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# İnsani Risk Yönetiminde Etki Tahmini ile Öngörücü Eylem Formülasyonu

## Formulating Anticipatory Action with Impact Forecasting in Humanitarian Risk Management

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### Öne Çıkanlar / Highlights

- Proaktif Risk Yönetimi: öngörücü eylem ve etki tahmininin entegrasyonu, insani risk yönetiminde bir paradigma kayması temsil etmektedir. Öngörücü analizler ve önleyici önlemler üzerine odaklanarak, insani kuruluşlar, afetlerin sonuçlarını etkili bir şekilde azaltabilir ve savunmasız topluluklarda dayanıklılığı artırabilir.
- Veri Tabanlı Karar Verme: Tarihsel verileri, mevcut eğilimleri ve ileri düzey analizleri bir araya getiren etki tahmin modelleri, öngörücü eylem planlarının geliştirilmesinde kritik bir rol oynamaktadır. Bu modeller, paydaşların potansiyel riskleri değerlendirmelerine ve kaynakları verimli bir şekilde tahsis etmelerine olanak tanır; bu sayede, etkilenen toplulukların özel ihtiyaçlarını karşılayan zamanında müdahaleler sağlanır.
- İş Birlikçi Yaklaşım: Etkili öngörücü eylem, hükümet ajansları, STK'lar ve yerel topluluklar dahil olmak üzere çok sayıda paydaşın iş birliğini gerektirmektedir. Eylem planlarını oluştururken farklı bakış açılarını bir araya getirerek ve doğru tahminlere dayanan net tetikleyici mekanizmalar oluşturarak, kuruluşlar müdahalelerinin uygunluğunu ve etkisini artırabilir.
- Proactive Risk Management:** The integration of anticipatory action and impact forecasting represent a paradigm shift in humanitarian risk management. By focusing on predictive analytics and preemptive measures, humanitarian organizations can effectively mitigate the consequences of disasters before they occur, fostering resilience in vulnerable communities.
- Data-Driven Decision Making:** Impact forecasting models, which combine historical data, current trends, and advanced analytics, are crucial for developing anticipatory action plans. These models enable stakeholders to assess potential risks and allocate resources efficiently, ensuring timely interventions that address the specific needs of affected populations.
- Collaborative Approach:** Effective anticipatory action necessitates the collaboration of multiple stakeholders, including government agencies, NGOs, and local communities. By engaging diverse perspectives in formulating action plans and establishing clear trigger mechanisms based on accurate forecasting, organizations can enhance the appropriateness and impact of their interventions.



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### Özet

İklim değişikliği ve sosyo-politik dinamiklerle derinleşen insani zorlukların artışı bağlamında, bu çalışma insani risk yönetiminde etki tahmini ile birlikte öngörücü eylem formülasyonunu araştırmaktadır. Geleneksel reaktif yaklaşımların yetersizliğini kabul eden araştırma, afet zararlarını azaltmak için öngörü verilerini kullanan proaktif stratejilerin gerekliliğini vurgulamaktadır. Bu çalışma, insani risk yönetimi kapsamında etki tahminine dayalı olarak desteklenen öngörücü eylemlerin oluşturulması ve uygulanmasını analiz etmek amacıyla nitel, keşifsel bir araştırma tasarımı benimsemekte ve karma yöntem yaklaşımını kullanmaktadır. Kapsamlı bir analiz aracılığıyla, çalışma öngörücü eylem ile etki tahmini arasındaki integral

*Stratejiler, Afet  
Haftıletme*

### **Keywords**

*Anticipatory Action,  
Impact Forecasting,  
Humanitarian Risk  
Management, Proactive  
Strategies, Disaster  
Mitigation*

ilişkiyi belirleyerek, uygulama için metodolojiler ve en iyi uygulamaları sunmaktadır. Ana bulgular, doğru tahminlerle bilgilendirilen öngörücü eylemlerin uygulandığı bölgelerin, afetle ilgili yaralanmaları ve kayıpları azaltırken, iyileşme sonuçlarını da iyileştirdiğini göstermektedir. Bu araştırma, insani yardım etkinliğinin artırılmasına yönelik literatüre anlamlı bir katkı sağlamakta; Türkiye'deki yetkili kurumlar için uygulanabilir bir entegrasyon iş akışı ve stratejik yol haritası önererek, öngörüye dayalı çerçevelere geçişi teşvik etmekte ve böylece dayanıklılık ile uyum kabiliyetini güçlendiren bir paradigma değişimini desteklemektedir.

### **Abstract**

In the context of escalating humanitarian challenges exacerbated by climate change and socio-political dynamics, this study explores the formulation of anticipatory action with impact forecasting in humanitarian risk management. Recognizing the inadequacy of traditional reactive approaches, the research highlights the necessity for proactive strategies that leverage predictive data to mitigate disaster impacts. This study adopts a qualitative, exploratory research design, employing a mixed-methods approach to analyze the formulation and implementation of anticipatory action supported by impact forecasting within humanitarian risk management. Through a comprehensive analysis, the study identifies the integral relationship between anticipatory action and impact forecasting, presenting methodologies and best practices for implementation. Key findings indicate that regions employing anticipatory measures informed by accurate forecasting experience reduced disaster-related casualties and improved recovery outcomes. This research contributes to the discourse on enhancing humanitarian effectiveness by advocating for a paradigm shift toward anticipatory frameworks that foster resilience and adaptability via proposing a simple integration workflow and strategic guidance for Türkiye authorities.

## **1. INTRODUCTION**

The humanitarian sector encompasses organizations, actors, and systems dedicated to preventing and alleviating human suffering during crises such as natural disasters, armed conflicts, epidemics, and forced displacement. It includes international and local NGOs, UN agencies, Red Cross and Red Crescent societies, and governmental bodies working to provide life-saving assistance—such as food, shelter, health care, and protection—to affected populations. The sector is guided by core principles of humanity, neutrality, impartiality, and independence, and increasingly incorporates anticipatory, risk-informed, and resilience-building approaches in its operations. In an era marked by unprecedented humanitarian challenges, the humanitarian sector faces an urgent need to adapt to the increasing frequency and intensity of disasters. Climate change, geopolitical tensions, and evolving socio-economic dynamics contribute to a landscape in which traditional reactive approaches to crisis management often fall short. This reality underscores the importance of proactive risk management strategies that prioritize anticipatory action, enabling humanitarian organizations to mitigate potential impacts before disasters occur.

Anticipatory action refers to measures taken ahead of crises, guided by predictive data and risk assessments, to prepare and respond effectively to impending emergencies. This proactive stance is complemented by impact forecasting, a systematic approach that utilizes data analytics and predictive modeling to estimate the potential consequences of disasters. Together, these concepts represent a paradigm shift in humanitarian risk management, aiming to foster resilience and enhance the efficacy of responses.

