# From Food Crisis to Resource Allocation

## :Tracking Humanitarian Aid in Afghanistan

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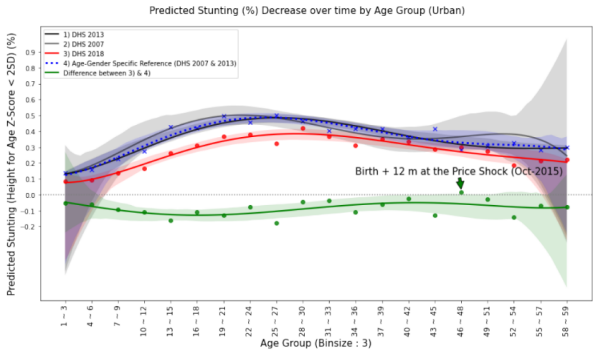
# About Me

- **Korean NGO Staff, Tanzania (2015–2017)**: Managed climate resilience projects (e.g., ag & livestock value chain) in the rural *Kilosa District*
- **Ph.D. Candidate, Agricultural and Consumer Economics (2019–Present)**: Focused on *food security, nutrition, and humanitarian aid* across various countries
- **Experience with UN Agencies**: Collaborated with UN FAO, IFAD, and IFPRI on food security initiatives
  - **Data Scientist, UN FAO (*Integrated Food Security Phase Classification* Unit)**: Enhancing the IPC's early warning function through advanced modeling

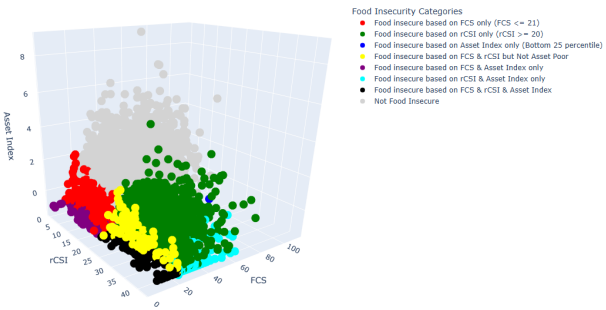
# Global Food Security

## Drivers, Measurements, Humanitarian Response

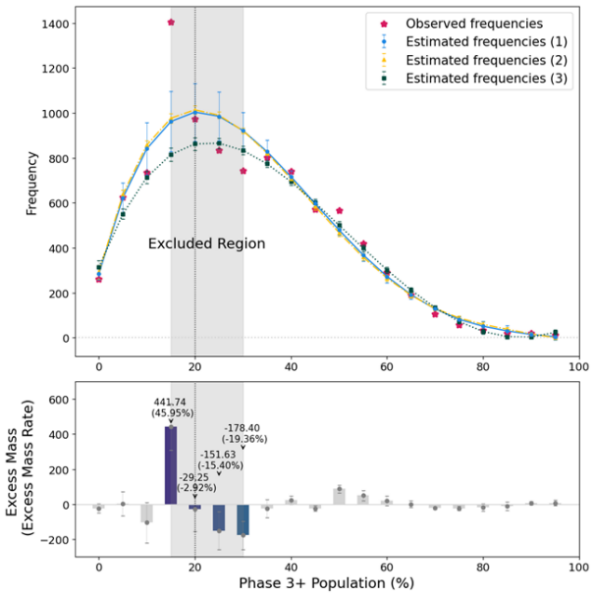
### Early-Year Milk Price & Child Stunting



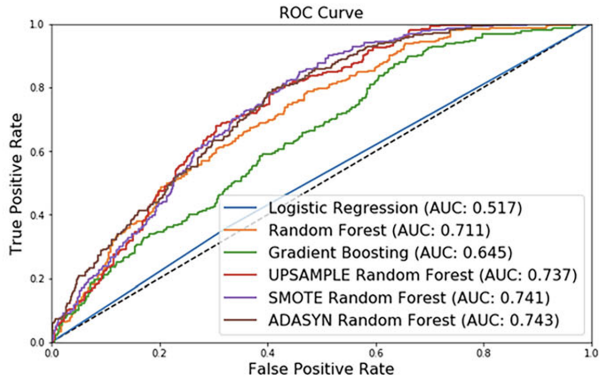

### Multidimensional Food Insecurity (FI)



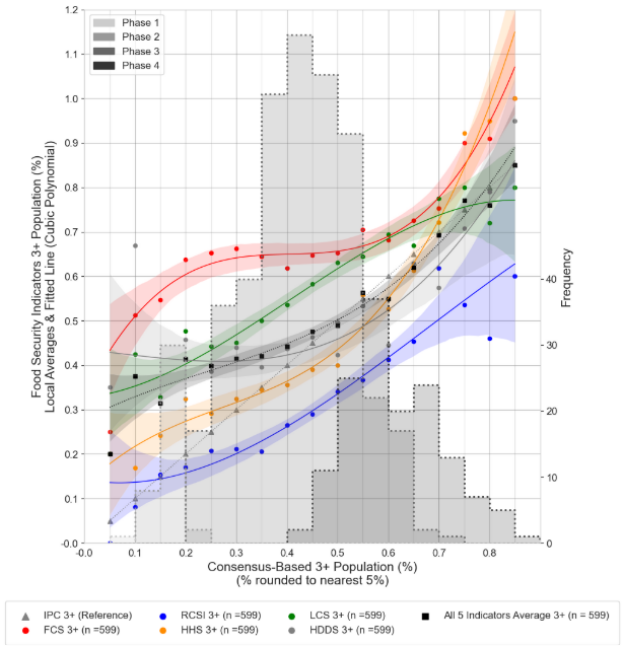

### Underestimation of Acutely Hungry




### Targeting FI using ML

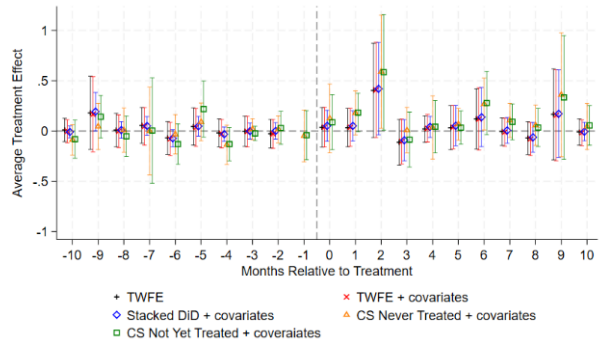



### Inconsistency in Food Security Metrics



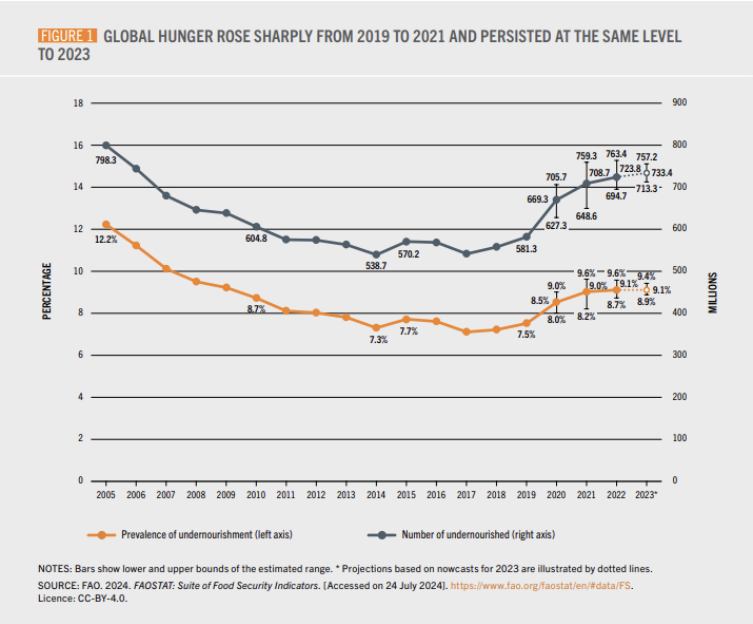

### Humanitarian Response to Food Crisis

Does humanitarian aid meet urgent needs?



