index ranks Tanzania as the 45 most vulnerable country and 151st most ready country¹ calling for more investment in enhancing resilience. Climate change threats are already visible in all socioeconomic sectors critical to Tanzania's livelihood and sustenance, including water resources, energy generation, food security, ecosystems and biodiversity, and human health (URT, 2021). Climate change has created a direct threat to people's existence in the most vulnerable communities (Mwanga S. et al., 2019), and has increased the risks of water scarcity, heat stress, biodiversity loss, food insecurity, and flooding.

Zanzibar archipelagos have complex and dynamic systems in terms of both human activity and biophysical conditions. They carry a substantial proportion of the national population and support several community livelihood options. Unfortunately, in Zanzibar, the economy, and the livelihood sectors of 87% of the population are climate sensitive with high level of vulnerability (especially agriculture, freshwater, settlement, fisheries, and tourism) and face environmental degradation. These linked challenges include droughts, storms, temperature rise, strong wind speed, floods, saltwater intrusion, coastal erosion and displacement, mangrove deforestation and more. These challenges are

¹ <https://gain-new.crc.nd.edu/country/tanzania#readiness>

resulting to significant economic costs, loss of life, poverty, and other human capital which compromise food and water security for most local communities.

Furthermore, increase in sea surface temperature, particularly in shallow water, are causing bleaching of Zanzibar's coral reefs and a decline in fish recruitment as well as seaweed production, a major source of livelihood for most people and women. Seaweed production and coastal tourism provide livelihoods and employment for thousands of women. In fact, the Zanzibar Strategy on Gender, and Climate Change reports that women, marginalized and poor communities are severely affected and vulnerable to climate change impacts and other natural disasters because of 1) their limited awareness on climate change issues, 2) poverty levels that limits their adaptative capacities 3) social roles attached to rural women. The above groups tend to be underrepresented in the development of climate change, climate finance and more important in discussions and decisions on strengthening adaptation options and climate resilient building. Yet, these groups possess unique and local specific skills and experiences important for conserving the environment and climate change adaptation. Their voices and potential should be empowered and amplified.

Nordic Development Fund (2014) adds that, climate change poses additional challenges for Zanzibar's fisheries among other important sectors, including: rising sea water temperatures, which cause biodiversity changes such as extinction, migration, or invasion of species, and make low-lying communities, infrastructure, and mooring areas vulnerable to damage, and increase coastal erosion and flooding. In short, lives, livelihoods, culture, and social cohesion of communities are likely to continue being jeopardized if communities are not supported in their efforts to keep their human-ecological systems stable (Mwanga et al, 2019).

Climate-smart and resilient development pathways have been shown to offer enormous investment opportunities worldwide, including in African countries like Tanzania, with a triple dividend of avoided losses, positive economic gains, and enhanced social and environmental benefits (Global Centre on Adaptation, 2023). Climatic services, which provide vital climatic data, information, counsel, and hands-on experience for enhanced decision-making and action while planning and executing livelihoods, are one of the recommended adaptation options for the majority of smallholders (fishers, farmers, and pastoralists).

Through its engagement with state and non-state actors in Zanzibar during the review and updates of the Nationally Determined Contribution (NDC) in 2021, CAN Tanzania learned that the level of knowledge on climate change among communities and other stakeholders in Zanzibar is still inadequate, with noticed extreme climate change challenges, particularly for smallholders (farmers and fishers) whose livelihoods are susceptible to climate change. Following these concerns, and to support government actions on climate change, CAN Tanzania co-developed a project titled "Strengthening the Contribution of Local Actors for a Climate Resilient Society in Zanzibar." This comprehensive baseline study was conducted in Chuini, a pilot Shehia, as an integral part of the project's implementation.

The study aimed to collect, analyze, and report information related to project objectives and indicators as a benchmark to inform project interventions. Furthermore, this study intends to provide a thorough understanding of the context of the climate change era in relation to the aspects targeted by this project. These aspects include livelihood activities, climate knowledge, attitude, and practice, as well as need and access to weather and climate services, gender equity and equality, knowledge, decision-making, plans, agenda, and strategies in place with the general practices and linkages.

This aim has been translated into the below study objective.

- a) Assess the community's awareness/knowledge of the impacts of climate change affecting their livelihood activities.
- b) Assess the current Knowledge, Attitude, and Practice (KAP) of the community on livelihoods within the context of climate change impacts and adaptation.
- c) Assess the demands and reliability of climate services that shall inform decisions on planning and execution of the community's livelihoods.

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CHAPTER 2

2. Study Methodology

2.1. Study Site Description

2.1.1. Geographical Description

The Zanzibar archipelago consists of two major islands, Unguja and Pemba, and 53 small and remote islets. It shares maritime waters with Tanzania mainland, the other part of the United Republic of Tanzania. Zanzibar is 30 kilometers (about 18.64 mi) off the coast of Tanzania in the Indian Ocean, just south of the Equator. The islands have many distinguishing features and natural capitals. The coastal capital is the West region, and the historic center, Stone Town, is a World Heritage Site. The islands also have extensive coral reefs that surround much of the island's shoreline, as well as important forests and mangroves. Culturally, Zanzibaris are the people comprised of the "Ungujans," also known as "waUnguja," from Unguja Island of the Zanzibar Archipelago, and the "waPemba" people from Pemba Island.

Zanzibar West District is one of two districts in the Zanzibar Urban/West Region. The Zanzibar North Region borders it on the north, the Zanzibar Central/South Region on the east, Kiwani Bay on the south, and the Zanzibar Urban District on the west. West A district, and particularly Chuini Shehia in Zanzibar, a dominantly Muslim district with fewer migrant Christians and Pagans, is part of the Swahili culture.

2.1.2. Climate

This study was conducted in Zanzibar's West A district which has a tropical climate, with temperatures ranging from 20° to 40° Celsius with a humidity of 76.51%. It also has a bimodal rainfall pattern, with a long rainy season (referred to as Masika in Swahili) and a short wet season (referred to as Vuli in Swahili). The long rainy season lasts from March or April to May, while the short rainy season lasts from September or October to December. During the long-wet season, the district receives between 900 and 1200 mm of rain, and between 400 and 500 mm during the short rainy season. With such an annual rainfall pattern, the district is ideal for agricultural production activities and cattle rearing.

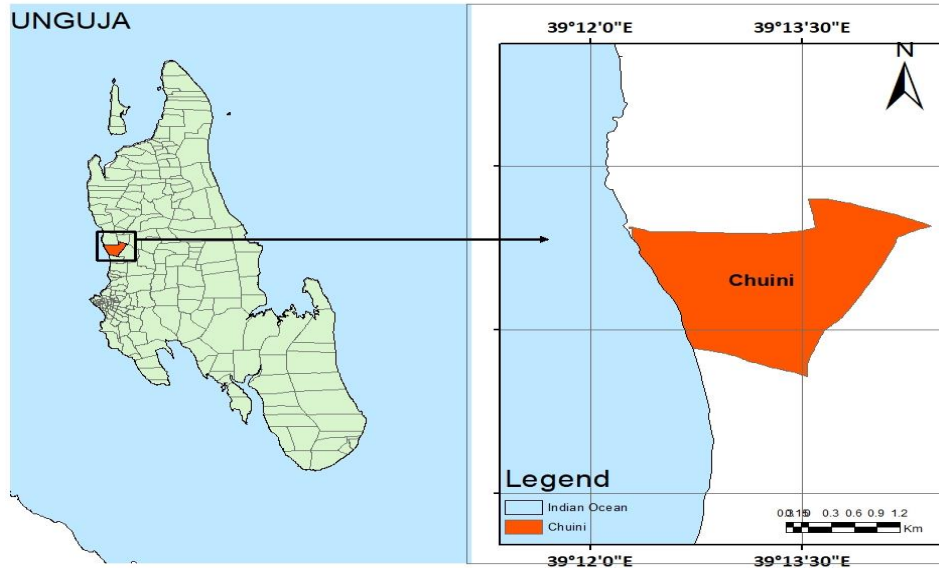


Figure 1. Location of the study site at Chuini Shehia, West A District, Zanzibar

This baseline survey was carried out in one (1) project Shehia, namely Chuini in Unguja's West A District. Chuini Shehia is one among 31 Shehia in the West A district of Zanzibar located on the west side of the island, with a population of 16,076 according to the National Census 2022 and covering 5.855 km². This Shehia has been selected based on the area being affected by climate change and its relevance to the project's subject matter of building climate resilience. Furthermore, the Shehia was selected based on the recommendations from key stakeholders such as CAN Tanzania -Network Members, CSOs, CBOs, DoE-FVPO, and the local LGAs.

The study had a sample size of 115 participants comprising community members, extension officers, and Non-Governmental Organizations/Civil Society Organizations (NGOs/CSOs) working within the Shehia.

2.2. Data Collection Methods and Tools

Different data collection and analysis methodologies and tools were applied to capture all required information, fulfilling the requirements of the study objectives and project implementation. Both primary and secondary information were collected. For the secondary data, in-depth document reviews for the districts and country at large on related topics were made to inform the understanding of the situation. Primary data and information were collected through a mixture of research

methodologies which are Key Informant Interviews (KII), Focus Groups Discussion (FGD), and household surveys.

2.2.1. In-Depth Document Review and Analysis

For the secondary data, an in-depth review of relevant documents was undertaken to inform the understanding of the situation around the coast and in the study sites. Data were collected from various sources including district offices, academia, and other online sources for recent studies within and beyond the study area.

2.2.2. Key Informant Interviews:

Key Informant Interviews were conducted to gain in-depth qualitative information and engage people with enough local information and communities. Participants consulted included Shehia and district technical officers and community leaders and old people with firsthand knowledge about community and climate change in the community. The team used an open data kit (ODK) an online tool to cover all the key questions that had been prior prepared based on the objectives and indicators of the study. The ODK tool helped to simplify the interview process by using smart phones and/or tablets linked with server through organizing questions and responses which were automatically synchronized with the server in the office.

2.2.3. Focus Group Discussions

A total of 2 groups with 8 to 10 participants each took part in the Focus Group Discussion from the study area in Chuini Shehia. Women, youth, and men and Shehia leaders representing different parts of the community, community group and religion took part in the FGDs. FGDs were led by printed guide questions on the topics that needed in-depth discussions and were complex or sensitive to be addressed and/or responded to by an individual. The discussions gave an opportunity to open up and share their perceptions, knowledge, attitudes and experiences on climate change and how culture, beliefs, gender interact with resource use and management, leading to climate vulnerability (Figure 2).

The FGDs were used to gather diverse and multi-faceted perspectives, options and understandings on different topics about the Shehia as per study objective.



Figure 2. The Focus Group Discussion in Chuini Shehia

2.2.4. Household Survey

In the household survey, to ensure a truly representative sample from the project beneficiaries, the survey listed down sub-Shehia that make up the Shehia. The number and names of these Sub-Shehia were confirmed by the council members during the Key Informant Interviews (KII). A random sampling of households was then applied to select community members for the interview together with identification of households that will require gender considerations such as having members with disability. To ensure that household members were not repeated during the interviews, each enumerator moved with one sub-Shehia leader. This approach ensured a diverse and representative sample that could provide comprehensive insights during the survey.



Figure 3. Household head interview at Shehia of Chuini in Zanzibar

2.2.5. Physical Observations

In addition to Key Informant Interviews, and Focus Group Discussions, the research team conducted physical observations on major issues under investigation including farming areas that have experienced saltwater intrusion, flooding and coastal erosion. Following the triangulation of the numerous sets of data acquired the study team gained further in-depth insight into the socio-cultural, behavioral, socio-economic, and ecological components of the real situation on the ground.

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Figure 4. Observed Severe coastal Erosion from Sea Level Rise

Table 1. Data source and collection

Methods	Data/information collected	Data source
Household surveys	Household specific information on Socioeconomic features; livelihood activities and climate change, weather, coping strategy, sources and accessibility of weather information, constraints; perceptions and reactions	Mixed participant
KII	Technical and community-based information on Household-specific information on Socioeconomic features; livelihood activities and climate change, weather, coping strategy, sources and accessibility of weather information, constraints; perceptions and reactions	Shehia and district technical officers, community leaders, and old people
FGDs	General community consequences, perception and options on Socioeconomic features; livelihood activities and climate change, weather, coping strategy, sources and accessibility of weather information, constraints; perceptions and reactions	2 groups
Literature review	Relevant information to inform the context and discuss the findings such as statistical data, weather information, findings from other similar studies for comparison, and many more.	Mixed information from different authors.