The humanitarian sector has witnessed significant advancements in anticipatory action and impact forecasting, yet critical gaps remain in both the theoretical and practical dimensions of these frameworks. This section elucidates the limitations of current anticipatory action strategies and highlights the insufficient integration between forecasting and action. Despite the growing emphasis on anticipatory action within humanitarian responses, several limitations hinder its effectiveness. Firstly, many anticipatory action strategies are predicated on historical data, which may not accurately predict future events (Forsgren et al., 2022). This reliance on past occurrences can lead to a misalignment between anticipated and actual needs, resulting in ineffective resource allocation and inadequate response measures (WMO, 2021). For instance, the World Meteorological Organization (2021) notes

that while weather forecasting has improved, the translation of these forecasts into actionable plans remains inadequate in many contexts, particularly in low-resource settings.

Additionally, the complexity and unpredictability of humanitarian crises, exacerbated by climate change and socio-political factors, render existing anticipatory action strategies less effective (Chaves-Gonzalez, 2022). The disconnect between rapid onset disasters and the slow pace of decision-making processes within humanitarian organizations often results in missed opportunities for timely intervention (Forsgren et al., 2022). Furthermore, existing frameworks frequently lack the flexibility required to adapt to emerging threats, leading to static responses that do not account for evolving risk profiles (Chaves-Gonzalez, 2022).

Another significant gap lies in the insufficient integration of forecasting with action plans. While advancements in predictive modeling and data analytics have enhanced the ability to forecast potential impacts of disasters (Marzouk et al., 2024), translating these forecasts into effective anticipatory action remains a challenge. Many organizations operate with siloed systems where forecasting, planning, and response activities are disconnected, impeding coordinated efforts (Forsgren et al., 2022).

Moreover, the lack of a standardized framework for linking forecasts to actionable interventions complicates the decision-making process for humanitarian actors. A study by Marzouk et al. (2024) emphasizes the need for more robust mechanisms that align predictive analytics with operational strategies to ensure that anticipatory actions are grounded in real-time data and contextual understanding. Without such integration, humanitarian efforts risk being reactive rather than proactive, diminishing their potential to mitigate risks and enhance resilience in affected communities (Chaves-Gonzalez, 2022).

The relationship between impact forecasting, anticipatory action, and disaster risk management is synergistic and sequential:

- Impact forecasting provides predictive insights into the likely consequences of hazards by combining data on exposure, vulnerability, and hazard intensity.
- These forecasts trigger anticipatory actions, which are pre-emptive measures taken before a disaster strikes to reduce harm and optimize response.
- Together, they enhance disaster risk management by shifting the focus from reactive to proactive strategies, enabling earlier, more effective interventions that reduce disaster impacts and strengthen resilience.

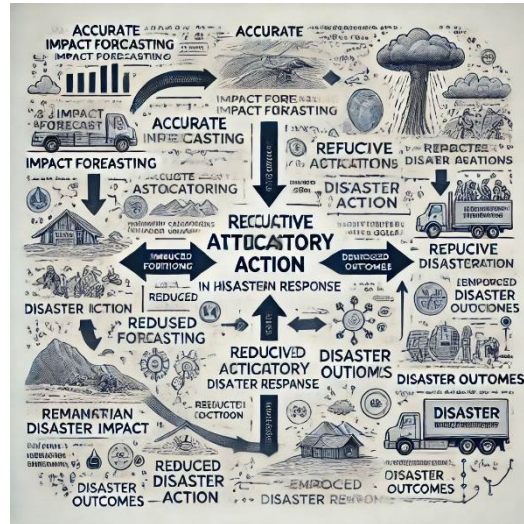
This study adopts a qualitative, exploratory research design, employing a mixed-methods approach to analyze the formulation and implementation of anticipatory action supported by impact forecasting within humanitarian risk management. Key data sources include peer-reviewed literature, organizational reports, early warning systems data, and outcome evaluations of anticipatory action frameworks. Analytical methods involve thematic analysis to identify best practices, critical success factors, and the operational interplay between forecasting accuracy and anticipatory outcomes.

The study is predicated on several foundational assumptions essential for guiding the research framework:

- It is assumed that effective humanitarian responses require a shift from reactive to proactive measures. This includes an approach that anticipatory action can significantly enhance preparedness and response efforts, mitigating the adverse effects of disasters.
- The research assumes that key concepts such as “anticipatory action” and “impact forecasting” are consistently understood and applied across various humanitarian contexts, which facilitates effective communication and implementation of strategies.

Based on the above-mentioned assumptions, the central hypothesis guiding this study posits that:

- Implementing anticipatory action, informed by accurate impact forecasting, enhances the effectiveness of humanitarian responses to disasters.



**Figure 1:** An iterative conceptual diagram illustrating the impact of anticipatory action in humanitarian disaster response  
 (Developed by author using AI)

This hypothesis can be broken down into several sub-hypotheses as follows:

- Anticipatory action leads to a measurable reduction in disaster-related casualties and losses.
- The accuracy of impact forecasting directly influences the success of anticipatory actions.
- Organizations that integrate anticipatory action into their existing frameworks exhibit enhanced operational efficiency and resource allocation during crises.

Recognizing the limitations of this study is crucial for contextualizing its findings and implications:

- **Data Limitations:** The availability and granularity of data on past disasters may be limited, affecting the robustness of impact forecasting models. Historical data may not always accurately reflect future scenarios, particularly in the face of climate change and evolving humanitarian challenges.
- **Generalizability:** The findings may be context-specific and not universally applicable across all humanitarian settings. Variations in local governance, cultural dynamics, and resource availability can significantly influence the effectiveness of anticipatory actions.
- **Complexity of Humanitarian Contexts:** The humanitarian sector is characterized by inherent complexities, including political, social, and economic factors that may not be fully accounted for in impact forecasting models. These complexities can hinder the implementation of anticipatory actions.

By acknowledging these elements, the study aims to provide a nuanced understanding of the role of anticipatory action and impact forecasting in enhancing humanitarian risk management.

## 2. LITERATURE REVIEW

The concept of anticipatory action in humanitarian responses has evolved significantly over the past few decades. Traditionally, humanitarian responses were reactive, focusing on addressing needs after disasters occurred (Forsgren et al., 2022). However, the increasing frequency and intensity of natural disasters, exacerbated by climate change and socio-political instability, have necessitated a paradigm shift towards proactive approaches. Anticipatory action, defined as measures taken before a disaster to mitigate its impact, has gained traction as a vital component of humanitarian risk management (Kurdi & Ruckstuhl, 2023). Reasons behind the paradigm shift as well as the influential actors can be studied in another discussion on the ‘mitigation/ risk reduction paradigm’ replacing ‘recovery paradigm’ would contribute to presenting the importance of mitigation measures including anticipatory action for humanitarian risk management.

The early frameworks for anticipatory action emerged from lessons learned during past humanitarian crises, particularly during the 2010 Haiti earthquake and the 2011 East Africa drought. These events underscored the limitations of traditional response strategies and highlighted the need for improved early warning systems and risk assessments (Chaves-Gonzalez, 2022). This context laid the groundwork for contemporary anticipatory action initiatives, which emphasize the integration of risk knowledge, community involvement, and multi-sectoral collaboration.

