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Research on Use of Artificial Intelligence in Anticipatory Action in Improving Wellbeing Outcomes for Children Affected by Climate Risks

Final Report

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LIST OF ABBREVIATIONS AND ACRONYMS

ADA	AUTOMATED DAMAGE ASSESSMENT TOOL
AI	ARTIFICIAL INTELLIGENCE
AI4D	ARTIFICIAL INTELLIGENCE FOR DEVELOPMENT
CCRI	CHILDREN'S CLIMATE RISK INDEX
CCRI-DRM	CHILDREN CLIMATE RISK INDEX-DISASTER RISK MODEL
CERF	CENTRAL EMERGENCY RESPONSE FUND
CHVS	COMMUNITY HEALTH VOLUNTEERS
CRC	CONVENTION ON THE RIGHTS OF THE CHILD
CSI	CHILD STATUS INDEX
DRR	DISASTER RISK REDUCTION
EAP	EARLY ACTION PROTOCOL
ECD	EARLY CHILDHOOD DEVELOPMENT
ECMWF	EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS
EVD	EBOLA VIRUS DISEASE
FAO	FOOD AND AGRICUTURE ORGANIZATION
FbF	FORECAST-BASED FINANCING
FGD	FOCUS GROUP DISCUSSIONS
IARP	INNOVATIVE APPROACHES TO RESPONSE PREPAREDNESS
IBF	IMPACT-BASED FORECASTING
IBM	INTERNATIONAL BUSINESS MACHINES CORPORATION
ICRC	INTERNATIONAL RED CROSS AND RED CRESCENT
ICT	INFORMATION COMMUNICATION TECHNOLOGY
IFRC	INTERNATIONAL FEDERATION OF RED CROSS
IFRRC	INTERNATIONAL FEDERATION OF RED CROSS AND RED CRESENT
IRRC	INTERNATIONAL REVIEW OF THE RED CROSS
ISO	INTERNATIONAL STANDARD ORGANIZATION
IBLI	INDEX-BASED LIVESTOCK INSURANCE PRODUCTS
ILRI	INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE
ICPAC	IGAD CLIMATE PREDICTION AND APPLICATION CENTER
IGAD	INTERGOVERNMENTAL AUTHORITY ON DEVELOPMENT
IT	INFORMATION TECHNOLOGY
KII	KEY INFORMANT INTERVIEWS
DHS	KENYA DEMOGRAPHIC AND HEALTH SURVEYS
DU-ISERC	DAYSTAR UNIVERSITY INSTITUTIONAL SCIENTIFIC AND ETHICAL REVIEW COMMITTEE
NAC0STI	NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY, AND INNOVATION
NDMU	NATIONAL DISASTER MANAGEMENT UNIT
NDVI	NORMALIZED DIFFERENCE VEGETATION INDEX
NGO	NON GOVERNMENTTAL ORGANIZATION
OCHA	OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS

OCS/OCPD	OFFICER COMMANDING STATION/OFFICER COMANDING POLICE DISTRICT
OHCHR	OFFICE OF THE UNITED NATIONS HIGH COMMISSIONER FOR HUMAN RIGHTS
OSRSG/VAC	OFFICE OF THE SPECIAL REPRESENTATIVE OF THE SECRETARY-GENERAL ON VIOLENCE AGAINST CHILDREN
PCRA	PARTICIPATORY CLIMATE RISK ASSESSMENT
PWD	PERSONS WITH DISABILITIES
SDG	SUSTAINABLE DEVELOPMENT GOAL
SEWAA	STRENGTHENING EARLY WARNING SYSTEMS FOR ANTICIPATORY ACTION
SMS	SHORT MESSAGE SYSTEM
TV	TELEVEISION
UNICEF	UNITED NATIONS INTERNATIONAL CHILDREN'S EMERGENCY FUND
WFP	WORLD FOOD PROGRAMME
WMO	WORLD METEOROLOGICAL ORGANIZATION

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SUMMARY

Children face significant risks from climate change, including health issues, malnutrition, and displacement. Subgroups such as girls, street-connected children, and those with disabilities are particularly vulnerable. Anticipatory action, supported by Artificial Intelligence (AI), can effectively mitigate some of these risks by predicting and responding to climatic threats. ChildFund and Barnfonden work with children across the full spectrum of their lives, working closely through local partners to keep them safe while also addressing their health and well-being, education, and life skills needs. Their programs also support the children's families and communities to build resilience. Across all spheres, children and youth are encouraged to actively participate in forums where decisions are made about their lives. Over many years, ChildFund and Barnfonden have noticed the increasing impact of climate change. El Niño weather events at the end of 2023 and the beginning of 2024 proved how vulnerable children can be. ChildFund Kenya launched an Anticipatory Action humanitarian response. Knowing there was a 90% chance of severe weather events hitting several areas where they work, they acted ahead of the impending disaster with interventions such as food distribution, cash transfers, health promotion, water treatment, and farmer training to minimize harm to children and their families. This research was commissioned on the back of this response.

There is a need for high-quality data to support effective anticipatory actions for climate hazards. While AI models can predict climate patterns, gaps exist in utilizing this data for child-focused pre-emptive measures. The purpose of the research was to identify sustainable AI solutions that prepare children and communities for climate-related disasters, improving resilience and wellbeing outcomes. The abridged research objectives were to assess AI usage in anticipatory actions for children, identify current system gaps, determine effective data types and delivery methods, and explore institutional support for sustainable AI use. Abridged research questions explored were:

1. What gaps exist in current anticipatory action systems for children?
2. How can AI data address these gaps?
3. Who are the primary data users?
4. How should data be delivered for maximum impact?
5. What institutional support is needed for sustainable AI use?

Qualitative methods, including focus groups, key informant interviews, and literature reviews, were used in Marsabit County context with case study design.

Key Findings:

1. Preparedness plans frequently overlook the comprehensive support needed by children, such as maintaining educational continuity, providing psychological support, and ensuring physical safety. As well, children are often excluded from participatory planning processes, resulting in disaster preparedness plans that do not address their unique needs. Incorporating children's perspectives can reveal specific risks and effective measures from their viewpoint. Key indicators relevant to children's wellbeing, such as rates of

malnutrition, school dropout rates, and incidences of mental health issues, are often not adequately monitored or analyzed in the context of climate risks.

2. Community members should not only know about the imminent climate-risk disasters but also how to prepare and respond before the disaster occurs with a specific focus on children
3. Participatory Climate Risk Assessment (PCRA) are being convened by some counties involving government, NGO partners and other stakeholders. For instance, the Marsabit adaptation strategy incorporating PCRA findings mentions children in the education sector, where there is a plan to invest in mobile schools, support school feeding programs during drought, and initiate food for free programs during harsh times, as well as cash transfer programmes for children-, PWD- and old age-headed households.
4. Currently, there is hardly any AI-initiated data for anticipatory action targeting children at risk of climate-related disasters.
5. The main Government agency that can potentially use AI-initiated data for anticipatory action that targets children at risk of climate-related disasters is the National Disaster Management Unit under the Ministry of Interior and Coordination of National Government.
6. The Ward Administration (electoral subdivision) could play a role in identifying ward-level trigger actions for anticipatory action, but they would need to motivate the County Government for any spending (which must be approved by the Assembly). Money is spent at ward and village level by the county governments themselves through their annual budgets. Some of their decision making (e.g., decision to close schools) is at the directive of various Ministries. There are 1450 Wards in Kenya.
7. Community Health Volunteers, Traditional Leaders, School Principals and other community guidance structures operate at Ward Level. This means any AI initiative developed for use at Ward level (the closest authority to children) needs to be motivated with Ministries, Country Governments, and Ward Councils.
8. The National Disaster Management Unit could integrate the many different Ministries involved. They are also the unit issuing guidance and instruction to the County Governments, who in turn work with the Ward Councils.
9. The Ministry of Information, Communication, and the Digital Economy (responsible for dissemination of public information and ICT); the National Disaster Management Unit; the Council of Traditional Leaders, County Government and Ward Council reps, and representatives from Kenya Youth Organisation would be natural partners to discuss first steps in developing a practical AI tool for use in anticipatory action benefiting children.
10. Collecting data on health and nutrition indicators, disease prevalence, climate conditions, and socio-economic factors can help AI systems predict risks more accurately. Using AI to develop scenario planning tools can help local authorities prepare for different climate risk scenarios.

11. Involving the community in designing and implementing AI initiatives can enhance relevance. For instance, setting up community advisory boards to provide input on AI projects can ensure they meet local needs. Ensuring that AI interventions are culturally appropriate can enhance acceptance. For example, working with local religious leaders and elders to design interventions that respect cultural norms and traditions can improve community support. Educating various sectors of the community on how AI works and how to use it will allow them to understand and 'buy into' the technology. The educating aspect could be assigned to universities or educational institutions, e.g., Maseno University could offer customized online courses on AI and data analysis can enhance local capacity.
12. Implementing AI-driven automated alert systems can ensure timely responses, which can guide the prepositioning of resources or the activation of child protection response services to be more vigilant to cases of child labour, child marriage etc.
13. AI-driven real-time monitoring systems can provide continuous feedback on intervention effectiveness, tracking progress and allowing interventions to evolve according to daily information. Collection tools would gather data which would be analysed by AI and looped back to refine future actions. For instance, information gathered from water points, health /community health workers, schools and traditional leaders could be triangulated and analysed to provide a snap shot of a situation, to guide Ward Council and County Government decisions. Involving the community in evaluating AI interventions can ensure they remain relevant and effective. Children and youth
14. There are apps existing for climate forecasting, informed by AI. These are not always reliable. Some apps provide recommendations for how to deal with impending disasters, such as recommendations to store food and sell stock. Ward level preparedness strategies are recommended.
15. The closest use of AI is by the Kenya Meteorological Department's Strengthening Early Warning Systems for Anticipatory Action (SEWAA) Project
16. A crucial source of data that is missed by AI models is traditional methods of forecasting weather by the elders. Community leaders such as elders, CHVs, and local chiefs have a lot of information and data that can help in registration of those in need. Additionally, these community members have a wealth of information on climate-related disaster response strategies that worked and those which are not effective which can also be documented. These data sources can be documented and picked by AI, with a specific focus on children.
17. There is low digital connectivity and low literacy in many hard-hit communities in Kenya. Information issued by authorities is hard to understand. Therefore, information delivered via local radio and TV stations, and personal technological devices like mobile phones are the most relied upon source of information. There is a need to convey the information in a language that the locals can understand without waiting for another party to interpret it. Youth and educated members have a critical role in interpreting, translating, and disseminating information to the rest of the community via channels such as social media,

mobile phone devices, and the internet. Community leaders and members are best to receive AI-initiated data and information through SMS and community meetings.

18. There is a major public finance management gap for anticipatory action (despite NDMU requirement for 80% concentration of resources in prevention, mitigation, and preparedness, while leaving 20% for response and recovery). There is a lack of a clear understanding of anticipatory action and how it fits into the planning process. It is also not clear which institution should drive anticipatory action. This is one reason why there is little investment in AI.
19. There are gaps in the policy and regulatory contexts to facilitate effective anticipatory action.
20. A number of vulnerability assessments have been undertaken by various state and non-state actors that can be used to model anticipatory actions, such as Child Status Index (CSI) for vulnerable children, nutritional assessments, and special studies and evaluations of the impact of climate related disasters and interventions. Response plans are also documented. Other sources include the national census (10 yearly); Kenya Demographic and Health Surveys (KDHS); and the Ministry of Health's Department of Family Wellness, Nutrition, and Dietetics County information.

Conclusions:

AI can transform anticipatory actions for climate-related disasters, especially for children. Addressing current gaps and leveraging AI capabilities can significantly improve wellbeing outcomes for children affected by climate risks. Artificial intelligence can be incorporated in forecasting impending climate related risks, designing strategies and when to trigger such strategies for operationalization. This would work to lessen the extent and severity of the hazard impact. To achieve this, there is need for continuous and consistent data collection especially through school-based programs and involving humanitarian actors who are majorly concerned with children affairs at local level. This is necessary since relevant data capturing the hazards and their consequent impacts is not available at local level.

Recommendations:

1. **Incorporate Child-Centric Indicators in AI Models**
   AI systems should integrate key child-specific data points—such as malnutrition rates, school dropout rates, and mental health issues—into predictive models to ensure that anticipatory actions address the unique vulnerabilities of children. This would require collaboration with education and health sectors to ensure real-time data collection and monitoring.
2. **Develop Community-Driven AI Tools for Anticipatory Action**
   Involve community members, particularly local leaders such as traditional elders, school principals, and health volunteers, in the design and implementation of AI tools.

Community advisory boards should guide the development of AI systems to ensure they are relevant to local contexts and culturally appropriate, with a focus on child protection.

3. **Create AI-Driven Early Warning Systems Tailored to Children's Needs**
   AI-based alert systems should be tailored to trigger early actions focused on children's safety and well-being. These systems should guide pre-disaster measures such as school closures, child protection services, and the activation of cash transfer programs for households with children, particularly in high-risk areas identified through AI predictions.
4. **Ensure Localized and Inclusive Communication of Climate Risks**
   Given the low digital connectivity and literacy levels in some communities, AI-generated data must be disseminated through accessible channels, such as local radio, TV stations, and mobile phones, in local languages. Youth and community leaders should be trained to interpret and communicate this data to ensure broader community understanding and preparedness, with special attention to children's needs.
5. **Integrate Traditional Knowledge with AI Models**
   Combine AI-driven data with traditional forecasting methods used by local elders and community leaders to improve the accuracy of climate risk predictions. Traditional knowledge, especially around seasonal patterns and local coping strategies should be digitized and incorporated into AI models to strengthen community ownership and enhance child-focused disaster response strategies.
6. **Enhance Institutional Coordination for Child-Focused Anticipatory Action**
   Strengthen the role of the National Disaster Management Unit in coordinating AI-driven anticipatory actions across different sectors, including education, health, and child protection. AI systems should facilitate collaboration between county governments, ward councils, and relevant ministries to ensure a unified and child-focused disaster preparedness framework.
7. **Build Capacity for AI Use at the Community and Ward Levels**
   Equip ward-level institutions, such as local councils and community health volunteers, with the necessary tools and training to utilize AI-driven climate data effectively. Capacity building should include AI literacy programs for community members, and partnerships with universities to offer customized AI training, especially targeting youth leaders and educators.
8. **Establish Real-Time AI Monitoring Systems for Child Protection**
   Implement AI-driven monitoring systems that continuously track the well-being of children during climate events. These systems should provide real-time data on key indicators such as food security, school attendance, and child labor. By triangulating data from schools, health centers, and local leaders, the AI systems can help identify and respond to emerging risks affecting children.
9. **Prioritize AI-Driven Budgeting for Child-Centric Disaster Response**
   Advocate for dedicated budgeting within government plans for AI-driven anticipatory

action focused on children. Ensure that public finance management gaps, particularly in prevention and preparedness, are addressed by channeling resources to AI systems that can inform spending decisions, such as supporting school feeding programs during droughts or cash transfers for vulnerable children.

10. **Enhance stakeholder collaboration, data, and information sharing**.
    This would involve data sharing amongst government and non-state actors on the forecasted climatic hazards and the associated risks. Information dissemination to the relief agencies and community members to set in motion anticipatory actions to alleviate the impending impact.

11. **Prioritize inclusive child participation in disaster preparedness.**
    Inclusivity would be achieved through curriculum- entrenched programs, sensitization, and structured but localized training based on the most prevalent hazards in the region.

12. **Strengthen institutional support for sustainable AI integration.**
    Institutional strengthening would involve infrastructure development, the provision of capacity building, and the training of personnel for effective use and dissemination. Other approaches could involve exchange programs and benchmarking to expose the various actors to up-to-date relevant information and infrastructure.

CHAPTER 1: INTRODUCTION

1.1 Background of the Research

Children are especially susceptible to the consequences of climate change, and they bear a greater impact from disasters, environmental deterioration, and the climate crisis compared to adults (UNICEF, 2023). This is manifested through exposure to pollution, life-threatening infections, and extreme weather events. For example, (i) environmental degradation and climate change are contributing to the increased prevalence of deadly pediatric diseases; (ii) children are at a higher risk of experiencing the negative effects of air pollution compared to adults; (iii) infants and young children have less ability to control their body temperature and are more susceptible to dehydration, making them more at risk during severe heat waves; (iv) child malnutrition is aggravated by crop failures and increasing food prices, which is further intensified by elevated temperatures and excessive rains associated with climate change; (v) each year, over forty million children experience interruptions in their schooling due to disasters that are worsened by climate change, furthermore, this figure is consistently rising; (vi) extreme heat is associated with an increase in mental health problems including posttraumatic stress disorder and depression in children and adolescents. There are also downstream effects of climate change caused in response to the stresses inflicted by climate-induced hardship: increases in child labour, child marriage, child recruitment into armed forces, to name a few (Barnfonden, 2021). The climate crisis, apart from altering the environment, has had an impact on children, right from conception where a mother's experiences (e.g., lack of enough nutritious food, stress etc.) can affect fetus development and organ formation during gestation, through to their growth into adulthood (UNICEF, 2023; Pacheco, 2020). It also leads to displacement, with a whole raft of different social, economic and environmental problems.

Certain subgroups of children, including girls, street-connected children, child laborers, children with impairments, and children who are married or at risk of being married, have specific protection concerns during emergencies that require special attention and prioritization (IFRC, 2021). According to OSRSG/VAC (2022) and Barnfonden's own research (2021), the climate crisis acts as an 'amplifier' for violence against children, worsening every problem—from poverty to displacement and loss of education—that allows such violence to flourish. Although all children are susceptible to the combined effects of the climate catastrophe and violence, those who are already the most impoverished bear the greatest brunt of this impact. OHCHR brings in the aspect of compounded factors and asserts that climate change has a greater impact on children who are in vulnerable situations, such as those who are economically disadvantaged, female children with disabilities, indigenous, belong to minority groups, or are migrants. Inadequate attention to accessibility in the planning and execution of evacuation, response, and relief operations during natural

disasters can increase the vulnerability of children, including those with special needs due to disabilities, to injury. Additionally, prejudice exposes them to the dangers of abuse, neglect, and abandonment during climate shocks. Climate change may exacerbate the vulnerability of girls to child labor, sexual assault, and trafficking. OHCHR further asserts that children residing in geographically susceptible locations, such as riparian and low-lying coastal areas, dry regions, high mountains, polar zones, and other fragile ecosystems, experience unequal and significant effects.