Physical Observation	Impact of climate change and adaptation measures	Various features observed
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2.3. Stakeholders' Inputs and Validation Workshop

As part of quality checks and quality assurance, a stakeholder validation workshop will be held to present preliminary findings and receive feedback on various aspects relevant to the study. The workshop also intended to reduce the possible biases, misinterpretations, and misunderstandings by the researchers. The validation workshop to invite representatives from study Shehia also will include included extension workers, local researchers, community members, Civil Society Organizations (CSOs), and media.

2.4. Data Analysis

The Statistical Package for Social Sciences (IBM SPSS 24) and Excel were used for analyzing the quantitative data collected. Through this software, several computations between variables were deployed through descriptive statistics and associations between variables that are likely to influence each other, while qualitative data obtained from interviews and FGDs were transcribed and organized into relevant themes based on the study aims.



CHAPTER 3

3.1. Findings

3.1.1. Household Characteristics

The Chuini community consists of Indigenous/elder, more established Swahili families and households who own land, speak Swahili, profess Islam, and follow an Islamic culture, and some immigrants mostly from Tanzania Mainland, who may have different religions, cultures, and languages. Being influenced by religion and culture, the Chuini community’s households are patriarchal communities practicing polygamous kinds of marriage.

The household sizes can be categorized as small (less than 3 people), medium (3 to 4 people), and large (5 people and above). Of the study participants, 72% of households have a large family, 23% have a medium family, and only 4% have a small family. The average household size in the sample is 6. A significant number of households have a size between 5 to 7, accounting for 45% of participants collectively. Furthermore, 96.33% of the participants have dependents, with the number of dependents per household being 1-2 (31.19%), 4-6 (49.54%), 7 and above (15.60%), and 3.60% of the interviewed households had no dependents. 76% of households are headed by married men while 23% of households are headed by women who were widows, divorced, or never married and 1% are headed by a boy(Figure 6)

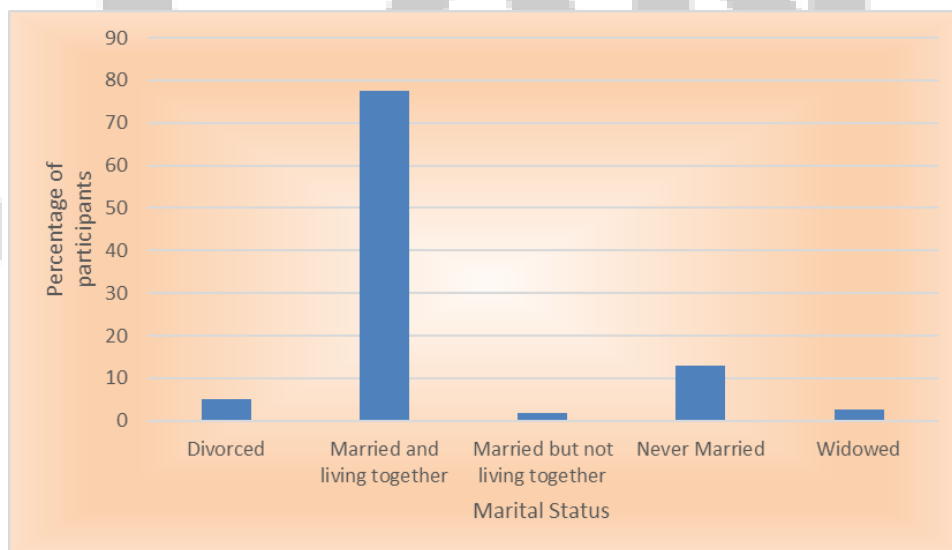


Figure 5: Households Marital Status

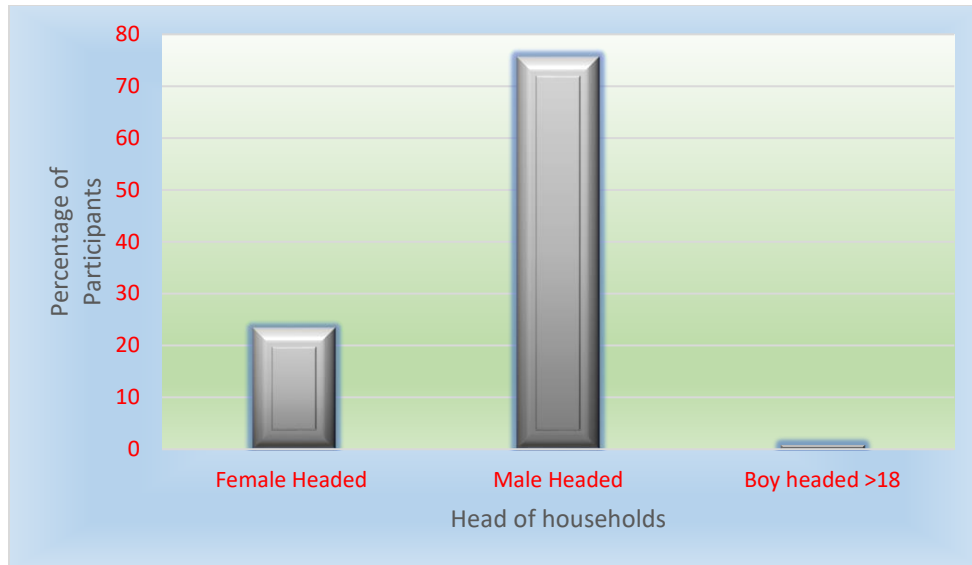


Figure 6: Household Heads

The education level of the participants where majorly primary education (37%) and secondary education(41%), with 12% having no formal education and a smaller number having university(8%) and tertiary education(2%)as seen in Figure 7 below.

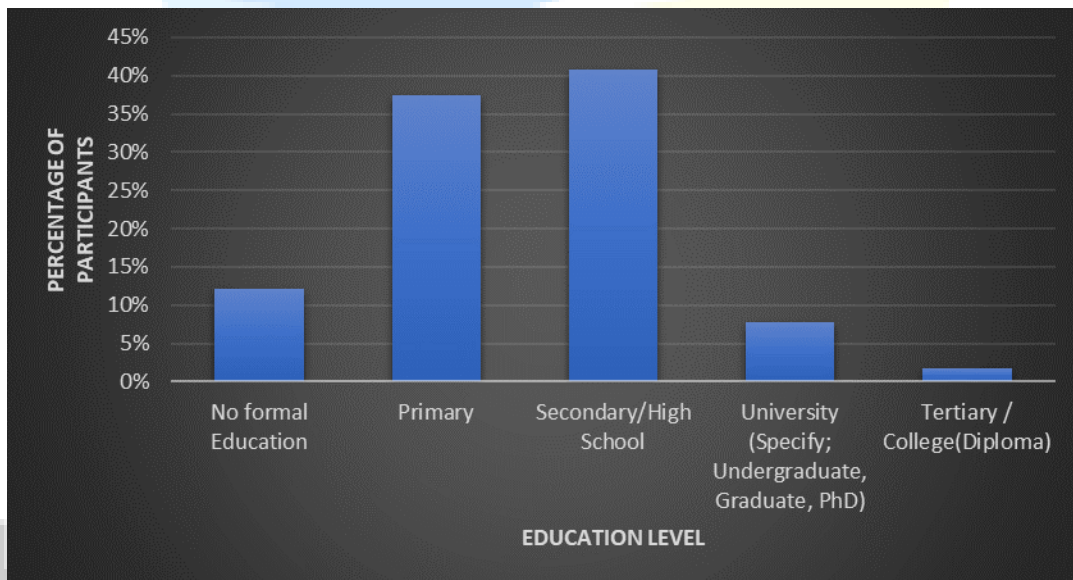


Figure 7: Education level of participants.

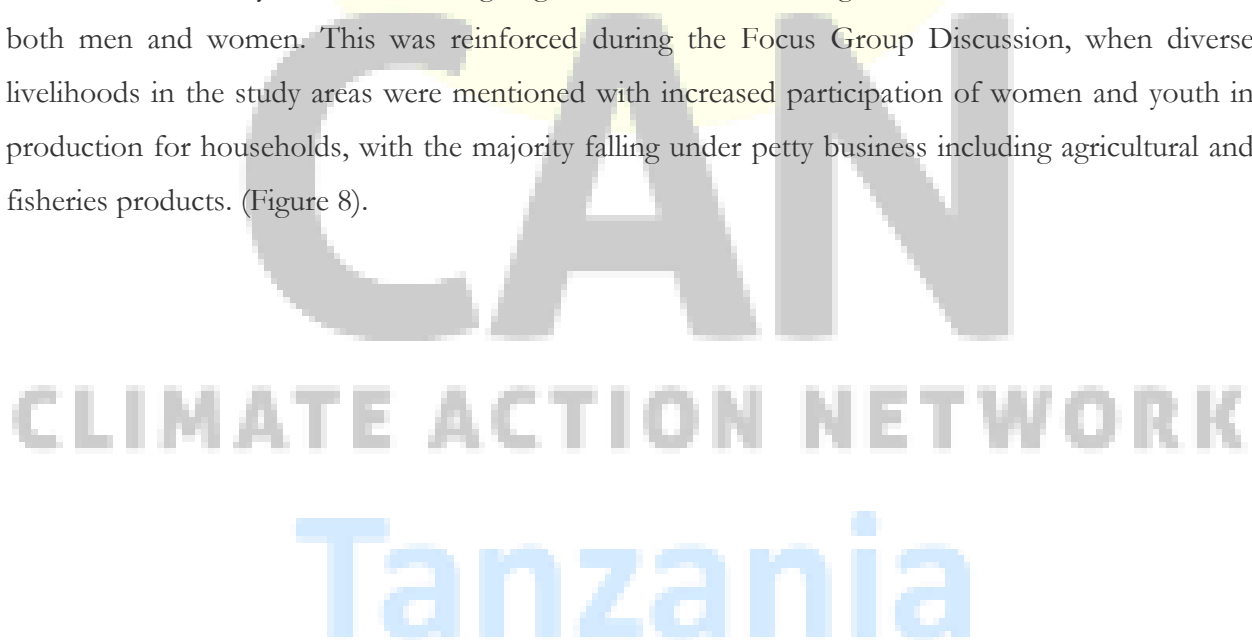
3.1.2. Socio-economic and Livelihoods Activities.

In this section, key socio-economic and livelihood activities, as well as their adaptation options will be discussed. According to the study, 30% of respondents are engaged in petty businesses such as tour guiding, shopkeeping, selling vegetables, and processing farm or sea products. Another 23% are

involved in subsistence farming, with a focus on growing vegetable crops like tomatoes, okra, eggplants, and cucumbers. The communities also grow food crops like cassava, sweet potatoes, rice, and bananas, but animal husbandry is not common, with only 2% practicing zero-grazing of dairy cows and open grazing of beef cows. 10% of respondents primarily engage in fishing mainly for sardines, while 11% integrate subsistence farming with other types of livelihoods. 12% earn their living through non-agricultural salary activities such as working in hotels and other formal employment, and 4% from short-term work such as casual labor. The remaining 9% receive either a pension or remittances from their family members.

A majority (89%) of interviewed households are engaged in only one type of livelihood, whether it be petty business, subsistence farming, fishery, animal husbandry, salaried work, remittances, pension, or short-term work. Households with a single livelihood are expected to be more vulnerable to climate change challenges compared to those with integrated livelihoods. A diverse livelihood allows individuals to cope with climate change challenges while also striving to recover, resulting in greater adaptability than a single livelihood alternative.

The activities derived from the focus group discussion show the relative distribution of livelihood activities in the study area, with an ongoing transition towards integration with other livelihoods for both men and women. This was reinforced during the Focus Group Discussion, when diverse livelihoods in the study areas were mentioned with increased participation of women and youth in production for households, with the majority falling under petty business including agricultural and fisheries products. (Figure 8).