Impact forecasting methodologies play a crucial role in informing anticipatory action by predicting the potential effects of disasters before they occur. These methodologies encompass a range of quantitative and qualitative techniques, including predictive modeling, scenario analysis, and risk mapping. The application of these methods enables humanitarian organizations to assess vulnerabilities, identify at-risk populations, and allocate resources more effectively (Merz et al., 2020).



**Figure 2:** En exemplary image for forecasting impact at the most basic level (Developed by author using AI)

One notable example of impact forecasting is the use of climate data and modeling to predict the likelihood of extreme weather events, such as floods or droughts. Organizations like the International Federation of Red Cross and Red Crescent Societies (IFRC) have implemented tools that combine climate forecasts with socio-economic data to estimate the potential humanitarian impacts of these events (IFRC, 2020). Furthermore, advancements in machine learning and artificial intelligence are enhancing the accuracy and timeliness of impact forecasts, allowing for more responsive and informed anticipatory actions (Grass et al., 2023).

Numerous case studies illustrate the effectiveness of anticipatory action in mitigating the impacts of disasters. For instance, the “Forecast-based Financing” initiative, implemented by the Red Cross in several countries, provides a compelling example of successful anticipatory action. This initiative utilizes weather forecasts to trigger financial support for pre-planned interventions, such as the distribution of food and supplies before predicted floods (Abdelmalek, 2024). In Bangladesh, the use of early warning systems combined with community engagement has significantly reduced mortality and displacement during cyclones (Seddiky et al., 2020).

Another illustrative case is the anticipatory response to the 2020 drought in Ethiopia, where the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) and local partners collaborated to



mobilize resources based on forecasted drought conditions. By pre-positioning food and water supplies, the initiative successfully mitigated the worst effects of the drought on vulnerable communities (OCHA, 2020). These examples underscore the importance of integrating anticipatory actions into humanitarian risk management frameworks, highlighting their potential to save lives and reduce suffering in crisis situations.

### 3. THEORETICAL FRAMEWORKS

The field of humanitarian risk management has evolved significantly, particularly in the context of anticipatory action and impact forecasting. This literature review focuses on three key theoretical frameworks: Disaster Risk Reduction (DRR), Resilience Theory, and Forecast-Based Financing (FbF) models (despite the fact that DRR and FbF are more practical frameworks). Each of these frameworks contributes to a comprehensive understanding of how anticipatory action can be effectively implemented in humanitarian contexts.

#### 3.1. Disaster Risk Reduction (DRR)

Disaster Risk Reduction (DRR) is a fundamental and practical framework that emphasizes the importance of reducing vulnerabilities and enhancing resilience before a disaster strikes. According to the United Nations Office for Disaster Risk Reduction (UNDRR, 2020), DRR encompasses strategies and measures aimed at minimizing disaster risks, which can significantly impact the effectiveness of anticipatory actions. The Sendai Framework for Disaster Risk Reduction (2015-2030) (Also 1994 Yokohama Strategy and Hyogo Framework for the period 2005-2015) articulates key priorities for action, including understanding disaster risk, strengthening disaster risk governance, investing in disaster risk reduction for resilience, and enhancing disaster preparedness for effective response (UNDRR, 2015).



**Figure 3:** An AI generated image for lack of anticipatory action in urban structures. (Developed by author using AI)

The integration of DRR principles into humanitarian action is essential for anticipating and mitigating the impacts of disasters. For example, findings from Mercer (2010) indicate that communities engaged in proactive DRR initiatives are better prepared to respond to disasters, thus facilitating more effective anticipatory actions. Additionally, implementing DRR strategies has been shown to reduce economic losses and enhance the overall effectiveness of humanitarian interventions (Forsgren et al., 2022).

Therefore, a robust understanding of DRR is pivotal for formulating effective anticipatory actions in humanitarian risk management.

### 3.2. Resilience Theory

Resilience Theory offers a complementary perspective to DRR by focusing on the capacity of individuals, communities, and systems to withstand, adapt to, and recover from shocks and stresses (Holling, 1973; Walker & Salt, 2012). In the context of humanitarian risk management, resilience is not merely the absence of vulnerability but involves proactive measures that enable communities to absorb disturbances while maintaining essential functions (Demiroz & Haase, 2020). Anticipatory actions informed by resilience theory can lead to enhanced preparedness and quicker recovery in the face of disasters. According to Haines et al. (2019), integrating resilience-building measures into anticipatory frameworks facilitates the identification of vulnerable populations and enables tailored interventions that address specific needs. Furthermore, resilience-oriented approaches encourage collaboration among stakeholders, fostering a more comprehensive understanding of risk dynamics and promoting effective impact forecasting (Béné et al., 2016). Hence, resilience theory is integral to shaping anticipatory actions that are responsive to the complexities of humanitarian crises.



**Figure 4:** An exemplary depiction of resilience illustrating multifactor approaches. (Developed by author using AI)

Anticipatory actions informed by resilience theory can lead to enhanced preparedness and quicker recovery in the face of disasters. According to Rocque et al. (2021), integrating resilience-building measures into anticipatory frameworks facilitates the identification of vulnerable populations and enables tailored interventions that address specific needs. Furthermore, resilience-oriented approaches encourage collaboration among stakeholders, fostering a more comprehensive understanding of risk dynamics and promoting effective impact forecasting (Bonfiglioli & Watson, 2011). Hence, resilience theory is integral to shaping anticipatory actions that are responsive to the complexities of humanitarian crises.

### 3.3. Forecast-Based Financing (FbF) Models

Forecast-Based Financing (FbF) represents an innovative approach that aligns financial mechanisms with predictive models to support anticipatory actions. FbF models utilize forecast data to trigger funding and resources before disasters occur, allowing humanitarian actors to implement timely interventions based on anticipated needs (Abdelmalek, 2024). This proactive financial approach addresses the limitations of traditional reactive funding mechanisms, which often hinder timely responses during crises (Crompton et al., 2021).

Research indicates that FbF can significantly enhance the effectiveness of humanitarian responses by enabling the pre-positioning of resources, improving logistics, and supporting vulnerable communities before disasters occur (Kurdi & Ruckstuhl, 2023). For instance, a study by Abdelmalek et al. (2024) highlights how FbF mechanisms have been successfully implemented in several countries, leading to reduced humanitarian needs and more effective resource allocation. The integration of impact forecasting within FbF models ensures that anticipatory actions are data-driven and context-specific, thereby optimizing the allocation of resources in anticipation of future shocks (Merz et al., 2020). As such, FbF models provide a critical framework for operationalizing anticipatory action in humanitarian risk management.

