

FORECAST-BASED FINANCING: A DECADE AFTER ITS INTRODUCTION

PRACTICES & EXPERIENCES IN THE RED CROSS MOVEMENT

Beleidsrapport

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Executive Summary

Forecast-based Financing (FbF), or Anticipatory Action (AA), has emerged as an innovative approach in disaster risk management, fundamentally shifting the paradigm from reactive to proactive interventions. This methodology aims to mitigate the impacts of imminent disasters by leveraging scientific forecasts to trigger early actions, consequently saving lives and livelihoods. Despite significant advancements, the journey of scaling up AA has been full of challenges, requiring a nuanced understanding of its evolution, current trends, and the obstacles that slow down its broader adoption.

This policy report thesis explores the evolution of AA since its inception, tracing the roots from early pilot projects led by the German Red Cross in 2013 to the current usage across multiple countries. The research delves into the complexities of this approach, examining how it has been implemented, the lessons learned, and the potential for scaling up this initiative to ensure they become integral components of national disaster risk management frameworks. The research identifies key trends in AA plans, highlighting the shift from small-scale pilot projects to more sustainable and widespread implementations. However, it also uncovers continuous challenges, including funding limitations, coordination issues among stakeholders, and the technical complexities linked with accurate forecasting.

These challenges are particularly obvious in regions like Sub-Saharan Africa, where the integration of global forecasting systems with local data remains a significant difficulty. By focusing on Uganda and Mozambique in our case studies, we make an effort to showcase the evolution from original pilot countries to current practices.

A critical aspect of the research is the focus on scaling up and mainstreaming AA. The research emphasises the need for stronger government ownership, better coordination between humanitarian agencies and national authorities, and the development of robust early warning systems that are designed for the specific needs of vulnerable communities. It also calls for a 'lessons learned' approach, encouraging continuous reflection and adaptation to enhance the effectiveness of these anticipatory actions.

In conclusion, while AA has shown considerable potential in reducing disaster impacts, the long-term success depends on addressing several challenges. Importantly, securing consistent funding is necessary to ensure that actions can be implemented effectively. Without reliable financial support, even the most well-planned AA initiatives risk being ineffective.

Furthermore, the need for coordination among stakeholders involved in DRM, including governments, international organisations, NGOs and local communities. Effective AA requires a

harmonised approach, where all actors work guided by clear protocols and shared objectives. Additionally, the accuracy and reliability of forecasting systems are fundamental to the success of AA. Accurate forecasts are the cornerstone of AA, enabling timely interventions that mitigate the worst effects of disasters. This policy report thesis provides recommendations for improving these systems, advocating for

greater investment in capacity building, the establishment of clear guidelines for early actions, and the integration of AA into broader disaster management policies. By addressing these areas, the humanitarian sector can better prepare for and respond to the increasing frequency and severity of natural disasters, ultimately building more resilient communities.

1 Introduction

The landscape of disaster risk management (DRM) has undergone a remarkable transformation in recent decades. Historically, humanitarian responses to disasters have been predominantly reactive, mobilising after a crisis has occurred, often resulting in mass casualties, destruction of houses and infrastructure, and long-term economic and social impacts. This traditional approach, while necessary, has increasingly been recognised as insufficient, especially in the context of a changing climate that is causing more frequent and severe natural disasters. In response to these challenges, the humanitarian sector has shifted towards more proactive strategies, represented by the development of Forecast-based Financing (FbF) or Anticipatory Action (AA). This innovative methodology marks a significant departure from conventional disaster response, focusing instead on predicting potential disasters and taking preventive actions to mitigate their impacts.

The concept of Forecast-based Financing was introduced as a means to address the limitations of post-disaster response. FbF leverages advances in climate science and forecasting technology to trigger early interventions before a disaster strikes, thereby reducing the need for emergency response and minimising the impact on vulnerable communities. This approach represents an evolution in DRM, it shifts the focus from reacting to anticipating to disasters and taking

action based on scientific forecasts and risk assessments. The origins of FbF can be traced back to early pilot projects initiated by the German Red Cross, which searched to explore the viability of using weather forecasts to inform humanitarian action. These initial efforts demonstrated the potential of FbF to enhance disaster preparedness and response, leading to its broader adoption within the Red Cross Red Crescent (RCRC) network and beyond.

Anticipatory Action, a broader concept that encompasses FbF, has since become a key component of disaster risk management strategies worldwide. AA refers to a set of interventions that are triggered by scientific forecasts or early warnings, with the aim of reducing the impact of imminent hazards. This approach has been increasingly embraced by humanitarian organisations, governments, and international agencies. AA is a more effective way to protect lives, livelihoods, and infrastructure from the devastating effects of natural disasters. The expansion of this initiative has been driven by a growing recognition of the need for more proactive disaster management strategies, particularly in the face of escalating climate risks.

The implementation of FbF or AA has resulted in a paradigm shift in how humanitarian organisations approach disaster risk management. By focusing on early intervention, this methodology has the potential to save lives, reduce economic losses, and build resilience in

communities that are most vulnerable to natural hazards. However, the adoption and scaling up of AA has not been without challenges. These include issues related to funding, coordination among stakeholders, the accuracy of forecasts, and the integration of anticipatory actions into national disaster management frameworks.

One of the key challenges in implementing AA is securing sustainable funding. While the benefits of early action are well-documented, the financial resources required to support these initiatives are often limited. This is partly due to the uncertainty associated with forecasting and the difficulty in justifying expenditures on actions that may ultimately prove unnecessary if a forecasted disaster does not materialise, called 'acting in vain'. Moreover, the current funding landscape for humanitarian action is mostly focused on post-disaster response, making it challenging to redirect resources towards anticipatory measures. Addressing this funding gap is critical to the success of AA, as it would enable more consistent and widespread implementation of this approach.

Coordination among stakeholders is another significant challenge in the context of AA. The successful implementation of anticipatory actions requires collaboration between a wide range of actors, including national governments, international organisations, NGOs and local communities. This collaboration is often complicated by different priorities, capacities and levels of commitment among stakeholders. Furthermore, the integration of anticipatory actions into existing disaster management

frameworks can be obstructed by a lack of political will. Conquering these challenges will require efforts to build partnerships, enhance coordination mechanisms, and stimulate a culture of collaboration among all stakeholders involved in DRM.

The accuracy of forecasts is crucial for the effectiveness of AA. While advances in climate science have significantly improved our ability to predict weather-related hazards, there remain limitations in the precision and reliability of forecasts, specifically in regions with limited meteorological infrastructure. This uncertainty can undermine the confidence of stakeholders in the forecasts and, by extension, in the anticipatory actions triggered by them. To address this issue, there is a need for ongoing investment in improving forecasting capabilities, as well as in developing decision-making frameworks that can serve the uncertainties in forecasting.

The integration of anticipatory actions into national disaster management frameworks is another area that requires attention. While there has been progress in incorporating FbF and AA into the policies and practices of some countries, in many cases, this approach remains on the edge of national DRM strategies. This is often due to a lack of understanding of the benefits of AA among policymakers, as well as the absence of mechanisms to support the integration into existing frameworks. To achieve greater mainstreaming of AA, it is essential to raise awareness of the benefits, build the capacity of national and local authorities to implement this approach and develop policies that support the use of anticipatory actions.

This policy report tries to explore the evolution, current state, and future directions of FbF and AA, with a focus on understanding how this methodology has developed since its origin, identifying key trends and challenges, and exploring opportunities for scaling up and mainstreaming this initiative. The research aims to contribute to a deeper understanding of how AA can be integrated into broader DRM frameworks and how it can be improved to enhance its effectiveness in mitigating the impacts of natural hazards.

The scope of this research is threefold: First, it investigates the historical development and evolution of FbF and AA, tracing their roots from early pilot projects to their current widespread implementation. This includes an examination of the role of the Red Cross Red Crescent in pioneering this approach, as well as the expansion of AA initiatives to a wider range of hazards and geographic contexts. Second, it analyses the trends and challenges associated with current AA plans, drawing insights from case studies and interviews with practitioners in the field. This analysis will focus on understanding the factors that have contributed to the success of AA initiatives, as well as the obstacles that have interfered with their implementation. Third, it explores strategies for scaling up and mainstreaming AA, offering recommendations for future improvements to ensure this methodology is more widely adopted and more effectively implemented.

The research questions guiding this study are as follows:

- How has FbF and AA evolved since their inception?
- What trends and challenges can we identify in current AA initiatives?
- How can we scale up and mainstream AA, and what improvements are needed for future implementations?

By addressing these questions, this research aims to provide an overview of the state of AA today, highlighting its successes, identifying areas for improvement, and proposing directions for the continued evolution of these DRM tools. The findings of this research are intended to inform practitioners, policymakers, and researchers engaged in the field of disaster preparedness.

In summary, the development and implementation of AA represents a significant shift in the approach to disaster risk management. This methodology offers a proactive and scientifically informed means of reducing the impact of natural disasters, with the potential to save lives, protect livelihoods, and improve community resilience. However, the successful scaling up and mainstreaming of these initiatives will require addressing key challenges related to funding, coordination, forecasting accuracy, and policy integration. This thesis tries to contribute to the growing body of knowledge on AA by providing an analysis of its evolution, current trends, and future directions.

2 Background: Historic context

2.1 Early disaster response mechanisms

Historically, humanitarian organisations were established mainly to respond to disasters after they occurred. However, practitioners in the field soon recognised the need for a more sustainable, long-term approach. This realisation led to a shift toward greater investment in disaster preparedness.

About a decade ago, disaster-related initiatives were typically categorised into two main areas: immediate post-disaster response and reconstruction, and long-term disaster risk reduction (DRR). Most investments in DRR at that time were concentrated on large-scale flood prevention infrastructure projects (Coughlan de Perez et al., 2015)¹.

Traditional disaster response, however, has faced significant challenges. Due to its inherently reactive nature, there can be delays in mobilising resources and reaching affected areas, intensifying the impact of the disaster. Humanitarian organisations often struggle with shortages of funds, supplies and personnel, which can limit their ability to respond effectively. The involvement of multiple agencies can also lead to coordination difficulties, overlapping efforts and

inefficiencies. Moreover, a prolonged reliance on external aid can create dependency among affected populations, limiting long-term recovery and self-sufficiency.

In response to these limitations, the sector has increasingly adopted more proactive preventive measures in disaster management. This shift includes greater investment in DRR strategies, such as the implementation of early warning systems that predict and monitor potential hazards, allowing for timely evacuations and preparations. Educating communities about disaster risks and preparedness enhances local resilience, while building and reinforcing infrastructure to withstand natural hazards reduces the likelihood of catastrophic damage.

In summary, while traditional disaster response has been essential in addressing the immediate needs of affected populations, its limitations have pushed the humanitarian sector to pursue more comprehensive approaches. These approaches include preparedness, risk reduction and resilience-building, all aiming to mitigate the impacts of disasters and improve the capacity of communities to recover and develop. The increasing impact of climate change, which has led to more frequent and severe natural hazards, has exposed the

¹ Much of the research presented in this thesis is grounded in the work by Coughlan de Perez et al. (2015), "Forecast-based financing: An approach for catalyzing humanitarian action based on extreme weather and climate forecasts."

This paper serves as the foundational literature for the development and origin of Forecast-based Financing (FbF) and has been instrumental in shaping the understanding and evolution of FbF, providing critical insights that have informed the analysis and conclusions of this study.

limitations of traditional disaster risk reduction strategies, particularly in countries with less resilient infrastructure and more vulnerable populations.

In these contexts, extreme weather events can rapidly escalate into full-scale disasters in the absence of preventive measures (Lopez et al., 2020). Recognising this, the humanitarian sector began to see the potential of using extreme weather forecasts as part of an early warning system. Such a system could significantly enhance preparedness and response capabilities. For example, by pre-positioning relief supplies, humanitarian organisations have been able to reach flood victims within days rather than weeks, thereby preventing further loss of life, reducing impacts on livelihoods and improving the efficiency of resource use. However, fully using the potential of these forecasts requires ongoing collaboration among disaster managers, climate scientists and humanitarian donors.

Interestingly, decision-making by using forecasts is not a completely new concept. For instance, humanitarian workers have prepared for different risks based on the specific challenges of cold versus warm climates. Disaster managers have also traditionally anticipated risks according to season patterns (Braman et al., 2013). This existing practice underscores that while the integration of forecasts into preparedness strategies is evolving, it has been an integral part of humanitarian efforts for a long time. In response to the growing interest in forecast-based approaches, researchers have explored the possibilities and limitations of

implementing extreme weather forecasts within disaster management frameworks.

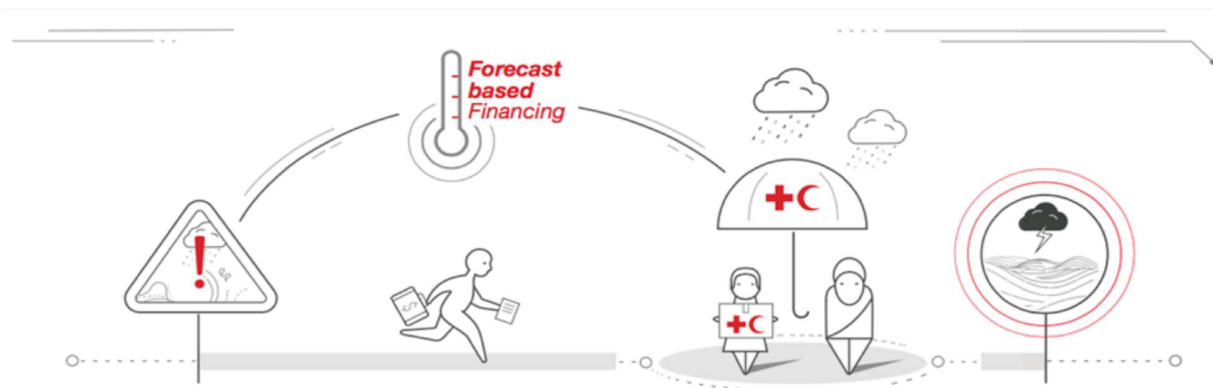
2.2 What is Forecast-based Financing or Anticipatory Action?

Forecast-based Financing (FbF) is a methodology that uses extreme weather forecasts and risk data to identify pre-emptive actions that can be taken before a predicted disaster strikes. This approach enables National Red Cross and Red Crescent Societies to anticipate potential disasters and implement measures to minimise their impact, with the goal of saving lives and protecting livelihoods. When specific trigger conditions are met, the necessary funding for these early actions is automatically released (IFRC, 2023).