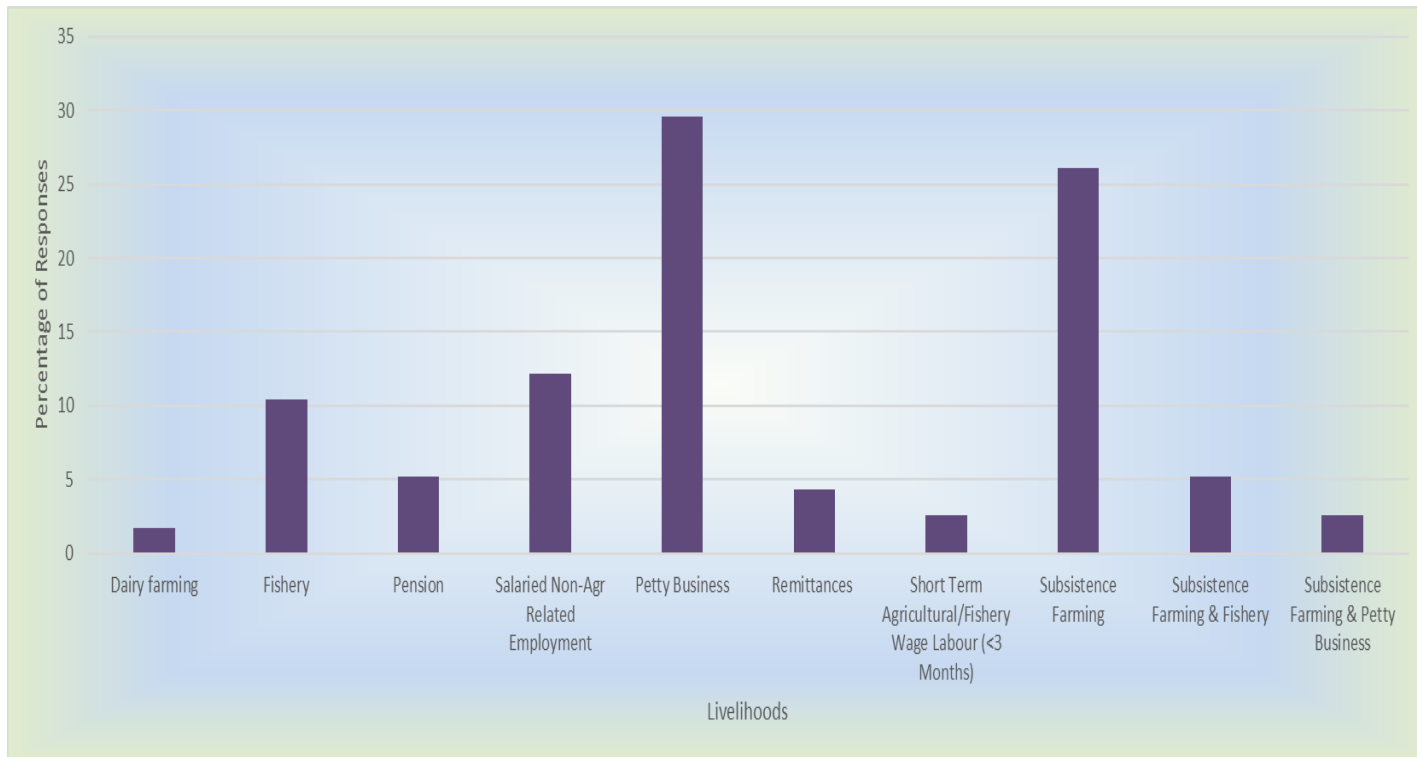


Figure 8. Proportion of livelihood activities in Chuini Shebia

3.1.3. Gender roles in socio-economic and livelihood activities

Within the socio-economic and livelihood activities there are different gender roles. Within the fishing sector, open sea fishing is mainly undertaken by men with women mostly working on inshore and species-specific fishing, processing, and selling of fisheries products. Meanwhile, petty businesses were observed to have insignificant gender sensitivity with both genders having nearly equal participation 40% and 41% in men and women ratios and 19% being done together (both men and women) respectively. Although men are more engaged in animal rearing accounting for 100% and in salaried employment accounting for 79%, Women (11%) and both (11%). With regards to the gender-oriented division of labor in agriculture, there is nearly equal participation with both genders being involved. The FGD highlighted men are more involved during field preparation and seed sowing while women and youth are more involved in weeding and harvesting. The gender-focused distribution within the various sectors is presented in Figure 9 below. The FGD participants reported an ongoing gradual community change where women and youth are taking more part in socio-economic and livelihood activities.

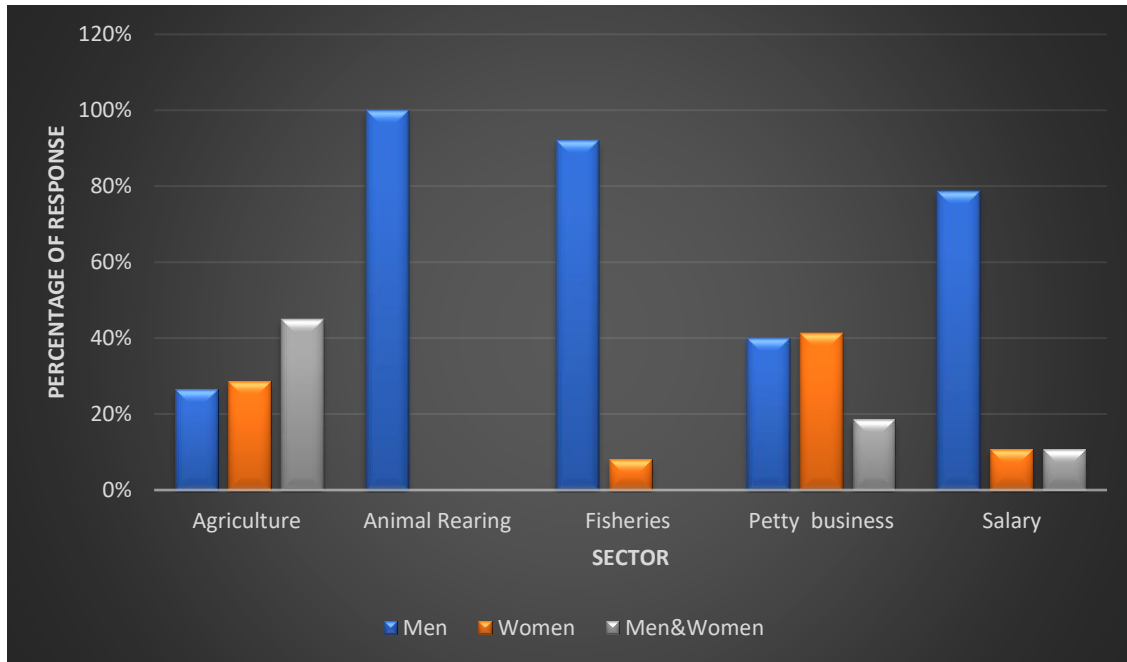


Figure 9. Gender-focused division of labor.

3.1.4. Selection of livelihoods and its performance trend in the span of 5 Years

This section seeks to explore the reasons influencing the selection or practice of the current livelihood activities together with the trend in their performance in the span of 5 years and the effect this trend had on them. The household survey reported the major drive for engaging in the livelihood currently practiced is to mainly to cater for income and food needs as Figure 10. From FGDs and key informant interviews, it has been responded that lack of capital has impeded their ability to engage in and access other viable livelihood options (affordability) while others own little resources that they inherited from their ancestors (fisheries, artists, and so on). Additionally, they reported diversity and changes in

farming, fishing, and animal-rearing practices in terms of end produce thus leading to less yield from farm fields as well as from the fish catches.

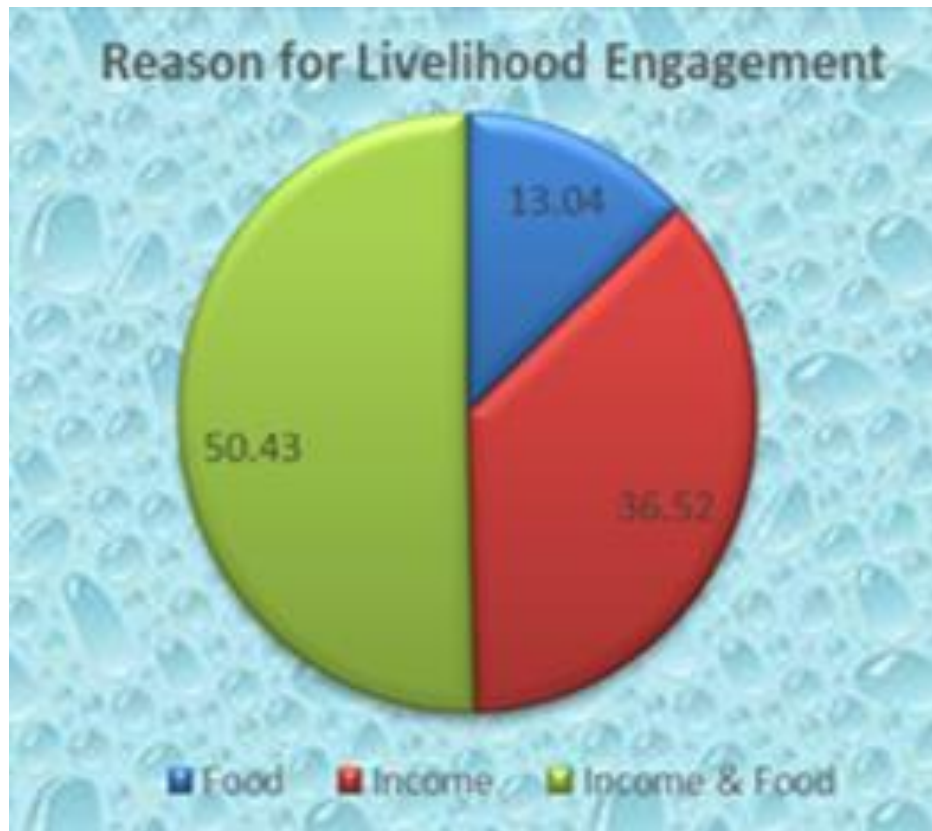


Figure 10. Reason for livelihood Engagement

Over the past five years, the trend of livelihood varied significantly in accordance to practiced livelihood as presented in Figure 11. For livelihood such as pension (pension (67%) and remittance (remittance (100%) had the highest percentage with no changes(difference), this was followed by Salaried Non-Agriculture Related Employment (36%). This can be attributed to their nature of being more reliable and not directly affected by climate change. For fishing, the trend has decreased (25%) and fluctuated with increase and decrease (75%) with a similar trend observed in Subsistence Farming & Cash Crop Farming and Subsistence Farming & Fishery both have 33% and 67% decreasing and fluctuating respectively for both livelihoods.

Although a different trend is observed in petty business and Subsistence farming having more diversity from those having decrease upto other having increased though in smaller amount as seen in Figure 11. A different trend is observed in animal husbandry, short term agricultural/fishery wage labour,

integrated subsistence farming, and petty business which have experienced decreasing trends. Lastly Salaried non-agriculture-related employment has no difference (36%) and increasing trend (43%) with fewer decreases (14%) and fluctuations (7%).

These findings were also complimented during Focus group discussions and Key Informant Interviews where participants reported a decline in livelihood activities specifically agricultural produce, and fish catches that led to price inflations in the study area. The factors behind these trends were identified to be multiple which are mostly climate change, market performance, limited farming land, and increasing price of commodities and inputs.