The UNICEF (2023) Children's Climate Risk Index (CCRI) illustrates the significant levels of exposure and susceptibility that African children face in relation to the impacts of climate change and environmental degradation. While the severity of these dangers varies across the continent, they have an impact on nearly every country and every child. Children and communities in northern Africa face increased risks due to water scarcity and air pollution. In contrast, those living in the western and eastern parts of the continent, especially in tropical areas, are more significantly impacted by vector-borne diseases, heat waves, and riverine flooding. Right before birth, environmental warming, depressed rainfall, and high variability in rainfall and temperature are linked to low birth weights and child stunting, leading to chronic health issues in Sub-Saharan Africa (Davenport et al, 2017). Specific regions of the continent have increased risks of tropical storms and coastal flooding, yet the risk of soil and water pollution affecting children is widespread across the whole continent without any discernible geographic pattern.

Kenya's contribution to global greenhouse gas emissions is less than 0.1%, according to UNICEF's Kenya Subnational Children Climate Risk Index-Disaster Risk Model (CCRI-DRM), but the effects of climate change have a disproportionately negative impact on the nation. This is primarily evident via the frequent and increasingly severe droughts and floods, which pose a threat not only to the progress made in development but also impede the trajectory of growth and development. Children bear the brunt of these threats on the ground, since their basic rights to education, water, good health, and quality nourishment are negatively affected. Droughts result in water scarcity and insufficient availability of healthy food, leading to a substantial proportion of children experiencing malnutrition and other health hazards. Floods result in the involuntary displacement of children as their homes are swept away, leading to the violation of their fundamental right to education due to the closure of schools. Moreover, the greater distance to water sources exposes women and girls, who frequently bear the responsibility of fetching water, to a heightened vulnerability to gender-based violence.

1.2 ChildFund/Barnfonden's efforts in climate action

Barnfonden and ChildFund's efforts in climate action align with two categories of Sustainable Development Goal (SDG) 13: adaptation and mitigation, but also tackle SDG

14 (conserve and sustainably use the oceans, seas, and marine resources for sustainable development) and SDG 15 (protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss). Their different but interlinked strategies describe climate action as actions that support children and their families' ability to positively adapt and protect against slow and sudden weather events caused by climate change (climate change adaptation and disaster risk reduction) and actions that prevent future effects of climate change that impact children's ability to reach their full potential and enjoy their rights, primarily through nature-based and environmental actions but also climate mitigation actions through environmental care and climate mitigation. ChildFund and Barnfonden believe climate and environmental catastrophe pose a significant challenge to the rights of children, as they not only endanger their future but also undermine their entitlement to live a life of utmost fulfillment. Consequently, they have incorporated a child rights viewpoint into their efforts and actively engage with children, their communities, and their partners, while also considering the insights of scientists and academics, in order to address the climate problem. These NGOs adopt a do-no-harm and safeguarding approach to effectively tackle the interconnectedness of rights and vulnerabilities, specifically pertaining to gender, disability, and identity discrimination, and they are cognizant and cautious of the unique and distinct characteristics of each country, culture, region, and environmental habitat.

Working together within the ChildFund Alliance[1], Barnfonden and ChildFund both promote the goal: "***Children and young people are transformation champions in addressing climate change and environmental issues as they affect their rights (local, national, and global levels).***". This goal is expected to be achieved by working towards the following outcomes:

i. Children and young people have a right to information about the issues to protect, prepare for, and act on them (CRC Articles 13, 17, 28, 29, 30, 31). This is realized through climate and environmental awareness and education to help build knowledge, skills, and behavior change to address the climate crisis.
ii. Children and young people have a right to space, tools, resources, and networks to act upon that knowledge and hold duty-bearers accountable to act on their future (CRC Articles 12, 14, and 15). This is realized through meaningful child participation to take actions to address the issues in their immediate surroundings as well as with duty bearers.
iii. Children and young people have a right to be prepared for a changed and unpredictable environment (CRC Articles 6, 24, 27, 32). This is realized through skill development and preparedness for the immediate and future impacts of climate change and environmental degradation.

[1] Eleven child-focused development and humanitarian agencies are part of the global ChildFund Alliance network, which helps children and their families overcome poverty and the underlying conditions that prevent children from reaching their full potential. Read more: https://childfundalliance.org/about-us/

ChildFund's country offices and local partners at the forefront of climate change have implemented many climate action initiatives under different names, including Disaster Risk Reduction (DRR), natural resource management, and sustainable livelihoods. Meanwhile, Barnfonden has added a focus on reviewing pressures from a 'now, soon, future' lens, ensuring that plans account for and transition towards a child and its community's needs over time, while avoiding maladaptation. They promote an intersectional approach, integrating climate responses into health, education, child protection, youth development, livelihood and humanitarian strategies.

1.3 Statement of the problem

Developing successful anticipatory action plans to address climate hazards such as droughts and floods relies on having timely, high-quality data and information. This is necessary to create response strategies that prioritize the needs of children and establish reliable triggers for action. Artificial Intelligence models are increasingly powerful in predicting climatic patterns. However, there are still methodological shortcomings in developing and implementing preemptive actions based on AI data, particularly in relation to the well-being of children.

1.4 Purpose of the research

The overall purpose of the research is to identify the problem, need, or challenge and find a sustainable, appropriate, feasible, and empowering AI solution to ensure children, their families, and the wider environment are prepared for and know how best to address anticipated climate-related disasters. The study's objectives are to gather information and offer useful suggestions that ChildFund Kenya, Barnfonden, and innovation design centers they work with can use to improve communities' resilience to climate change and disasters, initially for children living in Kenya's vulnerable regions who are either already experiencing or are at risk of climate-related disasters, but also to draw lessons to take to Barnfonden/ChildFund's wider work globally.

1.5 Objectives of the research

The objective of the research is to assess the potential use of artificial intelligence solutions to ensure children, their families, and the wider community are prepared for and know how best to address anticipated climate-related disasters.

1.6 Key research questions

The main research question is:

How can Artificial Intelligence (AI) be used to inform, curate, closely monitor and/or respond to effective, child-focused, anticipatory action strategies responding to potential

and ongoing climate threats i.e. floods/droughts, and encourages children's participation and the engagement of duty bearers to inform, prepare and engage?

The research sought answers to the following key research questions:

i. What specific gaps exist in the current Anticipatory Action system that targets children at risk of climate related disasters?
ii. Which types of data, if initiated by AI, can effectively contribute to addressing gaps in the current Anticipatory Action System that targets children at risk of climate-related disasters?
iii. Who are the primary users and uses of AI-initiated data for anticipatory action that targets children at risk of climate-related disasters?
iv. How should AI-initiated data be delivered to the primary users to ensure maximum impact of anticipatory action that targets children at risk of climate-related disasters?
v. What institutional support might be available to ensure the sustainability of potential AI use?
vi. How might the recommendations from the research fit within the current humanitarian action system present at community level?

1.7 Significance of the research

The approach to responding to climate change-related disasters has evolved from waiting for a disaster to occur before responding, to adopting a strategy of anticipatory action. This involves not only predicting impending climate conditions but also evaluating how these conditions will affect certain populations, thus enabling a proactive reaction and allocation of resources ahead of the event occurring. Artificial Intelligence models are becoming potent in climate forecasting, although there are still methodological deficiencies in enabling proactive measures, especially for the benefit of children. This research contributes to a better understanding of how AI can effectively enhance the preparedness and coordination of anticipatory action responses that specifically focus on children and their families and improve the presentation of information and provision of advice regarding external factors that affect children and families before and during disasters, as well as intrinsic factors such as the psychosocial well-being of families and children and their ability to cope.

1.8 Basic assumptions of the research

It is an assumption that data collected from the purposefully sampled respondents mirror the opinions and views of the non-sampled population. It is also assumed that respondents gave honest and objective responses to enhance the research's reliability and validity.

1.9 Limitations of the research

There are certain inherent limitations associated with non-empirical research. Among them are inconclusive deductions due to:

i. Limiting reliable data for inferencing is caused by time constraints and a few right stakeholders with relevant information.
ii. Being non-empirical, there was an overreliance on the respondent's memory that, at times, was evidently skewed and influenced by recent events rather than a holistic picture.
iii. Biased responses from the different stakeholders motivated by the expectation of support by the commissioners of the research.
iv. Respondents' anxiety due to the prevailing political tension occasioned by the demonstration organized by Gen Z at the time of field data collection.

1.10 Delimitations of the research

The research used a case study design in a community in Marsabit County and applied a mix of three qualitative data collection methods, i.e., focus group discussions (FGD), key informant interviews (KIIs), and document and literature reviews, to facilitate data triangulation, enhance research rigor, and enable the extension of findings to a broader population in similar contexts beyond Marsabit County. The researchers worked with local facilitators for FGDs and used simple language to explain AI to enhance the understanding of respondents.

CHAPTER 2: LITERATURE REVIEW

2.1 Status of climate relates risks in Marsabit county

According to County Government of Marsabit Participatory Climate Risk Assessment Report 2023, drought and flooding are the most prevalent climate hazards that are experienced in the county, as illustrated in Figure 1. Other climate hazards are resource-based conflicts and human and livestock diseases. Drought is the most prevalent and impactful and has been experienced across the county more than four times in the last 10 years. Climate risks associated with drought in the county are scarcity of water, shortage of food, animal theft, human wildlife conflict, scarcity of pasture, and bush fires during dry spells. Marsabit county is made up of four sub counties namely: Moyale, North Horr, Laisamis and Saku. Moyale Sub-County, the home of the Chalbi Desert, which is the only desert in Kenya, is normally the worst hit by drought and associated climate risks. Moyale Sub-County is also the most affected by flooding hazards, with attendant climate risks being destruction of properties, human and livestock deaths, increase in waterborne diseases, and high winds/cyclones. Flooding in Moyale Sub-County is mainly attributed to the fact that it hosts Chalbi Desert, the largest of the four drainage systems in the County. It receives run-off from Mt. Marsabit, Hurri Hills, Mt. Kulal and the Ethiopian plateau. Flash flooding due to torrential rains on drought-baked ground is also an issue. Resource-based conflict is most prevalent in North Horr Sub-County while human and livestock diseases occur mainly in Laisamis Sub-County. Saku sub-county experiences a strong and intense wind system. It also has deep gullies which is an indication of immense erosion activity by rain water that could be attributed to intense precipitation.

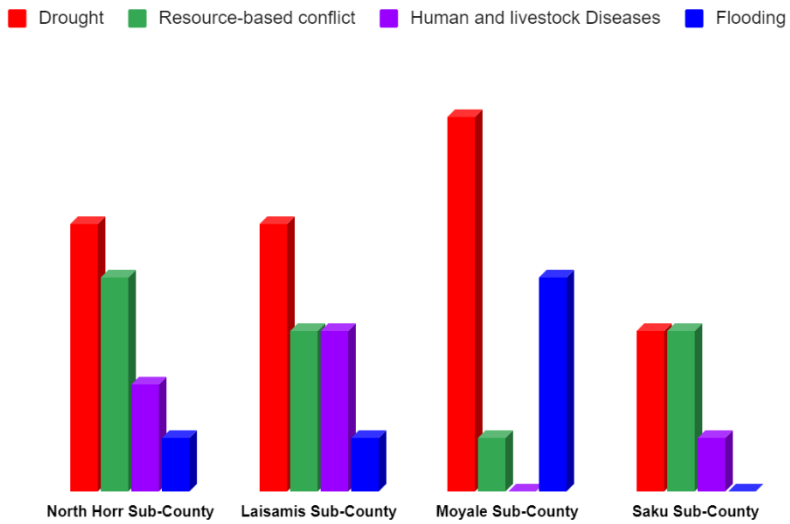


Figure 1: Prevalence of climate hazards in Marsabit County

Source: Adapted from County Government of Marsabit Participatory Climate Risk Assessment Report 2023

The Marsabit County Participatory Climate Risk Assessment Report 2023 articulates differentiated impacts of climate trends and risks on the various segments of the population. When families are faced with difficult decisions in order to survive, they may be forced to leave their children, including on streets or with relatives, so they can search for work or pasture; reduce the mouths they need to feed by engaging their children in forced marriage; or rely on their children for financial support by engaging them in informal or formal paid labor and essential household activities. High rate of malnutrition has also been recorded among children in the county. Pastoralist women find that with drought and other climate risks, their family responsibilities increase, and often, to cope, the women skip meals, making do with a meal a day and sometimes none at all. To help ease the burden at home, girls forfeit their education for work as house-helps in urban areas. Poor performance in school among the youths during drought due to poor feeding and concentration eventually leads to youths dropping out of school, engaging in crime like cattle rustling. Rural-urban migration is also a consequence, which can lead to youth committing petty crimes. Droughts tend to increase the elderly's vulnerabilities; for example, appropriate foods may be unavailable, their mobility might be reduced, and their dependence on others may increase. The traditional roles of older people are dismantled, leaving elderly people with less influence and power. Persons living with disabilities and terminally ill are affected as there is inadequate food, water, insecurity, and an increase in diseases such as urinary tract infections, among others. As their assets and livelihoods are wiped away by prolonged drought, people with terminal illnesses are often exposed to a lack of medication, which, in the long run, might cause death. Water scarcity during prolonged droughts causes limited access to safe water for drinking and for practicing basic hygiene at home, in schools, and in health-care facilities for the differently-abled.

2.2 Anticipatory action

Historically, disaster governance has primarily concentrated on emergency response, reconstruction, and rehabilitation in the aftermath of major catastrophes. Nevertheless, investing in proactive measures to mitigate disaster risk at an early stage is more economically viable (Van den Homberg et al., 2020). Anticipatory action involves taking proactive measures before a crisis occurs in order to minimize or alleviate the impact of the shock. This is claimed to be more efficient and effective, and the approach focuses on addressing risks rather than needs (IFRRC, 2021). It enhances the preparedness measures performed for potential future hazards that are now unknown by focusing on populations that are most vulnerable to the identified shock (Pichon, 2019). Anticipatory action usually starts with using existing data and evidence to start allocating money to projects that both government and non-government groups have chosen and agreed on ahead of time (CERF,

2020). OCHA (2024). Anticipatory Action Toolkit indicates that approximately 50% of the crises occurring today may be anticipated to some extent, while 20% of them can be significantly anticipated. However, less than 1% of the funding required for these crises is pre-arranged. Recently, the humanitarian community, including humanitarian coordination forums and technical working groups, has been aggressively seeking ways to proactively address crises by aiding people at the earliest signs of trouble and by using anticipatory measures.

There is a myriad of scientific models used to predict the likelihood of climate change-related phenomena like El Nino and subsequent flooding occurring. However, the game changer in containing the impacts of these climate change-induced disasters is coming up with and implementing effective anticipatory action plans and ensuring that these action plans are responsive to children too. Different terminologies are used by various stakeholders to refer to anticipatory actions. Examples include early action, preemptive action, early warning bulletin, and contingency plans among others. 14 of such anticipatory action plans were reviewed, ranging in geographic coverage from global to local for climate hazards such as floods, drought, climate-sensitive infectious diseases such as malaria, cholera, dengue fever, and epidemics such as Ebola Virus Disease (EVD) for the period October 2022 – June 2024. Two of these anticipatory action plans/reports did not mention children at all, while another 5 only mentioned children less than 10 times. Those that mention children several times (More than 20 times) are anticipatory action plans/reports developed by humanitarian actors with a more specific focus or interest in children such as UNICEF, WFP, and Plan International. The regular Drought Early Warning Bulletins prepared by the National Drought Management Authority occasionally mentions children, between 4-8 times for the January – June Reports reviewed.

FAO's Anticipatory Action uses risk analysis and forecasts to trigger interventions before a crisis escalates (FAO, 2023). In 2023, FAO developed the El Niño Anticipatory Action and Response Plan for August–December 2023 to mitigate the expected impacts of El Niño-induced climate extremes on agriculture and food security (FAO, 2023). However, the 2023 FAO El Niño action plan only mentioned children once and made reference to Colombia, where it was estimated that 2,303 children under 5 years of age were at risk of acute malnutrition due to the El Niño phenomenon. There was no mention of preemptive action specifically targeted at children. However, El Niño Anticipatory Action Plan for Zimbabwe released by OCHA in November 2023 mentioned "children" 35 times and had specific anticipatory actions directly targeted at children (OCHA, 2023).

IFRRC (2021) observes that there is a very limited connection between child safety and preemptive or anticipatory action. There is a scarcity of published information regarding the connections, and there are only a limited number of practical examples available. Barnfonden

(2022) asserts that there is a need to acknowledge that climate change is increasing levels of violence against children, and there is a need to continue to strengthen and test the evidence; strengthen prevention of violence against children through livelihood resilience, addressing social norms, and developing school-based programmes; strengthen disaster prevention and response services to incorporate the increasing risk of violence against children and promote anticipatory action; and listen to, engage, and support children and youth in planning and solution-finding to deal with the effects of a changing climate. Anticipation Hub (2023) also affirms that:

i. Protection, gender, and inclusion must be integrated across all anticipatory action approaches to better respond to the rights, needs, and priorities of girls and boys in all their diversity, alongside marginalized groups.
ii. Uphold and promote the right of girls and boys in all their diversity to participate in anticipatory action decision-making and actions at all levels.
iii. Improve cross-sectoral collaboration and invest in effective coordination mechanisms for anticipatory action to ensure that all community members, including girls and boys in all their diversity and marginalized groups, have continuous access to basic services for protection and education.

The Africa Youth Climate Assembly (2023), which took place in Nairobi, Kenya, acknowledged that despite the growing uncertainty about our future due to climate change and the gravity of its effects, there is one undeniable truth: we will leave this planet to children, young people, and future generations. The assembly further noted that Africa possesses the most youthful population globally, since 70% of the population in sub-Saharan Africa is under the age of 30. It is projected that by 2030, young Africans will make up 42% of the worldwide youth population. Consequently, the African continent has the potential to benefit from this demographic dividend in the development of the green growth agenda. The summit called for the meaningful, inclusive, and systematic integration of youth participation in African climate change frameworks and processes and specifically, among other recommendations, called for:

i. Institutionalization of youth participation in all climate-related decision-making.
ii. Investment in youth-led research, innovation, and data gathering initiatives.
iii. Strengthening the capacity of young people for climate change mitigation efforts.
iv. Strengthening child- and youth-specific adaptation and resilience efforts.
v. Building the capacity of youth with disabilities, their inclusion, expertise, and access to resources in responding to slow-onset climate events in semi- to extreme-arid areas.
vi. Developing policy and legal frameworks to protect and empower climate migrants and ensuring climate migrants, especially young ones, have access to basic human rights, health, and social security.