Disasters occur when extreme events impact vulnerable populations and assets without timely interventions to prevent damage and loss (Coughlan de Perez et al., 2015). Mass casualties often take place when people cannot access the aid they need in time. Humanitarian organisations acknowledge that a significant amount of preventable suffering still occurs. For at least two decades, the humanitarian community has recommended earlier and more strategic responses to crises in order to mitigate their devastating long-term impacts (Levine et al., 2020).

Early warnings are often available far in advance of extreme weather events, providing a crucial opportunity to reduce potential impacts. For example, early action based on seasonal forecasts predicting unusually wet conditions in

Figure 1 Visualisation of early warning early action.



Source: Red Cross Red Crescent Climate Centre.

West Africa, allowed Red Cross workers to implement flood preparedness measures, such as community evacuation plans and pre-positioning relief supplies. These proactive steps resulted in faster and more cost-effective flood response compared to situations where no early action was taken. Early intervention can be more effective than reactive disaster response, even if the forecasted event does not materialise. To bridge this gap, Forecast-based Financing (FbF) was developed to establish pre-agreed early actions, create science-based triggers and allocate earmarked funds before an early warning is issued (Braman et al., 2013; Coughlan de Perez et al., 2015; Lopez et al., 2020).

FbF is rooted in the recognition of the need to trigger early humanitarian action based on available early warning information. Post-disaster evaluations have emphasised the importance of mechanisms that consistently promote early action, with clear identification of responsible actors. However, the mandate to

act based on early warning systems has been challenging due to unclear decision-making responsibilities and the risk of 'acting in vain' when anticipated hazards do not occur as expected (Coughlan de Perez et al., 2015). The shift towards action-based forecasting methods has significantly enhanced disaster prevention strategies. Moreover, the selection and application of appropriate forecasts for specific humanitarian actions, even in regions with limited data, is made possible by these methods.

By taking into account the parameters of each action, when verifying a forecast, this approach leads to more targeted and effective preparedness measures (Coughlan de Perez et al., 2015). Additionally, linking forecasts with actions informed by past flooding events and accepting the occasional willingness to 'act in vain', improves the relevance and efficiency of disaster prevention efforts. As mentioned by Mechler (2005), most evaluations indicate that the benefits of preventive actions outweigh their costs, with avoided disaster losses

potentially justifying greater investment in risk reduction.

The main goal is to strengthen community resilience to hazards (Coughlan de Perez et al., 2015). The authors state that early warnings of impending disasters, such as flood forecasts, are often issued with some lead time before the extreme weather event occurs. This lead time offers a crucial window to mitigate potential socio-economic impacts. During this period, a variety of actions can be undertaken, for example evacuations, sandbagging vulnerable areas or relocating livestock to safer locations. A combination of these measures can significantly enhance resilience to hazards, both before and during the immediate threat of a disaster. Not to mention, this pioneering research by Coughlan de Perez et al. (2015), which advocates for a new chapter in disaster risk management, suggests incorporating climate information into decision-making processes. This would improve disaster preparedness and response by introducing a new forecast-based financing system that automatically triggers action based on climate forecasts or observations. Furthermore, this system aligns probabilities with specific actions, releases the required funding when forecasts meet established thresholds and develops standard operating procedures (SOPs) that authorise action when these thresholds are met.

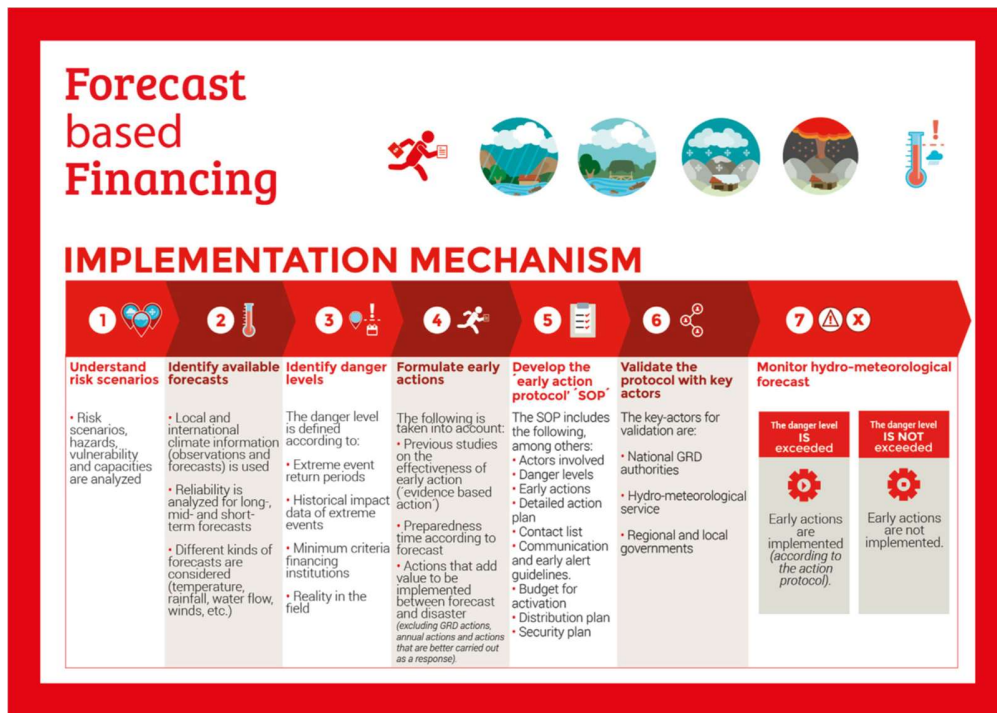
We pause to reflect on the true origins of the methodology. In 2012, during a climate training session in Peru in 2012, Thorsten Klose-Zuber and Pablo Suarez - who were then actively

involved with the German Red Cross and the Red Cross Red Crescent Climate Centre - introduced the term 'forecast-based financing'. *"We developed this term. We were in a climate training for the Peruvian Red Cross and German Red Cross delegates. Whilst designing this training we wanted to find a way to mobilise funding for reacting to early warning indicators"* (Interview 1).

These pioneers aimed to develop a mechanism to secure funding for responses to early warning signals of extreme weather. At that time, the primary challenge was the lack of available funding to respond to weather forecasts. This led to the idea of financing based on forecasts. The German Red Cross allocated funding for pilot projects in Peru, Uganda and Mozambique to test the accuracy of forecasts. The goal was to determine what types of extreme weather events were forecasted, how much time was available to respond, what actions could be taken and how effective these actions were in reducing the impact of events. These pilot projects, conducted in collaboration with the Climate Centre, played a crucial role in convincing the German Federal Foreign Office to invest in this concept from a humanitarian perspective.

The interviewees noted that *"Today this idea would not work anymore and five years earlier it would also not have worked. It was the ideal window of opportunity to be used"* (Interview 1). They capitalised on a favourable opportunity with the right triggers and funding to test this innovative approach. The focus was on selecting extreme weather events that could be predicted with some accuracy. They found that predicting

Figure 2 FbF has six major steps that can vary depending on country context



Source: Wasswa Jjemba et al., 2018.

cold waves in Bangladesh was particularly challenging, while predictions for flooding and cyclones were more reliable. Despite ongoing challenges, such as determining the precise location of the hazard and the available preparation time, they decided to plan ahead and allocate funds for actions before a disaster occurred. This represented a significant shift in mindset, from waiting for a disaster to happen to using forecasts to initiate early interventions. Additionally, having pre-agreed funding ready to deploy made a substantial difference. *“It has become an unstoppable narrative of what is desirable. Even more so, it is a waste to have a forecast that predicts a disaster unless you prevent the disastrous impacts”* (Interview 6).

2.3 Evolution to Early Warning Early Action and Anticipatory Actions

2.3.1 Evolution in terminology

Several researchers acknowledge that the terminology surrounding Anticipatory Action (AA), FbF, early action, forecast-based early action and livelihood protection can be quite complex and sometimes confusing (Tozier de la Poterie et al., 2023). While some anticipatory actions are based on forecasts, not all are. Similarly, some AA occurs before a crisis but after a weather event and some forecast-based actions focus on protecting livelihoods. Additionally, terms like AA and early action are sometimes used to refer to livelihood protection but not consistently. The used term can vary

depending on the actor and context but builds upon climate services to forecast extreme events, their impacts and to pave the way for action (Tozier de la Poterie et al., 2023). Anticipatory actions aim to reduce or mitigate the impact of disasters and improve post-disaster responses by using forecasts or early warnings of imminent shocks or stresses (Levine et al., 2020; Weingartner and Wilkinson, 2019).

The term 'Anticipatory Action' encompasses actions triggered by forecasts of a shock as well as those triggered by predictions of a humanitarian crisis. It can also refer to measures taken by individuals or communities likely to be affected by a crisis. *"In practice these terms are quite different. AA is the all-encompassing term for operational AA. FbF, however is the methodology behind AA while Forecast-based Action (FbA) is the activity behind this window"* (Interview 7). However, many humanitarian organisations use the term in a more specific sense, talking about a specific type of aid provided in response to forecasts and predictions (Levine et al., 2020).

In this policy report, AA is used in its broader sense, encompassing all actions taken to mitigate potential crises based on anticipatory thinking. However, given the focus of this research, the term is mostly applied to actions taken in anticipation of a specific shock or crisis, including the key criterium of pre-agreed triggers and funding (Levine et al., 2020). Our research scope focuses mainly on the Red Cross Red Crescent methodology of Forecast-based Financing and their according AA approach.

Early Warning Systems (EWSs) can collect information both from within and outside a potentially affected area. The concept of 'Early Warning Early Action', based on weather information, has received substantial interest among humanitarians and forecasters. For instance, there have been initiatives where the humanitarian and development sectors have collaborated with forecasters on early warning systems for disaster risk reduction, such as the Global Framework for Climate Services and the regional Famine Early Warning System. Critical moments often appear between a forecast and a disaster, presenting a 'window of opportunity' to address the limitations of traditional humanitarian and development responses (Coughlan de Perez et al., 2016).

2.3.2 Forecast-based Financing initiatives

Forecast-based Financing (FbF) initiatives are varied, with different approaches across agencies. They differ in the timing of decisions and actions, as well as in the types of forecasts, data and funding mechanisms used. FbF has the potential to transform DRM by creating mechanisms that respond directly to imminent meteorological threats (Wilkinson et al., 2018). Over time, several humanitarian agencies have piloted FbF projects, which are now commonly referred to and widely recognised as AA. As climate change has increased the frequency and intensity of certain extreme hydrometeorological events (Tozier de la Poterie et al., 2023; IPCC, 2021), scientists have also searched for enhancing their capacity to model and predict these and other hazards. To

improve the environment for early warning systems, AA has emerged as a risk-mitigation strategy that attempts to bridge the gap between development, long-term DRR and post-disaster humanitarian response (Tozier de la Poterie et al., 2023).

Interviews with staff from the Red Cross Red Crescent and other organisations have made it clear that the term AA is now widely used.

While humanitarian organisations approach AA differently, most share three core characteristics: pre-selected actions, impact-based forecasts and pre-agreed funding (Anticipation Hub, 2022). Moreover, the RCRC has been a pioneer in the development of the FbF methodology and a strong advocate for the expansion of AA. The International Federation of Red Cross and Red Crescent Societies (IFRC) has committed to allocating 25 percent of the funds disbursed through one of its main emergency response funding mechanisms, the Disaster Response Emergency Fund (DREF), to AA by 2025 (IFRC, 2020).

The expansion of AA initiatives extends beyond the RCRC network, with programmes now implemented by United Nations agencies and non-governmental organisations (NGOs) such as the World Food Programme (WFP) and the Start Network. Currently, over two million people across 57 countries are covered by AA plans (REAP, 2022). The Risk-informed Early Action Partnership (REAP) aims to scale this coverage to one billion people by 2025. Despite the growing investment in AA, there is a pressing need for a 'lessons learned' approach to refine existing systems and ensure that investments

are directed where they can have the greatest impact (REAP, 2022). Researchers have worked to demonstrate the benefits of AA over other forms of intervention, while also drawing lessons from specific cases and exploring strategies for scaling up and mainstreaming AA. Continuous critical reflection is essential to enhance current systems and guide future investments.

This research, drawing on interviews with practitioners involved in mainly RCRC AA programmes globally, builds on the collective knowledge and experience of AA practitioners and partners to identify practical lessons. In doing so, it addresses the following key questions:

- How has FbF and AA evolved since their inception?
- What trends and challenges can we identify in current AA plans?
- How can we scale up and mainstream AA, and what improvements are needed for future implementations?

Although AA has advanced rapidly since its initial implementation, challenges remain in creating more efficient systems. Unfortunately, humanitarian aid is often influenced not only by need but also by donors' geopolitical priorities and the agendas of in-country governments. Aid programmes are frequently designed and implemented by foreign actors. These actors often have limited knowledge of local contexts and are often driven by donor timelines, which can undermine local ownership and

sustainability (Tozier de la Poterie et al., 2018, 2023). The ownership of AA programmes by national and local governments is critical for sustainable implementation. This point was underscored by an interviewee of a German NGO *"In an ideal world, there would be complete ownership by the governments, and anticipatory action would be one tool in the toolbox of a government's disaster risk management system. Unfortunately, in reality, we have governments that either do not care or do not have the capacity to act. From a humanitarian perspective, we argue that every government is responsible for its citizens in a disaster. However, if a government is unable or unwilling to protect or assist, the international community must step in. Nonetheless, it is crucial that this does not become an excuse for governments to neglect their responsibilities"* (Interview 12).

2.3.3 Red Cross Red Crescent Anticipatory Action

The Red Cross Red Crescent Movement has played a pioneering role in the development and implementation of FbF and AA strategies. As one of the largest humanitarian networks, the RCRC has led the way in integrating climate science with humanitarian response, focusing on reducing the impact of disasters before by using predictive information to trigger early actions (IFRC, 2020). The concept of FbF, which allocates funds pre-emptively based on climate forecasts to mitigate disasters, was pioneered by the RCRC through collaboration with the Climate Centre and various national societies.

The German Red Cross has been influential in advancing FbF, initiating pilot projects in countries like Uganda and Mozambique. These initiatives provided valuable evidence that predictive models, when combined with pre-allocated funding, can significantly reduce the humanitarian impact of disasters (Wilkinson et al., 2018).