# Hunger: A Persistent Global Challenge

- **735 million people suffer from undernutrition**, and *250 million are experiencing acute food insecurity*, a number that is expected to rise (FAO et al., 2024).
- **Timely intervention is crucial**, as hunger leads to long-term consequences for health, income, and security (Ruel et al., 2008; Hoddinott et al., 2008; Lowcock, 2018).
- Humanitarian aid, primarily focused on addressing food insecurity issues, is coordinated by international stakeholders (e.g., USAID, European Union, UN Agencies) and guided by the **Integrated Food Security Phase Classification (IPC)** system.



# What is IPC?

- IPC is a standardized framework for classifying regional food insecurity severity in 30+ countries.
- IPC classifies populations into 5 food insecurity levels ("phases"). IPC Framework
- Technical Working Groups (TWGs) use a **'convergence of evidence'** process to evaluate data for classifications.
- Designed to guide humanitarian aid allocation (**$6 billion annually and globally** (FAO, 2023)).
- The effectiveness of IPC in driving aid is **under-explored due to data restrictions** (e.g. no in-country aid flow data) (Maxwell et al., 2023).

# I ask

- How effectively is humanitarian aid allocated across ***time*** and ***space*** to address acute hunger identified by IPC?
- ***Is the aid sufficient*** to meet the severity of the crisis?

# Why does it matter?

- **Efficient aid allocation maximizes resource impact**, reduces inefficiencies, and ensures optimal use to address critical needs.
- **Timely, sufficient aid saves lives**, mitigates suffering, and identifies obstacles to **improve future responses.**
- **Previous Findings:**
  1. Somalia's 2011 IPC famine declaration boosted aid; South Sudan's 2017 declaration saw modest gains (Maxwell et al., 2023)
  2. Concerns remain about the adequacy of aid flows during critical food crises (Alesina & Dollar, 2000; Kuhlgatz et al., 2010)
  3. More disaggregated aid data is needed(Koppenberg et al., 2023)

# What I Do & What I Find

- **Data Contribution:**
  - Construct **a novel subnational-level aid flow dataset tracking humanitarian funding**
- **Empirical Approach:**
  - Apply **staggered Difference in Difference to estimate the impact** of acute food crisis on humanitarian aid
  - Test alternative drivers of aid allocation (e.g., conflict, drought, price shocks)
- **Key Findings:**
  - **Aid increases** after IPC transitions to *Phase 4: Food Emergency* in Afghanistan.
  - However, **it remains insufficient** to meet the level of food insecurity.

# Food Insecurity in Afghanistan

- **Food Crisis in Afghanistan:**
  - One of the IPC priority countries, with food insecurity remaining a major concern
  - 15.8 million people are projected to face crisis-level food insecurity through March 2024 (IPC, 2023)
  - IPC has been in place in Afghanistan since 2017, with regular updates and a consistent level of data aggregation.
  - **Key drivers**: *Conflicts, Food Inflation Shocks, and Drought* (D'Souza & Jolliffe, 2013)

# Research Question

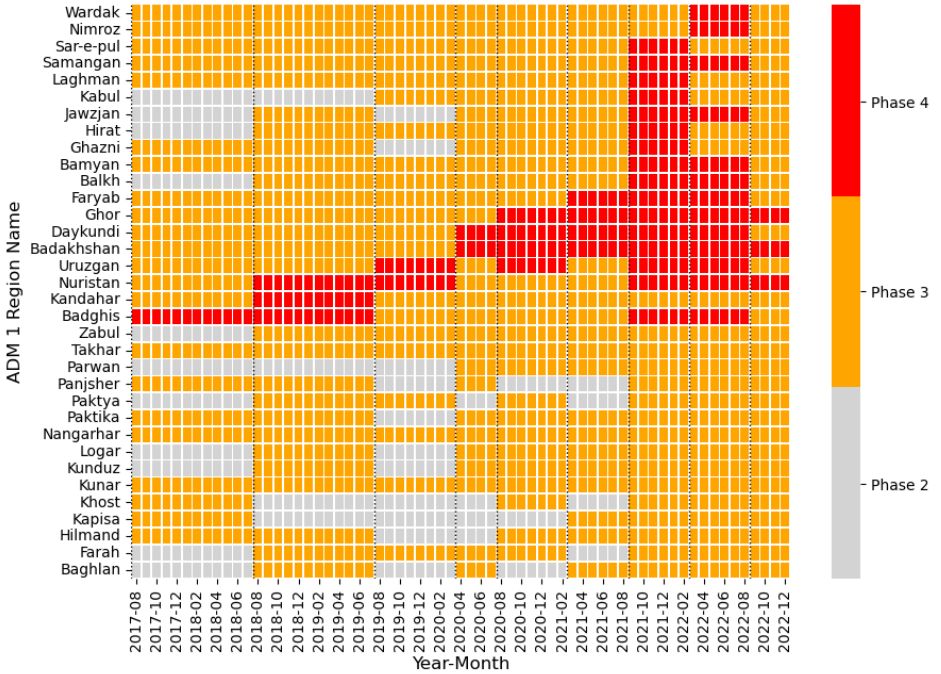
- How effectively is humanitarian aid allocated across ***time*** and ***space*** to address acute hunger identified by IPC in Afghanistan?
- ***Is the aid sufficient*** to meet the severity of the crisis?

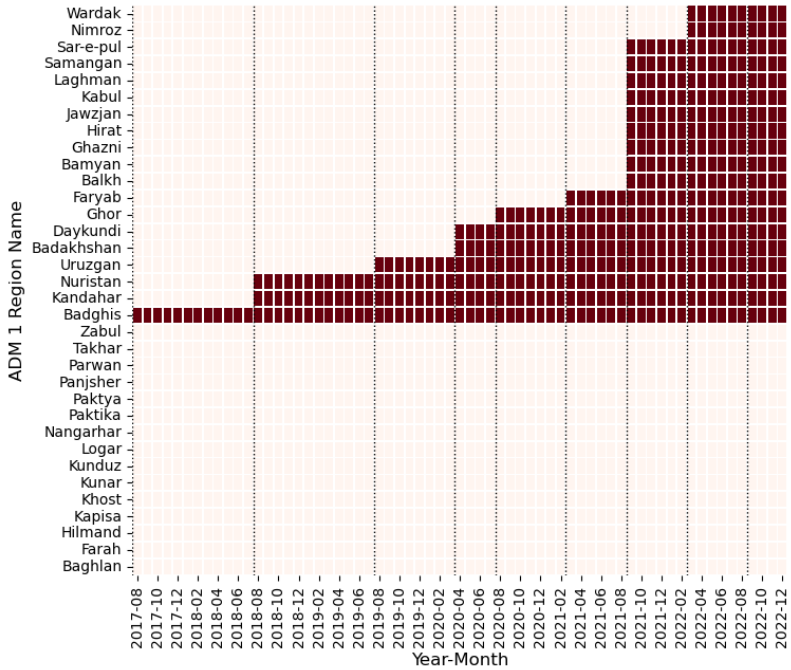
# Why is it hard to answer?

| | Challenges | Approaches |
|---|---|---|
| **Data** | **No** comprehensive database tracking **in-country aid flows** | Implement a **text-finder algorithm** for **geo-coding aid flow data** |
| | **Missing keywords** to classify aid transactions. | **Use NLP** to extract and **classify missing keywords** (e.g., "Food Security", "Health") |
| **Identification** | **Heterogeneous timing** of food crises | Apply **staggered DiD to estimate the impact** of the first acute food crisis on humanitarian aid |
| | **Endogeneity from shared drivers** of IPC and aid distribution | Test alternative drivers of aid allocation (e.g., conflict, drought, price shocks) |

# Acute Food Insecurity (AFI) of IPC

- Biannual and regional AFI classifications (2017–2022) and event definitions.
  - High prevalence of **Phase 3** ⇒ Focus on **Phase 4**[1]
  - Complexity of transitions ⇒ Focus on **first incidence** only




[1]IPC Phase 4 indicates that at least 20% of households face life-threatening food shortages, leading to high mortality risk.