2.3 Use of Artificial Intelligence in anticipatory action

Emeritus Stanford Professor John McCarthy coined the term Artificial Intelligence (AI) in 1955 and defined it as "the science and engineering of making intelligent machines" (Manning, 2020). In an attempt to understand the term better, context-based definitions have emerged. For instance, the IRRC (2020) defines AI systems as 'computer programs that carry out tasks—often associated with human intelligence—that require cognition, planning, reasoning, or learning'. On the other hand, IBM defines AI as technology that enables computers and machines to simulate human intelligence and problem-solving capabilities and further explains that, on its own or combined with other technologies (e.g., sensors, geolocation, robotics), AI can perform tasks that would otherwise require human intelligence or intervention. ISO/IEC 22989:2022 defines AI as "a technical and scientific field devoted to the engineered system that generates outputs such as content, forecasts, recommendations, or decisions for a given set of human-defined objectives.".

Beduschi, A. (2022), observes that data-driven AI technologies have the potential to progressively transform the humanitarian fiel d. However, they also highlight significant improvements necessary such as data quality, algorithmic bias and data privacy that may need to be addressed when such systems are deployed, The IRRC (2021) also says that AI could help humanitarian actors make the change from reactive to proactive approaches to humanitarian action. It also says that the improvements needed, such as those related to algorithmic bias and data privacy concerns, should be dealt with right away if AI is to be used to help humanitarian action and not against it. Kim, K., and Boulanin, V. (2023) identify three entry points for AI to respond to climate-related security risks: understanding climate hazards, managing vulnerabilities, and detecting climate-related grievances and tensions.

2.3.1 AI tools used in anticipatory action

Anecdotal feedback from ChildFund and Barnfonden local partners is that AI could play a significant role in anticipating not only the occurrence of an event (for which some apps already exist), but in improving the preparedness and coordination of an anticipatory action response that more directly targets children and their families. AI might also be used to present information and provide advice related to the external factors impacting children and families in the lead up to and during disasters (things they may not directly influence) or the intrinsic factors—for instance, family and child psychosocial health or capacity to cope. Current AI climate-related hazard predictive models largely forecast the likelihood of a hazard occurring, it's magnitude and effect on the general population such as displacements, physical harm and even death during flooding, and damage to crop lands. However, they fall short of anticipating specific impacts on children and their families such as psychosocial distress due to displacements, interruption of schooling, malnutrition, and ill health.

Anticipation Hub (2023) explains that there are current instances of AI being applied to humanitarian action and, more generally, to the reduction and mitigation of disaster risks. Presently, GraphCast by Google Deepmind and PanguWeather by Huawei stand as the most exceptional models. These utilize a fraction of the supercomputing capacity of the world's preeminent weather forecasting systems, such as the European Centre for Medium-Range Weather Forecasts. Specifically, they possess a high level of proficiency in forecasting the paths of tropical cyclones, a critical capability for cyclone preparedness. An alternative model is the EarthNet initiative, which forecasts more impact-centric variables using AI and satellite data. The visual manifestation of drought's consequences on vegetation and ecosystems is achievable through satellite imagery. Consequently, the objective is to generate precise forecasts of forthcoming satellite imagery that will enable the identification of impending drought impacts.

Huynh et al. (2023) point out that disaster response agencies are transitioning from a climate forecasting approach to an anticipatory action approach. This involves not only predicting the climate conditions but also evaluating how these conditions will affect certain populations. This enables proactive action and allocation of resources. Machine learning models are becoming effective in climate forecasting; however, there are still methodological gaps that need to be addressed to support proactive measures. Beduschi A. (2022) also contends that AI can assist humanitarian actors in transitioning from reactive to anticipatory methods to humanitarian action, thereby enhancing their effectiveness. Nevertheless, it emphasizes the need to prioritize addressing the current dangers associated with algorithmic bias and data privacy concerns to effectively utilize AI for humanitarian purposes without compromising humanitarian principles.

The digital initiative 510 collaborated with the National Red Cross and Red Crescent Societies and other partners to create the Impact-Based Forecasting (IBF) Portal, a digital one-stop shop for information that aids disaster management in their decision-making during anticipatory action operations (510, 2024). The IBF Portal presents information on the impact of an oncoming disaster at the appropriate time, allowing decision-makers to act and carry out pre-agreed early actions. When a disaster strikes, it is critical to determine as soon as possible how many people are affected, where they live, and the extent of the damage to appropriately plan response activities. 510 has also developed a deep learning model known as the Automated Damage Assessment Tool (ADA) that detects damaged structures in satellite images after a catastrophic event. The automation of this assessment significantly reduces reliance on human labor and allows 510 to promptly provide the required information. The reduction in assessment time from weeks to hours significantly impacts operational efficiency and, ultimately, the potential for life-saving outcomes. In obtaining a preliminary understanding of the situation, the ADA has proven to be incredibly useful. Disaster response teams can identify locations that were emphasized in

multiple models and on-the-ground data with the aid of AI-assisted satellite damage tools. This automated assessment of damage helps in ground truthing the pre-agreed early actions and determining the most probable and accurate version of the predictive model.

Innovations deploying the power of information technology (IT) in the field of anticipatory action / climate change exist but are still nascent in Africa. For example, forecast-based financing (FbF) is a strategy employed by the International Red Cross and Red Crescent Movement (ICRC) to safeguard lives and livelihoods before a disaster occurs through the utilization of cutting-edge technology and methodologies, as well as the analysis of data and weather predictions (Van den Homberg et al., 2020). An Early Action Protocol (EAP) outlines the potential high-risk areas where the Forecast-based Financing (FbF) mechanism could be activated, the prioritized risks to be addressed by early actions, the number of households to be reached against an expected activation budget, the forecast sources of information, the expected lead time for activation, and the agencies in charge of implementation and coordination. The first FbF trials were deployed in Togo in 2013 with a self-learning algorithm for flood forecasting and in Uganda using text mining of online newspapers to gather impact data for trigger calibration. Since the initial one in 2018, eight EAPs for sudden-onset disasters have been established and approved.

2.3.2 AI tools used in anticipatory action in Kenya

Motivation for AI tools in Anticipatory Action

The Netherlands Red Cross, British Red Cross, the 510 Global data team, and the Red Cross Red Crescent Climate Centre are supporting the Innovative Approaches to Response Preparedness (IARP) project (2018–2022) that the National Red Cross Societies of Ethiopia, Kenya, and Uganda are implementing (Pichon, 2019). Six early action protocols (EAPs) were to be developed: one on flood and one on drought for each of the three countries. Presently, numerous foreseeable catastrophic occurrences, such as floods and droughts, lead to calamities and anguish. Climate change is making this worse. To mitigate or prevent the consequences of these catastrophes, the utilization of climate and weather forecasting can be employed to initiate timely measures to offer ample preparation before a disaster. Anticipation Hub observes that rather than taking immediate action upon receiving a forecast, governments and humanitarian groups sometimes delay initiating their response operations until after the occurrence of the disaster due to insufficient planning and early funding to implement proactive measures (Pichon, 2019). Implementing such protocols would mitigate hazards for individuals who are susceptible and result in significant time and cost savings in humanitarian efforts. The goal of the IARP initiative is to fix this major problem by setting up forecast-based financial systems that are backed up by data preparation and cash-transfer programs for quick action. The implementation of these novel strategies would provide an early warning and early action system, allowing national societies, in collaboration with other essential stakeholders, to provide cost-

effective and prompt assistance to the most susceptible individuals. This will mitigate the impacts of climate change and disasters on the most susceptible individuals, safeguard their lives and means of livelihood, and promote their development. Barnfonden and ChildFund can play a role in advocating that children are central in anticipatory action plans for climate-related risk affecting the wellbeing of children (for instance, making cash transfers conditional on school attendance or nutrition training).

Anticipation Hub further explains that, as part of the IARP project, EAPs being developed will specifically target areas in Ethiopia, Kenya, and Uganda that are prone to flooding and drought. The focus of these plans will be on taking proactive measures to mitigate the impact of these natural disasters. These proactive measures encompass a variety of steps, including immediate interventions like reinforcing riverbanks, enhancing drainage systems, and employing sandbags to mitigate the likelihood of floods. They also involve more long-term strategies, such as providing drought-resistant seeds and implementing effective water management practices. When it comes to interventions aimed at reducing the risks of both floods and droughts, it is preferable to provide support in the form of cash and vouchers, especially through projects that involve paying people for their labor as a form of long-term strategy. In addition to the project's development, there is a specific focus on enhancing the capabilities of data teams in areas such as impact-based forecast modeling, rapid evaluation, and registration. The project also aims to improve the execution of payment modalities with financial service providers. IFRC activated an EAP for riverine floods in Kenya on 10 November 2023.

Example cases where Ai tools have been applied

Etherisc and ACRE Africa offer mobile phone and blockchain-driven insurance to protect small-scale farmers in Kenya from climate-related risks (Climate Ledger, 2023). Satellite weather data, namely drought conditions, trigger direct payments. Smallholder farmers rely on accessible and affordable crop insurance to safeguard their livelihoods and enhance their ability to withstand the impacts of climate change. Regrettably, conventional insurance fails to offer adequate protection. The software integrates crop insurance plans into smart contracts and associates them with local weather data. Extreme weather events trigger the activation of rules based on satellite data, facilitating prompt, transparent, and equitable reimbursements using mobile payment systems. This enables farmers to reinvest at an early stage, ensures the continuity of their season, and decreases transaction expenses.

In two Kenyan counties of Laikipia and Kajiado, Mercy Corps Ventures, in collaboration with Fortune Credit, Shamba Network, and DIVA Technologies, has initiated a novel pilot program to evaluate the efficacy of smart contracts enabled by blockchain technology in facilitating preemptive cash transfers to pastoralist communities (Mercy Corps Ventures, 2023). The fundamental component of this pilot initiative is a smart contract that escrows

donated funds and only transfers them to enrolled pastoralists in the event that pasture conditions are considered intolerable for the pastoralists. Using the NDVI (Normalized Difference Vegetation Index) as an indicator, the smart contract evaluates pasture conditions.

NDVI is a widelyused metric for quantifying the health and density of vegetation using se nsordata. International Livestock Research Institute (ILRI) has utilized NDVI effectively as the "index" for their index-based livestock insurance products (IBLI). Since vegetation generally mirrors the performance of precipitation, NDVI is an early indicator of livestock mortality. Based on an in-depth analysis of historical weather and NDVI patterns for each pilot location, the precise trigger points and payout trajectory are established.

The myAnga app is a component of Amfratech's CLIMARK project, with the objective of reaching over 300,000 pastoralists in Kenya within the next five years (World Economic Forum, 2021). Partners who support this initiative with funding and assistance include the Technical Centre for Agricultural and Rural Cooperation and the Kenya Livestock Marketing Council. By 2021, around 500 herders in Marsabit and Isiolo counties had registered for the free service since its launch in 2018. Additionally, approximately 2,000 others indirectly benefit from shared weather information throughout their communities. The app exceeds the weather forecasts provided by the meteorological agency by analyzing and offering suggestions to herders on how to safeguard their livelihoods. If a drought is expected to happen soon, the program recommends that herders sell their livestock in advance to minimize their financial losses. When a rainy season is approaching, the app advises them to avoid crossing flooded rivers and to vaccinate their animals as a precaution against diseases such as Rift Valley Fever.

The app helped women prepare their families for an imminent drought by enabling them to proactively accumulate food supplies. During periods of drought, mothers in the community no longer need to travel far with their children to the grazing areas where the herds location to obtain goat milk. In the past, during periods of drought, communities would dispatch scouts to travel up to 120 kilometers away from their homes in search of suitable grazing land and water sources. It would take many days for the scouts to return with information on the location where herders should bring their animals. During this time, some livestock would have died, while others would be too weak and thin to make the journey.

The app can now provide precise guidance to pastoralists regarding the optimal location to find pasture, saving them valuable time and potentially safeguarding the lives of their livestock. Additionally, it enables communities to monitor the movements of pastoralists and herds, facilitating the provision of veterinary services to sick animals and

immunization against disease outbreaks. The app disseminates weekly meteorological data in English, Swahili, and other languages spoken in northern Kenya. Additionally, herders have the ability to get weather forecasts for locations as specific as individual villages. Herders lacking smartphones have the option to subscribe to a toll-free number through which they can receive weekly weather notifications via text message. MyAnga obtains the information it transmits from Where, a company that provides weather data. This company utilizes information from meteorological stations and satellites worldwide to create a network of virtual weather stations. These stations are evenly distributed in cells measuring 9km by 9km, covering the entire globe.

The Kenya Meteorological Department recently, in April 2024, launched the Strengthening Early Warning Systems for Anticipatory Action (SEWAA) Project[2], Kenya National Chapter, which is aimed at strengthening early warning systems for anticipatory action (ICPAC, 2024). This collaborative effort, involving the World Meteorological Organization (WMO), the World Food Programme (WFP), the IGAD Climate Prediction and Application Center (ICPAC), the Ethiopia Meteorological Institute, the University of Oxford, and the European Centre for Medium-Range Weather Forecasts (ECMWF), is set to revolutionize weather forecasting using cloud-based machine learning. Considering the worsening of natural disasters caused by climate change, this project intends to improve the accuracy and timeliness of disaster notifications by using artificial intelligence, machine learning, and data analytics to empower communities to take proactive measures to protect their lives and livelihoods.

Here are other examples where Kenyans are utilizing artificial intelligence (AI) to address climate change and advance sustainability (Vota, W., 2023):

i. **AI Tools for Kenyan Reforestation and Forest Sustainability:** The Kenyan government is employing geospatial artificial intelligence to aid in the National Tree Growing and Restoration Campaign, which aims to promote reforestation and forest sustainability in Kenya. This program commences by employing artificial intelligence to discover and preserve natural water towers, which refer to forested terrains that possess the ability to hold water and play a vital role in the nation's water supplies. AstraZeneca's AZ Forest[3] Kenya initiative utilizes artificial intelligence to evaluate and monitor the growth of trees by analyzing drone footage and satellite imagery, thereby reducing the risk of deforestation through interventions such as intensified forest patrols. AI monitoring and management offer distinct perspectives that collaborate with

[2] https://www.icpac.net/news/icpac-receives-googleorg-funding-through-the-un-wfp-to-enhance-disaster-preparedness-in-eastern-africa/

[3] https://www.astrazeneca.com/media-centre/articles/2023/ai-to-optimise-astrazeneca-reforestation-africa-programme.html

local communities to establish a circular bioeconomy—local economic advantages that tackle climate change.

ii. **AI Solutions for Climate-Smart Agriculture in Kenya**: Kuzi is an AI system that utilizes satellite data, soil sensor data, ground meteorological observation, and machine learning to forecast swarms of desert locusts. The system presents a heat map indicating regions in Kenya that are at a high risk of an event, with a time frame of 2-3 months prior to its occurrence. Farmers have the capability to receive SMS notifications when there is a high probability of locust infestation in their vicinity, which includes crops intended for livestock feed. By utilizing satellites, pre-existing data sources, and machine learning, Amini AI is creating a centralized and trustworthy repository of environmental data that is verifiable, unchangeable, and actionable. The technology provides valuable information to farmers and supply chain operators, enabling them to plan for climate resilience and assess the risks associated with agricultural insurance. Additionally, it acts as a foundation for Africa's shift towards climate-smart agriculture.

iii. **AI Research Projects for Enhancing Kenya's Climate Adaptation:** The AI4D Africa (https://africa.ai4d.ai) study examines climatic patterns and constructs advanced artificial intelligence models to predict the effects of climate change in Kenya. The study specifically emphasizes the assessment of climate change impacts on terrestrial plant diversity and conservation, as well as their implications for the environment and the livelihoods of pastoral communities. The project encompasses county-specific climate change laws and policies that advance Kenya's dedication to climate action. The Flood Forecasting Initiative empowers Kenyan communities to utilize artificial intelligence (AI) for the purpose of predicting floods, creating early warning systems, and enhancing their preparedness for probable evacuation. AI models can forecast riverine floods up to seven days in advance, providing precise predictions of the timing and location of the floods. These models also provide accurate inundation maps, indicating varying water levels in different areas. This information enables residents to anticipate and prepare for the flood risks in their specific locations.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Research design

We used case study design since it allows in-depth, multi-faceted explorations of complex issues in their real-life settings. The design was appropriate for gathering information on challenges and gaps in Anticipatory Action, specifically as humanitarian responses apply to children, and how AI might be used to improve anticipatory action and/or its outcomes.

3.2 Sample size and sampling procedures

To identify the study respondents, we undertook a rapid stakeholder analysis based on the research objectives and questions and collected data from purposively sampled respondents as detailed in Table 1.

Table 1: Sample size

Participants	**No. of participants**		
	Male	**Female**	**Total**
FGD with parents/ caregivers of children in the community (Women)	0	10	10
FGD with parents/ caregivers of children in the community (Men)	9	0	9
FGD with youth community members (18-35 years)	4	4	8
FGD with community Health Volunteers (CHVs)	4	4	8
KII with ECD, primary and secondary school head teachers.	3	3	6
Humanitarian actors in the county e.g., Kenya Red Cross, UNICEF, WFP, WHO, FAO etc.	7		7
Government offices: County Agricultural Officers/Extension Officers; County/sub-county director of education office; Directorate of Children Services; Public Health Officer; National Disaster Management Authority staff; County disaster and emergency coordination office; National security agencies (Police OCS/OCPD, Area Chief);	5	2	7
Participatory workshop with children	6	6	12
Total	38	29	67

3.3 Data collection tools

We used qualitative data collection methods, specifically literature/document reviews, in-depth individual interviews (KIIs), focus group discussions (FGDs), and participatory workshops with stakeholders including children. In-depth interview schedules and FGD guides were used to collect qualitative data and enable a multifaceted overview of actual events in real life. Consequently, the research findings were based on ground truth and locally based solutions. Document/literature review specifically aided getting answers to the study questions.