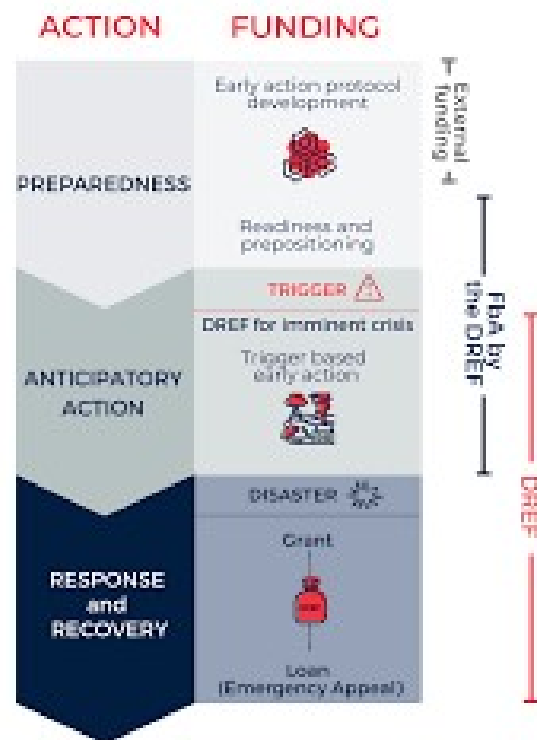
A central element of the RCRC's approach to FbF and AA has been the creation of Early Action Protocols (EAPs). These protocols provide a structured framework outlining specific actions to be taken when a forecast reaches a predefined risk threshold. EAPs are crucial in ensuring that anticipatory actions are both timely and coordinated (Coughlan de Perez et al., 2015). *"Since it is a pre-agreed plan, it gives national societies time to consult with communities and find out how they would prefer to receive assistance in advance"* (Interview 2).

By establishing clear guidelines for early intervention, the RCRC has successfully mobilised resources and implemented measures such as evacuations, pre-positioning of relief supplies, and community readiness activities before a disaster strikes, consequently reducing their potential impacts (Coughlan de Perez et al., 2015). The RCRC's commitment to AA has resulted in the expansion of these initiatives globally. By 2022, RCRC national societies had implemented AA programmes in over 60 countries, reaching millions of people at risk of natural disasters (REAP, 2022). This global expansion has been supported by a strategic partnership with the IFRC, which has committed to allocating 25 percent of its Disaster Response

Emergency Fund (DREF) to AA by 2025 (IFRC, 2020). This commitment highlights the RCRC's leading role in embedding anticipatory action within the broader humanitarian response framework.

The Disaster Relief Emergency Fund (DREF) was established by the IFRC in 1985 to provide immediate financial assistance to National Red Cross Red Crescent Societies (NS). This fund enables these societies to fulfil their crucial role as first responders following a disaster. Since its inception, the DREF has expanded significantly, benefiting over 200 million people through its allocations. The fund's existence is rooted in the need to offer rapid financial support to NS, allowing them to scale up their efforts in assisting communities facing emerging risks. The DREF allocates funds for both AA and responses to imminent, small, and large-scale disasters. The diverse range of situations addressed by NS through DREF funding includes weather-related disasters and other hazards. Additionally, the amount allocated for AA or response has increased five times since 2015. The significant growth is mostly due to the establishment of Forecast based Action by the DREF (FbA) in 2018, which provides funding to NS for pre-agreed early actions. NS continue to play a vital role in the donor base, often leading to valuable partnerships between NS, governments and the IFRC's DREF. Despite being a relatively recent initiative, FbA has already shown remarkable efficiency and in impact in anticipatory responses when triggered (IFRC, 2020).

Figure 3 FbA by the DREF



Source: IFRC, DREF brochure 2022.

Additionally, AA is increasingly recognised as a key solution to reduce the impacts of climate change and extreme weather events. These actions help organisations and people build resilience to future shocks by better understanding trends and highlighting the need to imbed risk information for short-term shocks that informs long-term adaptation. Building on decades of experience in disaster preparedness the IFRC and many other NS have pioneered the development of AA approaches such as FbF since 2014. Furthermore, together with WFP, FAO, OCHA and START Network as key partners,

anticipatory approaches are now being implemented more than 60 countries. In 2019, IFRC joined the Risk-informed Early Action Partnership (REAP) with the goal of making 1 billion more people safer from disasters, in addition to being promoted in several UN Resolutions and relevant international policy processes, FbF and AA have been embedded in relevant policies at IFRC (IFRC, 2021; REAP, 2022). One of the goals in the IFRC Strategy 2030 is to support people to anticipate, respond to and quickly recover from crises.

To manage the global challenge of evolving disasters and crises, the strategy calls for the use of technology and innovation to anticipate risks and disasters and provide proactive early action and predictable financing. As part of its 2021-2025 Plan and Budget, IFRC has set out a target to triple the size of its Disaster Response Emergency Fund (DREF) to CHF 100 million, out of which 25% is aimed at financing anticipatory action. The importance of Anticipatory Action is further underscored in the Climate and Environment Charter for Humanitarian Organisations as a means to step up our response to the impacts of climate and environmental crises. Anticipatory action is aligned with the IFRC DRM policy and National Society Preparedness Framework's common, integrated and multi-sectoral understanding of how various preparedness capacity strengthening initiatives should work together along the DRM continuum (IFRC, 2021).

What started out as a few pilot initiatives implemented by humanitarian agencies in a

small number of rural communities is now developing into a community of practice. The ambition is to scale up AA financing and coverage and drive a systemic shift towards AA, including through engagement with national risk management systems. There will need to be a clear logic for using development resources in a specific timeframe when a crisis is imminent, in addition to using them to reduce vulnerability.

The use of humanitarian funds for AA is justified if disbursing these resources earlier have a substantially greater impact on reducing human suffering before a disaster.

However, AA interventions need an explicit theory of change (ToC) to integrate approaches among practitioners as to how different AA mechanisms can be used to avoid human suffering alongside other types of support. Theories of change describe the logical sequence of an initiative from inputs to outcomes to goals. They are produced through a process of reflection and dialogue among stakeholders, through which ideas about change are discussed alongside underlying assumptions of how and why change might happen as an outcome of different initiatives.

A first step is to develop a thorough understanding of disaster impacts and how they materialise, then work backwards to identify the risk management measures that can help reduce these impacts (Wilkinson et al., 2020). For AA in particular, such an approach is recommended by the German Red Cross and the RCRC Climate Centre's FbF manual as part of the process to formulate, prioritise, monitor and

evaluate early actions (Anticipation Hub, 2024). Critically, AA should not be a substitute for investment and action to reduce vulnerability and strengthen people's capacity to manage risks effectively. Only where risks have not or cannot be effectively reduced should AA play a role. A ToC for AA will inevitably have different pathways to change, tailored towards specific hazard types and taking into account local contexts; these need to be clearly articulated so external agencies can be held accountable for their contribution (Wilkinson et al., 2020).

Being a pioneer in anticipatory actions, the RCRC Climate Centre designed a participatory game to assess possible actions that could be funded in anticipation of a flood. The game can be played with disaster-prone communities and with humanitarian staff, these types of "serious games" can be used to foster discussion and creativity in a collaborative setting (Coughlan de Perez et al., 2015; Games For A New Climate: Experiencing The Complexity Of Future Risks, 2022). The game involves a brainstorming session where actions to prevent specific disaster impacts are discussed. Participants play the game by designating some participants as a "flood" who penalise unrealistic actions and identify actions required funding. Possible actions are categorised based on lead times corresponding to available early warning information, such as observed rainfall, short-term rainfall forecasts, and seasons rainfall forecasts. The game helps in fostering discussion, creativity, and collaboration in determining appropriate actions to take based on different lead times and available

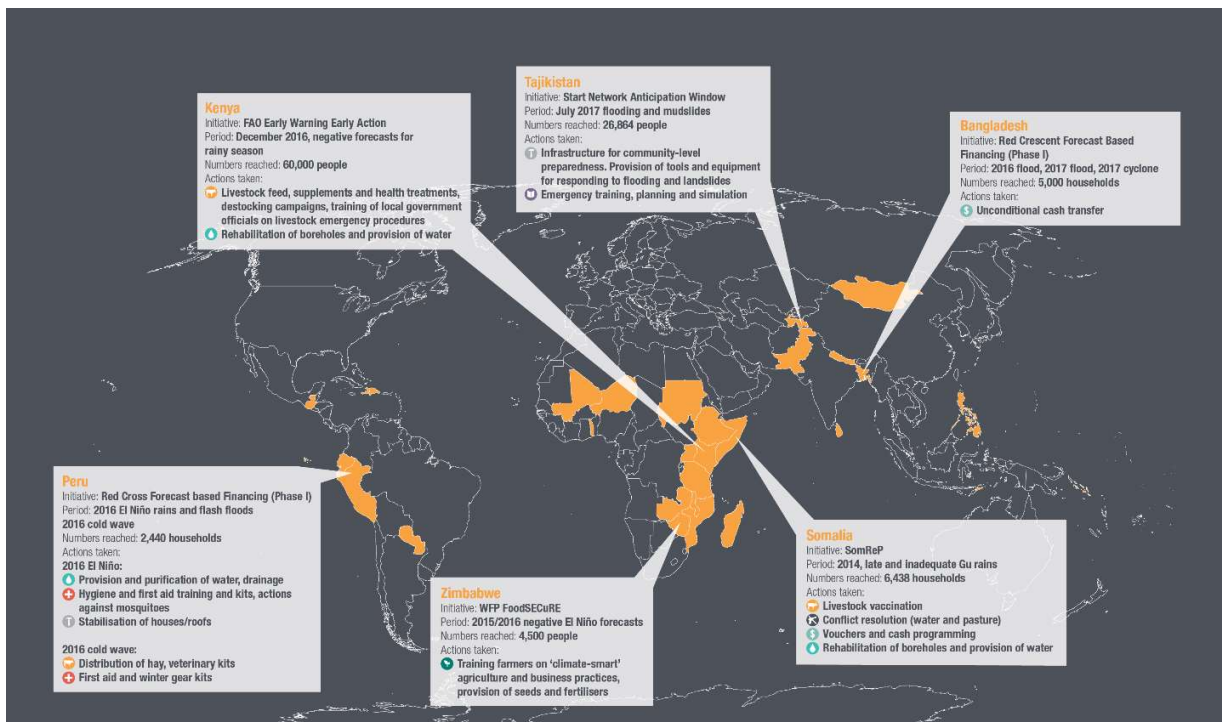
information (Coughlan de Perez et al., 2015).

"Games and humour were central to the origination of FbF as a concept and to its dissemination. By using humour we create a sense of confusion, it is an invitation for people to think out of the box" (Interview 6).

In addition to its operational role, the RCRC has been a strong advocate for the establishment of global standards and greater collaboration in the field of anticipatory action. The RCRC has worked closely with other humanitarian actors, UN agencies, and governments to promote the adoption of FbF and AA as standard practices in disaster risk management. This advocacy has included efforts to harmonise triggers across different organizations and to integrate AA into national disaster management frameworks, thereby enhancing the effectiveness and sustainability of these interventions (Coughlan de Perez et al., 2016).

Despite these successes, the RCRC continues to face challenges in scaling up FbF and AA initiatives, particularly in regions with limited forecasting capabilities and in contexts where national ownership of AA programmes is weak. To address these challenges, the RCRC emphasises the need for continued investment in capacity building for national meteorological services, the development of more accurate and context-specific forecasting models, and stronger partnerships with governments and local communities (Tozier de la Poterie et al., 2023). In summary, the Red Cross Red Crescent has been a central figure in the evolution and expansion of Forecast-based Financing and Anticipatory Action. Through its innovative approaches, advocacy efforts, and global reach,

Figure 4 Anticipation Hub overview for Anticipatory Action initiatives



Source: Wilkinson et al., 2018.

the RCRC has significantly contributed to transforming disaster risk management from a reactive to a proactive paradigm, thereby enhancing the resilience of vulnerable communities worldwide.

2.3.4 Lessons learned

“In addition to the pioneering of RCRC the Anticipation Hub is a platform to facilitate knowledge exchange, learning, guidance and advocacy around AA. The platform is hosted by the German Red Cross in cooperation with the IFRC and the RCRC Climate Centre with funding support from Germany’s Federal Foreign Office. The Anticipation Hub brings together partners

across the RCRC Movement, universities, research institutes, NGOs, UN agencies, governments, donors and network initiatives. The Anticipation Hub envisions a world that has an effective anticipatory humanitarian system which also informs, inspires and supports collaboration across the climate and development sectors to manage risks.”
(Anticipation Hub, n.d.).

Furthermore, their 2023 global overview elaborated on expansion and activations of AA. In 2023, AA continued to expand significantly across the globe. The number of frameworks, activations and people covered increased compared to previous years. Moreover, 107 frameworks were in place across 47 countries,

outlining actions to protect 10.9 million people before hazards occur, with pre-agreed financing totalling 147.8 million USD. Additionally, there were 98 activations in 2023, reaching 12.8 million people with financing worth 198 million USD. The number of activations more than doubled from the previous year, showcasing a considerable scale-up in operations. In addition to the existing frameworks, 133 more were being developed in 68 countries for 19 different hazards. This shows a strong trend towards building a more comprehensive AA system globally (Anticipation Hub, 2024).

A key trend in 2023 was the increasing role of government leadership in implementing AA. For example, in Mozambique, AA became predominantly led and monitored by the government, indicating a move towards institutionalising these approaches with national disaster management strategies. In addition, there is a shift towards government-led initiatives, with several countries adapting their national DRM policies to incorporate AA. Also, the range of hazards addressed by AA expanded in 2023, including innovative approaches like pre-positioning boats in Somalia for flood response and distributing School-in-a-Box kits in Fiji to ensure educational continuity post-disaster.

Despite these trends, the report indicates that the full potential of AA still has to be realised. There is a need for deeper integration into global initiatives like Early Warnings for All (EW4All) (Anticipation Hub, 2024).

2.3.5 Challenges with climate services

Challenges in climate services are also obstacles to AA programmes, as highlighted in interviews with several AA practitioners. National and local meteorological services often struggle to provide accurate and reliable forecasts, which are essential for making informed decisions about when to act. For example, determining the appropriate threshold for action involves assessing the flood risk based on forecasts and using hydrological models to simulate changes in the likelihood of flooding.

This decision-making process must balance the consequences of acting unnecessarily against the benefits of taking preventive measures, using both qualitative and quantitative assessments. Ultimately, the decision to act is guided by economic and social considerations. Furthermore, the capacity to produce reliable forecasts, especially for predicting storms and floods with a lead time of six days, is a key factor in maximising the effectiveness of early warning systems.