# UN-OCHA Financial Tracking Service (FTS)

- FTS is a centralized repository of global humanitarian funding flows, offering near real-time data by country.
- **Key Features:** timestamp (year-month), keywords (e.g., food security, health, protection), source and destination (country level), description (details of aid transactions), amount (USD), and funding status (e.g., commitment vs. paid, or new fund vs. existing budget)
- **Challenges:**
  - **Data is not geo-coded** to the IPC aggregation level (34 ADM 1 units)
  - Missing categorization of aid keywords (27% of entries lack this information) Keywords Distribution

# Georeferencing FTS - Humanitarian Aid Data

- Use a semi-automated **text-finder** algorithm that identifies ADM1 destinations in aid descriptions (e.g., *'Sar-e-pul'* for *'Saripol'*)
- It distinguishes similar names (*'Paktika'* vs. *'Paktya'*) and handles multiple ADM1s by distributing funds evenly or weighting them based on IPC severity.

**Case 1:** *"Emergency food assistance in **Badakhshan** Province facing crisis-level food insecurity."*

- \$1,000,000 ⇒ Badakhshan: \$1,000,000.

**Case 2:** *"Integrated Nutrition and WASH Drought Response in **Bamyan** and **Daikundi** Provinces."*

- \$1,000,000 ⇒ Bamyan: \$500,000 / Daikundi: \$500,000.

# Purpose-Label Data Using NLP Model

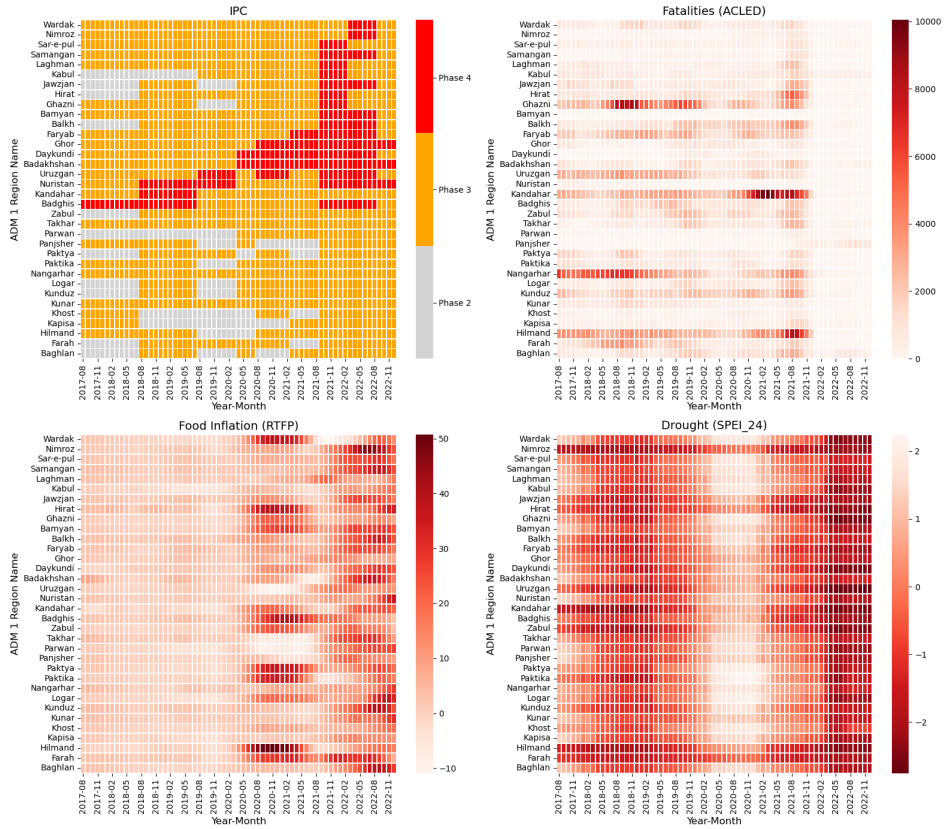
- I develop a **Natural Language Processing (NLP) model** using a **Multinomial Naive Bayes algorithm**, trained on a global dataset of categorized aid records ($n = 42,024$). The model predicts missing keywords based on tokenized descriptions. Model Pipeline Model Performance

*"Emergency food assistance for acutely vulnerable people in Badakhshan Province facing crisis-level **food insecurity**."*

- If no keyword is identified: $\Rightarrow$ **Food Security**

# Other Data Sources

- Conflict (e.g., Armed Conflict Location & Event Data Project(ACLED)).
- Price (e.g., World Bank Real-Time Food Prices (RTFP)).
- Drought (e.g., Standardized Precipitation Evapotranspiration Index (SPEI)).



# Identification

- **Approach:**
  - Utilize a **staggered Difference-in-Differences** (Callaway and Sant'Anna, 2021) to estimate the causal effect of Phase 4 (Food Emergency) transitions on humanitarian aid allocation.
  - Focus on **short-term (first three months)** aid responses following **initial Phase 4 transitions** to capture immediate impacts and minimize confounding from subsequent phase changes.
  - Apply an flexible *Event Study* to test the parallel trends assumption.
- **Model Specification:**

$$\text{Humanitarian Aid}_{it} = \alpha + \beta \cdot \mathbb{1}[\text{Phase 4}]_{it} + X_{it}'\gamma + \lambda_i + \delta_t + \epsilon_{it}$$

  - $\text{Humanitarian Aid}_{it}$: Humanitarian aid (USD) allocated to region $i$ at time $t$.
  - $\mathbb{1}[\text{Phase 4}]_{it}$: Binary indicator for the initial transition into Phase 4, remaining 1 thereafter.
  - $X_{it}$: Covariates (conflict intensity, drought severity, food price inflation).
  - $\lambda_i$: ADM 1 Region-specific fixed effects.
  - $\delta_t$: Year-month fixed effects.

# Aid increases, but only temporarily

- Humanitarian aid surges after Phase 4 escalation, peaking in the *second month* (0.539–0.731 million USD), indicating a temporary response.
- Over the first three months, average aid totals *0.819–1.107 million USD* per region, emphasizing the focus on immediate relief for regions in crisis.

Figure 10: **Event Study Results (Total Humanitarian Aid $)**

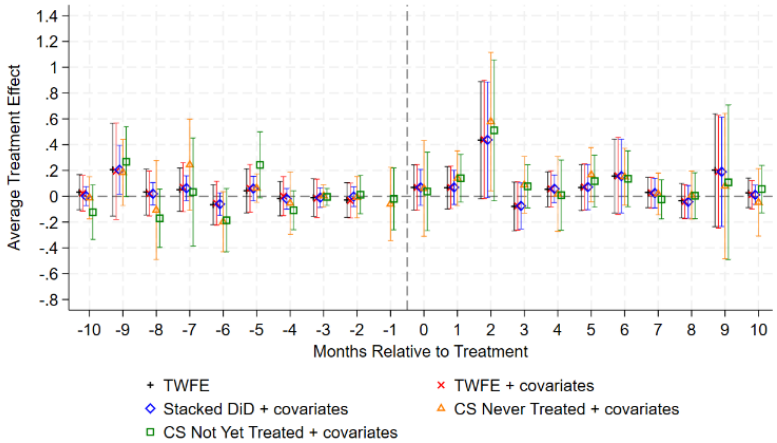



Table 5: Total Humanitarian Aid (Million USD)