3.4 Data quality

Quality of the study was assessed based on the criteria of credibility (Trustworthiness), conformity or neutrality (Can the results be confirmed?), dependability (Would another researcher come to similar conclusions?), and transferability (Can the findings be transferred to other contexts?). We applied methodological triangulation, which in essence involves using more than one method to gather qualitative data, to check and establish the study quality criteria by analyzing the research questions from multiple perspectives to arrive at consistency across qualitative data sources and approaches. Data collection was conducted by the four consultants themselves who have knowledge, skills, and experience in qualitative data collection methods. The consultants were assisted by four research assistants recruited locally, who had excellent local language skills. To ensure further data quality, a refresher team training was held on qualitative data collection methods and joint team understanding of the qualitative data collection tools and analytical approach.

3.5 Data analysis techniques

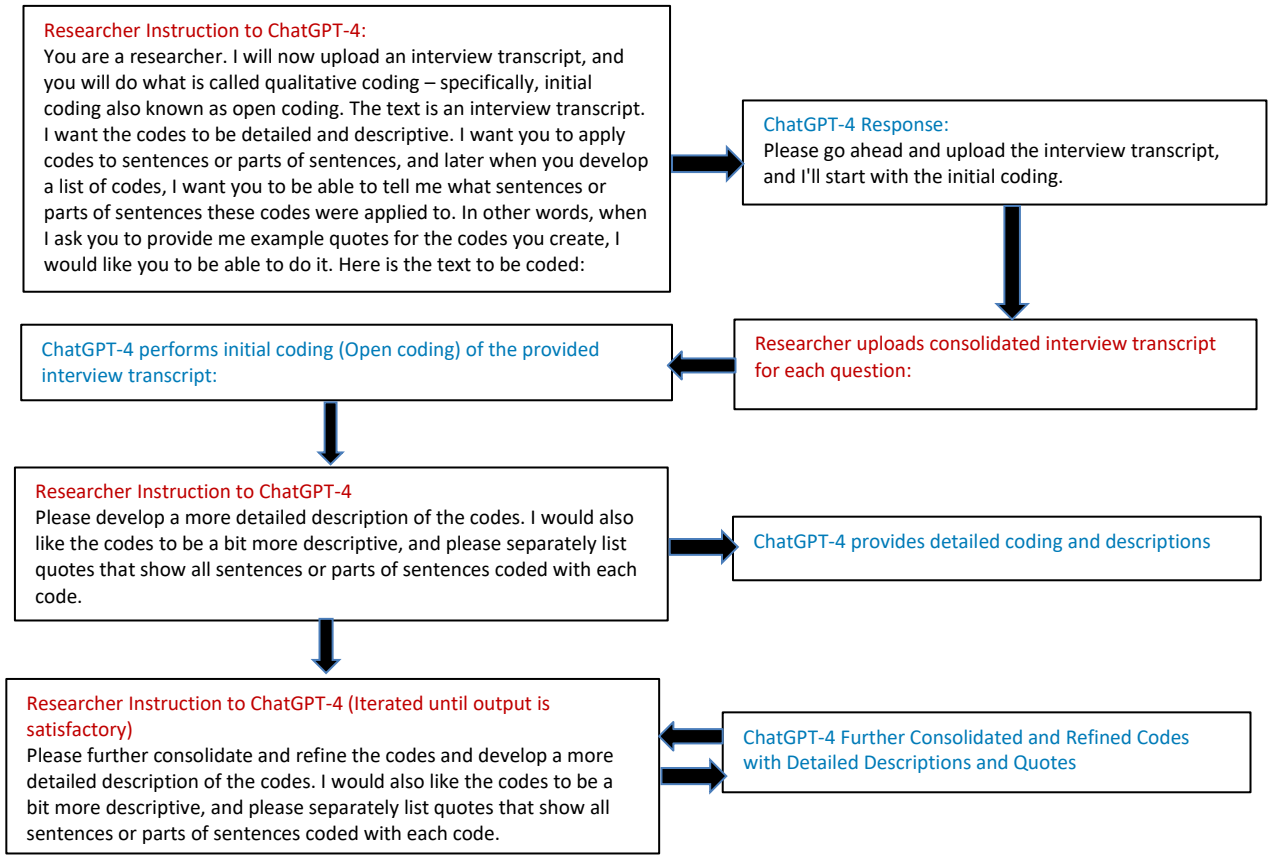
These data were analyzed qualitatively through theme, content, and pattern analysis with the aid ChatGPT-4 AI software to arrive at findings linked to each of the research questions. Primary data for each research question were consolidated and uploaded into ChatGPT and specific and clear instructions given on analytical approach. The specific instructions given to ChatGPT-4 and the iterative process is illustrated in Figure 1.

3.6 Ethical considerations

We sought ethical approvals for the research from the Daystar University Institutional Scientific and Ethical Review Committee (DU-ISERC) and a research license from the National Commission for Science, Technology, and Innovation (NAC0STI). Further, the research team paid attention to the following ethical issues: informed consent and assent, privacy and confidentiality, respect for autonomy, justice, and Do-No-Harm. The research team signed a data protection, child protection, and safeguarding policy. For purposes of informed consent/assent, privacy, and confidentiality, the following measures were taken to secure the informed consent and assent of the respondents: Explaining the objective of the assessment, the kind of information required and the intended use, and above all, providing

reasons for choosing the respondents. Anonymity and confidentiality were guaranteed. Appendix 2 shows the informed consent form. Overall, the research team ensured that all the data gathered is coded and stored safely with limited access.

*Figure 2:SEQ Figure * ARABIC 1: ChatGPT-4 qualitative data analysis instructions*



CHAPTER 4: DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSION

4.1 Climate-related risks and the role of community members in disaster preparedness and response

Discussions with community members in Marsabit revealed the main climate-related hazards, their impacts, and gaps in the current anticipatory action system that targets children at risk of climate related disasters as illustrated in Table 1.

Table 2: Community members views on main climate-related hazards, their impacts, and gaps in the current anticipatory action system

Views of community members on main climate hazards, their impacts, and gaps in current anticipatory action systems			
Parents/caregivers (Females)	**Parents/caregivers (Males)**	**Community Health Volunteers (CHVs)**	**Youth**
• Children are at risk of becoming thin and malnourished due to a lack of sufficient food, especially during droughts which is the most common and severe climate hazard in Marsabit County. Some community members rely on traditional methods, like observing stars and other natural signs, to predict weather changes and plan accordingly. During drought, community members move animals to other	• Drought being the most significant and frequent climate issue, leads to a lack of food and pasture, resulting in the loss of livestock and severe hardships for the people, particularly children, who are more vulnerable to hunger and thirst. Other environmental problems include extreme heat, which causes vegetation to dry up, and heavy rains, which lead to soil erosion, preventing crops from growing effectively. The community relies on a mix of modern and traditional methods to obtain	• Drought has been a severe and recurring issue, causing starvation and malnutrition, particularly among children. Other extreme weather events are flooding that caused infrastructure damage, such as the collapse of bridges and roads, preventing students from attending school. Additionally, strong winds damaged homes, forcing people to construct temporary shelters. • The community receives information about	• Drought is the most frequent and severe disaster in the community, leading to various adverse effects such as hunger, lack of water, and loss of livestock. Students drop out of school due to hunger, lack of concentration, and inability to pay school fees. Additionally, stress from the situation can lead to substance abuse and even suicide. The community experiences conflicts over scarce resources like water and pasture, leading to tribal fights and livestock theft where youth are usually the heavy casualties. The stress and pressure

areas to protect them and ensure they continue providing milk, which is crucial for child nutrition. • Coping strategies include storing water and food to mitigate the impact of drought; Collecting and storing pasture for animals during the dry season; and receiving various forms of external assistance from Government and humanitarian actors. • Gaps in the current system include needs of children at risk during climate-related disasters not being adequately addressed; and families sometimes resort to selling livestock at throw away prices engaging in activities like charcoal burning which is a threat to the environment to provide food for their children.	information about impending disasters. Local radio stations and mobile phones are common sources, while traditional practices like reading animal intestines and star observation are also used to predict weather changes. • In terms of coping strategies, the community tries to mitigate the effects of drought by selling livestock, preserving food, and evacuating vulnerable individuals to safer areas. There is a strong reliance on government and NGOs for disaster response, with these organizations providing food donations, cash transfers, and other forms of aid when disasters occur. • However, there is a general lack of prior preparation for such climate-related disasters such as droughts, making emergency response efforts not being very effective.	weather and climate risks from various sources, including meteorologists, local FM radio, village elders, and traditional practices like reading animal intestines. This information is vital for prior planning, though it is not always acted upon effectively. • The community often sells livestock before droughts to prevent losses and relies on food stored for later use during emergencies. The government assists by providing animal feed, digging dams and boreholes, and facilitating cash transfers and food donations through NGOs. However, the lack of prior planning, partly due to illiteracy, exacerbates the community's vulnerability to drought.	force some individuals to leave their homeland in search of jobs, leading to family separations. • Elders use traditional methods such as observing the behavior of animals, the appearance of trees, and the stars to predict droughts. They also listen to local FM stations for information. Families prepare for drought by selling off livestock. They might also grow drought-resistant crops, migrate livestock to better areas, or store grass for dry seasons. The government supports them by distributing pasture and opening markets for livestock sales. • Elders suggest forming youth groups to secure funding from organizations. They also encourage organizing football teams and other initiatives to empower youth economically. The government is advised to provide more contracts and help establish savings and credit cooperatives (SACCOs) for the

			youth to help them sustain themselves during droughts.

Drought and environmental hazards have a profound and multifaceted impact on the community in Marsabit County, with particularly severe consequences for children, youth, women, and families. Children face increased risks of malnutrition, starvation, and educational disruption, as food shortages and economic difficulties prevent them from attending school and affect their overall development. Youth are burdened with economic hardship, often leading to substance abuse, mental health challenges, and migration in search of jobs, which causes family separations and social instability. Women endure heightened workloads, as they are responsible for managing scarce household resources and caring for children, while also facing economic pressures that may force them into environmentally harmful practices like charcoal burning. Families as a whole struggle with resource depletion, conflicts over scarce water and pasture, and a heavy reliance on external aid, which is often insufficient and delayed.

To cope with these challenges, the community employs a variety of strategies, including selling livestock, storing food and water, and using both traditional knowledge and modern technology to predict weather changes. However, these coping mechanisms are frequently inadequate due to significant gaps in disaster preparedness and support. The lack of prior planning, insufficient government and NGO assistance, and limited opportunities for youth empowerment leave the community highly vulnerable to the recurring impacts of drought and other environmental hazards. These gaps exacerbate the economic, social, and environmental challenges faced by the community, highlighting the urgent need for more comprehensive and proactive measures to enhance resilience and reduce vulnerability.

During a participatory workshop with children, they shared valuable feedback on the climate-related risks they face and their impacts. Children indicated that drought causes an acute lack of food, leading to diminished physical strength and energy levels as a direct result of inadequate food quality and quantity intake. Various health problems and malnutrition-related diseases manifest during droughts, including diseases like kwashiorkor, caused by insufficient and unbalanced nutrition. Observable signs of malnutrition in children include disproportionately large heads, pot belly stomachs, and severe thinness (emaciation). Severe lack of water, due to drought, disrupts essential daily activities such as drinking, cooking, washing clothes, and maintaining personal hygiene, and this also has a broader impact on community health. The practice of marrying off young girls at an early age is frequently driven by economic hardship and societal pressures during droughts. There is educational disruption due to socioeconomic hardships, whereby children and teenagers leave school due to various difficulties, including food and water shortages, which hinder their ability to continue with their education. Environmental degradation from drought has a negative impact on plant life

and ecosystems caused by extended periods of drought, resulting in the drying out of vegetation and insufficiency of grazing land and pasture, leading to starvation and eventual death among livestock. Tribal conflicts and social unrest occur, with conflicts and disputes between different tribal groups often intensified by competition over scarce resources such as water access during droughts.

4.2 Roles of key stakeholders in disaster preparedness and response

4.2.1 Role of community members in disaster preparedness and response

Traditionally, community members have been using traditional predictive methods to predict drought, such as reading animal signs and celestial observations. However, modern information sources such as radio, television, print media, government, and NGO circulars and announcements are increasingly being relied on as reputable sources of climate information, particularly those relating to climate risks such as drought and floods. Children indicated that they receive information on climate-related risks from radio, television, Government announcements, internet, weather forecasts by meteorologists, mobile phones, the elderly in society, and their grandparents.

> "Yes, we get information through radios, but our elders read intestines and other animal organs to predict the climate" FGD with Youth

The community has some preparedness and reaction to emergencies, prioritizing children, and coping with unexpected crises. The community normally takes evacuation and safety measures to protect people and animals during drought emergencies. For instance, a community response team evacuates animals and people, especially children, to safer places with pasture and water. Sometimes, children are taken to wealthier relatives for care during drought emergencies. The community has self-sufficiency measures to prepare and sustain themselves during drought emergencies, including families and community's livestock offtake and taking money to the bank before the drought and later using the money to buy food for children and the family. Families also raise money to buy food during drought emergencies by burning and selling charcoal – a practice which exacerbates environmental degradation. Additionally, families prepare and preserve human food, especially cereals like millet/maize, for later consumption during drought emergencies. They also store water and engage in modern agricultural practices to boost food production.

> "Our elders are the ones o gives us direction on what to do in case of anticipated drought…… this involves moving to better pastures in case of drought…. We also sell some livestock to help us restock later" FGD with Men

> Sometimes it is men who move far with livestock while women and children remain in the village or move near water points or markets…… FGD with Women

Community leaders such as chiefs, village elders, and household heads play a pivotal role in coordinating responses and seeking aid during disasters such as droughts. They play an important role in helping identify community members most in need and guiding and organizing youth groups for mutual aid, securing funds, and creating income-generating opportunities. The government and NGOs have been instrumental in providing support, assistance, resources, and infrastructure during drought periods, such as food donations, non-food items, cash transfers, and support for school feeding programs.

4.2.2 Role of national and county Governments in disaster preparedness and response

The key roles of the government in disaster preparedness and response are collaboration and coordination with other stakeholders, addressing resource constraints, public communication and awareness, public health and hygiene initiatives, and providing support to vulnerable populations. The government establishes partnerships and oversees coordinated efforts between NGOs, government agencies, and other relevant institutions to enhance disaster preparedness, response, and management. This includes coordinating disaster response efforts through established government bodies and technical working groups to ensure effective and timely interventions and decision-making, and by developing comprehensive plans and ensuring community readiness for various disasters through risk assessments, action plans, and readiness initiatives for swift and effective responses. The government also establishes systems to provide early warnings, create evacuation plans to ensure community safety and prompt action during disasters, identify potential climate-related hazards, and implement measures to mitigate their impact, including raising awareness and developing sustainable practices.

> "The county government has institutional linkages to the national government to create awareness, mobilize interventions, and coordinate interventions within possible time frames to minimize human and livestock suffering when disasters strike." FGD with government officials

> "We mainly get information about climate related disasters and other disasters from the Ministry of Education. For example, during tribal conflict, the Ministry informed us and directed us to close school and send children home. Information from the ministry is normally transmitted through the Head Teachers WhatsApp group. The Head Teachers then inform teachers and the pupils." KII with a Head Teacher

The government addresses challenges posed by inadequate financial, material, and human resources that limit effective disaster response and mitigation, for example, by building and maintaining infrastructure and strategic stockpiles to support disaster management efforts, including water supply systems, boreholes, and food reserves. The government also provides targeted support and assistance to vulnerable groups, such as women, children, and persons with disabilities, to mitigate the adverse effects of disasters and ensure their well-being. Other resource support initiatives by the government include ensuring public

health and hygiene during disasters through the provision of clean water, disinfectants, and essential medical supplies to prevent disease outbreaks and supporting sustainable practices such as tree planting, water harvesting, and good hygiene, especially in educational institutions, to enhance resilience to disasters.

At the community level, the government ensures there are strategies to ensure clear communication with the public and raise awareness about potential disasters, risks, and necessary actions to mitigate impacts. The government is also involved in empowering community members with skills and knowledge in disaster prevention, agricultural practices, and response skills to enhance resilience and self-sufficiency, engaging with communities to understand their specific needs, and ensuring disaster response actions are tailored to meet those needs effectively. To cushion communities against the economic impacts of disasters, the government ensures market stability and economic resilience by ensuring the functionality of markets, the availability of staple foods, and maintaining fair trade practices during disasters to support economic stability and community resilience. Due to constrained resources, the Government, both national and county, takes lead and executes these strategies in partnership and collaboration with humanitarian actors and donors.

> "The role of the government agencies includes Communicating and disseminating information to the public, Conservation of grass for future use, Food distribution to most vulnerable within the community, giving out drought resistance seedlings, providing cash transfers…… FGD with Government officials

Marsabit County has endeavored to align its climate action policies, laws, and regulations with global, regional, and national policy contexts, among them; the United Nations Framework Convention on Climate Change (UNFCCC), Intergovernmental Panel on Climate Change (IPCC), and the Paris Agreement, African Ministerial Conference on Environment, the East African Community (EAC) Climate Change Policy (2010), and IGAD Drought Disaster Resilience and Sustainability (IDDRS) Strategy. Others include the Constitution of Kenya 2010, Kenya Vision 2030 and its Medium-Term Plans, Green Economy Strategy and Implementation Plan 2016-2030, Climate Smart Agriculture Strategy 2017-2026, Public Finance Management (Climate Change Fund) Regulations (2018), and The Climate Change Act (2016).