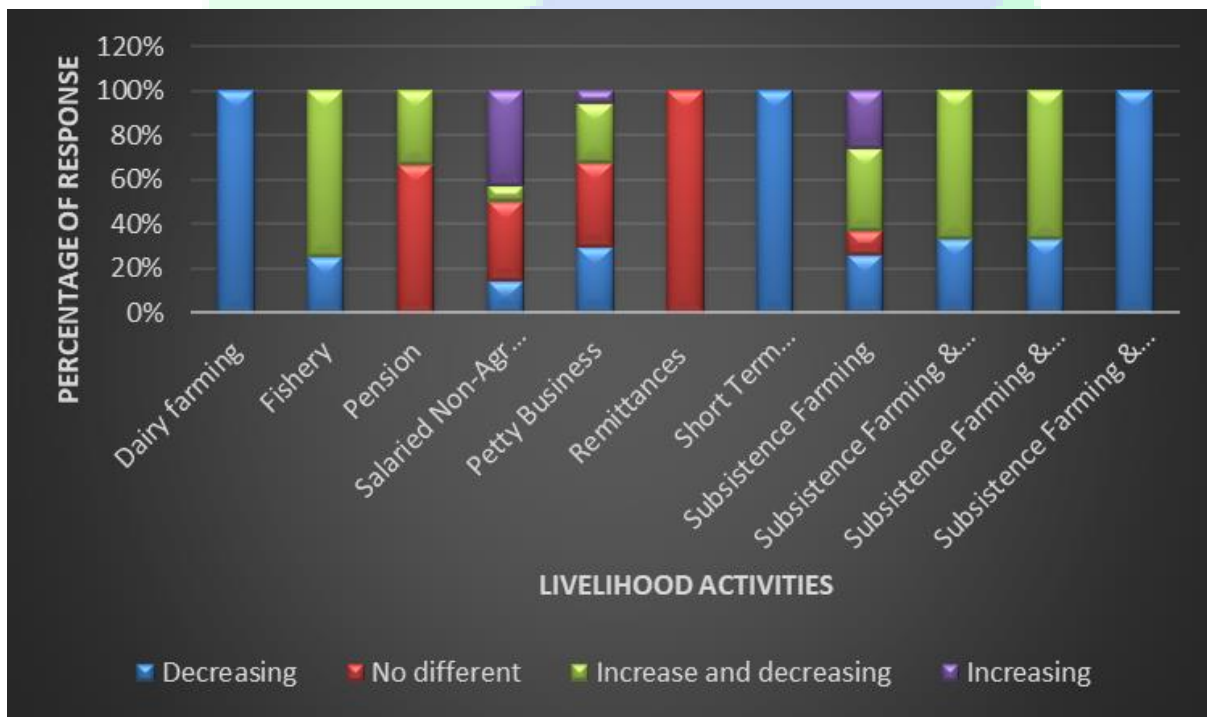


Figure 11. Trends of different livelihood activities

The trend in livelihood had various impacts on households, with an overall moderate impact as observed in Figure 12. The negative impacts included low productivity of farms due to unfavorable weather conditions, and high prices of commodities and agricultural inputs, which increased operational costs. Failure to pay school fees, low fish catches leading to a decline in income, difficulties in meeting household needs, resorting to purchasing on credit or borrowing money, inability to meet personal goals and ambitions, and lack of business (reduction in clients), reduction in the number of meals eaten, an increase in theft, low savings, and stress due to unpredictability of income. On the

other hand, the positive trend enabled households to have an available source of income, meet their basic needs, transition from mud houses to brick houses, and increase their overall expenditures.

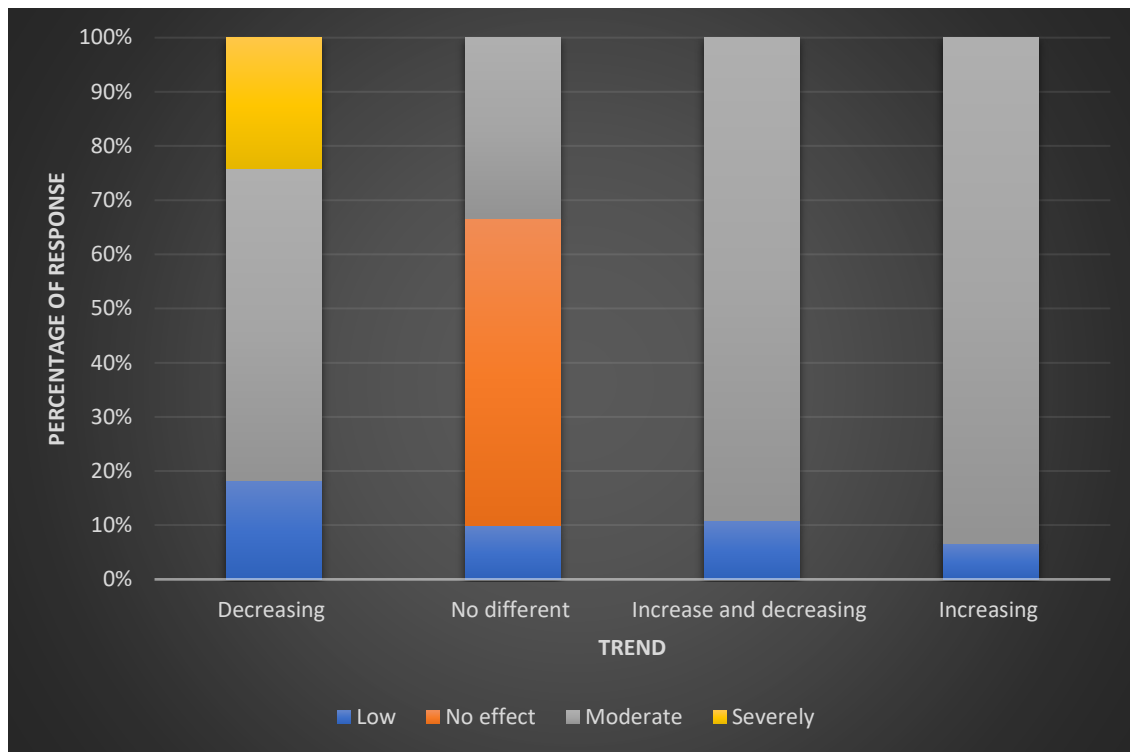


Figure 12: Severity of Effect of observed trend on livelihoods

3.1.5. Climate Change Awareness and Impact

The study conducted on climate change awareness revealed that a significant majority of the respondents, that is 67.83%, were aware of the changing climate and its related challenges. The remaining 32.17% were found to be unaware of climate change and its impacts on the environment and their livelihoods. Within the FGD the participants identified to be aware of climate change but not familiar with its causes and contributing factors. From the triangulation of data from household surveys, KII and FGD the highlighted climate-related challenges faced by the community include uncertain rainfall patterns, prolonged droughts, floods, sea level rise, sea inundation, saltwater intrusion, coastal erosion, and sea inundation and un-predictable sea storms (Figure 13).

These challenges together with other environmental and social issues have re-enforced each other or caused additional impacts to community livelihoods and socio-economic situation. The uncertain rainfall patterns have resulted in a mismatch between the crops' calendar and the season, leading to a reduction in agricultural productivity. The increased intensity of rainfall coupled with environmental

degradation, such as illegal sand mining, has significantly contributed to flooding in the areas, causing the destruction of crops, making some areas inaccessible, and contributing to the outbreak of epidemic diseases such as cholera. The impact of droughts, floods, and sea inundation on farming activities has led to under-production, destruction, or death of crops such as spoilage of cassava from floods, drying of vegetables together with lack of water for irrigation, and destruction of housing structures. In addition, the saltwater intrusion into underground aquifers has reduced the availability of fresh water, leading to water scarcity for household use, which is more critical for women due to their gender roles as house caretakers.

The increase in sea surface temperature has contributed to fish migrating to deep seas making them inaccessible to many of the fisherfolks who artisanal fishers are. This has resulted in a decrease in fish catches, which has a severe impact on the fishing livelihood. The increased unpredictability of sea storms has caused accidents within the oceans, causing the loss of fishing vessels and people's lives as well as increased coastal erosion and inundation of farm fields with sea water and thus become unfertile for farming activities. All these changes have had a cumulative effect on the community, leading to a reduction in employment opportunities for short-term laborers, lowering purchasing power in contributing, and an increase in the price of food items (Low supply) which has contributed to some people resorting to theft (rising theft incidences).

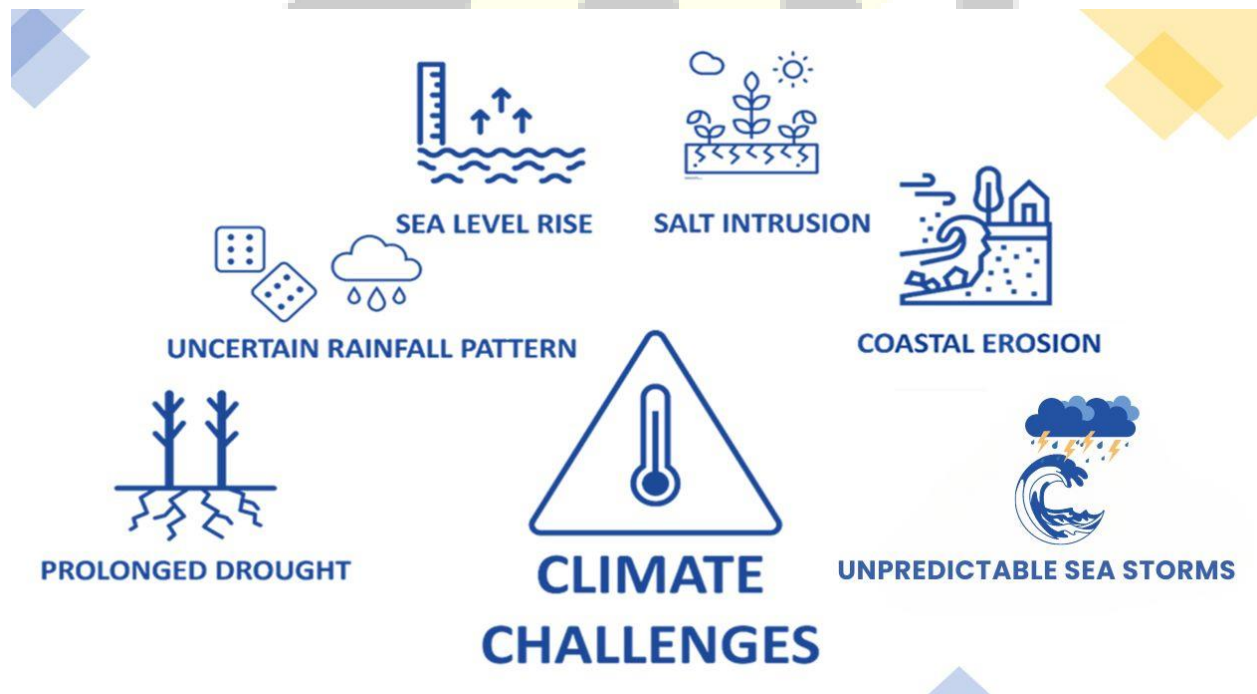


Figure 13. Climate Challenges reported in the study area.

3.1.6. Adaptation Capacity and Options

Among the participants surveyed, 67.83% were aware of climate change and its related impacts. Out of those, only 69% had taken some kind of adaptation measures, while 31% had no adaptation measures in place and were forced to live with the situation. The adaptation measures taken varied among the participants with noticeable differences in the livelihood and challenges they face. Some of the measures were common among many participants meanwhile others only few implemented them. Without consideration of the frequency of the measures below are the identified adaptation measures in the community.

In agriculture livelihoods, the identified adaptation measures include utilization of irrigation using purchased water or hand-dug wells, use of pesticides/herbicides, erection of barriers around farms to prevent water entrance, use of drought-tolerant seeds, following advice from experts, and pre-harvesting of crops before they are destroyed. For animal husbandry, they shifted to alternative livelihood options without implementing any measures to support their animal husbandry activities.

For fishery livelihoods, the participants reported having no measures to adapt to sea level rise, strong winds and storms. They are currently integrating with other livelihood options such as agriculture, shops, motorcycles together with waiting for the weather to calm down before entering the ocean to fish. They also identified relocating to safer areas or staying on top of rooftops to allow floods to pass through. Others identified living with caution and making informed planning.

Additionally, others sought help from different sources to be supported. One female respondent aged 70 currently engaged in petty business mentioned that her husband is old, and all her children are unemployed. The high theft incidence in her community has left her with no option but to seek help from others to meet her daily needs.

Capacity to cope and adapt to climate change challenges remains a major challenge in the study area. Women, youth, people with disabilities and elders are the most vulnerable group due to their social constructed roles and responsibilities but also their limited mobility that limit their exposure to potential and available adaptability options including technology and capital. Men reported migrating to potential areas where they could access other livelihood options. Whereas women, elders, and

people with disabilities reported immobility as a result of their roles and responsibilities at household levels, which increased their susceptibility levels to climate change challenges. Their main mechanism was shifting towards petty business, other reported strategies for coping with climate change challenges, particularly during the focus group discussion, included lowering households' expenditures, including skipping meals of the day for some members of the households, while others reported doing nothing but enduring the circumstance and hoping for recovery.