However, this capability varies widely, and in many locations, it is considered to be of medium to high capacity, which may indicate an increased risk of disasters (Coughlan de Perez et al., 2015). One of our interviewees, a regional advisor on FbF for IFRC, explained that in Uganda, for example, meteorologists were often sent to exchange programs with the UK Met Office to build the capacity of national hydro-meteorological services. *“Unfortunately, in many African contexts, these trained professionals are often recruited by other organisations, leading to a brain drain”*

(Interview 7). Furthermore, there is a need for joint responsibility on hydrometeorological services. *“However, sharing of trigger information has evolved. In the beginning organisations were very protective because they invested millions into this trigger development. They often felt if it were their trigger but in reality it should actually be owned by the government of this country. When following humanitarian principles you should share this system with other organisations but it should still be coordinated. It is extremely important to base on same trigger but with different operational timeframes or operational geographies. The conclusion is here is that if you do not share, organisations will overlap and in the end it will be waste of humanitarian funding”* (Interview 7).

Additionally, global forecasting systems like GloFAS (Global Flood Awareness System) are generally accurate for large river basins, but they often fall short in countries with smaller river systems. In these cases, GloFAS may provide general indications, but it is not ideal for determining triggers for early actions, leading to potential false alarms or missed opportunities. As one interviewee noted, while GloFAS is not a perfect system, it currently represents the best

available option for forecasting, though improvements are needed to address its limitations. *“For countries with smaller river basins GloFAS is going to give an indication but it is not the perfect system to use to determine triggers for early actions. Otherwise the result will be a lot of misses or false alarms. In conclusion, it is not an ideal forecasting system but at the moment there is no better alternative”* (Interview 7).

National meteorological services often lack the capacity to generate forecasts with the necessary level of accuracy. Additionally, RCRC AA projects, which operate under Early Action Protocols (EAPs), always require validation from a global forecasting system like GloFAS before action can be triggered. While a national system might issue the initial trigger, it must be confirmed by a global system for the protocol to proceed. An interviewee from RCRC Climate Centre states it is a challenge because without sufficient forecasting skill, organisations are not able to roll out meaningful and significant AA. *“Moreover, within RCRC we put an emphasis on just getting the actions done without working more closely with the weather and climate information providers to improve their capacity”* (Interview 11).

3 Methodology

This study employs a mixed-methods approach to highlight the interplay of structural factors, institutions and stakeholders in determining the interests in and incentives for scaling up FbF/AA approaches. Rather than breaking down the challenges into technical problems, this analysis attempts to understand the underlying drivers that shape the incentives of humanitarian decision-makers.

The study reviewed policy and programming documents, as well as research literature (Tanner et al., 2019). This was combined with interviews with practitioners engaged in AA, including mainly RCRC practitioners, Anticipation Hub, policy and regional advisors from IFRC. We have implemented a literature review, qualitative interviews and the analysis of secondary data. An elaborate review of existing literature on FbF and AA was conducted.

Sources included peer-reviewed articles, reports from relevant organisations and background information from humanitarian organisations. Databases such as Google Scholar and Web of Science were used to identify relevant publications. The literature review focused on the historical development, current practices and challenges associated with FbF. This analysis spans the period 2013 to 2023 and the primary objectives of this study are to examine the evolution of Forecast-based Financing (FbF) and Anticipatory Action from the origin, approximately 2013 to the present, and to

evaluate the current system in order to provide recommendations for future enhancements. (a) How has FbF evolved over the past decade? (b) What recommendations can be made to enhance the FbF system in the future?

Additionally, the findings of this study are based on interviews with practitioners in the humanitarian field, specifically in anticipatory action, a literature review and the analysis of secondary data. The goal of policy-oriented research is to help decision-makers improve their programmes through context-specific reflections on what is and what is not working in their programmes.

An elaborate review of existing literature on FbF and AA was conducted, focusing on the origin, development and evolution of this initiative. Semi-structured interviews were conducted with humanitarian practitioners from mainly the Red Cross Red Crescent movement. Additional interviews with practitioners from the Anticipation Hub, Food and Agriculture Organization (FAO), Welthungerhilfe (WHH) and Danish Refugee Council (DRC) provided a better perspective on the AA landscape from multiple organisations.

These interviews aimed to gather insights into the practical implementation, successes and areas for improvement in FbF systems. Interview participants were selected based on their expertise and involvement in FbF initiatives, also in Sub-Saharan Africa.

Informants were selected because of their role in implementing, managing, supporting AA programmes. All informants provided their informed consent to be recorded and have their responses contribute to programme evaluations and eventual publication.

Secondary data were obtained from various sources, including impact data from international databases, reports and datasets from organisations such as the EMDAT, OCHA, Red Cross Red Crescent, Anticipation Hub, WFP and Climate Centre. These data were used to analyse historical trends, evolution in FbF initiatives, and the effectiveness of FbF interventions in Uganda and Mozambique. The data analysis methods for this study included both qualitative and quantitative approaches. Thematic analysis was applied to the interview transcripts to identify common themes and patterns related to the evolution and implementation of FbF.

This method allowed for an in-depth understanding of practitioners' perspectives and experiences. Statistical analysis was conducted on the secondary data to assess trends in forecast accuracy, the frequency and severity of forecasted events, and the impact of FbF interventions. Descriptive statistics and time-series analysis were used to evaluate the effectiveness of FbF in mitigating the impacts of extreme weather events.

The research is grounded in Forecast-based Financing methodology, Theory of Change (ToC) and evaluation of existing literature on FbF, AA, hydrological models. These frameworks guided

the data collections and analysis processes, providing a structured approach to understanding the evolution and effectiveness of FbF systems. The scope of this study is limited to Sub-Saharan Africa, more specifically Uganda & Mozambique, focusing on the evolution and evaluation of FbF over the past decade. Case studies from these countries were selected to provide detailed insights into the implementation and outcomes of FbF initiatives in these countries.

Several limitations were identified in this study. The application of theoretical models may not fully capture the complexities of real-world FbF implementations. Limited availability of high-quality data in certain regions and restricted access to forecasts and climate data posed challenges for comprehensive analysis. We did not go in detail into meteorological models since these models have been covered by numerous previous researchers in the past decade. The integration of FbF into government policies and systems remains limited, affecting the sustainability and scalability of FbF interventions. Efforts were made but unfortunately, there is a lack of interview with practitioners from Mozambique and there was no possibility to interview local emergency responders and volunteers.

However, some interviewees with expertise provided some insight into this region. Despite these limitations, this study provides valuable insights into the evolution and effectiveness of FbF and offers recommendations for future improvements.

4 Case studies

In the following case studies, our focus is on Uganda and Mozambique within the scope of this research. Given our effort to trace the evolution of FbF and AA since their inception in 2013, it is particularly relevant to examine the countries where the first pilot projects were initiated by the German Red Cross. By concentrating on Uganda and Mozambique, we aim to provide a detailed analysis of how these pioneering initiatives were implemented and how they have developed over time. These countries serve as significant examples, as they were among the earliest to adopt and test the FbF and AA frameworks, offering valuable insights into the challenges and successes that have shaped the broader adoption of these strategies globally. This focused analysis allows us to understand the foundational role these early pilots played in the evolution of FbF and AA, and how lessons learned from these contexts have informed subsequent efforts in other regions.

4.1 Uganda

In 2022 Uganda reached a significant milestone in its efforts to implement AA across the country, holding its first ever Anticipation Hub National Dialogue on Anticipatory Action. Viewed as essential to progress from pilot projects and scale up this approach across the country. Unfortunately, in recent years, Uganda has experienced devastating impacts from a series of hazards. In 2022, multiple floods,

landslides and an extensive drought cost many people their lives and livelihoods. As climate change gathers pace, Uganda is likely to face more frequent and more intense hazards. Uganda is a country that is prone to disasters and against this backdrop, much of the conversation during the National Dialogue revolved around how to scale up Anticipatory Action and enable people to act ahead of these hazards. Robert Kwesiga, the secretary general of the Ugandan Red Cross Society, noted that Anticipatory Action is increasingly being imbedded within the country's humanitarian system and disaster risk management plans.

The final outcome of the event was a set of priorities related to risk assessment, anticipatory action and scaling up warnings. These include: (a) the need to strengthen impact-based forecasting in Uganda, (b) increased financing for Anticipatory Action more broadly, (c) improving the databases available for hazard observations, (d) developing anticipatory action at the local government level (A Major Step Forward For Anticipatory Action in Uganda, 2022).

4.1.1 Background: Overview of Uganda's Vulnerability to Climate-Related Risks

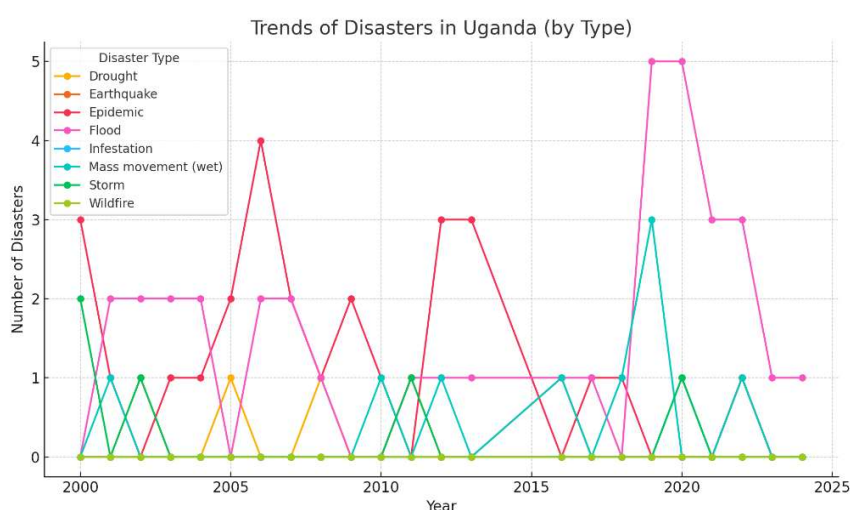
The African continent is historically the most vulnerable continent to climate change impacts, according to UNDP (Uganda's Approach To

Reporting Climate Actions From All Sectors, 2022b). Uganda is regularly affected by multiple natural hazards, including droughts, earthquakes, floods, epidemics, landslides and volcanoes. Flooding, particularly in low-lying areas, presents the largest risk. Each year, floods impact nearly 50,000 people, and droughts affected close to 2.4 million people between 2004 and 2013. Environmental degradation, underdeveloped irrigation systems, and near-absence of disaster preparedness at the community level are contributing factors to increasing drought risk in

Uganda. Rainfall variability and rising temperatures are expected to lead to higher incidences of droughts and water scarcity. These disasters are posing a serious challenge to Uganda's economic growth and achievement of the sustainable development agenda.

The graph in figure 5 displays the trends of various types of disasters in Uganda from 2000 to 2025, categorised by type. We will analyse the visual data below and elaborate on the most common hazards:

Figure 5 Impact data for disasters in Uganda for the period 2000-2024



Source: EMDAT Documentation.

First of all, epidemics appear to represent the most frequent disaster type in Uganda, with notable peaks around 2005, 2010 and 2020. Moreover, there is a significant peak in the frequency of epidemics from 2010, peaking in the early 2020s. This could reflect the global impact of health crises such as the Ebola outbreak in West Africa (which also affected

Uganda) and the COVID-19 pandemic. Furthermore, this upward trend in epidemic-related disasters highlights a growing health vulnerability. This trend could be linked to various factors including population growth, urbanisation and global health crises. Second, flood events have occurred consistently throughout the timeline, with noticeable spikes

around 2007, 2012 and 2019. The frequency of floods appears to fluctuate but generally shows a presence in almost every year, indicating that flooding is a recurrent and persistent issue in Uganda. Additionally, the consistence occurrence of floods suggests that Uganda is vulnerable to this type of disaster. This could be due to a combination of factors such as climate change, deforestation and inadequate infrastructure to manage heavy rainfall. Third, storms are less frequent but still present, particularly from 2010.

There is a slight increase in storm activity in the past decade, which could be linked to changing weather patterns. Finally, droughts are relatively infrequent but present, particularly around the early 2000s and the late 2010s. The scarcity of droughts in the later years could suggest improved water management or simply less documentation in recent years. In conclusion, this graph underscores the importance of a multi-layered approach to DRM in Uganda. The trend suggests a need for continuous improvement in infrastructure, healthcare and further investment in the face of climate change.

The FbF approach piloted in north-eastern Uganda seeks to contribute to this effort. In Uganda, FbF is implemented as part of Integrated Climate Change Adaption project, supported by the German Red Cross. It is envisaged that FbF will strengthen local early warning systems and subsequently reduce the impacts floods that often ravage the area. As the name suggests, the success of a FbF system largely depends on the quality of the forecasts.

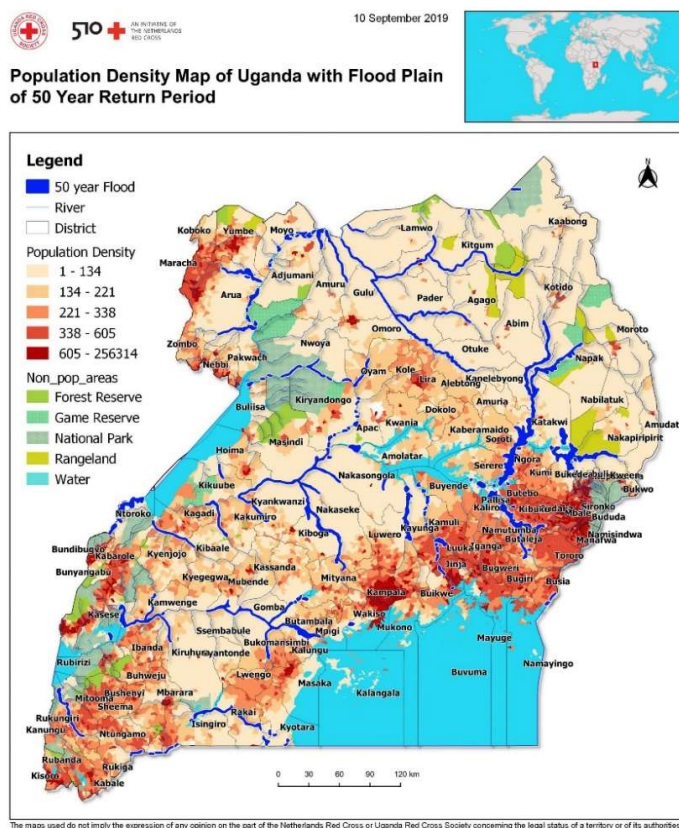
Accessing forecasts however does not immediately translate into saving lives, but it rather calls for a well thought through process to turn this scientific information into a locally useful resource that is actionable. Furthermore, forecasts were matched with appropriate actions and the selected actions were then compiled into Standard Operation Procedures (SOPs), detailing responsibilities, where to act, when to act, along with a specified budget allocated for each action. However, developing SOPs is just one of the six steps of the FbF process (Wasswa Jjemba et al., 2018). As explained by Ficchi et al (2021), one of the aims of an EAP (Early Action Protocol) is to set the triggers for early action, based on forecast skill information, alongside providing a local risk analysis, and describing the early actions, operational procedures and responsibilities (Ficchi et al., 2021).