Policies, laws, and regulations that Marsabit County has put in place as part of preparedness and response are:

i. **The Marsabit County Climate Change Action Plan (2023-2027)** which, among others, proposed reducing effects of drought and climate change on vulnerable communities, including children, for resilience building through strengthening

strategies used by communities to adapt to climate variability for reduction and management of risks. For example, the policy proposes installation of 19 uni-huts for mobile ECDE schools to cover pastoralist families moving with their children and cash transfers for child-headed households. However, there is no mention of the use of AI in early or anticipatory action to improve wellbeing outcomes for children at risk of climate-related disasters. Other adaptation actions include:

a. Upscaling production and promotion of drought tolerant, pest resistant as well as early maturing/drought escaping crops varieties; promotion of climate smart agriculture; flood-based irrigation and promotion of agro-forestry, livelihood diversification; and public education on climate change.
b. Supporting development of water infrastructure through improved water harvesting techniques and rehabilitation of existing ones; water catchment protection and strengthening community capacity to manage water schemes.
c. Improving access to clean water and sanitation facilities to limit outbreaks of water-borne diseases.
d. Reforestation of degraded forests; restoration of forests and woodlands; and promotion of suitable tree species as well as in-situ conservation.
e. Promotion of energy efficient cook stoves to reduce household and institutional demand on biomass energy and to reduce greenhouse gas emissions.

ii. **The Marsabit County Climate Change Adaptation Policy (2019)** whose objective is to reduce vulnerability to the impacts of climate change by building adaptive capacity, enhancing climate change resilience, and strengthening capacities for disaster risk reduction.

iii. **Marsabit County Climate Change Fund Act (2020)** which creates a fund that, among others, finances climate change programs in the county, mainstreams climate response in the county planning and budgeting cycle, domesticates national climate change policies, supports climate change awareness in the county, and creates various institutions, including community-level structures such as Ward Climate Change Planning Committees. The Act offers guidance on how to access additional finance for climate change interventions, including but not limited to the National Climate Change Fund and mechanisms to leverage Public Private Partnerships (PPPs) as vehicles for implementing low carbon climate resilient development activities in the county.

iv. **Marsabit County Climate Finance Framework (2023-2025)**. Section 14 of Marsabit County Climate Change Fund Act (2020) mandates the County Government to publish a County Climate Finance framework every three (3) years.

4.2.3 Role of humanitarian actors in disaster preparedness and response

Humanitarian actors are involved in livelihood and economic empowerment initiatives to enhance the economic activities of community members, with a particular focus on supporting women and youth. This includes providing training on business and entrepreneurship, setting up livelihood projects, providing biological assets such as livestock, and educating pastoralists and other community members on the diversification of their sources of income to reduce dependency on livestock (e.g. training on alternative livelihoods to enhance economic stability and resilience, modern farming techniques, and sustainable practices, including support for drought-resistant crops, water storage facilities, and food storage techniques to ensure food security and resource management).

Humanitarian actors are also engaged in disaster risk management and preparedness through the establishment of community-managed disaster risk committees, the development of disaster response and preparedness plans, and the provision of training on disaster risk reduction. These initiatives aim to build community resilience and reduce the impact of disasters. Safety and hazard awareness, climate and environmental sensitization, information dissemination, and community-led response and empowerment are other areas where humanitarian actors are engaged. They have been involved in raising awareness about safety measures and identifying potential hazards within the community. This includes educating the community on preventive actions to reduce the risk and impact of disasters. They also sensitize and support communities on climate-related projects and natural resource management, and they educate community members on sustainable practices and the importance of protecting the environment. Humanitarian actors collect and share relevant information with the community to enhance awareness, preparedness, and informed decision-making by disseminating data related to community projects, safety, and disaster management. They support and empower the community to take the lead in responding to challenges and disasters, an approach that fosters community ownership and sustainability of response efforts.

> "There was a recent training or coaching for 35 children from our school by Nawiri and Kenya Red Cross about disaster management. They trained them on what to do when disasters occur, not how to prepare for disasters before they occur." KII with Head Teacher

Humanitarian actors and the Government typically collaborate on disaster risk management and preparedness through technical working group on climate change and disaster management at the county level. The technical working group is well organized with office bearers such as Chair, Secretary, and thematic leads and meets regularly, however, in the lead up to and during disasters, their meetings are more frequent, normally weekly. During such meetings, they share information and data on climate risks, including those pertaining to children and other vulnerable populations. They also have a WhatsApp

group where they also share information and data and coordinate response actions. The technical working group membership include humanitarian actors who have a special focus on children such as UNICEF, Save the Children, Plan International, World Vision, and ChildFund among others.

4.2.4 Role of primary, secondary, and ECD school heads and teachers in disaster preparedness and response

One of the core roles of schools in disaster preparedness and response is child safety and parental engagement. They ensure the safety of children during adverse weather, climatic conditions and related disasters and encourage active parental involvement in their children's education and well-being. They are also involved in disaster preparedness and community sensitization by having strategies in place and taking actions to prepare for, educate about, and manage coping mechanisms with various hazards and disasters, such as droughts, floods, and epidemics. This includes advising learners and communities on safety protocols and risk mitigation. Schools have established and adapted remote learning systems, including training teachers and students in using digital tools to ensure educational continuity during disruptions occasioned by disasters such as floods and pandemics. They use various alternative educational delivery methods such as television programs, recorded lessons, and community-based group teaching to ensure students continue learning during disruptions caused by disasters.

> "We do train some teachers about remote learning because in Diri zone, I'm the ICT champion, so we train teachers in remote learning so that when disaster occur, the learning can continue…..the challenge is inadequate tables for learners." KII with Headteacher

Schools have made efforts to secure external assistance and resources, such as food and water, for pupils, particularly during drought conditions, to ensure their health and ability to concentrate in school. Some schools have been involved in peacebuilding and health education initiatives and efforts aimed at promoting peace, reconciliation, and health education among students and communities, particularly in post-conflict settings and during tribal skirmishes. They also have environmental conservation initiatives and activities aimed at improving the local environment, such as tree planting, to create a better microclimate and mitigate adverse weather conditions.

School feeding is normally an on-going undertaking in Government primary schools and is mainly supported by the Government in the form of food supplies for cooking in schools. Parents also contribute to supporting school feeding by covering the cost of labor - wages for cooks through financial contributions. Humanitarian actors also regularly step in to support where there is specific request by the school management or a need has been identified. Such support comes in the form of construction of water tanks for storing water,

rainwater harvesting infrastructure, and in some instances, water supply. Humanitarian actors also supply nutritional supplements to children in homes during droughts or floods based on need analysis. School attendance is always maintained and is a standard requirement, whether there is a disaster or not. Furthermore, CHVs also follow-up on children who miss classes from their areas and establish the cause(s) of persistent absenteeism and make referrals for action or support such as nutritional, medical, and psychosocial among others. The Government and humanitarian actors normally undertake nutritional assessments to ascertain the nutritional status of community members including children and other vulnerable populations. There are instances where schools have been closed due to climate hazards such as floods and extreme drought, however, such decisions are made by the Ministry of Education, not school management. However, school management are at liberty to adjust schedule for curriculum, co-curriculum, and extra-curriculum activities based on the prevailing weather such as heavy rains and excessive heat among others.

4.2.5 Role of children and their families in reducing the impact of climate risk

When children were asked, in a child workshop set-up, what they and their families could do if disasters occurred, or early in their occurrence, they made the following observations:

i. **Job seeking and employment:** Family members make efforts to seek and secure various forms of employment. These include job roles such as security, shepherd, and domestic worker, and performing tasks like washing clothes to earn money. This highlights the family's proactive approach to securing financial stability during disasters such as drought.
ii. **Social capital mobilization:** Family members and the community establish fundraising initiatives at different levels, i.e., family-based, community-based, or clan-based to raise funds to support vulnerable members, particularly in the areas of family subsistence, children's education, and health, as part of their response to the impacts of climate-related disasters. These actions reflect the family's strategies for managing financial difficulties and securing necessary resources when disasters strike, such as droughts and floods.
iii. **Selling assets and goods:** Family members sell family assets and various goods to generate income. Family assets sold include livestock, vegetables, milk, and miraa to meet financial needs. This highlights the family's efforts to leverage available resources to sustain themselves financially.
iv. **Basic needs and resource management:** Family members secure and manage basic necessities such as food, water, and firewood. They buy firewood, fetch water, and ensure that children have enough food. These activities underscore the family's daily struggle to provide for their essential needs and maintain their well-being.
v. **Healthcare and child protection:** Family members ensure the health and safety of children are safeguarded by taking children to the hospital when they are sick and

preventing teenage girls from early marriage by reporting to authorities. These actions reflect the family's commitment to safeguarding their children's health and future.

vi. **Education and school retention**: Parents and caregivers ensure that their children remain in school and do not drop out. This highlights the importance placed on education and the measures taken to prevent school dropout, reflecting the family's commitment to their children's educational development.

vii. **Shifting livelihoods:** Some families have been steadily shifting from traditional pastoralism practices to other forms of livelihoods such as agro-pastoralism, aquaculture, apiary, small and micro-enterprises, and coal mining among others as both complementary and alternative means of livelihood.

4.3 Findings on research questions

4.3.1 Research Question 1: What specific gaps exist in the current Anticipatory Action System that targets children at risk of climate related disasters?

Based on the secondary data analysis, KIIs and FGDs specific gaps were identified in the current anticipatory action system that targets children at risk of climate related disasters. These gaps include inadequate community sensitization that allows community members to not only know about the imminent climate-risk disasters but also how to prepare and respond before the disaster occurs with a specific focus on children; resource constraints often limit the effectiveness of climate related disaster preparedness and response; inadequate investment in technology such as AI; and gaps in the policy and regulatory contexts to facilitate effective anticipatory action.

Because proper understanding is absent long before a climate related disaster happens, massive damage to both people and animals occurs when the disaster finally occurs. Response to climate related disasters is largely reactionary, that is, actions are taken when the disaster is approaching or has occurred, but hardly before the disaster occurs. Furthermore, climate forecasting often lacks adequate precision in terms of timing, magnitude, and localization, making it challenging to rely on for anticipatory action planning. Sometimes climate forecasts are not very accurate, for instance, early warnings showed that there would be depressed rains during October-November-December (OND) season of 2023 but instead, heavy rains with attendant flooding occurred. In most cases, climate forecasts and predictions are given for a large focus area, for example, for the whole of Marsabit County, yet with a land area of 70,000 sq km, it is not homogeneous, and the climate-related impacts are normally localized and contextualized. Additionally, Marsabit county is transnational, yet climate forecasts and early warnings fail to provide information on what is happening in neighboring counties and Ethiopia, which might impact Marsabit and require anticipatory actions.

Developing and executing anticipatory actions requires substantial investment in technology architecture, logistical assets, training, and material supplies. However, given limited financial budgets and state and non-state actor's competing priorities, anticipatory action initiatives are often left unfunded or grossly underfunded. Furthermore, allocation of resources for climate related disaster preparedness and response is normally inefficient, with priority given to immediate relief rather than proactive activities and long-term resilience building. It is for this reason that the NDMU unit is endeavoring to sensitize government ministries, departments, and agencies (MDAs), county governments, learning institutions, NGOs, the private sector, and communities, among others, with the key driving force being to ensure 80% concentration of resources in prevention, mitigation, and preparedness, while leaving 20% for response and recovery.

In order to cushion key sectors against the impact of climate change, Marsabit County Government, partners, and stakeholders conducted Participatory Climate Risk Assessment (PCRA) in 2023 as per the Marsabit County Climate Change Policy (2019) and Marsabit County Climate Change Fund Act (2020). The assessment mapped sectoral risks, causes of the risks, adaptation strategies, and climate action priorities for each Ward. As an example, the assessment's adaptation strategies mention children in the education sector, where there is a plan to invest in mobile schools, support school feeding programs during drought, and initiate food for fee programs during harsh times, cash transfer programme for children-, PWDs and old age headed households. The assessment also recommends investment in early warning systems and infrastructure, dissemination of early warning information by ward to enhance preparedness, strengthening capacity of emergency response, early detection, prevention, and treatment of wastes. However, the assessment does not explicitly highlight the role of AI in early or anticipatory action and also falls short of providing an explicit trigger mechanism for anticipatory actions.

There still exist gaps in the Marsabit County policy and regulatory contexts such as the Marsabit County Climate Change Action Plan (2023-2027), Marsabit County Climate Change Adaptation Policy (2019), Marsabit County Climate Change Fund Act (2020), Marsabit County Climate Finance Framework (2023-2025) to facilitate effective anticipatory action. Also, there is no mention of the use of AI to facilitate anticipatory action. For example, AI initiated trigger mechanisms have not been integrated in these policy and regulatory contexts to facilitate timely and effective anticipatory action. Another gap that exists in the policy framework is how to handle funds released for anticipatory action based on early warnings, which turns out to be false. This is a major public finance management gap that can raise a myriad of financial governance queries. Furthermore, at the national and sub-national levels, there is still a lack of a clear understanding of anticipatory action and how it fits into the planning process. It is also not clear which institution should drive anticipatory action. Consequently, several terminologies are used

to give some indication of anticipatory action, such as early action, pre-emptive action, mitigation strategies, adaptation strategies, coping strategies, resilience programming, contingency planning, and so on and so forth.

4.3.2 Research Question 2: Which types of data, if initiated by AI, can effectively contribute to addressing gaps in the current Anticipatory Action System that targets children at risk of climate- related disasters?

Gaps identified in current anticipatory action system that targets children at risk of climate-related disasters include inadequate community sensitization, resource constraints, inadequate investment in technology such as AI, and gaps in the policy and regulatory contexts.

Community sensitization and preparedness relies on accurate and reliable data on climate forecasts and response preparedness. Humanitarian actors in climate risk preparedness and response rely on predictive models and early warnings from institutions and organizations such as ICPAC, NDMA, KMD, FAO, and the Famine Early Warning Systems Network (FEWSNET), among others, to develop their anticipatory action. These predictive models rely on datasets that include satellite imagery and data, remote sensing and GIS data, and weather data from weather stations located in various weather stations. IARP project has a specific focus on enhancing the capabilities of data teams in areas such as impact-based forecast modelling, rapid evaluation, and registration of beneficiary households. Etherisc and ACRE Africa use satellite weather data to trigger direct payments in their mobile phone and blockchain-driven insurance to protect small-scale farmers in Kenya from climate-related risks. Mercy Corps Ventures in collaboration with Fortune Credit, Shamba Network, and DIVA Technologies use smart contracts enabled by blockchain technology in facilitating pre-emptive cash transfers to pastoralist communities in Laikipia and Kajiado counties. myAnga app, a component of Amfratech's CLIMARK project, exceeds the weather forecasts provided by the meteorological agency by analysing and offering suggestions to herders on how to safeguard their livelihoods. The Kenya Meteorological Department’s Strengthening Early Warning Systems for Anticipatory Action (SEWAA) Project is set to use cloud-based machine learning in weather forecasting. A crucial source of data that is missed by these models are traditional methods of forecasting weather by the elders. Community leaders such as elders, CHVs, and local chiefs have a lot of information and data that can help in registration of those in need. Additionally, these community members have a wealth of information on climate-related disaster response strategies that worked and those which are not effective which can also be documented. These data sources can be documented and picked by AI, with a specific focus on children.

Humanitarian actors, such as the Kenya Red Cross Society (KRCS), utilize the KoboToolbox to collect data and coordinate humanitarian activities to give relief to

vulnerable populations and respond to emergencies in communities affected by climatic disasters. For example, during the recent floods in Kenya, KRCS used the Flood Situation Report Tool (Flood SitRep Tool)[4], which uses KoboToolbox's offline capabilities, to allow KRCS staff and volunteers to collect detailed data in remote places while also leveraging real-time information sharing to provide targeted interventions. They collected data on key indicators such as the number of affected and displaced people and the impact on critical infrastructure like schools, health facilities, and roads. By gathering precise and specific information on needs and response activities, the KRCS team was able to develop critical insights to deliver support where it was most needed. KRCS also has a toll-free emergency number that communities can use to share information on emergencies. Such data on key indicators can be used as input to AI models to help predict impacts of future weather and climate risks for anticipatory action.

There are also a number of vulnerability assessments that have been undertaken by various state and non-state actors that can be used to model anticipatory actions. These include C hild Status Index (CSI) for vulnerable children, nutritional assessments, and special studies and evaluations of the impact of climate related disasters and interventions. For instance, there is documented data by various state and non-state humanitarian actors on the actions which have been undertaken as preparedness and response plans for climate-related disasters such as floods and droughts (e.g. NGO project evaluations). Various government institutions also undertake general and specific/thematic assessments, which generate data that can be very helpful in anticipatory action. Examples include the national census, which is undertaken every 10 years; Kenya Demographic and Health Surveys (DHS); the Ministry of Health's Department of Family Wellness, Nutrition, and Dietetics County information; a survey dashboard; and nutrition reports.

4.3.3 Research Question 3: Who and what are the primary users and uses of AI-initiated data for anticipatory action targeting children at risk of climate-related disasters?

Currently, there is hardly any AI-initiated data for anticipatory action targeting children at risk of climate-related disasters. Primary data from AI is currently not deployed. The closest use of AI is by the Kenya Meteorological Department's Strengthening Early Warning Systems for Anticipatory Action (SEWAA) Project which is set to use cloud-based machine learning in weather forecasting. The primary users of AI-initiated data for anticipatory action that targets children at risk of climate-related disasters are Government agencies and department, Private sector and business community, Non-Governmental Orgnizations (NGOs), schools, and United Nation Agencies. The main Government agency that can potentially use AI-initiated data for anticipatory action that targets children at risk of climate-related disasters is the National Disaster Management Unit under the

[4] https://www.kobotoolbox.org/blog/data-driven-climate-disaster-response-how-the-kenya-red-cross-society-is-using-kobotoolbox-in-the-flooding-crisis

Ministry of Interior and Coordination of National Government. The unit can use AI-initiated data to execute its mission of effectively preparing for and responding to disasters and emergencies and managing recovery and mitigation efforts in Kenya in collaboration with other stakeholders in order to save lives, minimize property loss, and protect the environment. In executing this mandate, the unit can use AI-initiated data to develop a child-focused national anticipatory action plan.

Other Government agencies and departments can use AI-initiated data for anticipatory action that targets children at risk of climate-related disasters in the following ways:

i. **National Drought Management Authority:** Identification of potential drought risks, assessment of the impact of drought on various sectors, and development of appropriate measures to mitigate the impact of drought on vulnerable populations. AI-initiated data can be used to make decisions on interventions such as the provision of water and food relief, implementation of livestock off-take programs, the upscaling of child protection initiatives, and the promotion of alternative livelihood strategies.
ii. **Ministry of Health:** Early action in the management of waterborne epidemics such as cholera, which is common in flood situations.
iii. **Ministry of Education:** The 2010 constitution of Kenya provides for children's right to free and compulsory basic education, including quality services, and to access education institutions and facilities for persons with disabilities. The Fourth Schedule of the Constitution of Kenya assigns the national government responsibility for primary schools, special education, secondary schools, and special education institutions, among other responsibilities. The ministry of education can use AI-initiated data to develop anticipatory action plans that minimize disruptions in the education of children.
iv. **Ministry of Labor and Social Protection:** Anticipatory Action in Child Protection and Cash Transfer Programme for Orphans and Vulnerable Children (CT-OVC).
v. **Ministry of Agriculture and Livestock Development**: Early action in the management and control of pests and diseases.
vi. **Ministry of Water, Sanitation, and Irrigation:** Early action in ensuring access to water, sanitation, and hygiene in the face of climate-related disasters such as droughts and floods. Working closely with the ministry of agriculture and livestock development, they can use AI-initiated data to develop and implement early action to ensure access to water for crop irrigation and livestock use.
vii. **Ministry of Finance:** AI-generated triggers to access finance for anticipatory action.
viii. **Marsabit county governments:** Early action at the local level, including preparedness, response, and recovery efforts within their respective jurisdictions.