48% of respondents reported that their strategies for coping with climate change challenges were effective, while 37% indicated ineffectiveness, and 15% suggested partial effectiveness (Figure 14). The reported effective measures include adopting irrigation, diversifying livelihoods mostly through petty business, waiting for calm weather in the ocean, use of pesticides, listening to experts' advice in using drought resistant seeds. This has enabled them to be able to get the daily necessities and supplement the main livelihood activity. The reported measures which were ineffective or partially effective included migration or staying on roof tops to avoid floods, storage of food, irrigation. The ineffectiveness and partial effectiveness were attributed to large family size resulting in the available resources not meeting their needs, the solution being temporary addressing the challenge, unemployment among community members, high theft incidence, increase in food prices and illegal cow entry into farms where they eat vegetables.

When asked if they knew of any alternative adaptation measures that could work and they had not used yet, some participants identified irrigation, changing their agriculture and way of life, finding additional employment and business, diversification of livelihood, changing of cultivating areas, reduction of bad community morals like theft. The limiting factors mentioned were limitations in financial capacity to acquire irrigation systems, the government not constructing needed irrigation infrastructures, limitations in technical know-how, and lack of participatory and engaging meetings within the community.

CLIMATE ACTION NETWORK
Tanzania

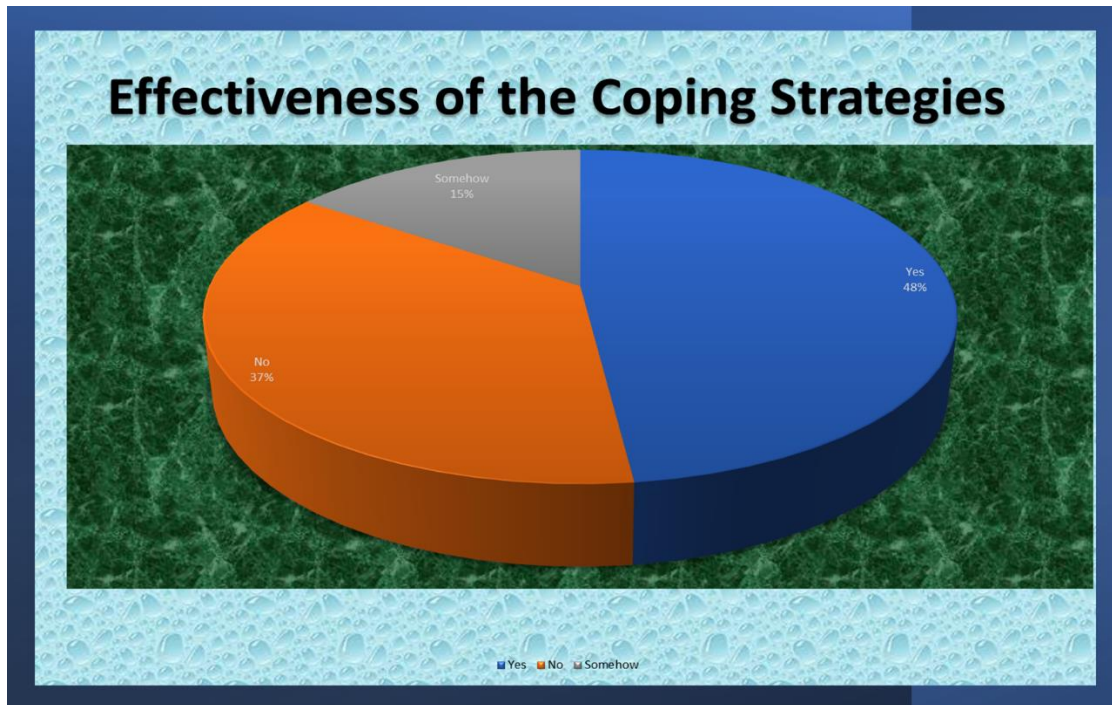


Figure 14. Effectiveness of the coping strategies on climate change challenges

The local government provides extension services to the community through the extension system. However, during a KII, it was identified that the extension officers primarily focus on improving production and are not adequately equipped to support the community in utilizing weather and climate information to make informed decisions. Their current system of operation only provides generalized information received through TMA on the expected weather, without more localized forecasts.

3.1.7. Climate and Weather Information

The weather and/or climate information provides end-users with means to help them make climate-smart decisions across the planning and execution of their livelihoods. The Tanzania Meteorological Authority (TMA) oversees conventional weather information in Tanzania meanwhile the elders in the community possess traditional knowledge of indicators to forecast the expected weather. Climate and/or weather services use a collaborative approach to produce, process, package, store, and disseminate weather-related information to end users. This section intended to assess the state of climate and weather services in the study area in terms of accessibility, sources, usefulness, and reliability.

3.1.7.1. Access and Sources of Weather Information

The survey revealed that 45.22% of the respondents receive climate and weather information, 32.17% occasionally receive and notably, 22.61% have no access to this information at all, Figure 15. The frequency of accessing weather forecasts is shown in Figure 15, whereby the highest frequency is accessed daily and seasonally.

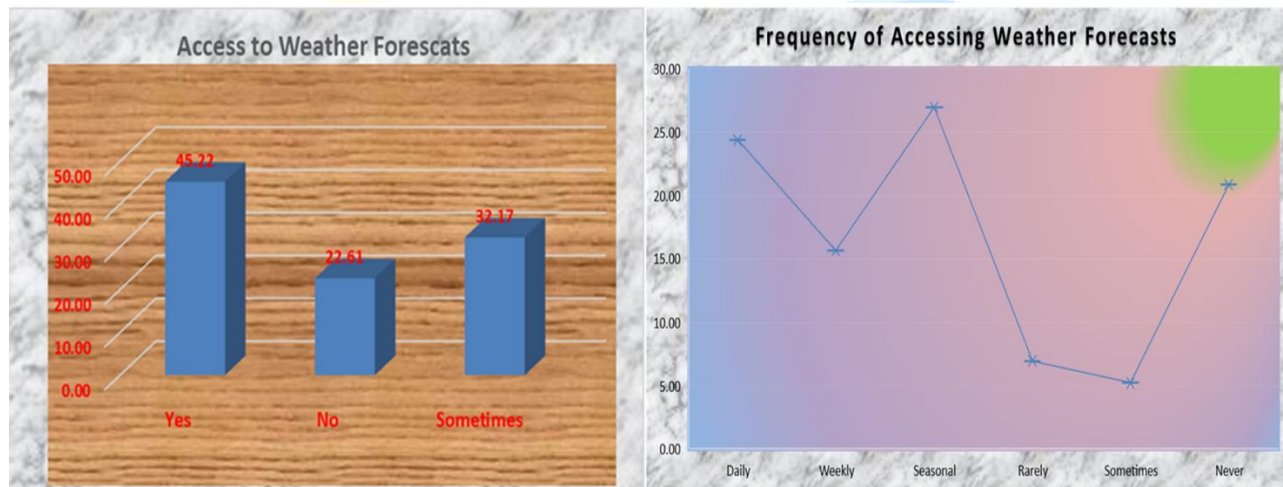


Figure 15. Proportion for acquiring weather and climate services.

In terms of weather and climate information sources, the study discovered that most respondents (69.57%) get their weather and climate information from TMA, with an insignificant proportion (9.57%) relying on traditional forecasters (Indigenous Knowledge) (Figure 16). The latter appears to have been employed previously but today's generation has ignored this source due to increased use of technology and relating the knowledge with witchcraft beliefs. The remaining 20.86% are completely unaware of the sources of their weather forecasts.

Then the study also revealed that weather information is accessible through an assortment of media, including Television, radio, newspapers, and word of mouth during social gatherings. Common media for dissemination and accessibility of weather information was revealed to be Television and/or radio (82.61%), with only 6.96% of the respondents relying on word of mouth and social/group gatherings e.g. village general assemblies, and social interactions to access and receive weather information, whereas 8.70% never receive the weather information at all (Figure 16)

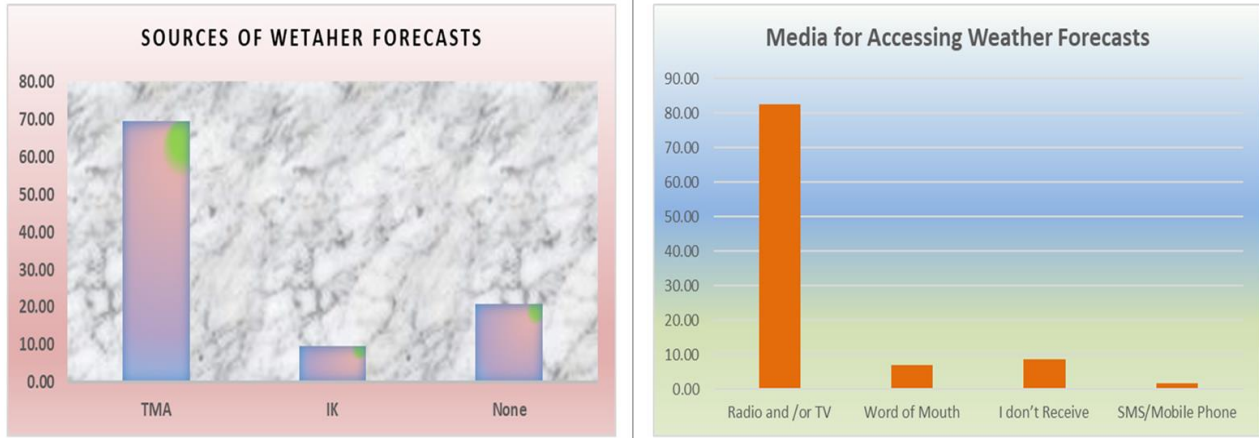


Figure 16. Source and Means of Acquiring Weather and Climate Information

3.1.7.2. Usefulness and Reliability

The household respondents identified that conventional climate and meteorological services from the TMA (60.87%) have positively been useful, particularly in informing communities' socio-economic and livelihood activities, although the traditional weather forecast was deemed un-useful. Respondents claim greater and improved accuracy in TMA information, particularly warnings and seasonal forecasts. They have used the data to plan and execute their livelihoods, with minor deviations from the actual projections provided. The forecast has contributed to them making decisions on the timings for going into the ocean for fishing, taking necessary precautions including relocating to other areas, informing agricultural activities, especially in the timing of planting and preparation of farms together with informing their other planning such as taking precautions for strong winds etc.