The government has taken steps to advance disaster risk management (DRM) and climate resilience. Uganda's economic development framework has identified disaster management as one of the enabling sectors to achieve sustainable development. The Ministry of Disaster Preparedness and Refugees in the Office of the Prime Minister facilitates collaboration among ministries, local government, and communities for disaster preparedness and management (IFRC, 2021). Global flood forecasting systems are helpful in complementing local resources and in-country data to support humanitarians and trigger early action before an impactful flood occurs. Freely available global flood forecast information from

the European Commission's Global Flood Awareness Sytem (GloFAS), a Copernicus EMS service is being used by the Uganda Red Cross

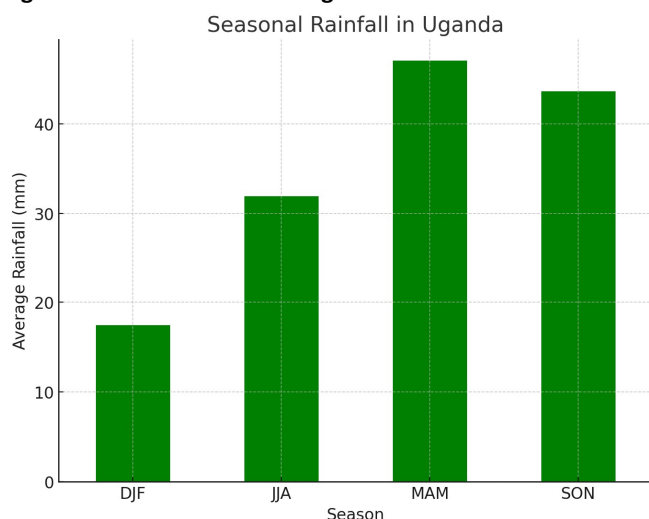
Society (URCS) alongside in-country knowledge to develop appropriate triggers for early actions for flood preparedness, within the FbF initiative (Ficchi et al., 2021).

Figure 6 Population density map of Uganda with flood plain of 50 year return period – Map developed for the Netherlands Red Cross FbF project in Uganda for the period 2018-2022



Source: <https://preparecenter.org/>

Figure 7 Seasonal rainfall in Uganda



Source: OCHA datasets

As highlighted, Uganda is significantly vulnerable to climate-related risks due to its geographical location and climatic conditions. The country experiences a tropical climate with bimodal rainfall seasons, occurring from March to May and September to November. These periods of heavy rainfall often result in severe flooding, particularly in flood-prone districts such as Ntoroko, Butaleja, and Kikuube (IFRC, 2023). Climate change has worsened Uganda's vulnerability, leading to increased frequency and intensity of extreme weather events. These include more intense and unpredictable rainfall patterns that heighten the risk of floods, which pose significant threats to livelihoods, infrastructure, and food security (van Aalst, 2006).

Flooding is a recurrent problem, causing displacement, loss of life, and extensive damage to crops and property. Additionally, the country's limited capacity for flood forecasting and early warning systems has historically

The graph in figure 7 visualises seasonal rainfall patterns in Uganda:

MAM (March-April-May) has the highest average rainfall, indicating a peak in precipitation during these months. SON (September-October-November) also experiences significant rainfall, close to the levels in MAM. JJA (June-July-August) and DJF (December-January-February) have lower rainfall compared to MAM and SON, with DJF being the driest season. This distribution reflects Uganda's bimodal rainfall pattern, where there are two rainy seasons each year.

hampered effective disaster response (Boelee et al., 2021).

Rural households in Uganda are particularly vulnerable due to their dependence on agriculture, which is highly susceptible to climate variability. The lack of diversified livelihoods and limited access to financial resources further exacerbate their vulnerability to climate risks (Boelee et al., 2021). Uganda's vision to become a middle-income country by 2040 is dependent on its ability to manage these climate-related challenges effectively (UNDRR, 2022).

4.1.2 Implementation of FbF and EWEA: Description of How These Systems Were Introduced and Evolved in Uganda

The implementation of FbF and Early Warning Early Action (EWEA) in Uganda has been a collaborative effort involving multiple stakeholders, including the Uganda Red Cross

Society (URCS), the Red Cross Red Crescent Climate Centre (RCCC), Uganda's Ministry of Water and Environment, the Uganda National Meteorological Authority (UNMA), and international partners like the University of Reading and the European Commission's Global Flood Awareness System (GloFAS) (Ficchi et al., 2021).

FbF was introduced in Uganda to address the gap between early warning and early action. The system uses weather forecasts to trigger pre-agreed financing for early actions aimed at mitigating the impacts of anticipated floods. The FbF approach in Uganda includes the development of Early Action Protocols (EAPs), which outline specific actions to be taken when certain forecast thresholds are met. For instance, the EAP for floods in Uganda is activated when GloFAS issues a forecast of at least 60% probability of a 5-year return period flood occurring in flood-prone districts (IFRC, 2023).

The evolution of these systems in Uganda has been marked by significant improvements in flood forecasting capabilities and the establishment of a robust early warning infrastructure. The collaboration with GloFAS has enabled the integration of high-resolution remote sensing data and advanced forecasting models, providing timely and accurate flood predictions (Boelee et al., 2021). Additionally, training and capacity-building initiatives have been conducted to enhance the skills of local stakeholders in interpreting forecasts and implementing early actions (IFRC, 2021).

Uganda has also benefited from pilot projects that integrate earth observations into anticipatory action. These projects have demonstrated the utility of satellite data in improving the accuracy of flood forecasts and informing early action decisions (WFP, 2021). Moreover, the National Policy for Disaster Preparedness and Management advocates for educating children about disaster risks and involving them in disaster management activities, recognising their potential as effective communicators within their communities (IFRC, 2021). *"We are starting to see community action plans also coming into play, focusing on hazards such as epidemics, wildfires and other hazards in a regional context. The focus has shifted to people and the people of the region"* (Interview 14).

4.1.3 Outcomes and Impact: Analysis of the Effectiveness and Impact of These Systems in Uganda

The implementation of FbF and EWEA in Uganda has yielded positive outcomes in terms of enhancing disaster preparedness and response. One of the key achievements has been the successful activation of the Early Action Protocol for Floods, which was triggered in November 2023. This activation facilitated timely interventions such as the distribution of water purification tablets, jerrycans, and soap to affected households, helping to prevent waterborne diseases and ensure access to safe drinking water (IFRC, 2023). The use of GloFAS forecasts has significantly improved the accuracy and reliability of flood predictions,

enabling more effective early actions. For example, during the 2023 activation, the forecast skill of GloFAS was assessed by comparing its predictions with actual river discharge observations, demonstrating a positive skill level (AROC > 0.5) at all lead times. This indicates that GloFAS provided more hits than false alarms, ensuring that early actions were based on reliable information (Ficchi et al., 2021).

The impact of these systems has also been evident in the reduction of disaster-related losses and the enhancement of community resilience. By taking anticipatory actions, such as pre-positioning emergency supplies and conducting community awareness campaigns, the Uganda Red Cross Society has been able to mitigate the adverse effects of floods on vulnerable populations. This proactive approach has not only saved lives but also minimised the economic impact of disasters on affected communities (WFP, 2021).

4.1.4 Challenges and Lessons Learned: Key Challenges Faced and Lessons Learned from Uganda's Experience

Despite the successes, the implementation of FbF and EWEA in Uganda has faced several challenges. One major challenge is the inherent uncertainty in weather forecasts, which can affect decision-making processes. While the accuracy of GloFAS forecasts has improved, there is still a need to address the uncertainties associated with probabilistic forecasting (Boelee et al., 2021). Uganda should be able to rely more on their meteorological office instead of

being mostly dependent on international forecast data. *“We should be able to learn, unlearn and relearn as we design and develop these AA systems. When we started with FbF the focus was extreme events with a five-year return period, along with the definition of an extreme event. However, this needs to be contextualised, because an event with a two-year return period can be just as impactful as one with a five-year return period”* (Interview 3).

Another significant challenge is the limited availability of historical flood data, which limits the validation and calibration of forecast models. The reliance on proxy data and limited observational records can impact the accuracy of flood predictions and the effectiveness of early actions (Ficchi et al., 2021). Additionally, there are logistical and financial constraints in implementing large-scale anticipatory actions, particularly in remote and hard-to-reach areas. Furthermore, even though the local communities are included in the institutional structure they are excluded in the policy implementation. This leads to lack of awareness and non-compliance at the local level. The author states that local communities in Uganda were not aware of who to report to in-case of the deteriorating water quality due to tree felling (Mitheu, 2022).

The main hazard focus for Uganda at the moment is floods, however the country has started to research multi-hazard EAPs for risks regarding droughts and epidemics. In the face of increased investment there is a need to study and document lessons learned “across the full value chain of risk-informed early action” to

improve existing systems and direct investments to where they will have the greatest impact (Tozier de la Poterie et al., 2023). One of the interviewees from Uganda Red Cross Society explained that firstly, there are significant needs in the area forecasts, data collection and trigger selection. *“For early warning systems to be effective we need a meteorological station that gives us accurate and timely data, and thresholds that can be communicated across the board. Secondly, we need to come down to the local level and strengthen those capacities. This way people are able to forecast accurately and communicate efficiently to the communities. Thirdly, at the national level there should be a discussion prioritising Anticipatory Action in national budgets. We should be pushing for Anticipatory Action to be imbedded in the disaster risk management plans. However, the issue for governments remains where the money comes from. Thus, we need to think of sources of financing for Anticipatory Action as well or how we can bring in other players”* (Interview 14).

Key lessons learned from Uganda's experience include the importance of multi-stakeholder collaboration and the integration of local knowledge with advanced forecasting technologies. Building strong partnerships between government agencies, humanitarian organisations, and international experts has been crucial in enhancing the effectiveness of FbF and EWEA systems. Furthermore, continuous capacity building and training are essential to ensure that local stakeholders can effectively interpret forecasts and implement timely actions (IFRC, 2021). Another important

lesson is the need for robust monitoring and evaluation frameworks to assess the impact of anticipatory actions and identify areas for improvement. Regular feedback and learning loops can help refine early action protocols and enhance the overall effectiveness of the systems (IFRC, 2021).

4.1.5 Integration and Adaptation within Broader Disaster Risk Management

AA should be integrated into broader disaster risk management (DRM) and climate adaptation strategies. This integration ensures that anticipatory measures are part of a comprehensive approach to managing risks, rather than being viewed as isolated initiatives. The alignment of anticipatory action with national and local DRM policies enhances the sustainability and scalability of these interventions (Wilkinson et al., 2020). *“A lot of the approach in DRM is already in place. The government is supporting DRM policies and a bill is being pushed into parliament to translate into law. When realised, this is going to support a lot of ownership”* (Interview 14).

The experience in Uganda has shown that Anticipatory Action can complement existing DRM efforts by providing timely and targeted interventions that address imminent threats. By focusing on low-regret actions that offer benefits even in the absence of a disaster, Anticipatory Action can build community resilience and reduce long-term vulnerabilities (Wasswa Jjemba et al., 2018). The implementation of Forecast-based Financing

and Early Warning Early Action in Uganda has demonstrated the potential of these systems to enhance disaster preparedness and response. While challenges remain, the positive outcomes and lessons learned provide a solid foundation for further improvements and scaling up of Anticipatory Action in Uganda and other vulnerable regions.

4.2 Mozambique

4.2.1 Background: Overview of Mozambique's Vulnerability to Climate-Related Risks

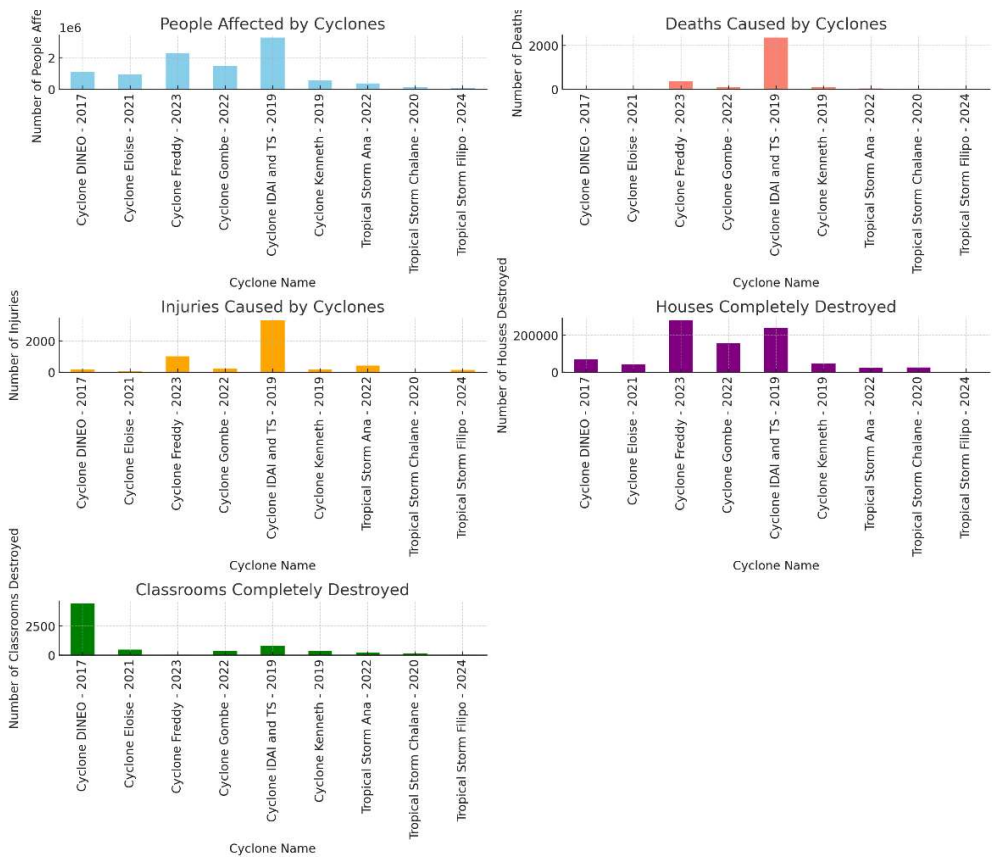
Mozambique is highly exposed and vulnerable to natural hazards and climate variability. Mozambique's extensive coastline is home to over 60 percent of its population and heightens the country's vulnerability to tropical cyclones and storm flooding. It ranks third among African countries exposed to multiplied weather related hazards such as flooding, cyclones and droughts (IFRC, 2021; REAP, 2021). The impact of climate change has intensified these vulnerabilities, leading to more frequent and intense extreme weather events. For instance, the Cyclones Idai and Kenneth in 2019 caused widespread devastation, highlighting the urgent need for effective disaster risk management and early warning systems (IFRC, 2021). Additionally, the reliance on agriculture for livelihoods makes rural communities particularly susceptible to climate variability and extremes (WFP, 2021). In early 2019, Mozambique experienced the devastating impact of two tropical cyclones. Cyclone Idai struck central Mozambique in March, followed by Cyclone Kenneth in the

northern region in April. Both cyclones were classified as intense, with Kenneth being the strongest cyclone to hit Mozambique in modern history. Cyclone Idai led to significant loss of life and left nearly two million people in Mozambique in urgent need of humanitarian assistance. Cyclone Kenneth, while less deadly than Idai, still caused 45 fatalities and displaced thousands of people across the country (Emerton et al., 2020).