Humanitarian actors, including NGOs and international organizations can utilize AI-initiated data to enhance their disaster preparedness and response efforts. They can use AI to analyze data from various sources such as weather reports, historical disaster patterns, and socio-economic data to predict where children are most at risk during climate-related disasters. This allows them to pre-position supplies and mobilize resources efficiently. They can leverage AI to optimize the distribution of food and nutritional supplies. By predicting areas that will be hardest hit by climate events, they can ensure that food reaches the most vulnerable children first, reducing malnutrition and starvation rates. They can also implement AI-based early warning systems that provide real-time alerts to communities about impending disasters. These systems can be tailored to local languages and accessible formats to ensure children and their families understand the risks and necessary actions.

Academic institutions can play a crucial role in advancing the understanding and application of AI in anticipatory action for climate-related disasters. Universities can conduct research on developing and improving AI models that predict natural disasters with higher accuracy. They can create collaborative platforms where researchers can contribute to and refine predictive models. They can conduct case studies on the effectiveness of AI-initiated interventions in past climate-related disasters and such research can provide valuable insights into what strategies work best for protecting children. They can also develop specialized programs and courses to train future humanitarian workers and policymakers in using AI for disaster preparedness and response, for example, offering courses on AI applications in humanitarian contexts, combining theoretical knowledge with practical case studies.

4.3.4 Research Question 4: How should AI-initiated data be delivered to the primary users to ensure maximum impact of anticipatory action that targets children at risk of climate-related disasters?

The main channels through which community members receive information are messages from government and organizations, announcements by local radio and TV stations, and personal technological devices like mobile phones. Children and other community members who do not have phones get information from school, elders, chiefs, CHVs, and other peers. The local community raised the issue that the information disseminated by KRCS cannot be easily interpreted by the locals, which is a major loophole. There is a need to convey the information in a language that the locals can understand without waiting for another party to interpret it.

> "Most of the community members do not have even a future phone and even those who do, some cannot read or write. Illiteracy is a big challenge among the community members." KII with Humanitarian Organization

Media, government, and private sector exert significant influence in disseminating information and supporting community preparedness, underscoring the necessity for accurate and timely information from these entities for effective community preparedness. Specific groups within the community, such as youth and educated members, have a critical role in interpreting, translating, and disseminating information about new technologies and other crucial information to the rest of the community from channels such as social media, mobile phone devices, and the internet. This is due to existing barriers to effective information use, such as language barriers, financial constraints, cultural beliefs, and issues with the timeliness and accuracy of information received.

> "The information should be delivered through local radio stations…through seminars and places of worship where people come together; and through SMS from organization like Kenya Red Cross." FGD with Youth

Government officials including school heads have access to internet and smart phones and can get AI-initiated data online. However, those in remote areas may have connectivity problems and hence Short Message Service (SMS) can supplement online delivery model. Community leaders and members can receive AI-initiated data and information through SMS and community meetings. All in all, radio communication remains the most effective and preferred mode of information delivery at the community level. Some schools have desktop computers and tablets for use by the children for learning at school and at home. However, they are not enough and with internet connectivity issues, not a reliable method for information delivery. Children essentially get information on climate and disasters from their school management and parents/caregivers.

4.3.5 Research Question 5: What institutional support might be available to ensure the sustainability of potential AI use?

There is assistance, frameworks, and resources provided by various state and non-state institutions to support the sustainability of AI use. The Ministry of Information, Communication, and the Digital Economy is mandated to formulate policies and laws that regulate standards and services in the information, communication, and technology (ICT) sector, telecommunications, and media industry. It is also responsible for developing and administering ICT standards, building the capacity of mass media and ICT, and the dissemination of public information. The Information and Communication Technology (ICT) Authority is a state corporation under the Ministry of Information, Communication, and Technology with a broad mandate that entails enforcing ICT standards in government, enhancing the supervision of its electronic communication, and promoting ICT literacy, capacity, innovation, and enterprise. Konza Technopolis is a smart city designed and implemented by the government of Kenya to enhance Kenya's innovation ecosystem and digital economy by providing the missing infrastructural and technological link. The Government of Kenya established the Konza Technopolis Development Authority

(KoTDA) as a special purpose entity to facilitate the development of Konza as a thriving, sustainable smart city and a vibrant innovation ecosystem contributing to Kenya's knowledge Economy.

In 2018, the government of Kenya created the Distributed Ledger and Artificial Intelligence Taskforce to develop a roadmap for emerging technologies that will define the evolving Fourth Industrial Revolution. The report of the task force noted that disruptive technological advancements such AI have created a variety of new scenarios to which existing legal and regulatory regimes should be applied. Advances in AI have been accompanied by increased scrutiny and debate over whether AI should be regulated. Those in favor of regulating AI express concerns about data privacy, the threat of weaponization and the expected reach of AI while those opposed to AI regulations argue that excessive regulations could have untold economic costs, that policy makers lack sufficient knowledge on which to base their regulatory decisions, and that the current fears are unrealistic. Ultimately, the challenge for regulation is how to balance supporting innovation and competition while protecting customers, market integrity, financial stability and human life. The report recommends three key activities that should be analyzed when considering the regulation, use and supportive development of AI solutions in a country:

i. Develop supportive policies to enable both short- and long-term use of AI by analyzing existing policies and creating new policies to ensure citizens' rights are protected. AI requires large amounts of centralized data to function effectively. However, centralizing such large amounts of data can pose a risk to privacy if effective policies regarding access, use, ownership and control of data by a third party (which could be a government) are not implemented.
ii. Create an effective ecosystem to support, manage and grow AI solutions, including infrastructure, skills development and cross-sector linkages. AI operates most effectively when it has access to large amounts of data, which also requires supportive infrastructure (increasing connectivity and improving data collection mechanisms) and interoperability through cross-sector linkages. Effective and inclusive skills development is also required to create and manage AI solutions to mitigate the risk of AI programs with hardcoded biases that can result in unethical AI.
iii. Manage and analyze the potential long-term effects of AI and develop systems to manage these risks early in the implementation. For Example, one of the most discussed risks is the resulting unemployment that occurs when tasks previously performed by humans are performed by AI systems. If a country does not effectively analyze and manage this risk prior to its occurrence, the social welfare system could easily become crippled by an unmanageable unemployed population. Emerging digital jobs could be tracked globally, and countries could develop effective training programs to re-skill citizens at high risk of unemployment.

The National ICT Policy (2019) objectives are to:

i. Create the infrastructure conditions for use of always on, high speed, wireless, internet across the country. Provide enabling infrastructure and frameworks that support the growth of data centres, pervasive instrumentation (Internet of Things), machine learning and local manufacturing whilst fostering a secure, innovation ecosystem.
ii. Grow the contribution of ICT to the economy to 10% by 2030, by using ICT as a foundation to the creation of a more robust economy, providing secure income and livelihoods to the citizenry.
iii. Leverage regional and international cooperation and engagements to ensure that Kenya is able to harness global opportunities.
iv. Position the country to take advantage of emerging trends such as the shared and gig economy by enhancing our education institutions and the skills of our people and fostering an innovation and start-up ecosystem that is able to lead on a global scale.
v. Gain global recognition for innovation, efficiency and quality in public service delivery. Services will be delivered in a manner that ensures we have a prosperous, free, open and stable society.

These National ICT Policy objectives will be actualized through four thematic focus areas: Mobile first; which will ensure that every Kenyan can access inexpensive internet and reasonable access to locally produced devices; Market; designed to increase the overall size of the digital and traditional economy to 10% of GDP by 2030; Skills and Innovation; which outlines a careful plan designed to jumpstart a self-supporting ecosystem that will produce world-class research, technology products and industries; Public Service Delivery; requires that all government services are available online, that every Kenyan has online access and that government services are delivered quickly and fully at the time and place that they are needed.

The Data Protection Act came into effect in Kenya in November 2019. This ushered the country into a new data privacy dispensation that aimed at ensuring Kenyans were empowered with enforceable privacy rights over their personal information, while providing clear guidelines for private and public institutions to handle their users' data with care. The Office of the Data Protection Commissioner (ODPC) is the designated government agency that is key to ensuring appropriate handling of personal data in Kenya as enshrined in the Data Protection Act (DPA) of 2019 with the following specific mandate: regulation of processing of personal data; ensuring that the processing of personal data of a data subject is guided by the principles set out in section 25 of the Act; protection of the privacy of individuals; establishment of legal and institutional mechanism to protect

personal data; and provision of data subjects with rights and remedies to protect their personal data from processing that is not in accordance with the Act.

The Kenya National Digital Master Plan (2022-2032) recommends development of a National AI Strategic Plan to address the following key areas and issues:

i. The long-term transformative effects of AI on the Kenyan economy and service delivery.
ii. The National and County Governments' Roles in AI Investments.
iii. Determine long-term investments in AI research. Prioritize investments in the next generation of artificial intelligence.
iv. Create effective methods for collaborating on human Artificial Intelligence. To create effective interactions between humans and AI systems, more research is required.
v. Recognize and address the ethical, legal, and societal implications of artificial intelligence. To understand the ethical, legal, and social implications of AI, as well as to develop methods for designing AI systems that align with ethical, legal, and societal goals, more research is required.
vi. Ensure the safety and security of AI systems. Before AI systems are widely used, assurance that the systems will operate safely and securely in a controlled, well-defined, and well-understood manner is required. More research is needed to address the challenge of developing AI systems that are reliable, dependable, and trustworthy.
vii. Create shared public datasets and environments for AI training and testing. The depth, quality, and accuracy of training datasets and resources have a significant impact on AI performance. Researchers must create high-quality datasets and environments, as well as provide responsible access to high-quality datasets, testing, and training resources.
viii. Use standards and benchmarks to assess and compare AI technology. Standards, benchmarks, testbeds, and community interaction are all important for AI progress. More study is needed to develop a wide range of evaluating tools.
ix. Gain a better understanding of the human capital (workforce) requirements for AI R&D in Kenya. AI advances will necessitate a large community of AI researchers. To ensure that adequate AI professionals are available to handle the priority R&D areas identified in this Plan, a better understanding of existing and future R&D workforce demands in AI is required.

In April 2024, Kenya marked a significant step towards integrating AI into its future. The Ministry of ICT and Digital Economy, in collaboration with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, launched the National AI Strategy

Development Process. This initiative, "FAIR Forward – Artificial Intelligence for All," emphasizes responsible AI development to drive sustainable growth. The project acknowledges AI's potential and challenges. The launch event brought together academia, industry, government, and civil society stakeholders. The discourse went beyond mere regulation, emphasizing a holistic approach that balances innovation with ethics. This includes investing in AI enablers like data infrastructure and talent development while mitigating risks. This proactive stance on AI governance positions Kenya as a leader in responsible AI development. The strategy development process prioritizes sustainability and societal impact and asserts that AI development must address climate change and inequality in Kenya.

The Kenya National Robotics and Artificial Intelligence Society Bill 2023 proposes to establish a Society to be known as the Kenya Robotics and Artificial Intelligence Society with the following functions:

i. Regulate and promote the development of the robotics and AI industry.
ii. Advise the Cabinet Secretary on the emerging robotics and AI trends.
iii. Make recommendations to the Cabinet Secretary on the implementation of strategies, plans and policies relating to robotics and AI.
iv. Formulate robotics and AI national standards acceptable internationally.
v. Carry out surveillance and inspections to ensure compliance with the standards and legislation on robotics and AI.
vi. Establish linkages with local and international training and research institutions to conduct scientific research and investigations in all areas pertaining to the development of robotics and AI.
vii. Undertake technology transfer and provide technical assistance to county governments on matters relating to robotics and AI industry.
viii. Collect, collate and disseminate information on the robotics and AI industry including the appropriate technology and practices to ensure maximization of gains of robotics and AI to the general populace.
ix. Regulate the robotics and AI by-products to conform to the quality or standards recognized in the international market.
x. Put in place a framework for capacity building and training of various players in robotics and AI.
xi. Develop and enforce the robotics and AI industry standards and industry code of practice in collaboration with the ICT Authority of Kenya and the Office of The Data Protection Commissioner Kenya and other relevant government agencies.
xii. Carry out periodic research to determine and make recommendations on robotics and AI emerging trends.

The Society shall consult and collaborate with the county executive committee members in the development, promotion and regulation of the robotics and AI industries in the respective counties. The bill is a legislative proposal by a Kenyan and is currently with the Petitions Committee of the National Assembly.

Most universities and colleges in Kenya have academic, technical training, and professional development programs in computer science, offering a range of certificates, diploma, degree, masters, and PhD qualifications. The University of Nairobi is set to establish an Artificial Intelligence school as part of the plans to create skilled manpower for the future. Recently, there have been initiatives to introduce AI programs and capacity building courses. For instance, Maseno University and Jomo Kenyatta University of Agriculture and Technology (JKUAT) offer master's degree programs in AI while the University of Nairobi has established the School of AI that will initially offer a master's degree program in AI. The university also partners with international institutions on AI applications in various sectors. In partnership with Huawei, Strathmore University's iLab is offering a 4-week professional development course in AI. Also, Strathmore University's Center for Intellectual Property and Information Technology Law has AI resources on AI use in Africa.

There are private sector and tech hubs that provide institutional support to AI development. Founded in 2013, IBM Research – Africa develops new technologies to transform lives and spark new business opportunities. IBM Research – Africa conducts research in key areas such as water management, agriculture, transportation, health care, financial inclusion, education, energy, security, and government. With facilities in Kenya and South Africa, IBM Research – Africa foster local innovation ecosystems and have created new models for partnerships with industry, academia, government, non-profits, and start-ups. Early 2024, Microsoft Corporation and G42 announced a comprehensive digital investment package in Kenya in partnership with the Ministry of Information, Communications, and the Digital Economy. Among the key priorities of the project in Kenya is constructing a state-of-the-art green data centre by G42 and its partners, which will host Microsoft Azure in a new East Africa Cloud Region. The initiative will include four additional pillars that will be pursued with local partners: (1) local-language AI model development and research; (2) an East Africa Innovation Lab coupled with broad AI digital skills training; (3) international and local connectivity investments; and (4) collaboration with the government of Kenya to support safe and secure cloud services across East Africa. The Microsoft AI for Good Lab in Nairobi will leverage AI technology to collaborate with nonprofit organizations and other partners to address economic and societal priorities across East Africa. This initiative will enhance food security by using advanced AI techniques to provide site-specific fertilizer recommendations, thereby increasing agricultural productivity and minimizing environmental impacts. The lab will use high-

resolution satellite data to assist the Nature Conservancy (TNC) in monitoring and mitigating water risks for downstream wildlife and communities in northern Kenya. The AI for Good Lab will enhance climate resilience by applying AI models to high-resolution satellite data for disaster preparedness and response in partnership with the Kenya Red Cross Society, Kenya Space Agency, and the National Disaster Management Unit. Working with the Smithsonian and Kenya Wildlife Trust, the lab will also use high-resolution satellite imagery and AI to monitor wildlife populations and track livestock expansion near protected areas in East Africa.

In mid-2024, the African Development Bank and technology giant Intel formalized their cooperation to transform the African digital ecosystem. The partnership aims to equip 3 million Africans and 30,000 government officials with AI skills. The initiative will help create a critical mass of Africans proficient in Fourth Industrial Revolution (4IR) skills to accelerate growth and productivity and position Africans as contributors, not just consumers of 4IR. The training will address socio-economic challenges and boost productivity in key growth sectors such as agriculture, health, and education, thereby disrupting traditional growth cycles. The partnership will also support African countries, regional economic communities, and continental organizations in developing harmonized policy and regulatory frameworks in AI, 5G, Wi-Fi 6E, data and cloud.

In mid-2022, the Rockefeller Foundation launched a $5.5 million collaboration with e-GUIDE and Atlas AI to accelerate economic development and promote climate resilient infrastructure investment across sub-Saharan Africa. Leveraging satellite data and machine learning technologies, this three-year effort will produce unprecedented insight into the well-being of communities through a groundbreaking digital platform, which builds upon new research and publicly available datasets covering the nexus of agriculture, energy, and transportation sector development conditions. Initially covering Kenya, Nigeria, Rwanda, and Uganda, the platform will provide policymakers with extensive cross-sectoral insight into where new infrastructure development can help mitigate community vulnerabilities and promote economic opportunities, ultimately assisting efforts to prioritize and sequence investments more effectively in these key sectors.

Google believes that artificial intelligence can provide new ways of approaching problems and meaningfully improve people's lives hence they support organizations that are using the power of AI to address social and environmental challenges. Selected organizations receive coaching from Google's AI experts, Google.org grant funding from a $25 million pool, and credits and consulting from Google Cloud. They also join a customized 9-month accelerator program, including guidance from their nonprofit partner, DataKind, to jumpstart their work. Microsoft's AI for Good Lab has projects in the areas of expanding opportunity for AI, earning trust for AI, fundamental rights, advanced sustainability,

geospatial machine learning, renewable energy, biodiversity surveys, and land cover mapping.

United Nations Development Program (UNDP) champions AI to accelerate progress towards sustainable development, whilst steadfastly promoting human rights. This involves the ethical, transparent and sustainable development and utilization of AI technologies to ensure their deployment strengthens local AI ecosystems and advances human dignity, equality and justice for all. In the country context, UNDP has been an early explorer and advocate for the power and potential (and development imperative) of AI. For example, UNDP India was using AI back in 2020 to tackle air pollution, whilst AI has been used by UNDP Country Offices for improving health, education and broader development outcomes – including tackling disinformation. The Accelerator Labs are using AI to analyze earth observation data (satellite data and drone data) to detect crop diseases (Cameroon and Cabo Verde) or areas of accumulated waste (Guatemala, the Philippines, Serbia and Viet Nam), and to generate land use and cover maps (Ecuador and India). Leveraging our vast experience, UNDP contributes to global AI and digital conversations, including for the Global Digital Compact and the Secretary-General's High Level Advisory Body on AI through the UN Inter-Agency Working Group on AI and the G7.