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| ***Dynamic Effect*** | | | | |
| Treated X 𝟙 (0 month) | 0.183 | 0.068 | 0.122 | 0.088 |
| | (0.176) | (0.176) | (0.136) | (0.140) |
| Treated X 𝟙 (1 month) | 0.168 | 0.308* | 0.159 | 0.183* |
| | (0.108) | (0.108) | (0.106) | (0.097) |
| Treated X 𝟙 (2 month) | 0.552* | 0.731** | 0.539* | 0.585** |
| | (0.290) | (0.290) | (0.292) | (0.294) |
| Treated X 𝟙 (3 month) | 0.010 | -0.051 | -0.011 | -0.085 |
| | (0.101) | (0.101) | (0.101) | (0.139) |
| Treated X 𝟙 (4 month) | 0.113 | 0.080 | 0.105 | 0.042 |
| | (0.094) | (0.094) | (0.088) | (0.133) |
| ***Average Immediate Effect*** | | | | |
| Treated X 𝟙 (0-2 month) | 0.301** | 0.369** | 0.273** | 0.285** |
| | (0.144) | (0.151) | (0.137) | (0.138) |
| Observations | 2448 | 2448 | 2448 | 2448 |
| Number of Distinct ADM1 Units | 34 | 34 | 34 | 34 |
| ADM1 Unit FE | Yes | Yes | Yes | Yes |
| Year-Month FE | Yes | Yes | Yes | Yes |
| Covariates (Conflict, Food Inflation, Drought) | No | Yes | No | Yes |
| Comparison Group | Never-Treated | Never-Treated | Not-Yet-Treated | Not-Yet-Treated |

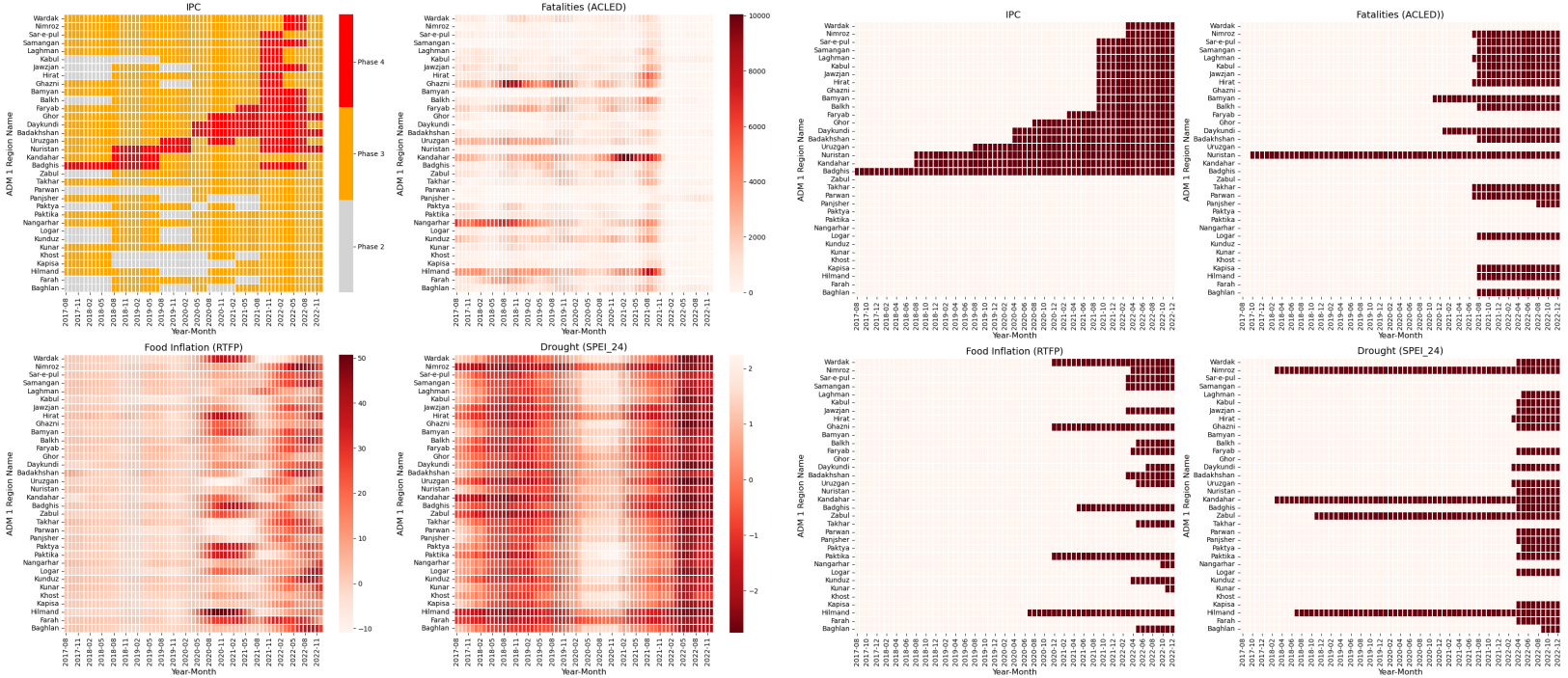
# Calculating the Need Gap

- Pre-escalation: Per capita aid for food-insecure populations was less than 20 USD, distributed across Phase 3+ populations (people in urgent need by IPC).
- Post-escalation: Aid increased by 0.82–1.11 million USD per unit over three months, with IPC Phase 4 populations rising from 79,425 to 186,661 per region (an additional 107,236 individuals).
- Per capita aid for new Phase 4 entrants: 7.64–10.32 USD over three months (2.55–3.44 USD/month), remaining below the estimated **minimum monthly food cost** of 98 USD/person[2].
- Finding: Aid remains insufficient to meet Phase 4 emergency needs, highlighting a significant gap.

[2] Source: Numbeo (2024).

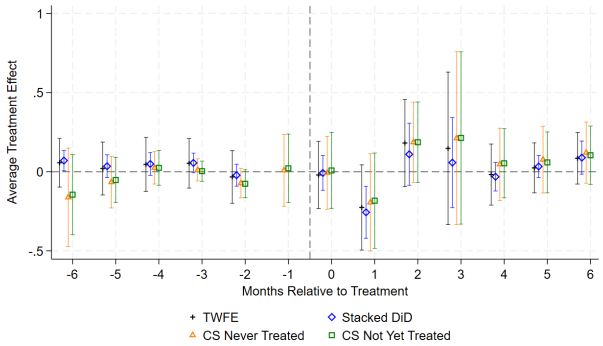
# Ruling out Alternative Mechanisms

- Testing if Aid allocation is based on alternative factors (e.g. political, economic, and weather shock)

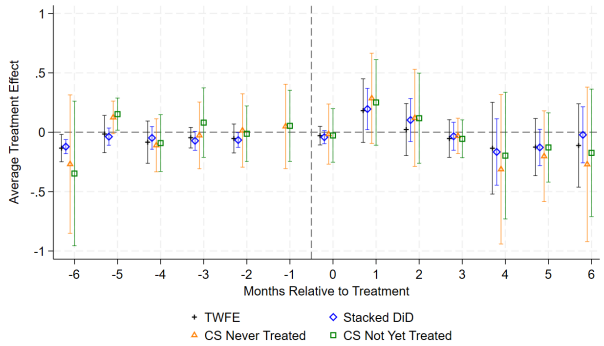


# Ruling out Alternative Mechanisms

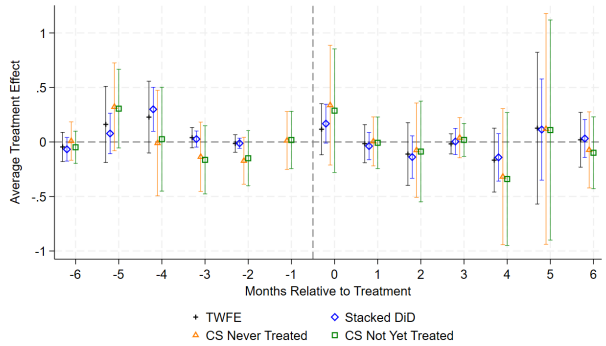
- Aid response is not necessarily triggered by a single indicator-based extreme event.