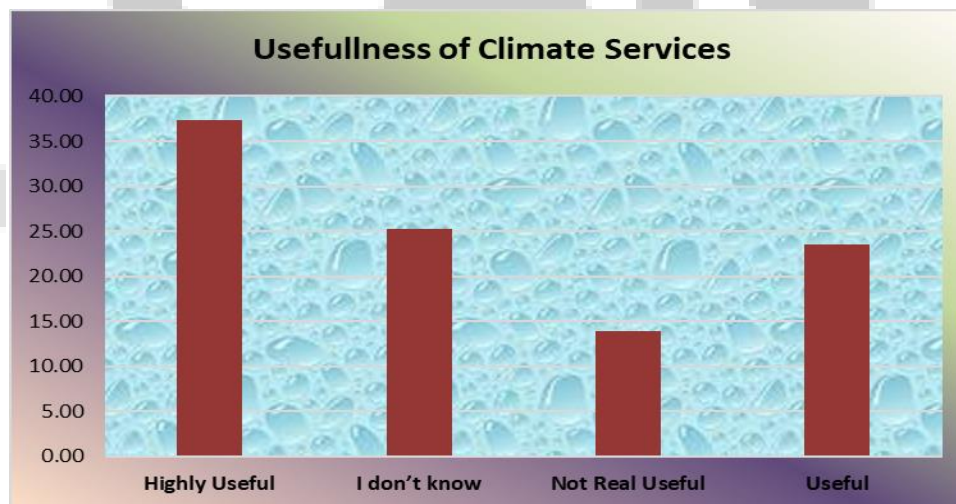


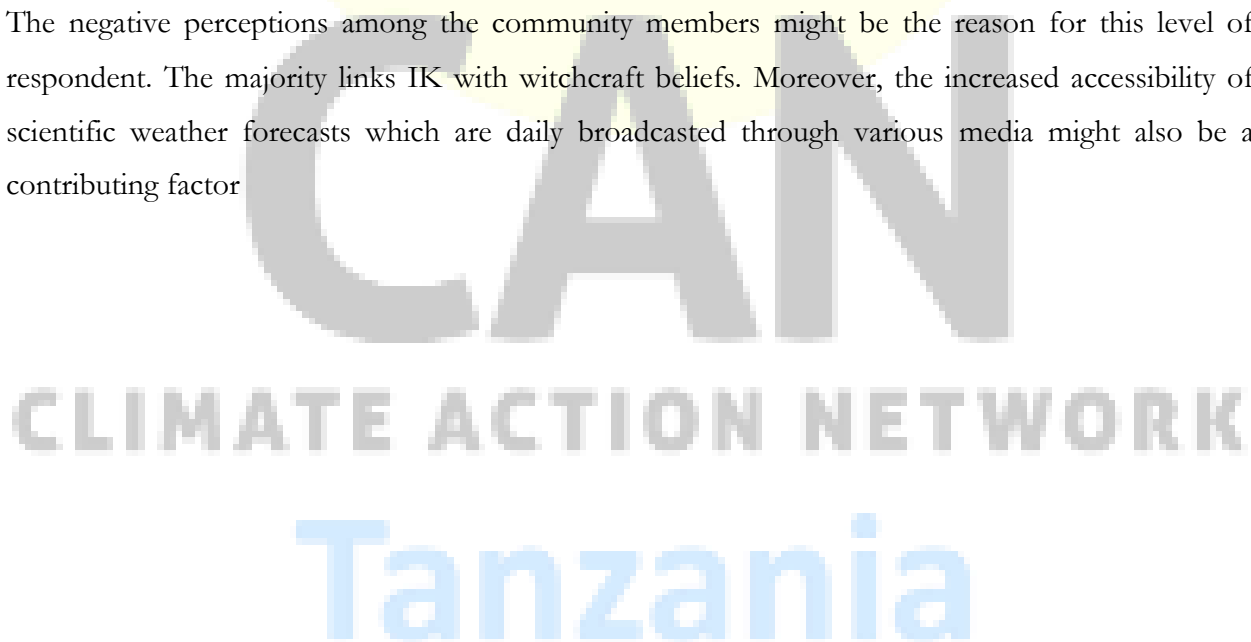
Figure 17. The usefulness of Weather and Climate Information from TMA

3.1.8. Indigenous Knowledge for Weather Forecast

The local weather and climate are measured and projected by locally observed variables and experiences using combinations of indicators including wind direction, plant phenotypes, birds, animals, insects, and astronomical indicators. This section aims at establishing the relationship between IK and climate prediction as it contributes to the community's awareness and its role in informing socio-economic undertakings.

According to the study, only 23% of the respondents were aware of and used Indigenous Knowledge (IK) which they find it being useful for climate prediction. 77% of the respondents claimed they were neither aware nor sure of the importance and use of traditional forecasters in the study area. The respondents stated that IK was useful mostly in the fishing livelihood. The observed indicators provide information on the ocean conditions such as waves and wind speed, inform proper timing to go fishing, location for fishing, and necessary precautions to take for safety considerations. Some of the participants highlighted that most of the recent fisherfolks are youth who are not aware of the traditional indicators used. Even the older generation listens to forecasts from the radio, yet in their discussion, they refer to traditional indicators.

The negative perceptions among the community members might be the reason for this level of respondent. The majority links IK with witchcraft beliefs. Moreover, the increased accessibility of scientific weather forecasts which are daily broadcasted through various media might also be a contributing factor



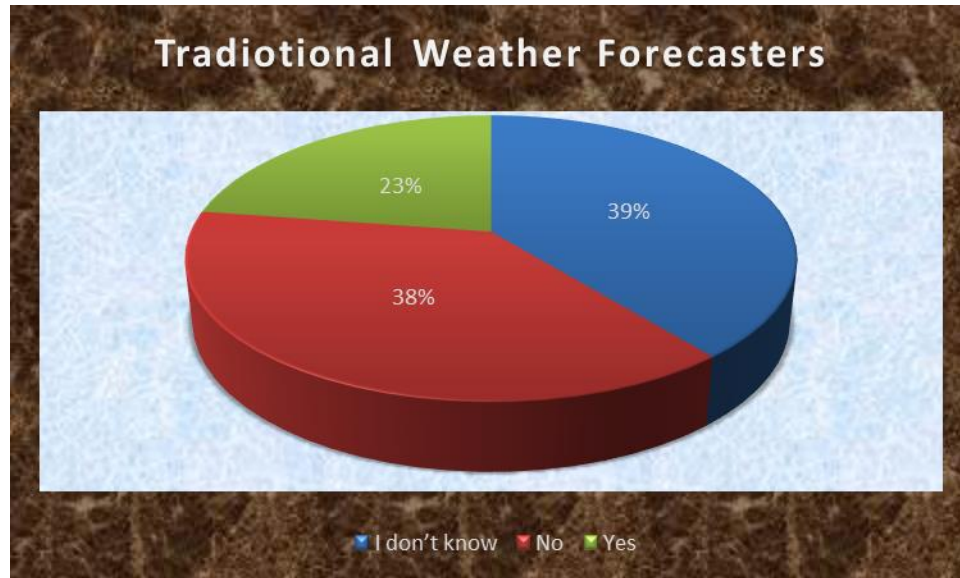


Figure 18. Awareness on Traditional Weather Forecasters.

3.1.8.1. Sources of IK and Reliability

Indigenous knowledge depends on changes in weather patterns, physical changes in trees (flowering, leaf dropping, etc.), and the behaviors of specific animal species (birds, amphibians, insects, and arthropods). According to 23% of those who claimed to be aware of traditional forecasts and their use, elders are the primary source of indigenous knowledge on weather and climate prediction, notably rainfall patterns and wind direction, but also sea storms. This is due to the fact that elderly people, as opposed to youth, have witnessed various climate-related occurrences that are linked to key socio-economic activity over time- together with having inherited the knowledge from their predecessors. It was observed and supported during KII majority of the older generation were aware of IK indicators used meanwhile the younger generations were not much informed and utilized the indicators.

CHAPTER 4

4.0. Discussion

4.1. Discussion

This chapter seeks to explore the implications of the study's findings, conducting a critical analysis within the broader context of the field and the existing literature.

4.1.1. Household Status

The Chuini Shehia community is a dominantly Muslim community with patriarchal setting whereby majority of household are headed by Men. The study finding showed the majority of households are large families based with more than 5 members. The household has been reported having multiple dependents among them with majority (49.54% being in the range of 4-6 dependents whereby on 3.6% of the respondents indicated not having any dependents. Multiple studies have shown a direct relationship between family size and resource consumption whereby the larger the size, the more the resources e.g. foods, housing, income required to support the daily needs of the family. The ability to acquire needed resources is affected by multiple factors among which but not limited to number of earners, economic situation, productivity of livelihoods and many more. This study did not assess the nature of the dependents on their engagement in production and contribution in meeting the required family needs.

The participants in the study were mostly characterized of primary and secondary education collectively accounting for 78% meanwhile with no-formal education being 12% and the rest having tertiary and university education. The level of education plays a contributing role in socio-economic development and in addressing understanding of complex issues such as climate change.

4.1.2. Socioeconomics and Livelihood Activities

The most significant socioeconomic and livelihood activities are petty business (30%), including tour guiding, shopkeeping, food vending and selling or processing agricultural or marine products. Subsistence farming, focusing on vegetables and staple crops, is practiced by 23% of respondents, while a smaller proportion (2%) engage in animal husbandry. Fishing is the primary occupation for 10% of respondents, and another 11% combine farming with other activities such as fishing and petty

business. Salaried work in non-agricultural sectors, such as hospitality, accounts for the livelihood of 12% of respondents, and casual labor is relied upon by 4%. The remaining 9% depend on pensions or remittances from family members.

The majority of households (89%) rely on a single type of livelihood. The motive for participating in socio-economic and livelihood activities was to generate earnings to cater for households' necessities as well as food for their families. Multiple studies have found that households with a single source of income are more susceptible to the effects of climate change than those with diverse or integrated sources of income. However, most of the significant socio-economic activities identified in this study are extremely susceptible to climate change and weather variability.

This means that these activities are at a significant risk of being affected by changes in climate and weather patterns. This could potentially increase their vulnerability to climate change challenges, as households with diverse livelihoods are generally better equipped to cope with and recover from such challenges. The impact on their livelihoods directly translates to limitations in food and income to support family needs such as education, health care, and more.

The findings identified the primary motivation for engaging in these identified livelihood activities is to cater for income and food needs. This implies that the change or impact on these livelihoods is directly related to them being unable to meet income and food needs. The dependence on single livelihood hood as currently practiced by community members further puts them at high vulnerability. The focus group discussions further highlighted the diversity of livelihoods in the study area, with a notable increase in the participation of women and youth in production for households. The majority of these activities fall under petty business, including agricultural and fisheries products.

(Makame, Salum, & Kangelawe, 2018) highlights the relations between climate vulnerability, community adaptive capacity, and livelihood assets and activities. He demonstrates dependence on climate-sensitive sectors increases the vulnerability toward climate vulnerability and other challenges meanwhile Access to different capitals and assets (i.e natural resources, financial capital, human capital, social capital, and physical capital) was found to affect the range and choices of livelihood activities available to households as well as their ability to cope and adapt to existing and new risk. Though the study did not examine in depth the livelihood assets of the household based on the factor influencing

their selection of livelihood activities it showcases a limitation in their range and choices of livelihood activities and thus their vulnerability and adaptive capacity.

4.1.3. *Distribution of Gender in Socio-Economic and Livelihood Activities*

The findings highlight the distinct gender roles within socio-economic and livelihood activities in the community. In the fishing sector, men predominantly engage in open sea fishing, while women are more involved in inshore and species-specific fishing, as well as the processing and selling of fisheries products. Furthermore, through KII and FGD it was identified women play a greater role in seaweed farming compared to men. Petty businesses show a balanced gender participation, with men and women participating almost equally, and a significant portion of these businesses being run jointly by both genders. Men are found to be more engaged in animal rearing and salaried employment, while agricultural activities see nearly equal participation from both genders. However, the division of labor within agriculture is gender-oriented, with men primarily involved in field preparation and seed sowing, and women and youth more involved in weeding and harvesting. Furthermore, the focus group discussions reported a gradual shift in the community, with women and youth increasingly participating in socio-economic and livelihood activities. In addition to their professional engagements, they also play a crucial role in caring for their families, which encompasses children, the elderly, and persons with disabilities. This showcases the multifaceted contributions of women to both economic activities and family support.

Apart from women, another gender group of consideration is elders who reportedly rely on pensions and remittances for their livelihood. This reliance on fixed or external sources of income could potentially make them more vulnerable to socio-economic changes and shocks. Pensions and remittances, while providing a steady stream of income, may not be sufficient to meet the rising costs of living, particularly in the face of economic inflation, unexpected expenses, and the impact of climate change on the community. Furthermore, these sources of income are not always reliable; remittances can fluctuate based on the financial situation of the family members providing them, and pensions may not keep pace with the cost-of-living increases. Moreover, the elders' ability to engage in other livelihood activities may be limited due to age-related factors, further exacerbating their vulnerability to climate change.

4.1.4. Livelihoods productivity Trends

Over the past five years, the trend of livelihood has varied significantly according to the type of livelihood practiced. Pensions and remittances, which are more reliable and not directly affected by climate change, have seen the least change. This was followed by Salaried Non-Agriculture Related Employment which either had no change or increased with few decreasing and fluctuating. This is expected as salaries increase or remain constant meanwhile some report being laid off. In contrast, livelihoods such as fishing and integrated Subsistence Farming & Cash Crop Farming and Subsistence Farming & Fishery have experienced either a decreasing or fluctuating trend, likely due to their direct dependence on environmental conditions that are affected by climate change. Among the few existing dairy farmers, they have all observed a decreasing trend.

A different trend is observed in subsistence farming where nearly equal numbers have experienced decreasing, fluctuation, or increasing productivity in 5 years. The findings from the focus group discussions and key informant interviews complement these observations. Participants reported a decline in livelihood activities, specifically agricultural produce, and fish catches, leading to market price inflations in the study area. This observation may be related to household practices that managed to adapt and capitalize on the market conditions. The same situation is reflected in petty business with an equal number experiencing decreasing, no change or fluctuation, and a small number experiencing an increase.