#### 4. ANALYSIS OF ANTICIPATORY ACTION FRAMEWORK

Anticipatory Action (AA) in humanitarian risk management represents a proactive approach that aims to reduce the impact of disasters before they occur. This framework is predicated on timely and informed decision-making that is anchored in robust data analysis and stakeholder engagement. The components of the Anticipatory Action Framework can be categorized into three main areas: trigger mechanisms, decision-making processes, and resource allocation strategies.

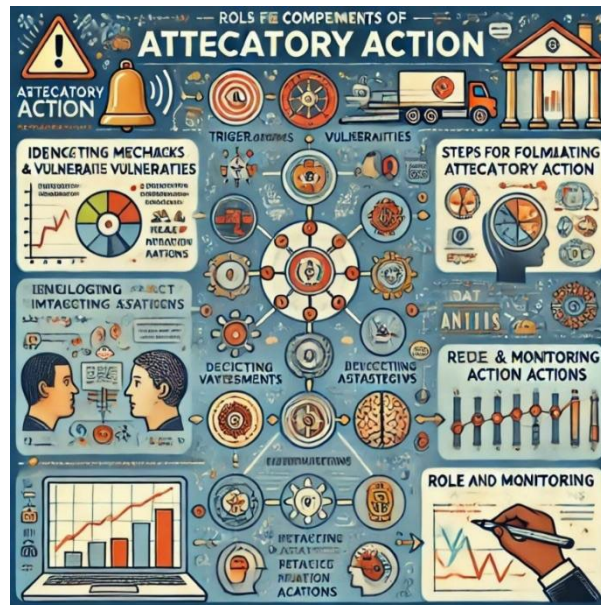


Figure 5: An AI generated exemplary infographic on anticipatory action (Developed by author using AI)

#### 4.2. Definition and Components of Anticipatory Action

Trigger mechanisms are essential for initiating anticipatory actions based on defined thresholds of risk. These thresholds are often established through historical data analysis and predictive modeling, allowing organizations to act before a disaster unfolds. For instance, the World Food Programme (2020) highlights that early warning systems can serve as trigger mechanisms by indicating potential food insecurity due to climatic events. Such systems provide critical data that enables timely interventions, thus reducing the adverse effects of disasters.

The decision-making processes involved in anticipatory action require a multidisciplinary approach that integrates inputs from various stakeholders, including local communities, governmental agencies, and humanitarian organizations. According to Marciano et al. (2024), these processes must be adaptive and inclusive, ensuring that the voices of those most affected by potential disasters are considered in planning and implementation. This inclusivity enhances the legitimacy and effectiveness of the actions taken.

Effective resource allocation is critical in executing anticipatory actions. Strategies must be developed to ensure that resources are mobilized quickly and efficiently in response to identified triggers. The



International Federation of Red Cross and Red Crescent Societies (2021) emphasizes that pre-positioning resources, such as food supplies and medical equipment, can significantly enhance response capacity. Resource allocation strategies should also include funding mechanisms that enable rapid financial support to affected areas.

#### **4.3. Challenges in Implementing Anticipatory Action**

One of the most significant challenges in implementing anticipatory action is the persistent lack of resources and funding. Many humanitarian organizations operate under constrained budgets, which limits their capacity to invest in proactive measures such as anticipatory action. This scarcity is often exacerbated by competing priorities and the urgent need for immediate response efforts, diverting attention and resources away from preventive strategies (Kurdi, S., & Ruckstuhl, 2023).

The funding landscape for humanitarian action tends to favor reactive approaches, where resources are allocated in response to ongoing crises rather than for anticipatory measures aimed at reducing the risk of future disasters (Forsgren et al., 2022). Without adequate financial support, organizations may struggle to develop the necessary infrastructure and systems for effective anticipatory action, such as data collection and analysis tools, which are crucial for impact forecasting. Consequently, the lack of investment in anticipatory action not only undermines its implementation but also perpetuates a cycle of reactive responses that fail to address the root causes of vulnerabilities (World Bank, 2019).

Institutional resistance to change presents another significant barrier to the effective implementation of anticipatory action. Humanitarian organizations often have entrenched practices and established operational frameworks that prioritize immediate response rather than long-term risk management (Zaman et al., 2022). This resistance can stem from a variety of factors, including organizational culture, fear of failure, and a lack of understanding of the benefits of anticipatory action (Kurdi & Ruckstuhl, 2023).

Moreover, implementing anticipatory action necessitates a paradigm shift in how organizations perceive risk and disaster management. This shift requires not only changes in organizational policies and practices but also a commitment to fostering a culture of innovation and adaptability. However, such transformations can be met with skepticism and inertia, particularly in environments where immediate results are valued over strategic foresight. As a result, institutional resistance can stymie efforts to integrate anticipatory action into existing frameworks, limiting the overall effectiveness of humanitarian interventions (World Bank, 2019).

One of the foremost challenges in implementing anticipatory action is the issue of data availability and reliability. Effective anticipatory action relies heavily on high-quality, timely data that can accurately reflect the socio-economic and environmental conditions of vulnerable populations (Zaman et al., 2022). However, in many contexts, particularly in low- and middle-income countries, data may be scarce, outdated, or of poor quality (Beduschi, 2022). This lack of reliable data can hinder the identification of at-risk populations and undermine the effectiveness of interventions. Furthermore, existing data collection systems may not be equipped to capture the complex, multi-dimensional nature of humanitarian crises, leading to significant gaps in understanding the potential impacts of such events (Rahman et al., 2022).

Additionally, data accessibility poses a significant barrier to implementing anticipatory action. Many humanitarian organizations face challenges in accessing critical datasets due to bureaucratic obstacles, restricted data-sharing practices, or a lack of collaboration among stakeholders (Cowan 2011). This limitation not only hampers the effectiveness of forecasting efforts but also increases the risk of implementing poorly informed actions that may exacerbate vulnerabilities instead of alleviating them.

The second critical technical challenge lies in the inherent limitations of forecasting models used in anticipatory action. While advancements in predictive modeling have improved the ability to forecast potential crises, these models often face significant uncertainties and limitations (Hasanuzzaman et al., 2023). Many models rely on historical data to make predictions, which may not accurately reflect future

conditions, particularly in a context of rapid environmental change or socio-political instability (Hernandez & Roberts, 2020). This reliance on historical data can lead to misestimations of risks and inadequate preparedness measures.

Moreover, the complexity of humanitarian crises often exceeds the capacity of current forecasting models to capture all relevant variables. Factors such as human behavior, social dynamics, and political contexts are challenging to quantify and integrate into models, potentially resulting in oversimplified predictions (Edoh et al., 2024). As a result, decision-makers may be presented with forecasts that lack the granularity necessary to inform effective anticipatory action, leading to a disconnect between model outputs and real-world conditions.

Trust can be fostered through transparency, consistent communication, and involving community members in decision-making processes (Walters, 2023). However, many humanitarian organizations face challenges in establishing this trust due to previous failures or perceived inadequacies in disaster response. For instance, communities may view external actors as disconnected from their realities, leading to skepticism about the proposed anticipatory actions (Nur & Amarnath, 2023). This skepticism can hinder participation and, ultimately, the effectiveness of anticipatory interventions.