World Food Program Innovation Accelerator launched the HungerMap LIVE that leverages the power of big data and predictive analytics to track and predict food security in near real-time. This was as an appreciation of the fact that Data is essential for understanding how hunger develops and changes, enabling humanitarians to track and respond to evolving needs. However, this involves a thorough analysis of information that is often scattered across different data sources and platforms. And when data is not readily available, humanitarians may lack relevant and timely evidence for decision-making, early warning and action. The HungerMap LIVE pulls together different publicly available data streams — such as data on food security, weather, population size, conflict, hazards, nutrition, and macro-economic data, including information from WFP's near real-time food security monitoring systems — to track and predict food security in near real-time. The HungerMap LIVE system integrates advanced analytics and data visualization tools to bring all this information into one place, making it available to all users through an interactive platform and analytic products that provide insights at global, regional and country levels.

4.3.6 Research Question 6: How might the recommendations from the research fit within the current humanitarian action system present at the community level?

In Marsabit County, various stakeholders including local NGOs, community health volunteers (CHVs), schools, and government agencies collect data on health, nutrition, water access, and other climate-related parameters. An AI-driven centralized data hub could aggregate data from these sources. For example, the Marsabit County Health Department could collaborate with organizations like ChildFund, UNICEF, and National Drought Management Authority and others to centralize data collection on malnutrition rates and climate patterns, enabling more comprehensive risk assessments. Strengthening the capacity existing coordination meetings between local stakeholders such as the Technical Working Groups can facilitate the sharing of AI insights. Capacity strengthening can be in the form of human resource training in the use of AI, financially resourcing the working groups and providing them with AI tools and equipment.

Collecting data on health and nutrition indicators, disease prevalence, climate conditions, and socio-economic factors can help AI systems predict risks more accurately. For example, gathering data on water sources, livestock conditions, and market prices in areas can provide AI with the inputs needed to forecast drought impacts. Using AI to develop scenario planning tools can help local authorities prepare for different climate risk scenarios. For instance, AI could model the impacts of varying rainfall patterns on water availability in different parts of Marsabit, helping to plan for worst-case scenarios. AI can create detailed vulnerability maps to identify the most at-risk children and communities. For example, mapping areas with high malnutrition rates and low access to clean water, such as parts of Chalbi Desert, can help target interventions more effectively. Developing tailored programs for different vulnerable groups can enhance impact. For instance, in areas with high rates of child malnutrition, AI can help design nutrition programs that provide specific supplements and support based on predicted needs.

Local community leaders and elders possess invaluable knowledge about traditional coping mechanisms and local climate patterns. Collaborating with them to refine AI models can improve accuracy. For example, integrating traditional weather prediction methods used by the Rendille and Borana communities can enhance AI models for predicting seasonal rainfall patterns. AI predictions can be validated through community feedback sessions. For instance, if AI predicts a potential increase in malnutrition due to anticipated drought, community health workers can verify this by observing actual conditions in villages, providing ground truth data to improve AI accuracy. Involving the community in designing and implementing AI initiatives can enhance relevance. For instance, setting up community advisory boards to provide input on AI projects can ensure they meet local needs. Ensuring that AI interventions are culturally appropriate can enhance acceptance. For example,

working with local religious leaders and elders to design interventions that respect cultural norms and traditions can improve community support.

Using local media, community meetings, and educational sessions in schools to raise awareness about AI can help demystify the technology. For example, running a radio program in the local Borana language to explain how AI helps predict and mitigate the impacts of droughts can increase community acceptance. Holding interactive sessions where community members can engage with AI experts and ask questions can build trust. For instance, organizing community forums where locals can see demonstrations of AI tools and their benefits can foster greater understanding and support. Conducting regular training workshops in Marsabit for local humanitarian workers on using AI tools can empower them to leverage AI predictions. These workshops can cover topics like data interpretation, AI tool usage, and integrating AI insights into anticipatory action plans. Implementing continuous learning programs with online resources and refresher courses can help local staff stay updated. For instance, setting up a partnership with local educational institutions like Maseno University to offer customized online courses on AI and data analysis can enhance local capacity.

Implementing AI-driven automated alert systems can ensure timely responses. For example, an AI system integrated with the Kenya Meteorological Department data could trigger alerts for Marsabit County Government, national Government agencies, and NGOs to mobilize resources when a severe drought is predicted. AI predictions can guide the pre-positioning of resources. If AI forecasts a high probability of drought, say, in North Horr, disaster response agencies and humanitarian actors can pre-position food, water, and medication supplies in strategic locations to ensure rapid distribution. AI can forecast the demand for essential supplies based on climate predictions. For example, predicting an increase in malnutrition cases due to anticipated droughts can help NGOs like ChildFund prepare by procuring additional food supplies. AI can optimize delivery routes to ensure timely aid distribution. For instance, using AI to determine the best routes for delivering water and food supplies to remote areas can reduce transportation costs and improve efficiency.

Implementing AI-driven real-time monitoring systems can provide continuous feedback on intervention effectiveness. For example, using AI to analyze health data from clinics in Marsabit can help track the impact of nutrition programs on child health in real-time. Defining KPIs for measuring the impact of AI interventions can help track progress. For instance, tracking the reduction in malnutrition rates and school attendance improvements in AI-intervention areas can provide measurable outcomes. Establishing feedback loops where data from interventions is continuously analyzed by AI can refine future actions. For example, data on the success of water distribution during droughts can be analyzed to

improve future distribution strategies. Involving the community in evaluating AI interventions can ensure they remain relevant and effective. For instance, collecting feedback from community members on the effectiveness of AI-predicted interventions can help refine the approach. Developing strict data privacy policies to protect community members' information is crucial. For instance, ensuring that data collected from health clinics and schools in Marsabit is anonymized and securely stored can protect privacy. Communicating clearly with the community about AI usage can build trust. For example, holding Chief's baraza to explain how AI data will be used and obtaining consent from community members can ensure transparency.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

AI tools can be used to understand and predict more frequent and intense climate hazards such as droughts, storms, floods, landslides, heatwaves, and sandstorms, less predictable rainfall, and increasing drying trends. AI tools can also be used to fight poverty and inequality by providing access to crucial resources and basic services, and reduce conflict-related displacement resulting from climate hazards. Finally, AI tools can be used to detect climate-related grievances and tensions that can potentially result in human insecurity, violent conflict, protests and riots, and intercommunal violence.

5.1.1 Research Question 1: What specific gaps exist in the current Anticipatory Action System that targets children at risk of climate-related disasters?

Lack of child-specific sensitization and education: Community sensitization programs often lack content specifically tailored to children. Without child-specific educational materials, children may not fully understand the risks of climate-related disasters or the steps they can take to stay safe. Current efforts rarely employ engagement strategies suitable for children, such as interactive games, storytelling, or child-friendly workshops, which could effectively raise awareness among young audiences.

Insufficient inclusion of children in disaster preparedness plans: Children are often excluded from participatory planning processes, resulting in disaster preparedness plans that do not address their unique needs. Incorporating children's perspectives can reveal specific risks and effective measures from their viewpoint. Preparedness plans frequently overlook the comprehensive support needed by children, such as maintaining educational continuity, providing psychological support, and ensuring physical safety.

Gaps in child-focused data collection: Data on climate impacts is often not disaggregated by age, which obscures the specific effects on children. This gap hampers the development of targeted interventions. Key indicators relevant to children's wellbeing, such as rates of malnutrition, school dropout rates, and incidences of mental health issues, are often not adequately monitored or analyzed in the context of climate risks.

Inadequate protective measures for children: Protective measures do not sufficiently address the heightened vulnerabilities of children, such as their dependence on adults, limited mobility, and higher susceptibility to exploitation and abuse during disasters. There is a need for systematic support mechanisms that ensure children's safety and wellbeing, including child protection services, emergency education programs, and family support systems.

5.1.2 Research Question 2: Which types of data, if initiated by AI, can effectively contribute to addressing gaps in the current Anticipatory Action System that targets children at risk of climate-related disasters?

Disaggregated child vulnerability data: AI can analyse data disaggregated by age and gender to pinpoint vulnerabilities unique to children, enabling more precise and effective interventions. Detailed assessments can identify the specific needs of children in various age groups and genders, such as nutritional requirements for young children versus adolescents.

Health and nutrition data: AI can predict trends in health and nutrition based on data from health clinics and surveys, allowing for pre-emptive action to mitigate issues like malnutrition and disease outbreaks. Real-time health data can help in rapidly identifying and addressing emerging health threats, ensuring children receive timely medical attention and nutritional support.

Educational impact data: Data from schools, including attendance records and performance metrics, can reveal the impact of climate risks on children's education. AI can help in identifying patterns and predicting disruptions. AI tools can monitor the safety and preparedness of school infrastructure, ensuring that educational facilities remain safe and operational during disasters.

Psychosocial wellbeing data: Data on children's mental health, gathered through surveys and counselling services, can be analysed to understand the psychological impacts of climate risks. AI can identify areas where children are experiencing high levels of stress and trauma. Integrating psychosocial data into anticipatory action plans ensures that interventions include support for children's mental health, helping them cope with the emotional and psychological aftermath of disasters.

5.1.3 Research Question 3: How should AI-initiated data be delivered to the primary users to ensure maximum impact of anticipatory action that targets children at risk of climate-related disasters?

Child-friendly communication channels: Information should be delivered in formats that are accessible and understandable to children, such as through cartoons, storybooks, and interactive games that convey safety messages in a relatable manner. Schools, after-school programs, and child-focused community centres can serve as effective platforms for disseminating information directly to children.

Parental and caregiver involvement: AI can help tailor messages to the specific needs and dynamics of families, ensuring that parents and caregivers receive clear and actionable information on how to protect and support their children. Training programs for parents and caregivers can enhance their ability to use AI-driven data and tools to take proactive measures, ensuring they are well-prepared to safeguard their children.

Utilizing schools and child-focused organizations: Schools can integrate climate risk information into their curricula, making it a regular part of children's education. This approach ensures that children learn about climate risks and preparedness in a structured and ongoing manner. Educators and community leaders trained in using AI tools can monitor risks and implement anticipatory actions, prioritizing children's safety and wellbeing.

Technological tools for reaching children: Mobile phones, tablets, and other digital devices can be used to deliver tailored information to children and their families. AI can customize content based on location, language, and cultural context, making it more relevant and impactful. Apps and games designed for children can engage them in learning about climate risks and preparedness in a fun and educational way, ensuring they retain critical safety information.

5.1.4 Research Question 4: What institutional support might be available to ensure the sustainability of potential AI use?

Child protection policies and frameworks: Government policies should explicitly support the use of AI in protecting children from climate-related risks, including mandates for integrating child-focused data into disaster management systems. Aligning child protection frameworks with climate resilience strategies can ensure a cohesive approach to safeguarding children, promoting sustainable AI use.

Partnerships with child-focused organizations: Partnerships with organizations dedicated to children's welfare, such as UNICEF, Save the Children, and local NGOs, and also government and academic institutions in AI and climate risk space can provide expertise and resources for effectively implementing AI-driven anticipatory actions. Collaborative efforts can improve data collection and analysis, ensuring comprehensive and well-coordinated interventions that address children's needs.

Capacity building for child services providers: Training programs for educators, healthcare providers, and child protection workers on using AI tools and data can improve their ability to implement anticipatory actions effectively. Building the capacity of child services providers to use AI ensures they are equipped to proactively address children's needs, enhancing the overall resilience of communities.

Sustainable funding mechanisms: Securing sustainable funding for AI initiatives targeting children is crucial. This can include government funding, grants from international organizations, and private sector investments. Establishing dedicated funds for child-focused anticipatory actions ensures that resources are consistently available to support these initiatives, promoting long-term sustainability.

5.1.5 Research Question 6: How might the recommendations from the research fit within the current humanitarian action system present at the community level?

Data centralization and coordination: Implementing an AI-driven centralized data hub that compiles information from local sources (NGOs, community health workers, schools, and government agencies) can streamline the process of risk assessment and anticipatory action. This hub would facilitate the tracking of health and nutrition indicators, educational attendance, and other critical factors affecting children, enabling more precise predictions and timely interventions. Training local stakeholders, including community leaders, teachers, and healthcare providers, on the use of AI tools and data interpretation can enhance their ability to leverage AI insights. Financial support and the provision of necessary equipment can empower these stakeholders to collect and share data effectively, fostering a collaborative environment that benefits children's well-being.

Accurate risk prediction and scenario planning: By collecting detailed, disaggregated data on children's health, nutrition, educational status, and socio-economic conditions, AI systems can improve risk predictions. For instance, monitoring water access, food availability, and disease prevalence allows AI to identify emerging threats and predict potential impacts on children, enabling proactive measures to be taken. AI-driven scenario planning tools can help communities prepare for various climate-related risk scenarios. These tools can model different outcomes based on potential climate events, providing local authorities with the information needed to develop contingency plans that prioritize children's safety and access to essential services.

Targeted interventions for vulnerable groups: AI can create detailed maps that highlight the most vulnerable children and communities. This enables the design and implementation of targeted interventions, such as nutritional support in areas with high malnutrition rates or educational programs in regions with low school attendance due to climate impacts. Developing specific programs based on AI predictions can address the unique needs of different vulnerable groups. For example, in areas prone to drought, AI can help design interventions that ensure children have access to clean water and adequate nutrition, reducing the risk of malnutrition and disease.

Community collaboration and cultural appropriateness: Collaborating with local leaders and elders, who possess valuable traditional knowledge about coping mechanisms and local climate patterns, can enhance the accuracy of AI models. This integration can improve community trust and the effectiveness of AI-driven interventions. Engaging the community in the design and implementation of AI initiatives ensures that interventions are culturally appropriate and meet local needs. Establishing community advisory boards can provide valuable insights and foster a sense of ownership, enhancing the sustainability and acceptance of AI-driven solutions.

Enhancing existing humanitarian systems: Strengthening early warning systems with AI capabilities can provide timely alerts about impending climate-related risks. This allows communities to take proactive measures to protect children, such as evacuating to safe areas or securing essential supplies. Ensuring that schools are equipped to handle climate-related emergencies is crucial for maintaining children's education and safety. AI can help

identify schools at risk and provide resources for emergency preparedness, such as food, water, and remote learning tools, ensuring educational continuity during disasters.

Institutional support and sustainability: Aligning AI initiatives with existing child protection and climate resilience policies can enhance their effectiveness. Local governments and NGOs can integrate AI recommendations into their programs, ensuring a cohesive approach to safeguarding children. Establishing partnerships with child-focused organizations and securing sustainable funding from government, international donors, and private sector investments can support the long-term implementation of AI-driven anticipatory actions. Community-based organizations can also mobilize local resources to sustain these initiatives.

5.2 Recommendations

Challenges of AI and Ethics

i. Inadequate representation: AI access to be improved and enhanced especially by considering all the stakeholders and including the local community. This was clear as stakeholders spelt out that approaches and dissemination of AI tools and information lack diversity and consequently inadequacy in coverage of impact on temporal, spatial and socioeconomic disparities.

ii. Bias in forecasts: The feeling and notion that there is biasness and inaccuracies in the AI produced forecasts of climate hazards. This leads to neglect and inaction from stakeholders eventually resulting in increasing the number of vulnerable persons especially children and severity of the impact. Therefore, there is a need to improve on projections and forecasts and ensure they are specific to regions. Similarly, bias in AI and data quality exists. AI models are data heavy. This reliance on data makes it important that the data that is fed into the models do not lead to bias in the AI output, especially when it comes to results that might affect children and those who are already from disadvantaged communities. Similarly, the issues of privacy arises when it comes to the sources of the data and personal identifiable information.

iii. Undesired consequences: The undesired results from technology related aspects can lead to erosion of the community's morals and beliefs. This arises as society feels that the use of modern technology which aid AI such as smartphones exposes the children to unintended negative norms such as easy access to pornography. Education and sensitization of the community on the need to embrace emerging technologies for improved livelihood such as on weather and climate forecasting.

iv. Complexity – AI models can be complex and difficult to explain and can also produce results that are not explainable. Care needs to be put on the data that goes into the AI models and the use of AI models whose choices and results can be explained.

Table 3: Specific recommendations on how AI can be used to improve wellbeing outcomes for children affected by climate risks

Domain	**Recommendation**
Interactive Learning	1. Create educational tools like mobile apps, interactive websites, and digital games that teach children about climate risks in an engaging way. 2. Organize storytelling sessions where climate-related stories are told in a captivating manner, using relatable characters and scenarios. 3. Conduct workshops that use hands-on activities, role-playing, and simulations to help children understand disaster preparedness and response.
School Integration	1. Integrate climate risk education into the existing school curriculum, ensuring it is age-appropriate and relevant to the local context. 2. Train teachers on how to effectively deliver this content and engage students in discussions about climate risks. 3. Develop child-friendly educational materials like books, posters, and videos that can be used in classrooms.
Community Programs	1. Use local community events and fairs to disseminate information through plays, puppet shows, and interactive booths. 2. Organize workshops that involve both parents and children, fostering a family-centered approach to learning about climate risks. 3. Utilize local media, such as community radio stations and local television, to broadcast educational content designed for children.
Participatory Planning	1. Form children's committees that can provide input on disaster preparedness plans from their perspective. 2. Conduct focus groups with children to gather their insights on risks and effective measures.

	3. Use surveys and consultations specifically designed for children to gather their opinions and suggestions.
Address Specific Needs	1. Ensure plans include provisions for maintaining education, such as temporary learning spaces and online education options during disruptions. 2. Incorporate psychological support services into disaster plans, including access to counselors and mental health resources. 3. Plan for safe spaces where children can stay during disasters, ensuring they are protected from harm and exploitation.
Child Ambassadors	1. Develop leadership programs that train children to become ambassadors for disaster preparedness. 2. Encourage child ambassadors to lead peer-to-peer education initiatives, sharing knowledge with their peers. 3. Provide opportunities for child ambassadors to speak at community events and planning meetings.
Age-Disaggregated Data	1. Collect detailed data on how climate impacts different age groups among children, including infants, toddlers, and adolescents. 2. Ensure data collection considers gender differences to address the specific needs of boys and girls. 3. Conduct longitudinal studies to track the long-term impacts of climate risks on children's development and wellbeing.
Key Indicators	1. Track health indicators such as rates of malnutrition, incidences of waterborne diseases, and water access, and vaccination coverage among others. 2. Monitor school attendance, dropout rates, and academic performance to assess the impact of climate risks on education. 3. Conduct regular surveys to assess children's mental health, including stress levels, anxiety, and signs of trauma.