The category of petty business includes multiple businesses of different natures which are exposed to different factors and thus may face different factors. The underperformance of other main livelihoods has a significant impact on the local economy. The Short Term Agricultural/Fishery Wage Labor all reported a decreasing trend that is characterized by a decrease in working opportunities. This trend indicates either under-performance within the livelihood activities as no workers had been imported or mechanization of the livelihood was not reported nor observed. The factors behind these trends were identified to be multiple, including climate change, market performance, limited farming land, and increasing prices of commodities and inputs. Though not mentioned by any of the participants it is worth noting the potential residual effect of covid 19 might have contributed to the provided feedback from the respondents, especially those engaged in petty business as tourism decreased.

The trend in livelihood has had various impacts on households. Negative impacts include low productivity of farms due to unfavorable weather conditions, high prices of commodities and agricultural inputs, which increased operational costs, and a range of socio-economic challenges. On the other hand, the positive trend enabled households to have an available source of income, meet their basic needs, transition from mud houses to brick houses, and increase their overall expenditures. However, the lack of capital and limited resources, often inherited, have impeded the ability of some community members to engage in and access other viable livelihood options.

4.1.5.2. Knowledge, Attitude, and Practice (KAP) on Climate Change

Under this study, the KAP assessed respondents' broad knowledge of climate change, including what climate change is, what causes climate change, and how climate change affects their livelihoods. It also assessed respondents' attitudes toward climate change, specifically their level of concern about the issue, perceptions of the importance of various actions that can be taken, perceptions of actions being taken at all levels, and willingness to take action to address climate change.

The majority of participants (67.83%) in the study area understand the notion of climate change in its widest sense, but they lack in-depth knowledge of what climate change is, what causes climate change, and what specific changes are related to climate change. Most people associate climate change with changes in weather patterns or weather conditions. Others interpret it as temperature changes, environmental changes, and global warming, while few of the respondents (32.17%) had no idea what climate change is.

Although they know that climate change causes changes in weather patterns, the majority can only identify the key changes based on their own experiences rather than comprehensive knowledge. They identified several climate-related challenges faced by the community, including uncertain rainfall patterns, prolonged droughts, floods, sea level rise, saltwater intrusion, coastal erosion, and unpredictable sea storms. The observed challenges correlate with the Nordic Development Fund (2014), which also identified similar challenges including rising seawater temperatures, which cause biodiversity changes such as extinction, migration, or invasion of species, and coral bleaching; extreme weather events, which impede agricultural and fishing activities, make low-lying communities, infrastructure, and mooring areas vulnerable to damage, and increase coastal erosion and flooding from severe sea level rise.

These challenges have had a profound impact on the community's livelihoods and socio-economic conditions. The community reported uncertain rainfall patterns have led to a mismatch between the crops' calendar and the season, resulting in a reduction in agricultural productivity and losses. Similarly, the increased intensity of rainfall, coupled with environmental degradation such as illegal sand mining, has significantly contributed to flooding in the areas. This has led to the destruction of crops, making some areas inaccessible, and contributing to the outbreak of epidemic diseases such as cholera.

The intrusion of saltwater leads to the inundation of low-lying agricultural land, rendering agricultural land unproductive and contaminating drinking water, specifically wells that have become salty, contributing to water scarcity for household use. This is particularly critical for women due to their gender roles as household caretakers. The increase in sea surface temperature has contributed to fish migrating to deep seas, making them inaccessible to many of the artisanal fisherfolks. This has resulted in a decrease in fish catches, which has a severe impact on the fishing livelihood.

The increased unpredictability of sea storms and strong winds have caused accidents within the oceans, causing loss of fishing vehicles and people's lives together with flooding within the community. The study findings correlate with (makame, Shackleton, Wa, & Filho, 2021) findings in Kiuyu Mbuyuni, Pemba, and Matemwe, Unguja communities faced similar challenges within their livelihood: Agriculture, Fisheries, and Seaweed farming.

Agriculture, in relation to climate change stressors, adopted similar approaches which are irrigation and fast-maturing seeds together with other measures to address soil quality. Livestock keepers have adopted the use of baobab leaves as fodder, collecting grass outside the area, migrating with animals to look for pasture, and use of tap water. Meanwhile, in Fisheries one-third had no adaptation measures, while the remaining used a variety of fishing methods during a single fishing trip or shifted from one method to another based on the season, engaged in selective catching of high-value fish namely octopus, to maximize their catch or was to regularly change fishing grounds with a few shifting to motorized boats to go into deeper waters.

Although with (makame, Shackleton, Wa, & Filho, 2021) findings show there is a possibility for fisherfolks in the study area to improve their fishing practices to better adapt. For example, one of the methods currently adopted by fisherfolks in Kiuyu Mbuyuni and Matemwe is the use of GPS to track

fish stock as in increased distance offshore, the traditionally used indicators for navigation (i.e. stars, tall trees, telephone towers) are no longer visible.

All these changes have had a cumulative effect on the community, leading to a reduction in employment opportunities for short-term laborers, lowering purchasing power in the community, and an increase in food prices. This has contributed to some people resorting to theft. These impacts have a cascading effect on petty businesses as trading reduces in the community thus affecting them. Overall, climate change has caused economic losses, contributed to food insecurity, and increased poverty within the community.

Based on the 67.83% of the community is aware of climate change and its associated impacts only 69 have taken some form of adaptation measures, while the remaining 31% have no adaptation measures in place. This measure does not include the 32.17% of the participants who had no awareness of climate change hence did not implement any measures. This indicates a gap in the community's capacity to respond to climate change challenges. It is important to acknowledge the possibility of community members implementing adaptation measures without knowledge of climate change.

The adaptation measures taken by the aware/informed participants are diverse and are influenced by the specific livelihoods and challenges they face. In agricultural livelihoods, adaptation measures include the utilization of irrigation, use of pesticides/herbicides, erection of barriers around farms to prevent water entrance, use of drought-tolerant seeds, following advice from experts, and pre-harvesting of crops before they are destroyed.

However, animal keepers have shifted to alternative livelihood options without implementing any measures to support their animal husbandry activities. Similarly, fishery livelihoods reported having no measures to adapt to sea level rise, strong winds, and storms. Instead, they are integrating with other livelihood options such as agriculture and petty businesses, and waiting for the weather to calm down before entering the ocean to fish.

Other community measures included relocating to safer areas or staying on top of rooftops to allow floods to pass through within the residential areas and farmland. Meanwhile, others lowered household expenditures and skipped meals. The degree of adaptation measures undertaken within the community, though diverse, has not yet made the household completely climate resilient. This is evident based on the performance of livelihood activity. Additionally, the community has failed to

adapt or mitigate the impact of floods, saltwater intrusion, and sea level rising within their locality. The assessment found similar results whereby the community measures included cementing their houses, migration during floods, and repairing of houses after flooding. Such measures are not cost-effective and long-term solutions in the climate change era (Nassor & Makame, 2021).

There is a need for further strengthening the adaptation capacity of the community members not only in floods but in all other challenges so that they can be more resilient. For example, in agriculture livelihoods, the scaling of irrigation is not only cost-intensive in consideration of the locality economy but also threatens the sustainability of underground water. It is important to realize cost-effective, pro-poor solutions that can be scaled and implemented by all members of the community meanwhile maintaining the integrity of the environment.

The study also highlights the vulnerability of certain demographic groups, including women, youth, people with disabilities, and elders, due to their socially constructed roles and responsibilities and their limited mobility.

48% of respondents reported that their strategies for coping with climate change challenges were effective. The highlighted measures include adopting irrigation, diversifying livelihoods mostly through petty business, waiting for calm weather in the ocean, use of pesticides, and listening to experts' advice in using drought-resistant seeds. This has enabled them to be able to get the daily necessities and supplement their main livelihood activity. Despite these efforts, 37% of respondents reported that their strategies for coping with climate change challenges were ineffective, and 15% suggested partial effectiveness. These measures included migration or staying on rooftops to avoid floods, storage of food, and irrigation. The ineffectiveness was attributed to large family size resulting in the available resources not meeting their needs, the temporary nature of the solutions, high operation cost for irrigation, unemployment and low salaries among household members, high theft incidence, increase in food prices, and illegal cow entry into farms where they eat vegetables.

In the study by (Makame, Shackleton, Wa, & Filho, 2021), the discontinuance of adaptation measures was highest in petty businesses, livestock and poultry keeping, and participation in cooperative and saving groups. This was mainly due to a lack of adequate capital and unrecovered credit. Unrecovered loans, especially food loans, were identified as a major reason for the closure of several established

food stores in the neighborhood. Poverty and low returns from natural resource-based activities were some of the reasons for poor recovery/payments of these loans.

Additionally, climate variability affected water availability and influenced the occurrence of climate-related pests and livestock diseases. All of these factors, combined with the inability to recover from past shocks due to poverty, were responsible for the discontinuation of these businesses. The findings from this study highlight the future possible risk that may face Chuini community members as their livelihood productivity continues to decrease with limited adaptation and the majority of them are transitioning to petty business and agriculture. The recovery and resilience building of community livelihood and the socio-economic conditions is very important to realize a thriving and resilient local economy that can support the community.

Within the study area, participants identified potential adaptation measures they were aware of but had not implemented. These measures include the use of irrigation, changing their agriculture and way of life, finding additional employment and business, diversification of livelihood, changing cultivating areas, and reducing bad community morals like theft. However, these measures are hindered by limitations in financial capacity, lack of government support in constructing needed irrigation infrastructures, limitations in technical know-how, and lack of participatory and engaging meetings within the community. This aligns with (Makame, Salum, & Kangalawe, 2018) who identified the livelihood assets and activity have a direct relationship with one adaptive capacity and vulnerability. Within the study areas, the large family coupled with few earning assets has limited the adaptive capacity of the community further subjecting them to dependence on climate-sensitive livelihoods, hence increasing their vulnerability.

From the findings, it's evident there are multiple adaptation approaches taken at the individual level. To attain wide community impact, it would be beneficial to attain a community-led adaptation approach with clear plans and consideration of their livelihood assets and activities. This will enable the promotion of low-cost and smallholder-friendly adaptation measures such as agroecology practice and rainwater harvesting together with addressing challenges associated such as the cost of establishing irrigation infrastructure. (Ali & Rwiza, 2020) cautions on the over-exploitation of underground water pumping for irrigation in Zanzibar, as it can lead to pollution, collapse, and an increasing rate of seawater intrusion threatening the aquifer's sustainability. Water quality can degrade due to over-pumping, leading to high levels of electrical conductivity, chloride, total dissolved solids, total

hardness, and nitrate. Climate variability, such as temperature variations and low rainfall, can affect the groundwater supply. The East African coast is threatened by salinization due to fluctuations in recharge patterns and groundwater over-abstraction. Unsustainable groundwater pumping can result in alterations of aquifer systems thus it is important for it to be properly planned and monitored.

Furthermore, in livelihoods such as animal husbandry and fishery, there are limited adaptation actions currently in place calling for more interventions within the areas. The significant transition towards integrating petty business may lead to the over-saturation of business in the locality and the new business being susceptible either directly or indirectly to climate change. The awareness raising on climate change coupled with empowerment on risk assessment is important in enabling the community to best plan.

Climate smart and resilient development pathways have been shown to offer enormous investment opportunities with a triple dividend of avoided losses, positive economic gains, and enhanced social and environmental benefits (Global Centre on Adaptation, 2023). Climate and weather information services, which give essential climatic data, information, advisory, and expertise to enhance decision-making and action while planning and executing livelihood, are one of the recommended adaptation strategies for most smallholders (fish folks, farmers, and pastoralists).

4.1.5.3. Access and Utilization of Climate Services

Downscale climate and weather services are considered important in increasing coastal community resilience and addressing devastating climate change impacts. Improved access and utilization of climate services would equally support decision makers to manage anticipated climate challenges including early warning and hence enhance the resilience of coastal communities towards socio-economic transformation and wellbeing. Discussions with participants revealed that, to address existing climate challenges intended climate services are important towards enhanced adaptation, climate resilient, and disaster risk management in the fields of farming, fisheries and water, health, and women empowerment. On the other hand, early warning and disaster preparedness information were mentioned by fisherfolks to be among the important ingredients for an enhanced resilient society.

The study findings reveal a significant gap in the access and utilization of climate and weather information among the respondents. While 45.22% of respondents receive this information, a notable 22.61% have no access at all and 32.17% occasionally receive the forecast. The majority (69.57%) rely

on the Tanzania Meteorological Agency (TMA) for their weather and climate information, with a small proportion (9.57%) using traditional forecasters with the remaining 20.86% completely unaware of the sources of their weather forecasts. This low utilization of indigenous knowledge could be attributed to the increased use of technology and misconceptions associating indigenous knowledge with witchcraft beliefs.