Moreover, the cultural context plays a vital role in shaping how communities engage with anticipatory actions. Different cultures have varied communication styles, decision-making processes, and approaches to risk management (Nordberg, 2018). Therefore, humanitarian organizations must adapt their engagement strategies to align with local cultural norms and values. Failure to do so may result in misunderstandings and a lack of community buy-in, limiting the potential impact of anticipatory actions (Orsato, 2019).

Risk perception is another critical factor influencing the implementation of anticipatory action. Individuals and communities perceive risks through a cultural lens, which can significantly affect their response to anticipatory measures. For instance, cultural beliefs about the causes of disasters can influence whether communities view anticipatory actions as relevant or necessary. If a community attributes disasters to divine intervention or fate, they may be less inclined to engage in anticipatory action (Kahneman, 2011).

Additionally, behavioral responses to risk can vary widely across different cultural contexts. Research indicates that communities with strong social cohesion may exhibit collective behaviors that enhance resilience, while others may respond individually or with mistrust towards external interventions (Haque & Fatema, 2022). The effectiveness of anticipatory actions depends on understanding these behavioral patterns and tailoring interventions accordingly.

Furthermore, the availability of information and education plays a crucial role in shaping risk perception. Communities with limited access to accurate information may underestimate the risks they face, leading to inadequate preparedness and participation in anticipatory actions (Zaman et al., 2022). Therefore, it is essential for humanitarian organizations to prioritize education and information dissemination, ensuring that communities are well-informed about the risks they encounter and the benefits of anticipatory action.

#### **4.4. Steps for Formulating Anticipatory Action**

Identifying Risks and Vulnerabilities is the first step in formulating anticipatory action is the identification of risks and vulnerabilities within a community. This involves conducting thorough risk assessments that consider socio-economic factors, environmental conditions, and historical data on past disasters. As noted by the United Nations Office for Disaster Risk Reduction (2019), understanding local contexts and vulnerabilities is crucial for tailoring anticipatory actions effectively.

Once risks are identified, conducting impact assessments helps in evaluating the potential consequences of various disaster scenarios. These assessments provide a clearer understanding of the implications of

inaction and assist in prioritizing actions based on potential human and economic losses (Thalheimer et al., 2022).

Engaging stakeholders throughout the anticipatory action process ensures that actions are relevant and community-led. This engagement fosters collaboration and enhances the ownership of the proposed interventions, which is vital for their sustainability (Abdelmalek, 2024). Building relationships with local organizations and communities is essential for effective communication and the successful implementation of anticipatory measures.

After engaging stakeholders, the next step involves the development of detailed action plans that outline specific interventions, timelines, and responsible parties. These plans should be flexible enough to adapt to changing circumstances while remaining focused on the defined objectives. The action plans must be based on the findings of risk and impact assessments and the insights gained from stakeholder engagement.

The final step involves the implementation of the action plans, accompanied by robust monitoring systems to evaluate effectiveness. Regular monitoring ensures that actions remain relevant and effective, allowing for real-time adjustments as necessary (Enenkel et al., 2022). Feedback mechanisms should also be integrated into the monitoring processes to facilitate continuous improvement.

#### **4.5. Role of Technology and Data in Anticipatory Action**

Predictive analytics plays a pivotal role in enhancing anticipatory action by providing insights derived from data patterns. These analytics enable organizations to forecast potential risks and allocate resources accordingly (Aljohani, 2023). Machine learning models, for instance, can analyze vast datasets to identify risk patterns, thereby improving the accuracy of predictions.

Early warning systems (EWS) are fundamental in disseminating timely information about potential hazards to vulnerable communities. These systems integrate meteorological data, social media inputs, and local knowledge to generate alerts that inform decision-making (Lentz et al., 2020). EWS can be linked to trigger mechanisms to ensure prompt action in response to imminent threats.

The establishment of data-sharing platforms facilitates collaboration among various stakeholders by providing access to relevant information. These platforms enhance transparency and enable stakeholders to make informed decisions based on shared data. The integration of technology in data-sharing also aids in creating a centralized database that can be leveraged for future anticipatory actions (Lentz et al., 2020).

### **5. ANALYSIS OF IMPACT FORECASTING**

Impact forecasting is a systematic approach that involves predicting the potential impacts of disasters and humanitarian crises on communities, economies, and ecosystems. It serves as a critical tool in humanitarian risk management by enabling organizations to anticipate adverse outcomes, thereby facilitating proactive measures that can mitigate the effects of such events (Schneider et al., 2023). By employing impact forecasting, humanitarian agencies can effectively prioritize resources and interventions, ensuring that vulnerable populations receive timely support and assistance (Knox Clarke & Campbell, 2020). This proactive stance not only enhances the resilience of communities but also fosters a more strategic approach to disaster response, aligning with the broader objectives of humanitarian action (Forsgren et al., 2022).

Impact forecasting informs decision-making processes by providing stakeholders with essential insights into the likely consequences of specific events. This evidence-based approach allows for informed choices regarding the allocation of resources, the design of interventions, and the implementation of preventive measures (Hasanuzzaman, 2023). Moreover, effective impact forecasting can enhance collaboration among humanitarian actors, governments, and local communities, fostering a shared understanding of risks and a collective response strategy (Nakhaei et al., 2023).

Quantitative methods, including statistical models and simulations, play a pivotal role in impact forecasting by providing empirical data and predictive analytics. Statistical models utilize historical data to identify trends and correlations, enabling forecasters to estimate the potential impacts of future disasters (Nuñez, 2005). For instance, regression analysis can quantify the relationship between disaster variables and socioeconomic outcomes, informing projections of potential losses. Additionally, simulations, such as Monte Carlo methods, allow for the exploration of various scenarios by incorporating uncertainties and multiple variables, enhancing the robustness of forecasts (Tariq et al, 2021).

Qualitative methods, such as expert judgment and scenario planning, complement quantitative approaches by providing contextual insights and narrative-based assessments. Expert judgment involves soliciting input from seasoned professionals and practitioners who possess deep knowledge of specific humanitarian contexts (Hasani, 2013). This method can illuminate factors that quantitative models might overlook, such as local socio-political dynamics and community resilience. Scenario planning, on the other hand, allows stakeholders to explore a range of possible futures, fostering adaptive strategies that can address uncertainty and variability in humanitarian contexts (Lin et al., 2014).

The integration of local knowledge and expertise is paramount in enhancing the effectiveness of impact forecasting methodologies. Engaging with local communities, stakeholders, and indigenous knowledge holders can provide valuable insights into vulnerabilities, capacities, and risk perceptions (Reichel & Frömming, 2014). This participatory approach not only enriches the forecasting process but also fosters a sense of ownership among communities, ensuring that interventions are culturally sensitive and contextually appropriate. As a result, impact forecasts that incorporate local knowledge are often more relevant and actionable, leading to improved disaster preparedness and response outcomes (Zaman et al., 2022).