Below graph presents various impacts of cyclones in Mozambique across different dimensions: the number of people affected, deaths, injuries, houses and classrooms

destroyed. By analysing the visual data below we will elaborate on the most disastrous cyclones:

Figure 8 Impact data for cyclones in Mozambique for the period 2017-2024



Source: OCHA datasets.

First of all, Cyclone Idai in 2019 stands out as the most devastating in terms of the number of people affected, with over 1.6 million people impacted. Furthermore, Idai was the deadliest cyclone, causing hundreds of deaths, which is significantly higher than any other cyclone in the dataset. Additionally, similar to the death toll, cyclone Idai caused the highest number of injuries, with around 2,000 people injured. The

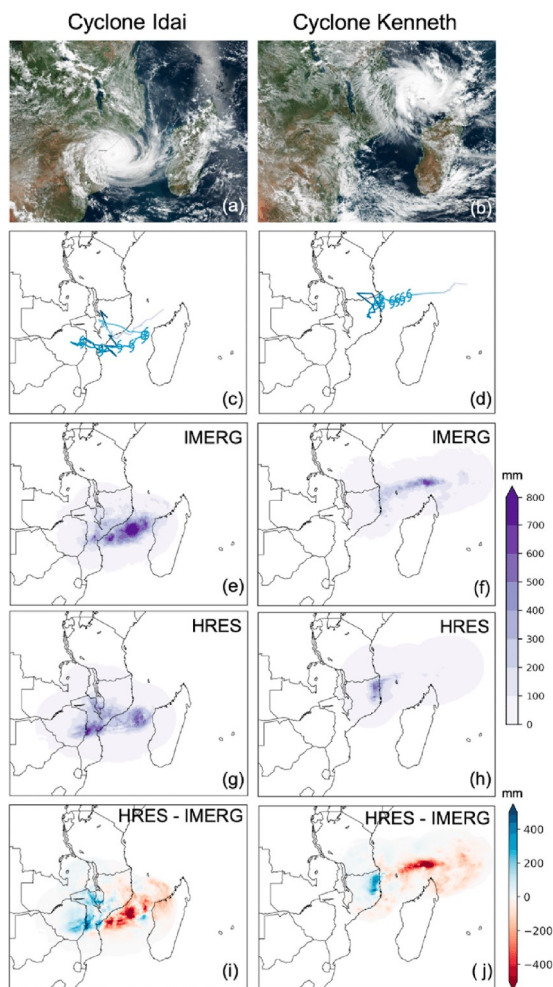
destruction of houses was particularly severe during Cyclone Idai and the following Cyclone Kenneth, with each causing significant destruction. In conclusion, Cyclone Idai emerges as the most catastrophic cyclone in recent history in Mozambique, causing the highest number of deaths, injuries and destruction of houses and classrooms. This event underscores

the extreme vulnerability of the region to such large-scale natural disasters.

Since 2015, the German Red Cross and the IFRC have been advocating for AA in Mozambique and supporting the Mozambique Red Cross Society. As an auxiliary to the government, the National Society has helped to build systems to

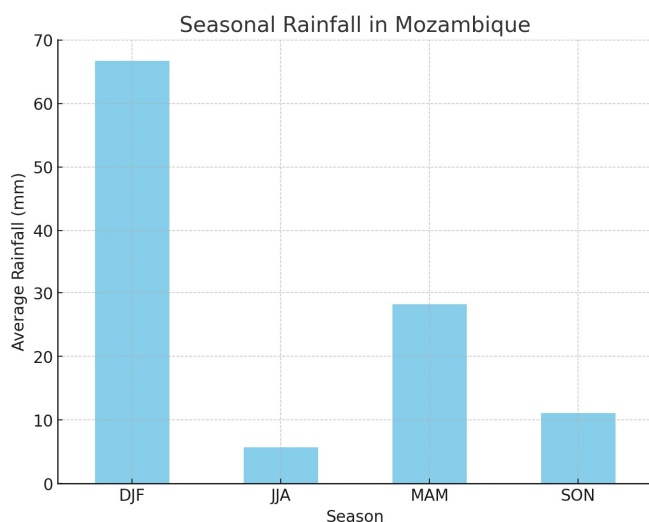
act ahead of forecast floods and cyclones. These have, in turn, contributed to advocacy efforts and strengthened the government's capacity to implement Anticipatory Action (Anticipation Hub, 2023). *"Mozambique is a great example but when it boils down to it, are we able to reach the communities in time with the planned actions?"* (Interview 7).

Figure 9 Observed tracks and rainfall analysis for Cyclones Idai and Kenneth



Source: Emerton et al., 2020.

Figure 10 Seasonal rainfall in Mozambique



Source: OCHA datasets.

The graph in figure 10 visualises seasonal rainfall patterns in Mozambique:

The DJF (December-January-February) season has the highest average rainfall.

The JJA (June-July-August) season experiences the least rainfall.

The other seasons (MAM and SON) have moderate rainfall levels.

This pattern aligns with Mozambique's climate, where the wet season typically occurs during the Southern Hemisphere summer months.

4.2.2 Implementation of FbF and EWEA: Description of How These Systems Were Introduced and Evolved in Mozambique

The implementation of Forecast-based Financing (FbF) and Early Warning Early Action (EWEA) in Mozambique has been a collaborative effort involving multiple stakeholders, including the Mozambique Red Cross (CVM), the Red Cross Red Crescent Climate Centre (RCCC), and international partners such as the World Food Programme (WFP) and the International Federation of Red Cross and Red Crescent Societies (IFRC) (WFP, 2021).

Although preparedness has been a concept in DRM for some time, humanitarianism remained largely reactive. According to the authors Tozier de la Poterie et al (2023) RCRC staff in Mozambique believe that a shift from reactive response to approaches based on prepositioning and planning was a core achievement of AA. One of their interviewees

stated that prior to AA, CVM was accustomed to acting 72-hours after the occurrence of a disaster rather than 72-hours before.

FbF was introduced in Mozambique to bridge the gap between early warnings and early actions. This approach uses weather forecasts to trigger funding for pre-agreed early actions aimed at mitigating the impacts of anticipated disasters. The development of Early Action Protocols (EAPs) in Mozambique involved defining specific thresholds for activating early actions, such as distributing relief supplies, reinforcing infrastructure, and conducting community awareness campaigns (IFRC, 2021). Setting up AA systems requires National Societies (NS) to collaborate and coordinate closely with National Disaster Management Agencies, hydrometeorological services, and other key stakeholders. The authors Tozier de la Poterie et al (2023) state that government officials in Mozambique noted increased

communication between NS and national forecasting and disaster management agencies because of AA projects.

Figure 11 Example of disseminated advise for cyclones



Source: RCCC-Impact-based-forecasting-Guide.

The evolution of these systems has seen significant improvements in the accuracy and reliability of forecasts, facilitated by collaborations with organizations like the European Commission's Global Flood Awareness System (GloFAS). These partnerships have enabled the integration of advanced forecasting models and high-resolution remote sensing data, enhancing the early warning capabilities in Mozambique (WFP, 2021).

In 2023, El Niño was expected to hit at a time when southern and central Africa was already facing serious food insecurity. To help communities prepare, the decision was made to implement a series of anticipatory actions, and taken in a participatory manner by the government-led Technical Working Group for Drought Early Warning Systems and Anticipatory Action. The actions were then

implemented under the leadership of the National Institute for Disaster Management and Risk Reduction (INGD). Government leadership is essential for Anticipatory Action to become an established approach within a country. WFP and other partners have been advocating for such leadership in Mozambique since 2019, and Anticipatory Action is now predominantly led and monitored by the government. Legislative frameworks for disaster risk management now integrate Anticipatory Action which, along with proactive partnerships, has created a productive environment for this approach to be institutionalised within the country.

Mozambique is now a leading example of how to embed Anticipatory Action within national processes and tools. *"The relationship and coordination with the government in*

Mozambique is amazing, however, it is a huge country. When you have such a long coastline and potential for a cyclone to make landfall, how will you anticipate?” (Interview 7). It also provides insights into how to develop an Anticipatory Action programme in conflict-affected areas, with WFP assessing the feasibility of multi-hazard Anticipatory Action approach in northern Mozambique, which has seen regular outbreaks of conflict in recent years (Anticipation Hub, 2024).

4.2.3 Outcomes and Impact: Analysis of the Effectiveness and Impact of These Systems in Mozambique

The implementation of FbF and EWEA in Mozambique has delivered promising results, significantly enhancing disaster preparedness and response. One of the key successes was the activation of the EAPs during Cyclones Idai and Kenneth in 2019, which facilitated timely interventions such as the pre-positioning of emergency supplies and the dissemination of early warnings to vulnerable communities (IFRC, 2021). The use of advanced forecasting models has improved the accuracy of predictions, enabling more effective early actions. For example, the activation of the EAPs during the cyclones allowed for the timely evacuation of at-risk populations and the distribution of essential supplies, which helped to mitigate the impacts of the disasters on affected communities (WFP, 2021).

The impact of these systems is also evident in the increased resilience of communities. By implementing anticipatory actions, such as

reinforcing infrastructure and conducting community awareness programmes, the Mozambique Red Cross has helped to reduce the vulnerability of communities to future disasters. This proactive approach has not only saved lives but also minimised the economic impact of disasters on livelihoods (UN OCHA, 2021).

4.2.4 Challenges and Lessons Learned: Key Challenges Faced and Lessons Learned from Mozambique's Experience

Despite the successes, the implementation of FbF and EWEA in Mozambique has faced several challenges. One major challenge is the inherent uncertainty in weather forecasts, which can affect the decision-making process. While the accuracy of forecasts has improved, uncertainties remain, necessitating continuous improvement of forecasting models and methods (Boelee et al., 2021).

First of all, logistical and financial constraints, particularly in remote areas, pose challenges to the implementation of large-scale anticipatory actions (WFP, 2021). Another challenge in setting up AA systems has been securing access to quality hazard, impact and vulnerability data with which to develop reliable forecast triggers and accurately target those most at risk.

Detailed hydrometeorological (or other hazard) data often has gaps, must be pieced together from various sources, or has not been digitised and controlled for quality (Tozier de la Poterie et al., 2023).

Another significant challenge is the limited availability of historical climate data, which

limits the validation and calibration of forecast models. The reliance on proxy data and limited observational records can impact the accuracy of flood predictions and the effectiveness of early actions (Ficchi et al., 2021). Impact data is often fragmented, imprecise or not available at the scales needed for analysis. Without impact data, National Societies struggle to establish the trigger for the different locations. Often relevant data existed, but agencies who had hazard, demographic and impact data refused to share it with the NS for financial or political reasons despite extensive outreach by the NS (Tozier de la Poterie et al., 2023).

Key lessons learned from Mozambique's experience include the importance of multi-stakeholder collaboration and the integration of local knowledge with advanced forecasting technologies. Building strong partnerships between government agencies, humanitarian organisations, and international experts has been crucial in enhancing the effectiveness of FbF and EWEA systems. Continuous capacity building and training are essential to ensure that local stakeholders can effectively interpret forecasts and implement timely actions (IFRC, 2021). Lack of ownership can be contributed to the top-down, externally driven, project approach to RCRC AA initiatives to date and the highly technical, resource intensive process of developing and approving EAPs.

When project timelines interfere with the development of connections to existing systems, project-based limitations can contribute to AA developing in silo rather than

integrating with existing programmes and leveraging existing relationships with the broader DRM system. They can also lead to pressures for external actors to push the project forward, bypassing local actors and undermining long-term relationship building and buy-in. Furthermore, building internal understanding of and support for AA takes a long time. Because of funding cycles, no National Societies have been able to plan for long-term engagement from the outset, but National Societies in Mozambique have each secured multiple rounds of project funding to build momentum and promote sustainability. The need for long-term stakeholder engagement is something also experienced during OCHA AA projects in some other countries, but such engagement can be difficult to sustain given capacities and funding cycles (Tozier de la Poterie et al., 2023).

Another important lesson is the need for strong monitoring and evaluation frameworks to assess the impact of anticipatory actions and identify areas for improvement. Regular feedback and learning loops can help refine early action protocols and enhance the overall effectiveness of the systems (OCHA, 2021).

The implementation of Forecast-based Financing and Early Warning Early Action in Mozambique has demonstrated the potential of these systems to enhance disaster preparedness and response. While challenges remain, the positive outcomes and lessons learned provide a solid foundation for further improvements and scaling up of anticipatory action in Mozambique and other vulnerable regions.

5 Results

This section presents the detailed findings from the qualitative analysis of interviews conducted with various stakeholders involved in FbF and AA initiatives. The analysis highlights key themes, patterns and insights that emerged from the interviews, providing a comprehensive understanding of the evolution, current state and future directions. To identify the evolution and lessons, each interviewee elaborated on the successes, challenges and improvements they encountered in their work on AA. Here we review the primary themes that emerged across these conversations.