Conflict



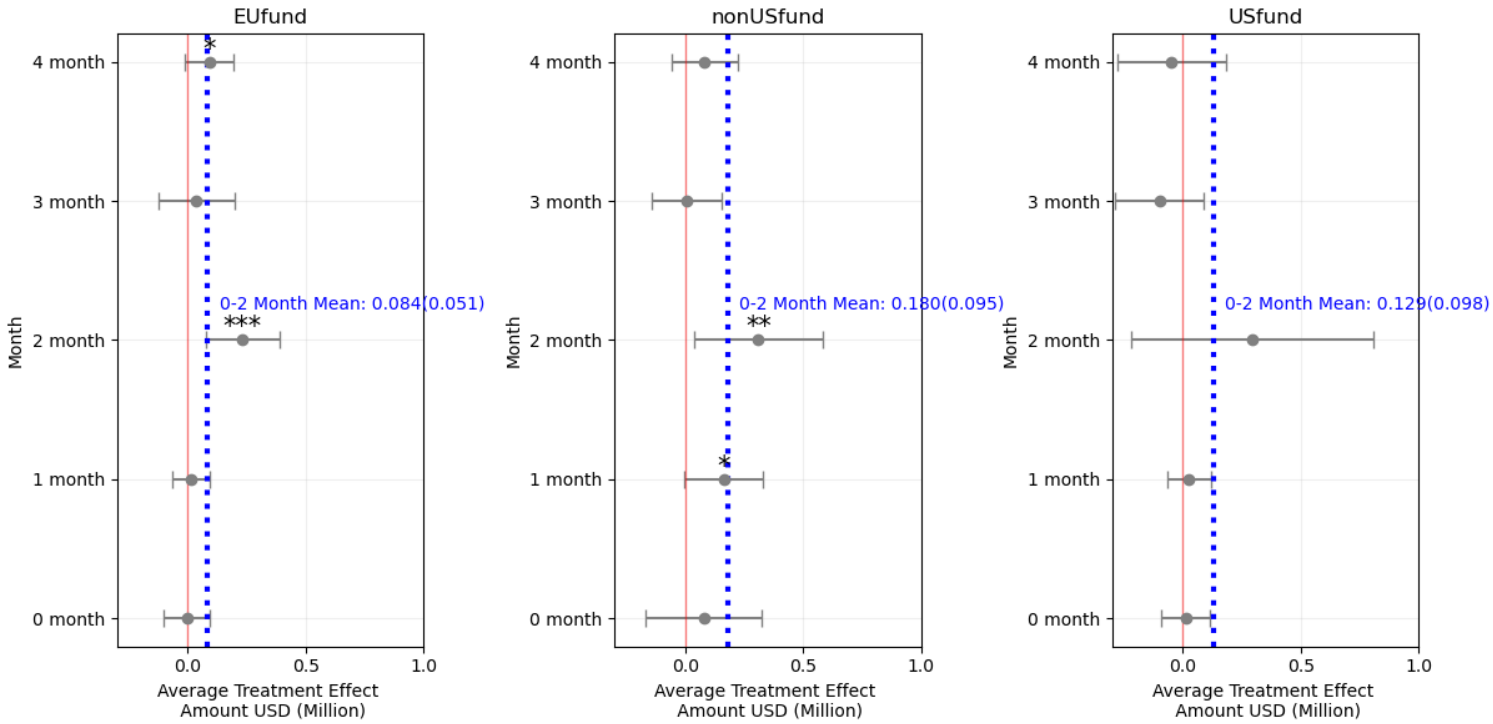

Food Inflation




Drought

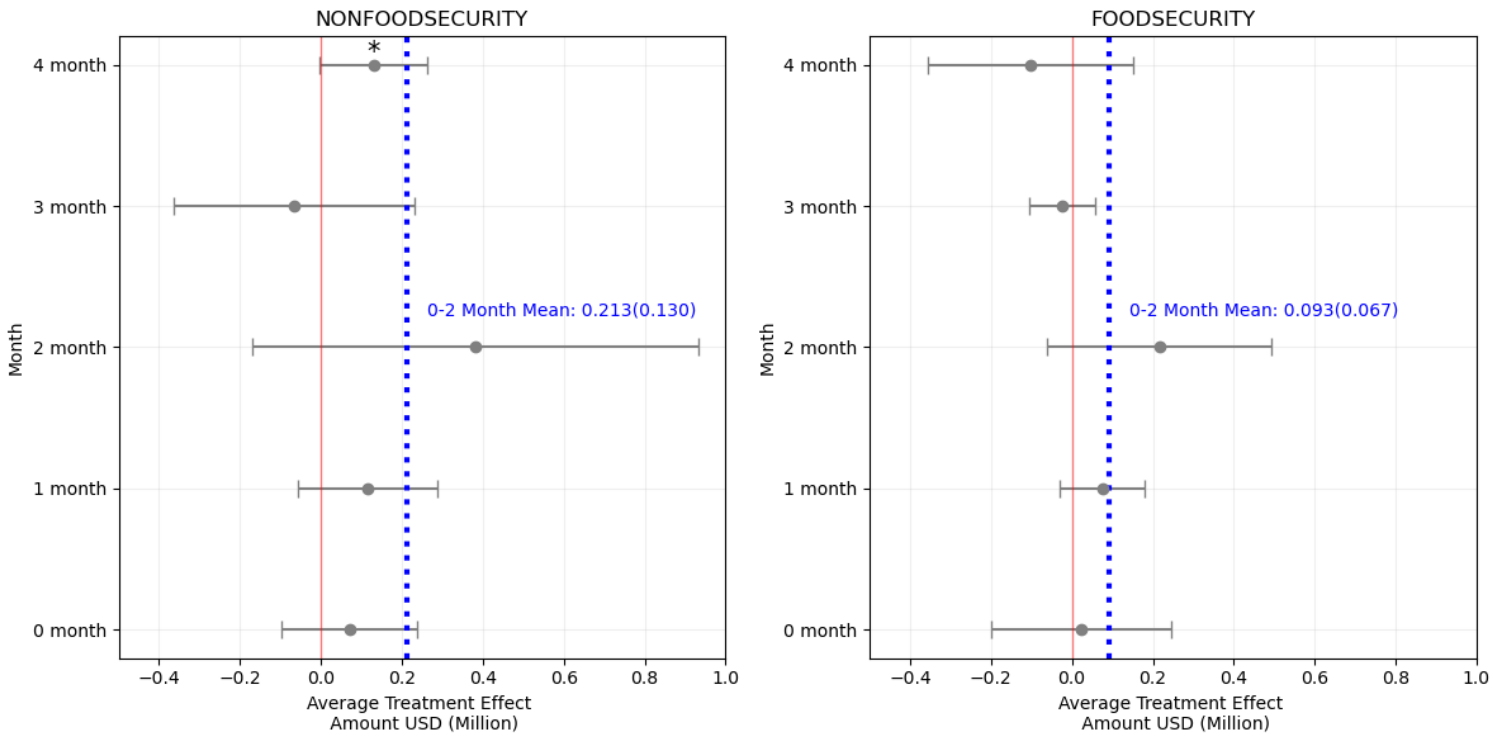
# Aid Allocation by Funding Source

- **EU & Non-US Aid:** Demonstrates an immediate response during the crisis phase.
- **US Aid:** Positive but statistically insignificant effects, potentially relying on alternative systems like FEWS.



# Aid Allocation by Purpose

- Disaggregation by purpose shows no significant effects, suggesting overall aid responds to Phase 4 escalation, and initial funding purposes may shift over time.



# Other Findings

- **Fund Types:** “Disbursed" funds are mobilized more effectively compared to “Committed" funds.
- **Allocation Type:** “Newly allocated funds" demonstrate slightly larger immediate effects than “existing budgets", although existing budgets contribute the majority of total aid quantities.
- **Before and after Taliban Offensive:** Aid responsiveness is higher “post-Taliban offensive (May, 2021)" than pre-offensive periods.