Several humanitarian crises exemplify the successful application of impact forecasting methodologies. The 2010 Haiti earthquake, for example, prompted extensive impact forecasting efforts that involved a combination of quantitative modeling and qualitative assessments (Salam & Khan, 2020). Following the earthquake, organizations utilized statistical models to estimate the potential impacts on infrastructure and livelihoods, which guided resource allocation and recovery planning.

In the context of the Syrian refugee crisis, impact forecasting has been instrumental in informing policy decisions and humanitarian responses (Abdelmalek, 2024). Through the integration of quantitative models that assess demographic trends and qualitative insights from local NGOs, stakeholders were able to forecast the needs of displaced populations effectively. This multifaceted approach not only improved the efficiency of aid distribution but also facilitated collaboration among diverse actors, ultimately enhancing the resilience of refugee communities (Wicke et al., 2022).

## **6. FORMULATING IMPACT FORECASTING WITH ANTICIPATORY ACTION IN RISK MANAGEMENT**

Anticipatory action, coupled with impact forecasting, has emerged as a crucial approach in risk management, particularly in humanitarian and disaster response contexts. This method involves taking proactive measures before an anticipated hazard occurs, with the aim of minimizing potential damages and losses (Coughlan de Perez et al., 2015). The process of formulating anticipatory action with impact forecasting requires integrating predictive analytics, risk assessments, and response planning in a way that ensures the effectiveness and timeliness of interventions. In this section, we explore key steps in formulating such actions and the role of forecasting models in enhancing decision-making and risk mitigation efforts.

### **6.1. Identifying the Hazard and Vulnerability Context**

The first step in formulating anticipatory action is to clearly identify the hazards that pose potential risks and the vulnerability context in which these risks are situated. This requires a comprehensive hazard analysis that includes both natural and anthropogenic threats, such as floods, droughts, pandemics, or



conflicts. Alongside hazard identification, it is essential to assess the exposure and vulnerability of communities, infrastructure, and ecosystems. This can be achieved by gathering historical data, understanding socio-economic conditions, and mapping out high-risk zones (Chaves-Gonzalez et al., 2022). Impact forecasting plays a critical role in this stage by providing probabilistic scenarios based on early warning systems, satellite imagery, and climate models. By leveraging tools like the Global Forecasting Initiative or the Famine Early Warning Systems Network (FEWSNET), risk managers can predict the severity, timing, and geographic spread of potential hazards, thereby tailoring anticipatory actions accordingly (de Winter, 2023).

### **6.2. Integrating Forecasting Models with Risk Scenarios**

Forecasting models are central to the success of anticipatory action as they allow for a data-driven approach to decision-making. These models utilize historical patterns, current data, and machine learning algorithms to generate possible future outcomes. In risk management, this involves combining impact forecasting models with risk scenarios to understand potential consequences and identify tipping points at which action must be taken. For example, hydrological models can predict the likelihood of river flooding, while agricultural models may estimate the impact of drought on crop yield, informing when and where anticipatory interventions should occur (Kurdi & Ruckstuhl, 2023). To enhance the precision of forecasting models, multidisciplinary approaches should be adopted, incorporating meteorological, geological, and socio-economic data. This ensures a comprehensive understanding of risks and increases the accuracy of impact forecasts. By including vulnerability assessments within these models, stakeholders can better allocate resources, prioritize actions, and mitigate the specific needs of vulnerable groups, such as women, children, and displaced persons (Coughlan de Perez et al., 2015).

### **6.3. Formulating Trigger Mechanisms for Early Action**

A core element of anticipatory action is the development of trigger mechanisms, which are predetermined thresholds that prompt immediate response measures. These triggers must be based on the outputs of forecasting models and clearly linked to operational plans. For instance, in drought-prone regions, a reduction in rainfall below a specific threshold may trigger the release of funds for water trucking or the distribution of drought-resistant seeds. Trigger mechanisms should be designed with flexibility to accommodate uncertainties and variations in forecast accuracy. However, it is also important that they are specific enough to ensure timely and appropriate responses. The use of impact-based forecasting, which translates forecasts into actionable information about how a hazard will affect people and systems, is a particularly useful method for refining trigger mechanisms (de Winter, 2023).

### **6.4. Coordinating Stakeholder Engagement and Resource Allocation**

Effective anticipatory action requires the coordination of multiple stakeholders, including governments, non-governmental organizations, and local communities. This coordination ensures that anticipatory measures are implemented in a cohesive and resource-efficient manner. Formulating anticipatory action plans with input from all relevant parties, particularly those affected by the hazards, can enhance local ownership and the appropriateness of interventions (Chaves-Gonzalez et al., 2022). Resource allocation is a critical component of anticipatory action and must be addressed in advance of potential hazards. Financial mechanisms such as forecast-based financing (FbF) allow for pre-allocated funds to be released automatically when trigger thresholds are met, ensuring timely interventions (Coughlan de Perez et al., 2015). In designing such systems, it is essential to account for the capacities and constraints of implementing agencies, ensuring that logistics, personnel, and funding are in place to support rapid deployment.

### **6.5. Monitoring, Evaluation, and Learning (MEL) Systems**

An integral part of formulating anticipatory action is the establishment of robust monitoring, evaluation, and learning (MEL) systems. These systems provide the means to assess the effectiveness of anticipatory measures and to adapt strategies based on real-time feedback and post-event analysis. Monitoring systems should track the implementation of anticipatory actions, measure their impacts, and identify lessons learned to improve future interventions (Kurdi & Ruckstuhl, 2023). Evaluation criteria should include the accuracy of impact forecasts, the timeliness of responses, and the extent to which anticipated damages were mitigated. Continuous learning from past experiences is critical for refining impact

forecasting models and anticipatory action plans, thereby improving the resilience of communities over time (Chaves-Gonzalez et al., 2022).



**Figure 6:** An AI generated exemplary infographic illustrating the process of formulating anticipatory action with impact forecasting in risk management. (Developed by author using AI)

## 7. RESULTS AND RECOMMENDATIONS

The integration of anticipatory action and impact forecasting into humanitarian risk management is imperative for enhancing the sector's agility and resilience in the face of emerging crises. The following recommendations provide a strategic blueprint for humanitarian organizations to implement these approaches effectively, positioning them to anticipate, mitigate, and respond to the multidimensional effects of disasters in a timely and coordinated manner.

### 7.1. Strengthening Data Collection and Analysis Capabilities

Organizations must invest in robust data collection and analysis systems encompassing diverse data sources—historical records, climate models, socio-economic indicators, and community vulnerability assessments. Leveraging advanced technologies such as remote sensing and machine learning can enhance predictive precision (Coughlan de Perez et al., 2015). Moreover, fostering partnerships with research institutions can provide access to innovative forecasting methodologies and data analytics platforms (de Winter, 2023). To further refine anticipatory insights, integrating AI-powered data fusion tools and anomaly detection algorithms can support real-time threat recognition and adaptive scenario planning. These capabilities should be aligned with assurance mapping to ensure gaps in data validation, risk assumptions, and system integrity are identified and mitigated.