AI Integration	1. Use AI to analyze collected data and predict future trends, helping to identify emerging risks and areas in need of intervention. 2. Develop user-friendly dashboards and visualizations that make it easy for stakeholders to understand and act on the data. 3. Implement real-time monitoring systems that provide up-to-date information on the status and needs of children in vulnerable areas.
Child Protection Services	1. Enhance child protection services to ensure they can respond effectively during disasters. 2. Train child protection workers on how to address the specific needs of children during and after disasters. 3. Establish hotlines and reporting mechanisms that children can use to seek help and report issues during emergencies.
Emergency Education Programs	1. Set up temporary learning spaces in safe areas where children can continue their education during disruptions. 2. Develop remote learning options, such as online classes and radio-based education programs, to ensure continuity of education. 3. Provide educational supplies like books, stationery, and digital devices to children affected by disasters.
Family Support Systems:	1. Implement systems to help reunite families separated during disasters, ensuring children are not left alone. 2. Provide economic support to families, such as cash transfers and food assistance, to help them recover from the impacts of disasters. 3. Strengthen community networks that can provide mutual support and resources to families in need.
Health and Nutrition Data	1. Use AI to develop predictive models that can forecast health and nutrition trends based on existing data.

	2. Implement AI-driven early warning systems that alert communities to emerging health threats, allowing for timely interventions. 3. Use AI to optimize the allocation of health and nutrition resources, ensuring they reach the most vulnerable children.
Educational Impact Data:	1. Use AI to monitor school attendance in real-time, identifying patterns and predicting potential disruptions. 2. Assess the safety of school infrastructure using AI tools, ensuring schools are resilient to climate risks. 3. Analyze performance metrics to understand how climate impacts children's learning outcomes and identify areas for improvement.
Psychosocial Wellbeing Data	1. Use AI to analyze data on stress indicators, such as changes in behavior and self-reported anxiety levels, to identify areas needing psychological support. 2. Implement AI-driven systems that match children with appropriate counseling services based on their specific needs. 3. Use AI to design community outreach programs that provide psychosocial support to children and their families.
Child-Friendly Formats	1. Create cartoons and storybooks that explain climate risks and safety measures in an engaging and easy-to-understand way. 2. Develop interactive games that teach children about disaster preparedness through play. 3. Use visual aids like infographics and animated videos to convey important information.
Parental Involvement	1. Use AI to tailor messages to the specific needs and dynamics of families, ensuring parents and caregivers understand how to protect their children.

	2. Develop training programs for parents and caregivers on how to use AI-driven data and tools to take proactive measures. 3. Organize workshops that involve entire families in learning about climate risks and preparedness.
School and Community Channels	1. Work with schools to integrate climate risk information into their regular teaching schedules. 2. Collaborate with child-focused organizations to disseminate information and support children's needs. 3. Identify and train local champions, such as teachers and community leaders, to act as points of contact and support for AI-driven initiatives.
Child Protection Policies	1. Advocate for government policies that explicitly support the use of AI in protecting children from climate-related risks. 2. Align child protection frameworks with climate resilience strategies to ensure a cohesive approach to safeguarding children. 3. Work with policymakers to develop regulations that support the ethical and effective use of AI in this context.
Partnerships	1. Develop collaborative projects with organizations like UNICEF, Save the Children, and local NGOs to leverage their expertise and resources. 2. Partner with government bodies and academic institutions working in AI and climate risk to enhance data collection and analysis. 3. Share resources and best practices across organizations to improve the overall effectiveness of AI-driven anticipatory actions.
Capacity Building	1. Implement training programs for educators, healthcare providers, and child protection workers on using AI tools.

	2. Facilitate knowledge-sharing sessions where stakeholders can learn from each other's experiences and best practices. 3. Develop skill-building initiatives that enhance the capacity of local stakeholders to effectively use AI in their work.
Sustainable Funding	1. Secure commitments from governments to provide long-term funding for AI initiatives targeting children. 2. Apply for grants from international organizations dedicated to children's welfare and climate resilience. 3. Encourage private sector investments in AI-driven anticipatory actions, highlighting the potential for social impact.
Data Centralization	1. Implement a centralized data hub that compiles information from local sources such as NGOs, community health workers, schools, and government agencies. 2. Train local stakeholders, including community leaders, teachers, and healthcare providers, on using AI tools and data interpretation. 3. Provide necessary equipment and financial support to empower local stakeholders to collect and share data effectively.
Accurate Risk Prediction	1. Collect detailed, disaggregated data on children's health, nutrition, educational status, and socio-economic conditions. 2. Use AI-driven scenario planning tools to help communities prepare for various climate-related risk scenarios. 3. Develop contingency plans that prioritize children's safety and access to essential services based on AI model outcomes.
Targeted Interventions	1. Use AI to create detailed maps highlighting the most vulnerable children and communities.

	2. Design and implement specific programs based on AI predictions, such as nutritional support and educational initiatives. 3. Optimize resource allocation to ensure targeted interventions reach the most vulnerable groups.
Community Collaboration	1. Collaborate with local leaders and elders to integrate traditional knowledge with AI models. 2. Establish community advisory boards to provide insights and foster ownership of AI-driven solutions. 3. Ensure interventions are culturally appropriate and meet local needs by engaging the community in their design and implementation.
Enhance Early Warning Systems	1. Strengthen early warning systems with AI capabilities to provide timely alerts about impending climate-related risks. 2. Ensure schools and communities are equipped to handle climate-related emergencies through preparedness training and resources. 3. Implement measures to ensure educational continuity, such as remote learning tools and emergency supplies for schools.
Institutional Support and Sustainability	1. Align AI initiatives with existing child protection and climate resilience policies to enhance their effectiveness. 2. Integrate AI recommendations into NGO and government programs for a cohesive approach to safeguarding children. 3. Secure sustainable funding from government, international donors, and private sector investments to support long-term implementation. 4. Mobilize local resources through community-based organizations to sustain AI-driven initiatives.

REFERENCE

1. 510. (2024, August 13). https://510.global/ Accessed 16th August 2024

2. Africa Climate Youth Assembly 2023 Nairobi Declaration.
3. Anticipation Hub (2023). Integrating child protection, education and gender-based violence into anticipatory action. ttps://www.anticipation-hub.org/Documents/Briefing_Sheets_and_Fact_Sheets/AH-Integrating_briefing_FINAL.pdf Accessed 1st May 2024.
4. Anticipation Hub. (n.d.) Innovative approaches to response preparedness. . https://www.anticipation-hub.org/experience/anticipatory-action-in-the-world/kenya/innovative-approaches-to-response-preparedness Accessed 16th August 2024
5. Barnfonden (2022). Strategies to end violence against children in a changing climate
6. Beduschi, A. (2022). Harnessing the potential of artificial intelligence for humanitarian action: Opportunities and risks. International Review of the Red Cross (2022), 104 (919), 1149–1169
7. Chen, C. (2021). The future is now: artificial intelligence and anticipatory humanitarian action. Humanitarian Law and Policy. https://blogs.icrc.org/law-and-policy/2021/08/19/artificial-intelligence-anticipatory-humanitarian/ Accessed 29th April 2024.
8. Child Fund. Understanding Climate Action. Brief. (Doesn't look complete citation)
9. ChildFund Alliance (2023). Climate and Environmental Action
10. Childfund Climate Change Programme Interventions brief. (Doesn't look complete citation)
11. Davenport, F., Grace, K., Funk, C., & Shukla, S. (2017). Child health outcomes in sub-Saharan Africa: A comparison of changes in climate and socio-economic factors. Global Environmental Change, 46, 72-87.
12. Food and Agriculture Organization of the United Nations (2023). El Niño Anticipatory Action and Response Plan August–December 2023
13. IBM. What is artificial intelligence (AI)? https://www.ibm.com/topics/artificial-intelligence Accessed 30th April 2024.
14. Huynh, B. Q., & Kiang, M. V. (2023). AI for Anticipatory Action: Moving beyond Climate Forecasting. In *Proceedings of the AAAI Symposium Series* (Vol. 2, No. 1, pp. 78-84).
15. IGAD Climate Prediction and Application Center (ICPAC). ICPAC receives Google.org funding through the UN WFP to Enhance Disaster Preparedness in Eastern Africa. Press Release. https://www.icpac.net/news/icpac-receives-googleorg-funding-through-the-un-wfp-to-enhance-disaster-preparedness-in-eastern-africa/#:~:text=Today%2C%20the%20Center%20announced%20the,enhance%20early%20warning%20information%20systems Accessed 28th April 2024.

16. International Federation of Red Cross and Red Crescent Societies (IFRRC). (2021). Anticipatory Action & Child Protection: Acting Early to Better Protect Children in Emergencies Issue Brief. Geneva, Switzerland.
17. International Organization for Standardization (ISO). What is AI? All you need to know about artificial intelligence. https://www.iso.org/artificial-intelligence/what-is-ai Accessed 30th April 2024.
18. Kaithuru, P. and Misiani, Z. (2023). Anticipatory Early Action: Considering Responsive Community Targeted Mental Health Intervention to Complex Climate Change Impacts. International Center for Humanitarian Affairs.
19. Kenya Meteorological Department (2023). Analysis of El Niño's influence on weather and climate in Kenya: a comprehensive update. Ministry of Environment, Climate Change & Forestry.
20. Kim, K. and Boulanin, V. (2023). Artificial Intelligence for Climate Security: Possibilities and Challenges. Stockholm International Peace Research Institute (SIPRI), Solna, Sweden.
21. Manning, C. (2020). Artificial Intelligence Definitions. Stanford University Human Centered Artificial Intelligence. https://hai.stanford.edu/sites/default/files/2023-03/AI-Key-Terms-Glossary-Definition.pdf Accessed 29th April 2024.
22. Office for the Coordination of Humanitarian Affairs (OCHA): Anticipatory Action Toolkit. https://anticipatory-action-toolkit.unocha.org/ Accessed 29th April 2024.
23. "Office of the High Commissioner on Human Rights (OHCHR) (2017). Analytical study on the relationship between climate change and the full and effective enjoyment of the rights of the child. https://documents.un.org/doc/undoc/gen/g17/110/91/pdf/g1711091.pdf?token=5LRlIeKb9MeXw9VZuf&fe=true Accessed 30th April 2024.
24. Office of the Special Representative of the Secretary-General on Violence Against Children (OSRSG/VAC) (2022). The Climate Crisis and Violence Against Children. New York.
25. Pacheco, S. E. (2020). Catastrophic effects of climate change on children's health start before birth. The Journal of clinical investigation, 130(2), 562-564.
26. Pichon, F. (2019). *Anticipatory humanitarian action: What role for the CERF*. Working Paper 551). London: Overseas Development Institute. Retrieved from https://www. odi. org/sites/odi. org. uk/files/resource-documents/12643. pdf.
27. UNICEF Kenya El Nino Floods Humanitarian Situation Report No. 1, 15 December 2023.
28. United Nations Children's Fund (UNICEF). (2023). Time to act: African children in the climate change spotlight. Advocacy Brief. Nairobi, Kenya.
29. United Nations Children's Fund (UNICEF), The climate-changed child: A children's climate risk index supplement, UNICEF, New York, November 2023.

30. United Nations Children's Fund: The Kenya Subnational Children Climate Risk Index-Disaster Risk Model (CCRI-DRM). https://www.unicef.org/kenya/kenya-subnational-children-climate-risk-index-disaster-risk-model-ccri-drm#:~:text=A%20significant%20number%20of%20children,of%20sufficient%20and%20nutritious%20food Accessed 30th April 2024.
31. Van den Homberg, M. J., Gevaert, C. M., & Georgiadou, Y. (2020). The changing face of accountability in humanitarianism: Using artificial intelligence for anticipatory action. *Politics and Governance*, *8*(4), 456-467.

Appendix1: Informed Consent Forms for Children and Adults

ChildFund Informed Assent Form for Children
(To be used for obtaining the assent of children 7–17-year-olds)

Greeting
How are you? My name is _____. I work with (*name of organization*), and have come to learn about the children of this village.

Background
We have come to learn about the children of this village as part of a large project supported by ChildFund International and Nawiri Child Development Programme. The project is not limited only to your village. It is also being carried out in (*name any other villages or communities in-country*).

Purpose of Project
The purpose of this project is to learn about how your community cares for their children, and our goal is to better understand how the community can work together with the government and NGOs to improve the lives of children.

Today we will be talking with about 12 children and youth, and you are one of the people we would like to talk with, if you agree. This is a group discussion, and we will ask questions about places in your village where girls and boys and young women and young men may feel safe and not so safe, how they may be harmed, and if they are harmed, what are the different types of harm they may experience. And we'll ask questions about what happens when a girl or boy, or young woman or young man, is harmed—where do they or their families go for help? We aren't going to ask you any personal questions about your own experiences or ask you to share private information--we are going to ask you general questions about what you know about the experience of people in your community.

In addition, we are requesting your permission to record this session for notetaking purposes. The recording will assist us to document information shared during the group discussion. The recording file(s) will be treated with confidentiality by being stored on a secure server and will be destroyed at the termination of the research project.

In a moment, I am going to ask if you are interested in taking part in the group discussion that will take place (*state the time, day, and location*) and last for about 3 hours. But first, let me say a few more things.

Benefits and Risks
What you tell us may help people here to understand how children and adults see their situation, to help us know more about how to support families, care for children, and decrease the problems that young people face. You will not benefit personally by taking part in this discussion. You will not receive money or material benefits.

While the questions will be asked as part of the group discussion, some of these questions may talk about things that some people find quite personal, or may be difficult to answer. If any of the questions make you feel uncomfortable or you don't want to answer them, you do not have to. You don't have to talk. If any of the questions upset you, or if you would like to talk to someone about the feelings you experienced during the discussion, please let me know and I, or another responsible adult, and we will be happy to take that time with you.

Confidentiality
The information that's collected will be used to protect children, make children safer, and help to better support children and their families. While we are going to write down what people say during the discussion, we aren't going to say who says what. The only time we might share private information is if a child reports a personal experience of being harmed, in which case we have an ethical obligation to report this to the proper authorities.

Voluntary Participation
There is no pressure on you to participate in the group discussion. Your participation is completely voluntary. You are free to say "No" if you prefer not to talk with us.

So I would like to ask your permission—are you willing to talk with us today? If you agree, and at any point during the discussion, you do not want to continue, you can say, and you will be free to leave. That is fine.

Assent

I have talked about this group discussion, including the purpose, risks, benefits and confidentiality. I am willing to talk with the researcher and share my experiences.

PARTICIPANT (Print Name): _____

NOTE WHETHER PARTICIPANT/SUBJECT/RESPONDENT AGREES:

[ ] DOES NOT AGREE. (THANK PARTICIPANT FOR HIS/HER TIME AND END.)

[ ] AGREES.

Name of Person Obtaining Assent: _____

Signature: _____ Date: _____

Name of Witness: _____

Signature of Witness_____ Date: _____

ChildFund Informed Consent Form for Adults
(To be used for obtaining the consent of adults ages 18 and older to participate in an interview or Focus Group Discussion)

Greeting
Hello, my name is _____ and I work with Nawiri and have come to learn about the children of this village.

Background of research
We have come to learn about the children of this village as part of a large project supported by ChildFund International and Nawiri Child Development Programme .

Purpose of research
The purpose of this project is to learn about how your community cares for their children, and our goal is to better understand how the community can work together with the government and NGOs to improve the lives of children.

Today we will be talking with about youth and adults, and you are one of the people we would like to talk with, if you agree. This is a group discussion, and we will ask questions about places in your village where girls and boys and young women and young men may feel safe and not so safe, how they may be harmed, and if they are harmed, what are the different types of harm they may experience. And we'll ask questions about what happens when a girl or boy, or young woman or young man, is harmed—where do they or their families go for help? We aren't going to ask you any personal questions about your own experiences or ask you to share private information--we are going to ask you general questions about what you know about the experience of people in your community.

In addition, we are requesting your permission to record this session for notetaking purposes. The recording will assist us to document information shared during the group discussion. The recording file(s) will be treated with confidentiality by being stored on a secure server and will be destroyed at the termination of the research project.

In a moment, I am going to ask if you would like to take part in the group discussion that will take place in this school today and last for about one and half an hour. But first, let me say a few more things.

Benefits and Risks
You will not benefit personally by taking part in this study. You will not receive money or material benefits. What you tell us may help people here to understand and know more about how to support families, care for children, and decrease the problems that young people face.

While the questions will be asked as part of the group discussion, some of these questions may talk about things that some people find quite personal or may be difficult to answer. If any of the questions make you feel uncomfortable or if you don't want to answer them, you do not have to. You don't have to talk. If any of the questions upset you, or if you would like to talk to someone about your feelings, please let me know. Either I or another responsible adult, will be happy to take the time to talk with you in private.

Confidentiality
The information that's collected will be used to protect children, make children safer, and help to better support children and their families. While we are going to write down what people say during the discussion, we aren't going to say who says what. The only time we might share private information is if someone reports a personal experience of being harmed, in which case we have an ethical obligation to report this to the proper authorities.

Voluntary Participation
There is no pressure for you to participate in the group discussion. Your participation is completely voluntary. You are free to say "No".

So, I would like to ask—would you like to talk with us today? If you agree, and at any point during the discussion, you do not want to continue, you will be free to leave. That is fine.

Informed Consent
I have talked about this group discussion, including the purpose, risks, benefits and confidentiality. I would like to participate.

Thank you for listening to me.

Adult (Print Name): _____

NOTE WHETHER RESPONDENT AGREES TO PARTICIPATE:

[ ] DOES NOT AGREE TO PARTICIPATE. (*THANK PARTICIPANT FOR HIS OR HER TIME AND END*.)

[ ] AGREES TO PARTICIPATE.

Name of Person Obtaining Consent _____

Signature: _____ Date: _____

Name of Witness: _____

Signature of Witness_____ Date: _____