The study also highlights the role of various media in disseminating weather information, with Television and/or radio being the most common (82.61%) followed by word of mouth (6.96%) and Mobile Phone(1.73%) . Despite this, there is a significant proportion of respondents (8.70%) who do not receive weather information at all. 60.87% of respondents acknowledged the usefulness of conventional climate and meteorological services from the TMA in informing their socio-economic and livelihood activities. The usefulness was focused on providing warnings and seasonal forecasts, timings for going fishing, taking precautions such as relocating or preparing for strong winds together with informing agricultural activities mostly on planting and farm preparations. Within the FGD it was highlighted the are multiple incidences in which the forecasts deviated from the actual reality.

The information from TMA is accessed as a scientific setup with region-level coverage. Limited availability and access to downscaled climate information poses a challenge for end users to plan, manage, and respond to extreme weather events affecting the coastal community of Chuini. This lack of access and the limited understanding of meteorological terms pose a challenge for end users in planning and managing extreme weather events, thereby increasing vulnerability among coastal communities.

There are limited weather stations (especially automatic weather stations) linked to low capacity to analyze and interpret climate information. Limited availability and weak capacity to analyze and interpret climate information further pose difficulty to prepare and manage extreme weather events especially floods, droughts and storms hence increasing vulnerability among coastal communities. Sometimes early warnings are not given out timely and even when they are out are not utilized by the community due to limited understanding and poverty. The National Framework for Climate Services (2018) aims to improve the provision of climate services at local levels. But, based on this baseline study, this goal has not been achieved, and more work remains.

Both literature review and key informant interviews revealed limited access to downscaled and local-specific climate services in time to inform decision-making on livelihood options. Discussions with local leaders revealed that households were not receiving information helpful to make informed decisions for farming and fishing. Even those who receive the general climate services had no interactions with other existing local committees that could meet and interpret offered information and link with indigenous forecasters.

It is very important that, at the beginning of the season, communities have an opportunity to meet and interpret the offered climate forecasts so that everything is customized to inform local-specific decision-making and responses. Even if communities have access to climate services if the service is not received in time, is not context-specific and communities have no means to have common interpretations and understanding it means will not be able to help the community in terms of identifying certain livelihood options or addressing a certain climate shock. The use of TV and radio only as the means to share weather and climate forecasts was also reported to limit access and take time to reach the end users who are in rural areas. Also, some respondents reported having low trust in climate information from the Meteorology authority. This could be linked to the fact that, some years back, more forecasts were generalized, not timely available, and were not associated with relevant services and advice.

To inform decisions during the planning and execution of livelihoods for enhanced climate resilience, effective and efficient climate services must be provided in a more accurate manner, area-specific, timely, and reliable, particularly for rural populations whose livelihoods are highly vulnerable to climate change challenges. Furthermore, climate services must be coproduced, packaged, and distributed in an inclusive and participatory manner.

4.1.5. *Traditional and Indigenous Knowledge*

Indigenous knowledge (IK) plays a pivotal role in weather forecasting, offering a wealth of insights derived from generations of close observation and interaction with the natural environment. This knowledge is centered on discernible changes in weather patterns in relation to biophysical changes. Local weather and climate are measured and projected using locally observed elements and experiences, such as wind direction, plant phenotypes, animals, insects, and astronomical indicators. Elders are often the primary custodians of IK, having accumulated a vast array of experiences and

observations over time together with inheriting it from their predecessors. Their deep understanding of weather and climate-related phenomena is intrinsically linked to major socioeconomic activities, providing invaluable guidance for their communities.

In essence, the relevance of indigenous knowledge in weather forecasting is profound as it offers a practical, cost-effective method of predicting localized weather and climate forecasts. Moreover, integrating indigenous knowledge into conventional weather forecasting has several key benefits. It enhances the accuracy of forecasts by incorporating detailed local observations. It ensures local relevance, as IK is deeply rooted in the local context. It aids in cultural preservation, acknowledging the value of indigenous practices in contemporary science. It empowers local communities, affirming the value of their knowledge and encouraging their active participation in weather forecasting and climate science. Lastly, it is cost-effective, as IK methods often require fewer resources. Thus, the integration of indigenous knowledge with conventional weather forecasting can lead to more accurate, locally relevant, and sustainable weather prediction models, benefiting both modern meteorology and the preservation of indigenous wisdom.

The study found that 23% of the household participants were aware and utilized IK for weather forecasting meanwhile the remaining 77% were unaware. The issue of low trust was also reported on Indigenous knowledge and forecast and was linked with witchcraft belief thus limiting its useability.

Indigenous knowledge of weather and climate forecasting remains the most accessible, timely, area-specific, and affordable source of weather and climate information for smallholders. Based on the findings from respondents, it is important to ensure that Indigenous knowledge from traditional forecasters is blended with scientific information to produce local and enhanced forecasts and services. If the two are interlinked they achieve three things: 1. accuracy, 2. Ownership/confidence, and 3. timing. At a moment when those three are achieved then automatically community members will build and enhance trust in the information and service. Increases in usage are expected to lead to reduced crop failure, and preparedness and reduce climate-related losses and shocks.

Some participants reported that older and more experienced fisherfolks integrate both IK and scientific forecasts. Upon receiving the scientific forecast, they engaged with fellow fisherfolks where they also included traditional indicators observed in making their plans on fishing and where to fish. The youth and recent fisherfolks have been reported to be unaware of the tradition.

CHAPTER 5

5.0. Conclusion and Recommendation

5.1. Conclusion

The communities' livelihoods within Chuini Shehia have been affected by climate change in different ways. For the weather dependent livelihoods such as farming, animal husbandry, and fisheries have experienced the most impact with decrease and fluctuation in production although few experience increase following their adaptation. The petty businesses in the areas have been affected indirectly following the community impact. For non-climate service livelihoods like salary workers, pensions, and remittance were least affected by the changes. These impacts can not only be attributed to climate change as there might be other factors in play such as the effects of Covid 19 which disrupted the tourism sector which is the major source of revenue and consumers of products thus having an overall impact on the economy.

A major part of the community is aware of climate change's existence through its impacts on their life although they lack comprehensive knowledge of climate change causes and adaptation measures. Within the community climate change is associated with the observed weather and seasonal changes that face the community. The reported climatic challenges were uncertain rainfall patterns, prolonged droughts, floods, sea level rise, sea inundation, saltwater intrusion, coastal erosion, and sea inundation and un-predictable sea storms. The challenges have impacted the livelihoods, economy, and lives of the community. This has contributed to an increase in theft incidences and a decrease in the availability of casual labor opportunities in the community.

In response within the community has not been adequate and sufficient. The respondents who were unaware of climate change did not implement any adaptation measures meanwhile among those aware only 69% implemented some measures with the remaining (31%) having no measures. The implemented measures according to livelihood, were mainly undertaken in agriculture through the use of irrigation and use of drought-resilient seeds. Within animal husbandry and fishery, there were insufficient to no adaptation measures whereby the majority went directly to integrating with other livelihoods mostly petty business and agriculture. The response to community disasters mainly consisted of relocating and staying on rooftops together with waiting for the weather to subside before going fishing. This showcases the limitation and gap in the extent and comprehensiveness of building

climate resilience within the community livelihood options. Furthermore, some of the climatic challenges such as saltwater intrusion and sea level rise have not been addressed at all meanwhile floods have not been mitigated at all.

The effectiveness of the measures was nearly equally divided whereby irrigation, diversification of livelihoods, and use of drought-resilient seed were seen to be effective. Meanwhile, other adaptation measures were deemed to be less effective due to their temporary nature, not meeting the household requirements, and raising operational costs. Therefore, it is important to attain a community-led adaptation approach that can realize a more comprehensive approach towards minimizing and mitigating the impact of climate change together with enabling the recovery of the community and ecosystem.

Importantly, to ensure a well-informed intervention that could last longer, it is important that a wide range of issues such as inclusive and participatory public awareness and engagement, Civil Society Organizations (CSOs) coordination and engagement on climate resilient building, climate change policies development and implementation tracking, as well as climate financing to support climate actions, need to be strengthened. Linked to other factors, such as coordination and limited awareness and resources, local CSOs' engagement in ensuring sound contributions and tracking climate policies, climate finance, and climate change initiatives is still low.

The accessibility of weather and climate information is not adequate to reach all or nearly all of the community members. The major channel of dissemination currently used is TV and Radio. Those accessing have reported the provided information has supported them in their planning and execution of livelihood action mostly in regard to taking precautions measures such as relocating, deciding on the suitability of going fishing and agricultural activities in planting and farm preparation. The majority of the information is derived from TMA with a small amount from IK. The is limited use of IK within the community following it being perceived as witchcraft and the advancement of scientific knowledge. This perception is not correct as Indigenous knowledge of weather and climate forecasting is based on generation knowledge of the ecosystem changes in relation to weather changes. IK is used mostly by natives especially rural communities as a means of informing and making vital decisions for their livelihoods against climate change-related weather variability.

Furthermore, , the country systems (TMA) confront constraints, including technical investments that impede the production of more downscaled weather forecasts at the village and/or Shehia levels. This report recommends that this information be downscaled at least at the ward level to be effective in informing livelihood planning and execution, particularly for smallholder farmers and fisherfolks provided.

5.2. Recommendations

Based on the study findings and analysis, the project provides the following recommendations which have been categorized according to stakeholders' addresses as follow here under

5.2.1. Ministry, Departments and Agencies

- a) This research and its findings highlight the need for the Revolutionary Government of Zanzibar (RGoZ) to allocate investments and bolster the capabilities and resources of the Tanzania Meteorological Authority and other related institutions focused on meteorological data encompassing both terrestrial and marine domains. The Key priorities areas of concern specifically climate services are to be strengthened with improved data collection and interpretation that shall inform the public from time to time about climate change and its challenges. Promote institutional capacity for climate change coordination and mainstreamed mechanisms in all strategic sectors including non-state actors for resilience society in Zanzibar. The government and its institutions shall establish frameworks that shall coordinate and undertake an evaluation of areas affected by climate change, and this shall ensure digitization and show the impact, causes, livelihood activities, and proposed measures to mitigate climate change. To ensure no one is left behind, all stakeholders should be involved during the mapping exercise, including citizens (communities), investors, non-governmental and Community-Based Organizations, the central government, and local authorities.
- b) The integration of scientific weather forecasts and traditional weather forecasts should be put into consideration to enable the downscaling of weather forecasts, making them more useful, accurate, and reliable for enhanced climate resilience. The study also recommends that TMA cooperate with Local Government Authorities and community members (traditional weather forecasts) to undertake the integration process at the district level, where development plans and budgets are prepared to inform the regional and national decision-making processes.

- c) Additionally, Mainstreaming gender in climate change policies and programs helps ensure the integration of women's issues, needs, and contributions across the planning and execution cycle of climate change policies and projects.

5.2.2. Local Government Authorities

- a) District and ward extension officers play an important role in providing extension services and advising on community life, but they are currently facing a number of issues, one of which is a lack of capacity. The study recommends that district and Ward Extension Officers be capacitated in order to support smallholders in the areas of interpretations of TMA's weather and climatic information services, as well as the generation of advisory services that will inform decisions during the planning and execution of their livelihoods.
- b) It is recommended that the local government support the safeguarding of traditional weather forecasting knowledge and facilitate an unambiguous data flow between community and district-level leadership. The initiative advises the promotion of Indigenous people with this expertise, as well as the establishment of communication channels that collect and offer feedback on the traditional weather forecasts provided, as well as their integration with scientific forecasts. Furthermore, deliberate measures should be taken to ensure the perpetuation of this critical knowledge throughout generations and to enhance community awareness in order to counteract the negative impression of Indigenous Knowledge (IK) as being associated with witchcraft rituals.

5.2.3. Chuini community and its stakeholders

- a) It is important for the community to develop a comprehensive adaptation plan and strategy that is led by the community itself. Such a plan will guide all community members toward building resilience against the effects of climate change. The study recommends that the community, in collaboration with its stakeholders such as civil society organizations, should undertake a participatory assessment of climate and disaster risks. This assessment will enable the formulation of an adaptation plan that can guide the community in building resilience.

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