### 7.2. Developing Comprehensive Risk Profiles

Creating detailed risk profiles for specific regions or communities is essential to understanding the particular hazards and systemic vulnerabilities they face. This entails holistic hazard assessments, factoring both natural and anthropogenic risks, and examining socio-economic dynamics that exacerbate exposure (Wilkinson et al., 2018). Local stakeholder engagement remains pivotal for contextual insights

and legitimacy in risk strategy design. Integrating AI-enabled geospatial analysis and probabilistic risk modeling can enhance the granularity and timeliness of these profiles. Embedding risk profiles into an organization's assurance map ensures that known and emerging risks are continuously monitored, cross-validated, and dynamically adjusted through real-time dashboards.

### **7.3. Implementing Impact-Based Forecasting Models**

The adoption of impact-based forecasting translates meteorological and hazard data into actionable insights on potential consequences for populations and critical infrastructure (de Winter, 2023). Operationalizing these models demands capacity building and structured protocols to ensure seamless integration into decision-making frameworks. AI-driven simulation tools can optimize these models by learning from historical intervention outcomes and adjusting for local variables. Linking these models to risk ownership lines within assurance maps enables targeted oversight and timely escalation of high-impact forecasts.

### **7.4. Establishing Clear Trigger Mechanisms**

Organizations must formalize well-calibrated trigger mechanisms tied to impact forecasts. These should articulate thresholds that activate predefined measures such as fund disbursement or rapid deployment. Flexibility remains vital to accommodate real-time data updates and forecast uncertainties (Kurdi & Ruckstuhl, 2023). AI tools, such as adaptive thresholding algorithms and Bayesian networks, can improve the sensitivity and reliability of triggers. Mapping these mechanisms onto organizational assurance frameworks provides transparency in accountability, decision rights, and operational readiness across departments.

### **7.5. Enhancing Stakeholder Coordination and Engagement**

Multi-stakeholder coordination—including governmental, non-governmental, and community-based actors—is essential for anticipatory action effectiveness. Platforms for joint planning, communication, and knowledge exchange help align anticipatory interventions with local needs and capacities (Wilkinson et al., 2018). AI-supported stakeholder analysis tools and decision support systems can help map interdependencies, track engagement, and identify coordination gaps. Integrating stakeholder roles into the assurance map strengthens systemic visibility and harmonizes distributed responsibilities across the ecosystem.

### **7.6. Creating Financial Mechanisms for Anticipatory Action**

Forecast-based financing (FbF) facilitates timely access to funds once trigger thresholds are reached, accelerating response times and amplifying the impact of preparedness measures (Coughlan de Perez et al., 2015). Humanitarian actors should advocate for FbF within donor ecosystems to ensure sustainable anticipatory funding. Incorporating AI-driven financial modeling tools can enhance the predictability and risk-based allocation of anticipatory funds. Embedding these financial mechanisms into an assurance framework allows organizations to track fiscal exposure, funding adequacy, and fiduciary accountability in alignment with forecast risks.

### **7.7. Developing Monitoring, Evaluation, and Learning (MEL) Frameworks**

Robust MEL systems are essential for assessing the effectiveness of anticipatory actions and refining predictive models. Organizations must develop performance indicators to evaluate forecast accuracy, response timeliness, and community outcomes (Kurdi & Ruckstuhl, 2023). Embedding learning loops from past interventions supports continuous improvement. AI-enabled natural language processing and pattern recognition tools can automate MEL data synthesis and generate actionable insights. By mapping MEL feedback into the assurance structure, organizations can close the loop between strategy, performance, and accountability.

### **7.8. Investing in Capacity Building and Training**

Investing in training programs for personnel and partners enhances knowledge and operationalization of anticipatory action and forecasting principles. Methods such as simulation exercises and workshops foster readiness and responsiveness (Coughlan de Perez et al., 2015). Integrating AI-based learning platforms and adaptive training modules can personalize capacity development based on role-specific

risk exposure. Linking training outcomes with assurance indicators ensures that skills and competencies are tracked, verified, and aligned with organizational risk maturity.



**Figure 7:** An AI generated example of participatory, inclusive and collaborative approaches (Developed by author using AI)

## 8. CONCLUSION

The evolution of anticipatory action frameworks—anchored in impact-based forecasting—signals a paradigm shift in humanitarian risk governance, steering the sector from reactive crisis response toward strategic foresight and preemptive resilience-building. This transformation is propelled by the convergence of predictive analytics, community engagement, and scenario-based planning, allowing for interventions that mitigate humanitarian impacts before crises reach their full disruptive potential.

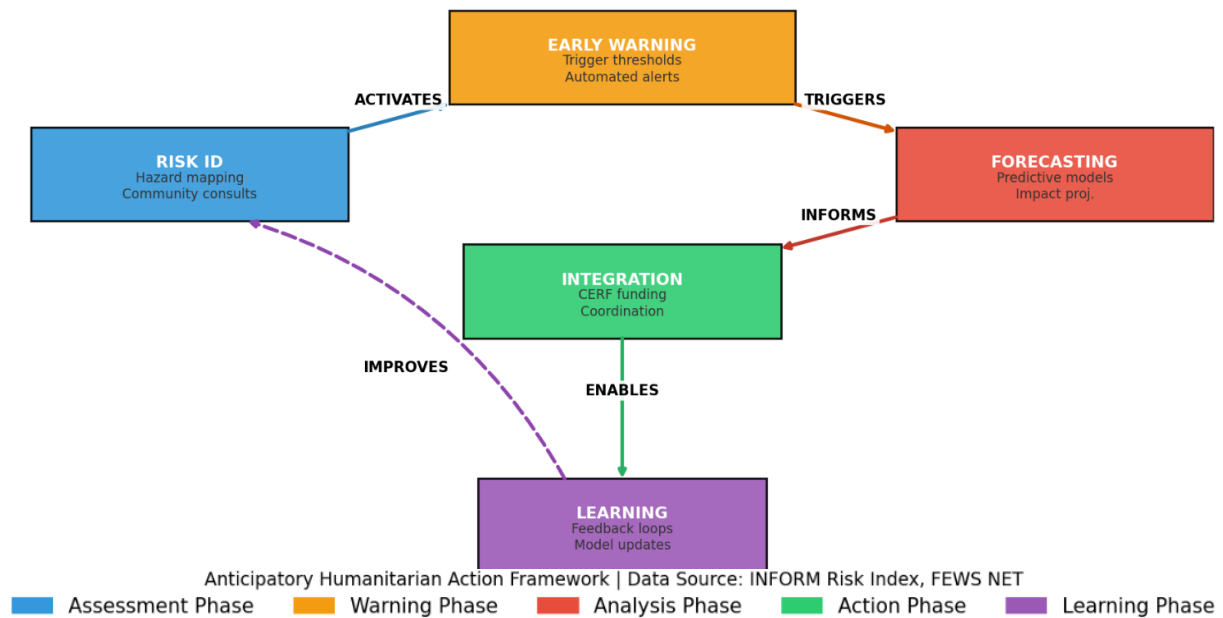
At the heart of this advancement lies the strategic use of real-time data, artificial intelligence (AI), and machine learning (ML) to forecast risk trajectories and inform timely, evidence-based decision-making. When coupled with inclusive stakeholder engagement and iterative learning cycles, these mechanisms form the foundation of a proactive, context-sensitive, and ethically responsive humanitarian ecosystem.