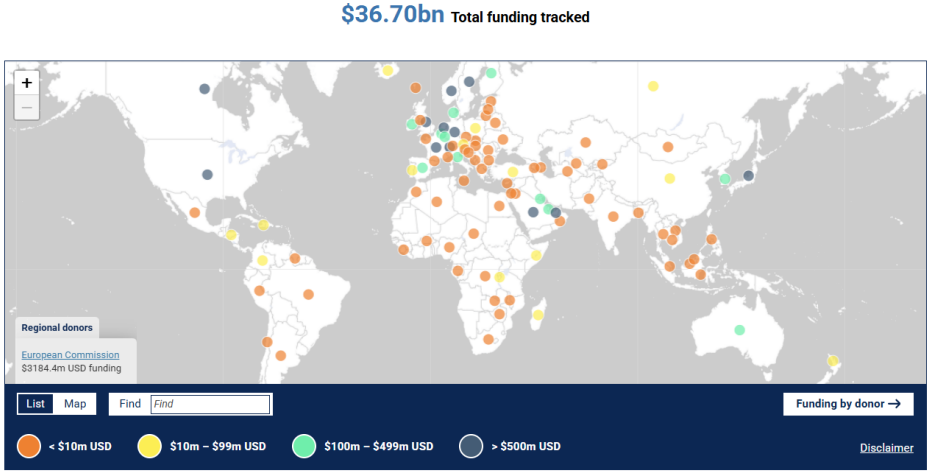
# Conclusion

- IPC (e.g., Phase 4 Food Emergency) triggers aid, but gaps remain in aid adequacy.
- Donor behavior varies, with non-US & EU aid being more responsive to Phase 4 escalations.

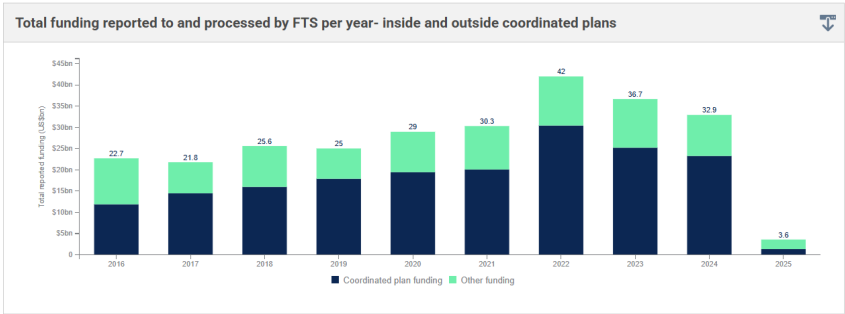
***Again, Phase 4 represents life-threatening food shortages and rising death rates, closer to famine.***

# Mapping Global Humanitarian Aid Flows

- Develop a global, monthly dataset of sub-national aid flows using UNOCHA's Financial Tracking Service (FTS).
- Apply text analysis and NLP to geo-reference and label aid data by purpose.




Total Funding tracked by FTS in 2023




FTS Tracks Aid Since 1985

# Potential Use Cases of the Aid Dataset

- **Evaluating Aid Allocation Mechanisms:** Incorporate data from IPC, IPC-compatible systems (e.g., FEWS NET), WFP Hunger Map (e.g., FCS, rCSI), and other sources.
  Explore IPC & Aid at Country Level
- **Enhancing Targeting Accuracy:** Integrate aid flow information into nowcasting/forecasting food insecurity models, addressing gaps highlighted in previous studies (e.g., Zhou et al., 2021).

# Thank You

## Thank You!

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**Access the Full Paper:**

# IPC Framework

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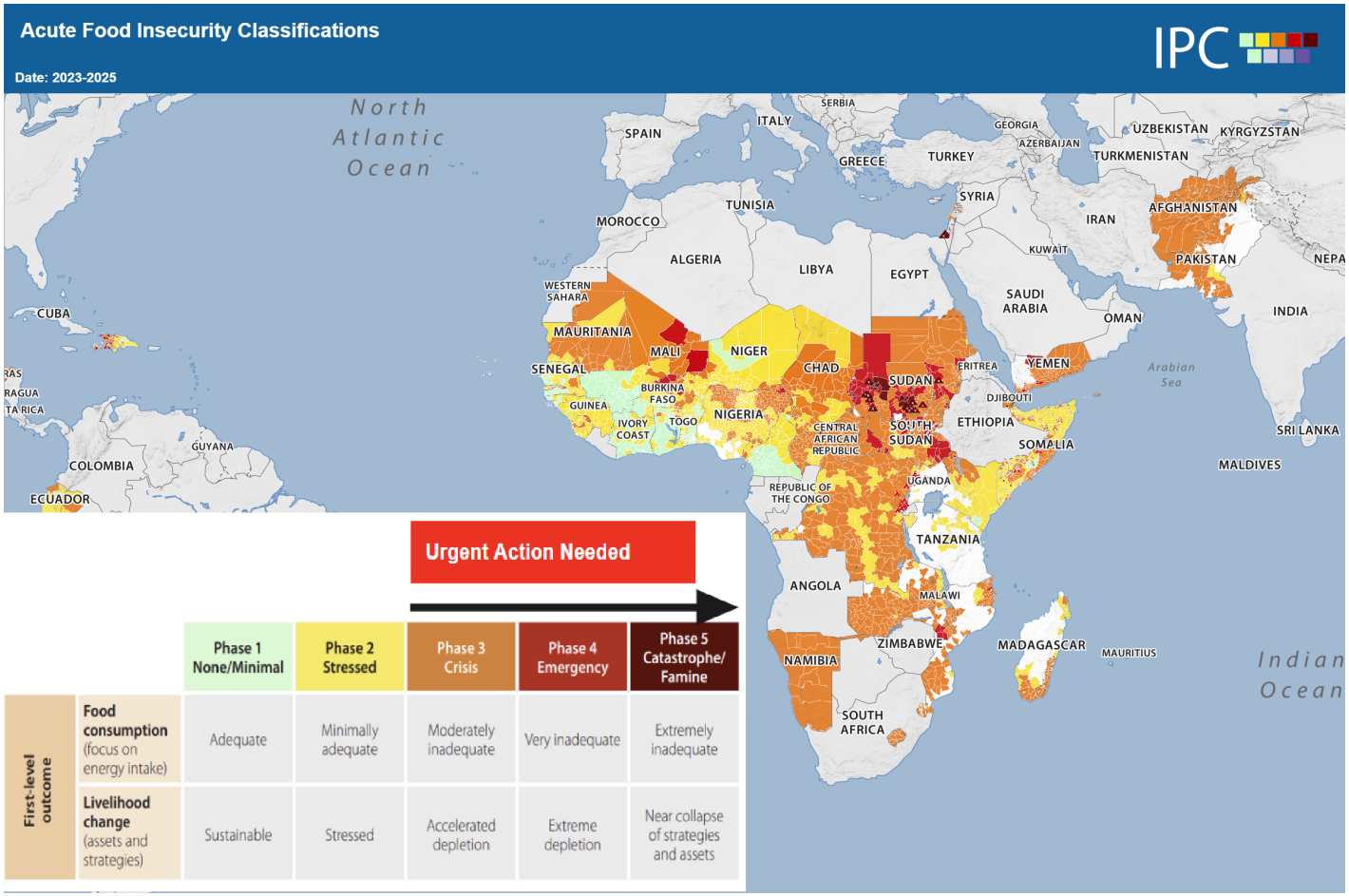