5.1 Evolution of FbF/AA programmes

Our interviews revealed a paradigm shift in disaster management through the evolution of Forecast-based Financing (FbF) and Anticipatory Action (AA) initiatives. This transition from reactive to proactive approaches requires identifying key moments to intervene before an onset disaster. By capitalising on the advantages of anticipatory measures, stakeholders can effectively mitigate potential impacts while stimulating an environment of continuous learning and collaboration.

This evolution is characterised by significant milestones and shifts in approach. One of the critical aspects of this evolution is the identification of early triggers, particularly in regions prone to frequent disasters, such as the Horn of Africa. By identifying these triggers stakeholders can implement timely interventions to mitigate the negative

consequences of disasters (Levine et al., 2020). This proactive approach represents a departure from traditional reactive methods, where actions are taken only after a disaster has occurred. This approach emphasises the importance of early action and the need for constant adaptation and knowledge exchange among stakeholders.

The benefits of AA are numerous. By taking preparatory measures before disasters occur, the loss of lives, property and livelihoods can be substantially minimised. This proactive approach not only saves resources but also enhances community resilience, enabling them to better withstand future shocks. Continuous learning and adaptation are crucial elements of the evolution on FbF and AA. Stakeholders emphasise the need for ongoing development and improvement of anticipatory actions based on lessons learned from past experiences (Bazo et al., 2019; Tozier de la Poterie, 2023). Continuous learning and adaptation are essential components of the evolution of FbF/AA. Stakeholders emphasise the need for ongoing development and improvement of anticipatory actions based on lessons learned from past experiences.

This repetitive process ensures that strategies remain relevant and effective in the context of changing climate conditions and emerging challenges. *“There should be more incentive to look under the hood of what we did and investigate how it could have been better. How*

to be better next time, in the absence of a constant learning mechanism it will not work as well as possible” (Interview 6).

Additionally, collaboration and knowledge exchange also play a critical role in the evolution of anticipatory actions. Engaging multiple partners – including government agencies, NGOs, local communities and international organisations – promotes a holistic approach to disaster risk management. *“For example, we need to train emergency responders and volunteers in a holistic approach. We can contribute to resilience building by giving these actors a holistic training package” (Interview 3).* Such collaborative efforts facilitate the sharing of best practices, innovations and resources, thereby enhancing the overall effectiveness of these initiatives.

In below sections we will discuss the key factors for a successful implementation and elaborate on the most important factors.

5.2 Key factors for successful implementation

Successful implementation of anticipatory actions depends on several key factors. One of the most important is the development of strong forecasting systems. Accurate and reliable forecasts are the cornerstone of AA, as they provide the necessary information to trigger early interventions. Developing these systems often requires collaboration between various stakeholders, such as meteorological agencies, research institutions and technology

providers. This collaborative approach ensures that forecasting models are comprehensive, accurate and adapted to the specific needs of each region.

Another crucial factor is securing financing resources. Despite the clear benefits of AA, obtaining consistent and sustainable funding remains quite a challenge. Many interviewees highlighted the need for innovative financing mechanisms and the importance of persuading donors of the value of proactive measures.

Without sufficient funding, it becomes difficult to effectively implement and maintain anticipatory actions. The Early Warnings for All (EW4All) initiative has set an ambitious goal: to ensure that every person on Earth is covered by advanced early warning systems by 2027. In 2023, this initiative transitioned from its theoretical stage to the phase of implementation (Anticipation Hub, 2024).

Integrating these actions into national disaster frameworks is also vital to ensure they align with broader disaster risk management policies.

This integration helps to institutionalise AA, making it a standard practice within national and local government operations. Embedding these actions within national frameworks also ensures that they receive the necessary political support and resources for long-term sustainability. *“National governments investing is the ideal exit strategy for humanitarian actors to withdraw from the context. This way they can hand over the concept to the government authorities and organisations in-country” (Interview 1).*

Building local capacity is another essential element for success. Investing in the skills and knowledge of local communities and organisations ensures that actions are both relevant and effective. Capacity building at the local level includes training programmes, workshops and practical exercises that strengthen the ability of communities to respond to early warnings and implement proactive measures. *“We truly work with the local actor, the Red Cross National Society. There are challenging issues like staff turnover and logistical capacity, but the local actor is at the centre of the whole thing. For example, their volunteers are often part of the communities we are trying to protect which gives an advantage in trust building”* (Interview 4).

Finally, engaging stakeholders from the beginning is critical for the successful implementation of AA. This involvement fosters a sense of ownership and collaboration among all parties, including government agencies, NGOs, community leaders, and international partners. By including all stakeholders in the planning and decision-making processes, anticipatory actions are more likely to be well-coordinated, relevant and widely supported.

Interviewees from mainly RCRC movement and other humanitarian organisations revealed that successful implementation of anticipatory actions depends on several interconnected factors. Our interviews suggest that the key factors of AA go beyond selection of triggers and prearranged finance. A majority of our informants include community engagement and implementation in local and national

frameworks as primary factors of setting up AA systems. However, these are not the only indicators for a successful implementation of AA projects. We describe the central key factors below.

5.2.1 Community engagement

Community involvement is fundamental to the success of AA. Actively engaging communities in identifying potential disaster impacts and readiness practices ensures that interventions are relevant and tailored to the specific needs and circumstances of the people they are designed to protect. This participatory approach helps to identify the most urgent risks and the most effective ways to address them, making actions more effective and culturally appropriate.

Another crucial element of community involvement is leveraging local knowledge. Indigenous knowledge and traditional practices can offer valuable insights into effective risk management. By incorporating this local expertise into AA efforts, stakeholders can enhance the relevance and acceptance of interventions within communities. Existing community structures, such as local committees, grassroots organisations and informal networks play a key role in implementing AA. These structures facilitate communication, coordination and mobilisation, ensuring that early warnings and proactive measures effectively reach all community members. Utilising these established networks helps build trust and foster a sense of

ownership among community members, further strengthening the sustainability of AA initiatives.

To ensure the success of these actions, it is essential that they are relevant and appropriate for the community. This means considering the cultural, social and economic contexts of the communities at risk. By designing interventions that line up with local practices and preferences, stakeholders can increase the likelihood of community buy-in and active participation. Furthermore, to set up a successful early warning system, there is a need for trained staff and regional volunteers and good knowledge of the intervention area. This set-up should be the first step in any FbF intervention, even before there is an indication that a disaster will happen, before an EAP is triggered by forecasts (Bazo et al., 2019). Community involvement is fundamental to effective anticipatory action. *“Local and national organisations have the infrastructure in terms of knowledge, resources and capacities to be able to support communities to do Anticipatory Action. Often there is a mismatch between community early warning systems and the national early warning systems”* (Interview 3).

Ideally, every step of the way, communities need to be engaged and there should be national levels validating. Therefore, engaging these communities in identifying potential impacts ensures that interventions are relevant and appropriate. Using local knowledge and utilising existing community structures enhance the effectiveness of these actions, making them more sustainable and culturally sensitive.

Humanitarian actors should always involve community members in the planning and decision-making processes of AA initiatives (Bazo et al., 2019; Levine et al., 2020; Lopez et al., 2017).

This ensures that their needs, knowledge and preferences are considered. They could establish local committees or working groups that include community representatives to oversee and contribute to AA activities.

“Community-led AA empowers communities because they are the ones that can respond the fastest, especially to a hazard cyclones. They have to be able to respond themselves because sometimes there is almost no lead time. For example, a few hours’ notice for flash floods jumps the system straight to the response phase” (Interview 7).

Similarly, inclusive participation should also not be neglected. We need to ensure that AA initiatives are inclusive and represent the diverse makeup of the community, including women, youth, elderly and marginalised groups. There is a need to implement gender-sensitive approaches that address the specific needs and vulnerabilities of women and girls in disaster risk management (Cooper & Wheeler, 2017).

Furthermore, there should be trust-building and transparent processes. Ensure that all processes related to AA are transparent and that community members are informed about decisions and resource allocations.

Finally, *“engaging communities creates accountability, humanitarian actors will be accountable towards those we engage in delivering what we promised to deliver”*

(Interview 12). We should maintain consistent and long-term engagement with communities, building trust and fostering collaborative relationships.

To return to our main argument, this approach fosters ownership and empowers communities to actively participate in disaster preparedness and response.

5.2.2 Implementation in frameworks for ownership

Embedding Anticipatory Action within government frameworks is vital for its sustainability. In Mozambique, historically there have been different levels of government buy-in. This country is an example where the government leads the drought framework for AA, with financial support from humanitarian organisations (REAP, 2022).

However, these strong relationships with the government and local authorities don't negate logistical challenges due to the country's size and infrastructure limitations. *"When you have 2.400km of coastline where a cyclone might potentially make landfall, where do you store protection shelter kits for distribution? Cyclone activation means labour-intensive anticipatory actions, with short lead times to brief the right communities"* (Interview 7). This is the reason we often need less labour-intensive actions which are preferably cash-based. Moreover, cash distributions and evacuations are much quicker actions but the question is posed if it is a dignified way to help people (Mogge et al., 2024). We have to keep all these considerations

in mind because *"aid is very context-specific, meaning there are no blanket approaches"* (Interview 7). For instance, strong forecasting systems developed through stakeholder collaboration ensure accurate predictions. Securing financial resources is also important but challenging, highlighting the need for sustainable funding mechanisms.

Therefore, embedding anticipatory actions within national frameworks secures alignment with broader DRM policies, while building local capacity ensures that interventions are effective and relevant at the community level (IFRC, 2020). *"In an ideal world imbedding in these frameworks is done by governments and AA is one tool in the toolbox of a government's DRM system. However, in the real world, we have governments who don't have the capacity. From the humanitarian angle we say that every government is responsible for its citizens in a disaster. Simultaneously, if a government is not able or willing to protect or assist, the international community must play its role"* (Interview 12).

Furthermore, integration into national budgets is another key component of embedding AA within government frameworks. Ensuring that actions are prioritised in budgets reflects their importance and guarantees that they can receive the necessary financial support. This budgetary commitment is essential for the long-term sustainability and scaling up of anticipatory actions (Willits-King et al., 2020).

Considering the discussion above, utilising national climate data ensures that actions are

based on reliable information. Government leadership in AA efforts signifies a commitment to proactive disaster management. *“As international organisations we may take the first steps to prove the concept, however, if we want the project to be sustainable it needs to transition into government structures”* (Interview 13).

Integrating AA into national plans and budgets ensures that these actions are prioritised and adequately funded, paving the way for long-term resilience building. Therefore, there should be advocacy for the integration of AA into national disaster management and climate adaptation policies (Willits-King et al., 2020). This can ensure that AA is recognised as a priority and allocated specific budget lines in national and local government budgets. Furthermore, engaging international donors is necessary to secure long-term funding. There is a need to secure multi-year funding commitments, reducing the uncertainty of year-to-year funding cycles (IFRC, 2020; REAP, 2022; Tozier de la Poterie et al., 2023). There is as well importance to negotiate bilateral and multilateral agreements that include provisions for sustained AA funding. For instance, we should invest in pooled funding mechanisms where multiple donors contribute to a common fund dedicated to AA. This can streamline funding processes and reduce competition for resources.

Finally, another possibility is to provide training and support to local organisations and governments to improve their financial management and fundraising capabilities. They

should develop financial planning and management systems to ensure transparent and accountable use of funds, building donor confidence (Tozier de la Poterie et al., 2023).

5.2.3 Interagency cooperation and harmonisation

Interagency cooperation is crucial for coordinated disaster responses. Effective AA requires strong cooperation and harmonisation. Establishing agreed standards and procedures ensures that all agencies operate within a framework. IASC (Inter-Agency Standing Committee) partners are actively integrating new processes into Anticipatory Action frameworks and plans in over 60 countries. However, these efforts are often limited in scale and tend to be specific to individual agencies, with insufficient collaboration in joint planning, targeting and coordinated actions across different sectors (IASC, 2023). This standardisation helps to streamline processes, reduce confusion and improve the overall efficiency of anticipatory actions. Using common triggers for action enables different agencies to synchronise their efforts, leading to more effective and efficient disaster preparedness and response (Nobre et al., 2023).

A majority of the interviewees stated that there should be international agreed standards and procedures. According to one of the ‘founding fathers’ *“it is essential to follow the same methodology and important procedures. We need to distinguish what the methodology is and what needs to be followed in order to call it AA*

and what is not AA. Furthermore, there is a need for better in-country coordination between Red Cross Movement, WFP, FAO, NGOS and UN CERF. Different organisations that don't agree on the methodology and coordination in-country are only confusing governments. Unfortunately the humanitarian system is competitive because at the end of the day it is a sort of business. What matters for many organisations is to get their budgets approved and afterward they don't coordinate sufficiently anymore" (Interview 1).

Interagency cooperation also involves regular communication and collaboration. By encouraging a culture of collaboration, agencies can share information, resources and proven techniques. This cooperation helps to build a unified approach to disaster management, where all stakeholders work towards common goals and objectives (Anticipation Hub, 2021; REAP, 2021; Tozier de la Poterie et al., 2023). Information exchange is significant and *"sharing of trigger information has evolved. In the beginning organisations were protective of their built trigger. Whereas, it should be a owned a country, a government. Following humanitarian principles, you need to share this developed trigger with other organisations. Without sharing organisations overlap and humanitarian funding will be wasted"* (Interview 7).

Therefore, by sticking to common standards and using uniform triggers, different agencies can work together more effectively, ensuring coordinated and harmonised responses to impending disasters.

5.3 Challenges

Several challenges obstruct the implementation of anticipatory actions.

First of all, ensuring accurate and reliable weather forecasts. Several interviewees stated that there is a need for more investment in working with national meteorological offices, but simultaneously supplement with international forecast models like GloFAS, where necessary. *"Often local forecasts for floods do not give sufficient lead time. Usually we use a mix of forecasts, GloFAS for pre-activation for longer lead times, and local forecasts to activate the high cost actions"* (Interview 4). We should strengthen local meteorological offices to reduce reliance on international forecast data and improve the accuracy of local forecasts. Inaccurate forecasts can lead to inappropriate or badly timed actions, reducing the effectiveness of AA initiatives. *"In the past, also in Uganda, we sent meteorologists to exchange programmes at Reading University with UK Met Office to build the capacity of national hydro-meteorological services. Unfortunately, because government jobs do not pay well in many African contexts, they are captured by other organisations which leads to a brain drain"* (Interview 7).