In Türkiye, institutions such as the Disaster and Emergency Management Authority (AFAD) and the Turkish Red Crescent (TRC) are uniquely positioned to serve as regional exemplars and system integrators in this new anticipatory landscape. AFAD, with its mandate for national disaster risk reduction and coordination, can play a central role in institutionalizing dynamic risk modeling at multiple levels of governance, fostering cross-sectoral data interoperability, and anchoring anticipatory protocols within public policy frameworks. Likewise, the Turkish Red Crescent, with its expansive community reach, auxiliary role to public authorities, and field-based expertise, can operationalize anticipatory action at the grassroots—embedding community feedback loops, contextual risk signaling, and locally customized early action plans.

Looking ahead, these institutions should jointly prioritize the co-development of AI-enabled early warning architectures, the establishment of anticipatory financing mechanisms, and the creation of regional innovation hubs for disaster foresight and simulation. Such initiatives can position Türkiye not only as a beneficiary of anticipatory systems but also as a strategic contributor to their global advancement.



Nevertheless, the implementation of these frameworks is not without challenges. The multi-dimensional nature of crises—exacerbated by misinformation, geopolitical volatility, and institutional inertia—demands that anticipatory systems be both agile and ethically grounded. Adaptive decision-making must be embedded within institutional cultures that are capable of learning in real time, absorbing feedback, and adjusting course amidst uncertainty. Transitioning from static risk registers to dynamic, feedback-driven models is no longer a mere operational upgrade—it is a strategic imperative as is simply given in the figure below.



**Figure 8:** Humanitarian risk management workflow diagram integrating anticipatory action with impact forecasting frameworks proposed by author

Moreover, the growing body of scientific evidence highlighting the high likelihood of a major earthquake in the Istanbul–Marmara region underscores the urgency of strengthening anticipatory capacities. Experts warn that such a seismic event could have catastrophic consequences for critical infrastructure, public health systems, and economic stability. In this context, anticipatory action must encompass not only conflict-driven scenarios but also the preparation for large-scale natural disasters, with contingency plans that integrate seismic risk modeling, rapid logistics deployment, and community preparedness campaigns. AFAD and TRC, in collaboration with academic institutions and municipal authorities, will play a vital role in developing scenario-based response frameworks capable of addressing this looming hazard with foresight and precision.

Crucially, the integration of advanced analytics and AI tools must align with principles of inclusivity, transparency, and human dignity. Community co-production of anticipatory strategies ensures cultural relevance, strengthens trust, and enhances the sustainability of interventions. In this regard, TRC and AFAD can jointly lead efforts to establish participatory risk governance platforms, harmonize data sharing protocols, and elevate community voices in national resilience planning. In light of rising geopolitical tensions, the prospect of a gradual military escalation involving Israel and the United States poses significant humanitarian and disaster preparedness challenges across the Middle East—particularly for Lebanon, Syria, Iraq, Iran, and Türkiye. These countries, already grappling with varying degrees of political instability, displacement, and fragile infrastructure, are likely to experience cascading effects including mass displacement, cross-border migration, food and fuel insecurity, and intensified health system burdens. Türkiye, given its geostrategic position and proximity to conflict zones, will likely serve as both a frontline responder and humanitarian corridor. This necessitates reinforced contingency planning by national agencies such as AFAD, the Turkish Red Crescent, and regional coordination mechanisms. Emergency preparedness frameworks must anticipate not only acute conflict-related surges but also secondary risks—such as cyber disruptions, disinformation campaigns,

critical infrastructure sabotage, and economic destabilization. In Lebanon and Syria, where governance fragmentation and economic decline already limit emergency response capacity, anticipatory systems must integrate conflict-sensitive approaches, localized early warning, and pre-positioned aid mechanisms. In Iraq and Iran, preparedness must include multi-scenario risk modeling that accounts for internal political fault lines, regional alliances, and the likelihood of simultaneous natural and man-made disasters. Across all these contexts, the development of regional anticipatory coordination platforms—supported by predictive analytics, diplomatic foresight, and transboundary risk-sharing protocols—will be critical in ensuring a calibrated, scalable, and principled response to a deteriorating regional security environment. The humanitarian sector must not only prepare for imminent threats but also invest in adaptive capacity-building and cross-border resilience architecture capable of weathering prolonged instability.

To ensure institutional coherence and accountability, the integration of anticipatory action systems must be aligned with internationally recognized risk management standards, particularly ISO 31000 and the COSO Enterprise Risk Management (ERM) Framework. These frameworks provide robust, principle-based structures for identifying, assessing, and responding to risks in a systematic and organization-wide manner. Embedding anticipatory action within these frameworks enables organizations to treat emerging humanitarian threats not merely as operational disruptions but as strategic risks that demand foresight, preparedness, and coordinated response. Under ISO 31000, anticipatory mechanisms can be categorized as proactive risk treatments, emphasizing risk avoidance or mitigation before impact materializes. Within the COSO ERM structure, anticipatory action directly contributes to several core components, including risk identification, event response, information and communication, and strategic alignment. It reinforces the emphasis on risk culture, organizational agility, and value preservation in the face of volatility. Moreover, by linking early warning triggers and decision-support tools with risk registers and key risk indicators (KRIs), institutions like AFAD and the Turkish Red Crescent can ensure that anticipatory efforts are not siloed, but are instead embedded across governance, strategy, operations, and compliance functions. This convergence fosters a harmonized, transparent, and forward-looking risk architecture—one that is not only reactive to today's hazards but resilient and adaptive to tomorrow's uncertainties.

In sum, anticipatory action represents not only a methodological shift but also a transformative opportunity to empower societies to confront uncertainty with preparedness, dignity, and foresight. By embedding intelligent forecasting within agile risk management ecosystems, humanitarian actors can transcend legacy constraints and co-create a future-ready model of humanitarian governance—one that is predictive, participatory, and principled.

Future research should deepen inquiry into the integration of AI-driven tools and dynamic risk analytics into national anticipatory systems, particularly in complex, data-scarce, and politically sensitive contexts. Attention must also be given to the evolving role of institutions like AFAD and TRC in fostering regional leadership, combating disinformation, and embedding anticipatory action within national adaptation, development, and emergency response strategies.

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