Figure: An illustration of the IPC framework

# Aid Trend in Afghanistan

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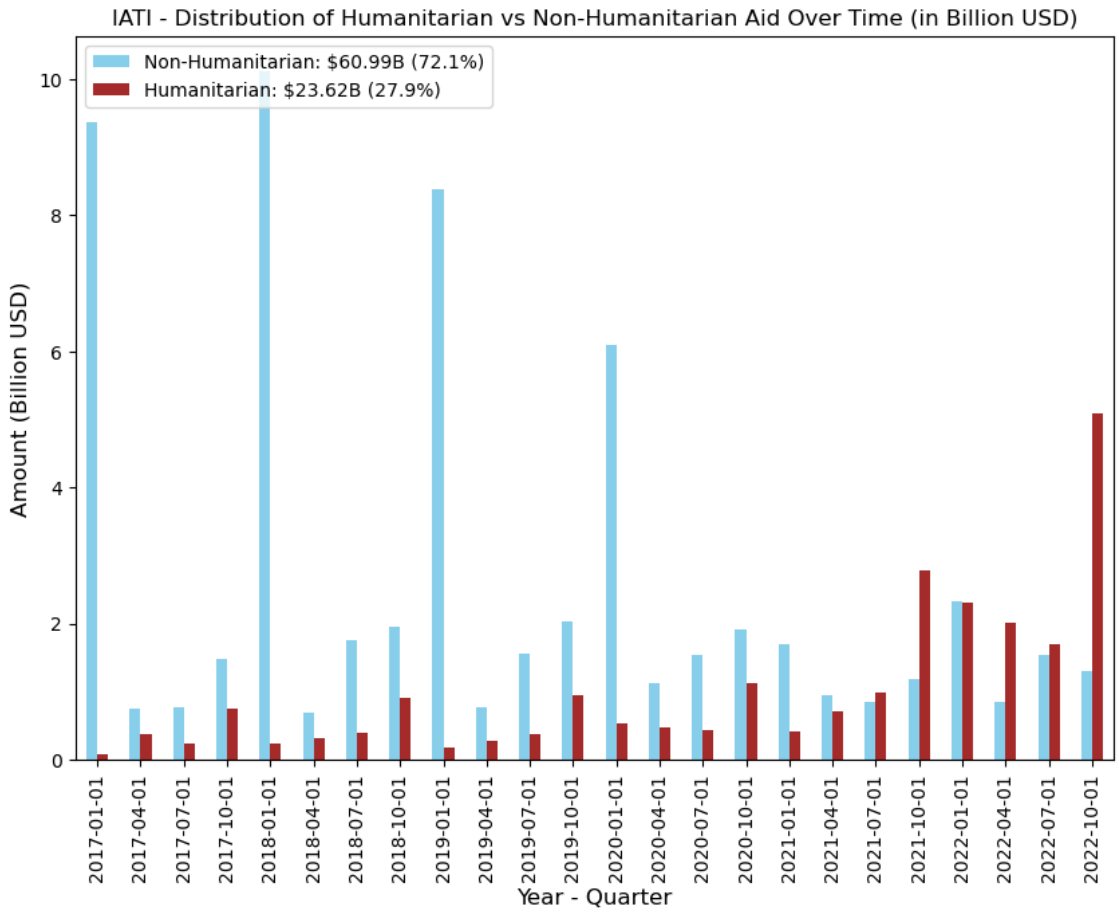


Figure: Aid Trend in Afghasnitan

# Comparison: International Aid vs. Humanitarian Aid

| Aspect | International Aid | Humanitarian Aid |
|---|---|---|
| **Scope** | Broad, including development and emergency support | Focused on emergency relief and crisis situations |
| **Objective** | Economic growth, social welfare, development | Immediate life-saving assistance during crises |
| **Duration** | Long-term, sustainable development | Short-term, urgent response |
| **Focus Areas** | Infrastructure, education, healthcare, poverty reduction | Basic needs: food, water, shelter, medical care |
| **Examples** | Development programs, technical assistance | Aid for natural disasters, conflict zones, famine |

# UN-OCHA FTS keywords

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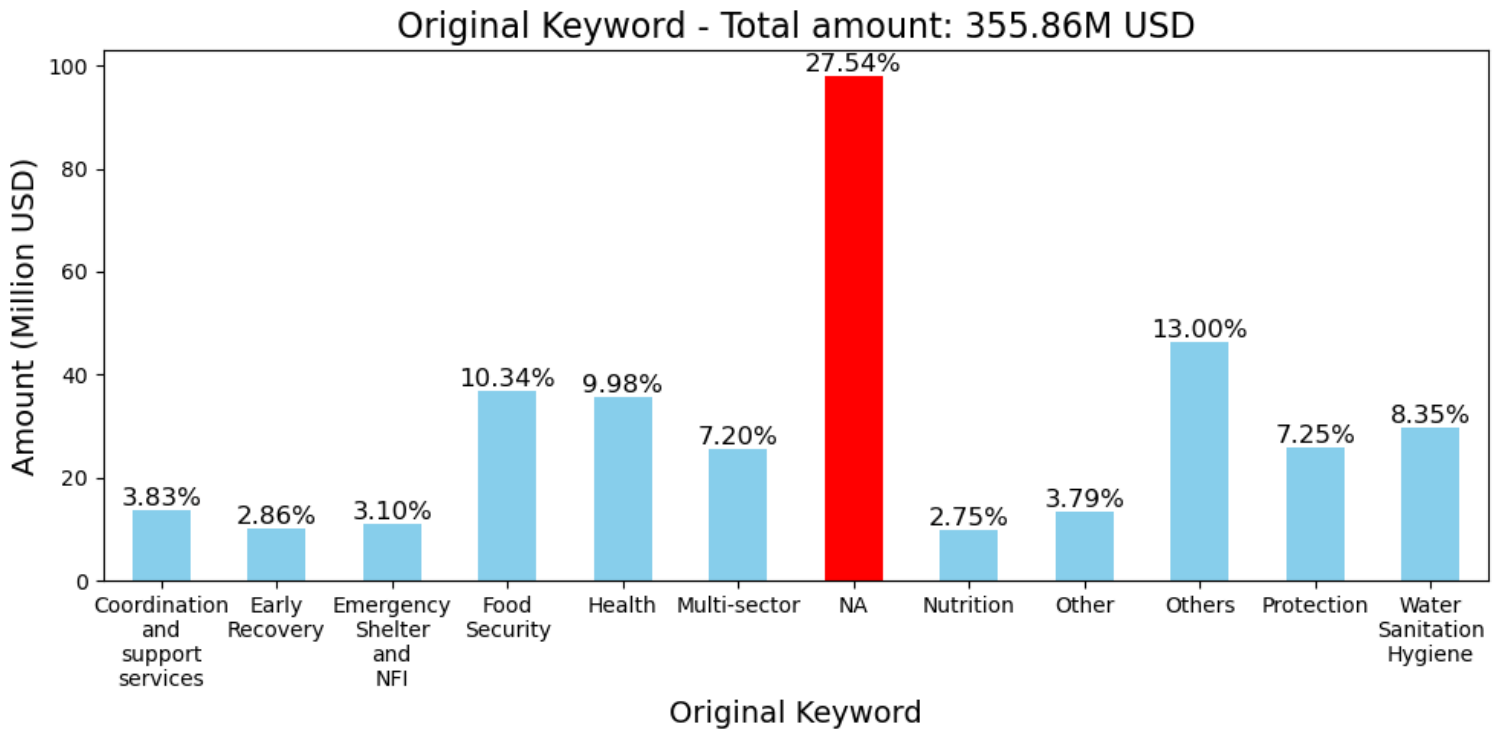


Figure: Humanitarian Aid Distribution by Original Keyword (n = 3017)