Furthermore, we need to establish elaborate data collection methods and encourage data sharing among agencies to fill historical data gaps and improve forecasting models (Lopez et al., 2017; Mitheu et al., 2021).

Second, convincing donors of the value of proactive measures is critical for securing

funding. *“Germany is cutting their humanitarian budget which will put pressure on scaling up anticipatory action. The country is perceived as an innovator in the system, but without sufficient funding there will be less space for research and innovation”* (Interview 1). A distinction should be made between fuel money and build money². There is a need to integrate AA within broader disaster risk reduction (DRR) frameworks to avoid it being perceived as a standalone intervention (Tozier de la Poterie et al., 2023). Ensuring sufficient financial resources and maintaining the integrity of the AA concept are essential for its success and sustainability. *“We need to hand over the concepts to national authorities and find other players to finance these initiatives”* (Interview 1).

Third, there is limited availability and quality of historical and real-time data. *“In theory, triggers should be based on historical data. However, this is a complex matter because it is extremely difficult to have access to impact data. This kind of data is not systemically recorded, or it might be recorded, but not made available to organisations”* (Interview 11). Poor data quality affects the accuracy of risk assessments and forecasting models. Gaps in historical data, limited access to real-time information, and inconsistent data collection methods can undermine the reliability of forecasts and early warnings. *“Impact data is not sufficiently granular, we have no idea where exactly the*

impacts were felt. For example, we can see there was a certain flood in Mozambique but there is no data on where, how, when and what happened? Therefore, impact data needs to be improved because we need to correlate with forecasts” (Interview 7). Improving data infrastructure, investing in technologies, and promoting data sharing among agencies can help address these challenges. Collaboration with research institutions and international partners can also enhance data collection and analysis capabilities.

Fourth, there is a need to effectively engage and involve local communities in AA initiatives. However, effectively involving communities can be challenging, especially in regions with low levels of awareness or trust in external interventions. Without community buy-in, actions may be less relevant and less sustainable. This could lead to misconceptions and lack of understanding of AA among community members. Misunderstandings can lead to resistance and lack of support for AA initiatives. Humanitarian actors should utilise participatory approaches and support local knowledge and expertise (Tozier de la Poterie et al., 2018). They should also conduct awareness campaigns and educational programmes to highlight the benefits and processes of AA. By addressing these challenges, stakeholders can improve resilience and reduce the impacts of disasters on vulnerable populations.

² Fuel money refers to the direct, pre-arranged funds allocated for activation, which are released when specific trigger conditions for a hazard are met. Build money, however, refers to the structural funds that

support, ensure and enhance the core elements of the systems that deliver Anticipatory Action (Anticipation Hub, 2023).

Fifth, AA requires strong coordination and harmonisation among different agencies and stakeholders. However, achieving this level of cooperation can be challenging due to differing mandates, priorities and operational procedures. Lack of coordination can lead to fragmented efforts, resource wastage and confusion among communities. Establishing agreed standards, common triggers and regular communication channels is key.

Sixth, we should not neglect overcoming policy and institutional obstacles to integrating AA into broader disaster risk management frameworks (Anticipation Hub, 2023). Institutional resistance and policy gaps can slow down the adoption and scaling up of AA. Therefore, humanitarian agencies should advocate for policy reforms and strengthening institutional capacities.

Another challenge is dealing with technological and infrastructural constraints in implementing AA. Inadequate infrastructure can limit the reach and effectiveness of early warnings and anticipatory actions. Investing in technology upgrades and infrastructure improvements could be a solution for this challenge (Coughlan de Perez et al., 2015; Chaves-Gonzalez et al., 2022; Lopez et al., 2017).

Finally, ensuring flexibility and adaptability in AA protocols and actions is necessary. Rigid protocols may not be suitable for all contexts and evolving risks. Therefore, designed triggers should be flexible and there need to be adaptable action plans that can be tailored to specific needs and circumstances.

The detailed interpretation of interview themes provides valuable insights into the evolution, implementation and future directions of AA. These findings highlight the importance of proactive measures, community involvement, government leadership, and strong collaboration among stakeholders. Addressing the identified challenges and leveraging the emerging trends can enhance the effectiveness and sustainability of actions, ultimately reducing disaster impacts and building resilience in vulnerable communities.

Anticipatory actions are evolving towards more proactive, coordinated and community-driven approaches. Despite challenges in funding and perception, the future of AA looks promising with continuous learning, flexible responses and increased community involvement. These insights provide a comprehensive understanding of the current state and future directions of AA in disaster risk management.

6 Conclusion

Our findings highlight the evolution of FbF/AA, the challenges and most of all the benefits, with the way forward for scaling up AA. The findings from the qualitative analysis of interviews with humanitarian practitioners involved in FbF and AA initiatives, mark a significant transformation in the field of disaster risk management. This transformation is illustrated by a shift from reactive to proactive approaches, where anticipatory measures are prioritised to mitigate the impacts of disasters before they occur. The evolution of these initiatives underscores the importance of timely intervention, continuous learning, and robust collaboration among diverse stakeholders.

One of the central themes that emerged from the analysis is the growing recognition of the benefits of Anticipatory Action. By focusing on early triggers and pre-emptive strategies, stakeholders have been able to reduce the loss of lives, houses, and livelihoods in vulnerable regions. This proactive position not only maintains resources but also strengthens the resilience of communities, enabling them to better withstand future shocks. The ongoing process of continuous learning and adaptation has been vital in ensuring that these strategies remain relevant and effective in the face of changing climate conditions and emerging challenges.

The successful implementation of anticipatory actions depends on several key factors. The development of accurate and reliable

forecasting systems is significant, these systems provide the essential data needed to trigger early actions. The efforts of meteorological agencies, research institutions, and humanitarian organisations to collaborate, have contributed to enhancing the accuracy and reliability of these forecasts. However, securing sustainable financial resources remains a challenge. Despite the advantages of AA, obtaining dependable funding is difficult, highlighting the need for innovative financing mechanisms and sustained donor engagement.

Another crucial factor for success is the integration of anticipatory actions within national disaster frameworks. Embedding these actions into government policies and budgets ensures that they receive the necessary political and financial support for long-term sustainability. This integration also facilitates the alignment of anticipatory actions with broader disaster risk management strategies, making them a standard practice within national and local government operations.

Community engagement emerged as a cornerstone of effective AA. Involving communities in the planning and implementation of interventions ensures that these actions are culturally appropriate, relevant, and adapted to the specific needs of the people they aim to protect. Utilising local knowledge and existing community structures enhances the effectiveness of these actions,

promoting a sense of ownership and accountability among community members. The emphasis on inclusive participation, transparency, and trust-building further strengthens the relationship between humanitarian actors and the communities they serve.

Despite the progress made, the implementation of anticipatory actions is not without challenges. Ensuring the accuracy of weather forecasts, securing sustainable funding, and addressing gaps in data quality are never-ending obstacles that need to be overcome. The limited availability of historical and real-time data, coupled with the challenge of engaging local communities, underscores the need for ongoing investment in capacity building, data infrastructure, and community awareness programs. Additionally, the coordination and harmonisation of efforts among different agencies and stakeholders are essential to avoid fragmented approaches and resource wastage.

The analysis also highlights the importance of embedding anticipatory actions within government frameworks to ensure their sustainability and scalability. Government leadership in AA efforts reflects a commitment to proactive disaster management, while the integration of these actions into national plans and budgets ensures that they are prioritised and adequately funded. Engaging international donors and securing multi-year funding commitments are also critical to reducing the uncertainty of year-to-year funding cycles and ensuring the long-term viability of these initiatives.

Interagency cooperation and harmonisation are crucial for coordinated disaster responses.

Establishing agreed standards and procedures, using common triggers and encouraging collaboration among agencies enhance the efficiency and effectiveness of these actions.

However, the competitive nature of the humanitarian system can sometimes hinder coordination efforts, highlighting the need for a unified approach to disaster management. The challenges identified in the implementation underscores the importance of continuous adaptation and flexibility.

Designing triggers that are adaptable to specific contexts, investing in technological and infrastructural upgrades, and promoting policy reforms are essential steps to overcoming these challenges. Ensuring that AA initiatives are inclusive, transparent, and culturally appropriate will also contribute to their long-term success and sustainability.

In conclusion, the evolution of AA reflects a significant advancement in disaster risk management, moving towards more proactive, coordinated, and community-driven approaches. While challenges remain, the future of AA looks promising, with potential for further improvement and expansion through ongoing learning, innovation, and collaboration. By addressing the identified challenges and leveraging the emerging trends, humanitarians can improve the effectiveness and sustainability of anticipatory actions, ultimately reducing disaster impacts and building resilience in vulnerable communities.

7 Recommendations

Based on the insights gained from the qualitative analysis of interviews with stakeholders involved in AA initiatives, several key recommendations emerge to enhance the effectiveness and sustainability of this approach in disaster risk management.

Recommendation 1: Strengthen Forecasting Systems and Data Infrastructure

The accuracy and reliability of forecasting systems are critical for the success of anticipatory actions. It is recommended that continued investment will be made in developing and improving these systems, with a particular emphasis on enhancing collaboration between national meteorological offices and international forecast suppliers. Additionally, there is a need to address the gaps in historical and real-time data by establishing strong data collection methods and encouraging data sharing among agencies. Collaborative efforts with research institutions and the use of advanced technologies can further improve the accuracy of risk assessments and early warnings.

Recommendation 2: Secure Sustainable Funding Mechanisms

Securing consistent and long-term funding remains a challenge for anticipatory actions. To master this, it is essential to advocate for the integration of AA into national disaster management budgets and climate adaptation policies. Ensuring that AA is recognised as a priority at the national level will help secure

specific budget lines and political support. Additionally, engaging international donors to secure multi-year funding commitments can reduce the uncertainty of year-to-year funding cycles. Innovative financing mechanisms, such as pooled funding and multi-donor funds dedicated to AA, should be explored to streamline funding processes and ensure sustainability.

Recommendation 3: Embed Anticipatory Actions within National Frameworks

For anticipatory actions to be sustainable and effectively aligned with broader DRM strategies, they must be embedded within national and local government frameworks. This integration ensures that AA initiatives receive the necessary political backing and are institutionalized as part of standard disaster management practices. It is recommended that governments take a leading role in these efforts, supported by international partners where capacity is limited. Additionally, integrating AA into national plans and budgets should be coupled with training and capacity-building programmes for local governments and organisations.

Recommendation 4: Enhance Community Engagement and Participation

Community involvement is fundamental to the success of anticipatory actions. To ensure that interventions are relevant, culturally appropriate and sustainable, it is highly important to engage communities at every

stage of the planning and implementation process. This includes leveraging local knowledge, utilising existing community structures, and ensuring that AA initiatives are inclusive and represent the diversity of the community. Special attention should be given to gender-sensitive approaches that address the specific needs of women, youth, elderly, and marginalised groups. Building trust and fostering long-term collaborative relationships with communities will enhance the ownership and effectiveness of AA initiatives.

Recommendation 5: Promote Interagency Cooperation and Harmonisation

Effective disaster response requires strong interagency cooperation and harmonisation. It is recommended that agencies establish agreed standards, common triggers and regular communication channels to ensure coordinated efforts. This approach will reduce confusion, streamline processes, and improve the overall efficiency of anticipatory actions. Additionally, promoting a culture of collaboration among agencies will enable the sharing of information, resources and best methods, ultimately leading to more unified and effective disaster management strategies.

Recommendation 6: Scale Up Anticipatory Actions Through Systematic Coordination

Scaling up AA requires careful coordination and a strong emphasis on preparedness. It is recommended that stakeholders align to expand AA initiatives within existing frameworks, ensuring that all parties appreciate the value of readiness. Strengthening and harmonising the methodology behind AA will send these stakeholders in the right direction. Continuous learning, sharing of leading practices and allowing flexibility in response triggers will also be key to successfully scaling up these efforts. Additionally, increasing volunteer involvement can enhance community engagement and support for AA initiatives, further contributing to their sustainability and impact.

In conclusion, these recommendations provide a roadmap for improving the effectiveness, sustainability, and flexibility of anticipatory actions in disaster risk management. By addressing the identified challenges and building on the emerging trends, stakeholders can ensure that AA initiatives continue to evolve and contribute to reducing disaster impacts and building resilience in vulnerable communities.

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Annex: List of interviewees

Interview number	Name	Job description	Date + Location
1	Dr. Thorsten Klose-Zuber	Help - Hilfe zur Selbsthilfe e.V. – Secretary General – Formerly German Red Cross (2009-2021)	April 10 th , 2024 + July 30 th , 2024 (Online Teams interview)
2	Melanie Ogle	IFRC - DREF Capacity strengthening senior officer	April 17 th , 2024 (Online Teams interview)
3	Irene Amuron	Red Cross Red Crescent Climate Centre - Program manager Anticipatory Action	April 24 th , 2024 (Online Teams interview)
4	Stefanie Lux	German Red Cross/ Anticipation Hub - Head of Anticipation Unit	May 9 th , 2024 (Online Teams interview)
5	Yousri El Adak	Rode Kruis-Vlaanderen - Technical Project Manager	May 23 th , 2024 (Online Teams interview)
6	Pablo Suarez	Red Cross Red Crescent Climate Centre - Associate director for research & innovation	June 5 th , 2024 (Online Teams interview)
7	Jurg Wilbrink	IFRC - Eastern and Southern Africa advisor FbF	June 11 th , 2024 (Online Teams interview)
8	Anita Auerbach	German Red Cross/ Anticipation Hub - Cash and social protection advisor	July 1 st , 2024 (Online Teams interview)

9	Alexander Kjaerum	Danish Refugee Council (DRC) - Global Advisor & Senior Analyst	July 2 nd , 2024 (Online Teams interview)
10	Thomas Smarczyk	German Red Cross/Anticipation Hub – Technical Manager Anticipation & Methodology Development	July 5 th , 2024 (Online Teams interview)
11	Kiswendsida Guigma	Red Cross Red Crescent Climate Centre - Regional Advisor Sahel & Western Africa	July 8 th , 2024 (Online Teams interview)
12	Matthias Amling	Welthungerhilfe (WHH) - Team lead Anticipatory Action	July 11 th , 2024 (Online Teams interview)
13	Niccolò Lombardi	Food and Agricultural Organisation (FAO) – Emergency and Rehabilitation Officer / Team Leader, Anticipatory Action	July 19 th , 2024 (Online Teams interview)
14	Catherine Mugisha	Uganda Red Cross Society - AA Program Officer	July 29 th , 2024 (Online Teams interview)