# NLP Model Workflow for Multi-Class Keyword Prediction

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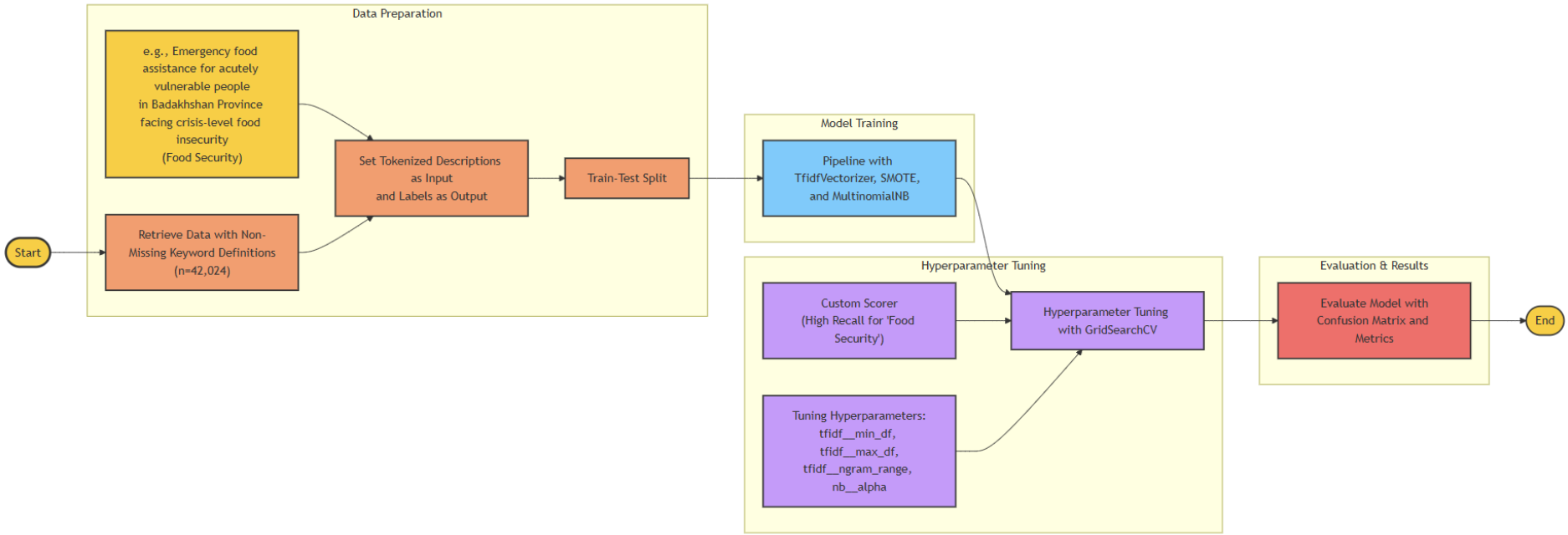


Figure: NLP Model Work Flow

# NLP Model Performance

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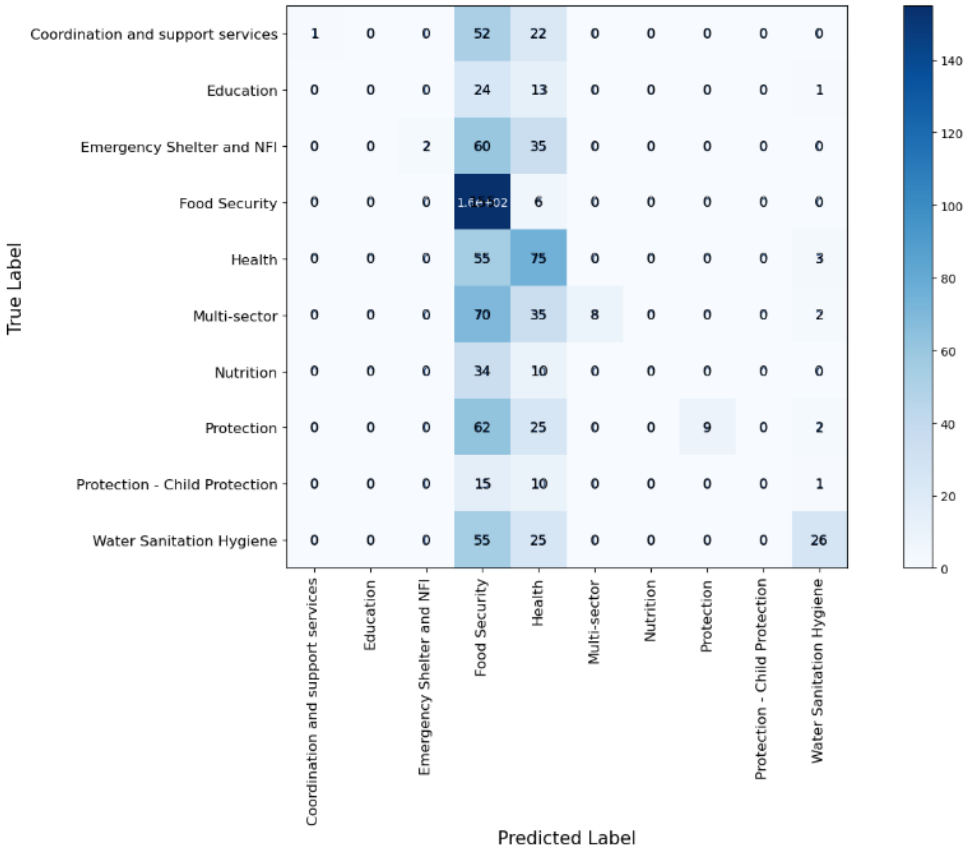


Confusion Matrix

Table 9: **Results of NLP-Based Keyword Predictions**

| Category | Precision | Recall | F1-Score | Support |
|---|---|---|---|---|
| Agriculture | 0.00 | 0.00 | 0.00 | 9 |
| COVID-19 | 0.00 | 0.00 | 0.00 | 6 |
| Camp Coordination / Management | 0.00 | 0.00 | 0.00 | 8 |
| Coordination and Support Services | 0.33 | 0.05 | 0.09 | 75 |
| Early Recovery | 0.00 | 0.00 | 0.00 | 50 |
| Education | 0.00 | 0.00 | 0.00 | 38 |
| Emergency Shelter and NFI | 1.00 | 0.03 | 0.06 | 97 |
| Emergency Telecommunications | 0.00 | 0.00 | 0.00 | 1 |
| Food Security | 0.14 | 0.96 | 0.25 | 161 |
| Health | 0.19 | 0.35 | 0.24 | 133 |
| Logistics | 0.00 | 0.00 | 0.00 | 26 |
| Multi-Sector | 0.33 | 0.05 | 0.09 | 115 |
| NA | 0.00 | 0.00 | 0.00 | 321 |
| Nutrition | 0.00 | 0.00 | 0.00 | 44 |
| Other | 0.00 | 0.00 | 0.00 | 33 |
| Protection | 0.89 | 0.08 | 0.15 | 98 |
| Protection - Child Protection | 0.00 | 0.00 | 0.00 | 26 |
| Protection - Gender-Based Violence | 0.00 | 0.00 | 0.00 | 26 |
| Protection - Housing, Land and Property | 0.00 | 0.00 | 0.00 | 1 |
| Protection - Human Trafficking & Smuggling | 0.00 | 0.00 | 0.00 | 1 |
| Protection - Mine Action | 0.00 | 0.00 | 0.00 | 24 |
| Water Sanitation Hygiene | 0.42 | 0.09 | 0.15 | 106 |

Model Evaluation Results

# IPC and Humanitarian Aid in Other Priority Countries

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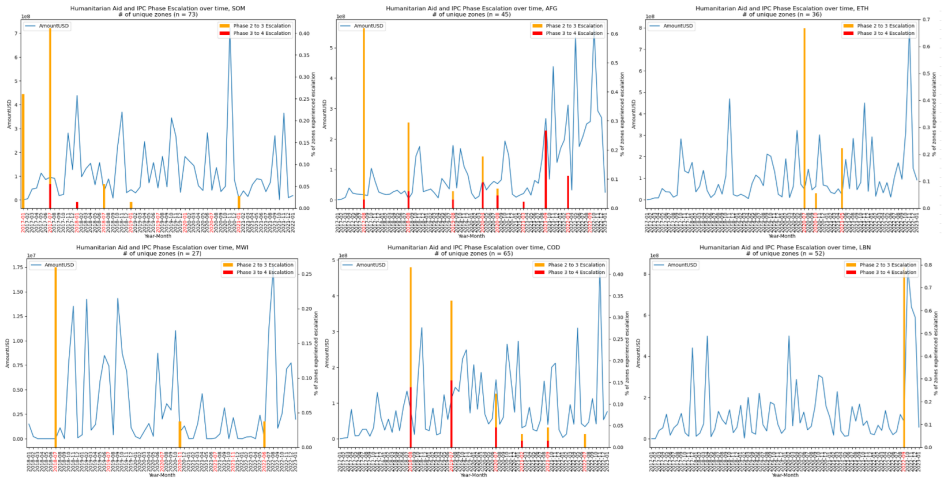
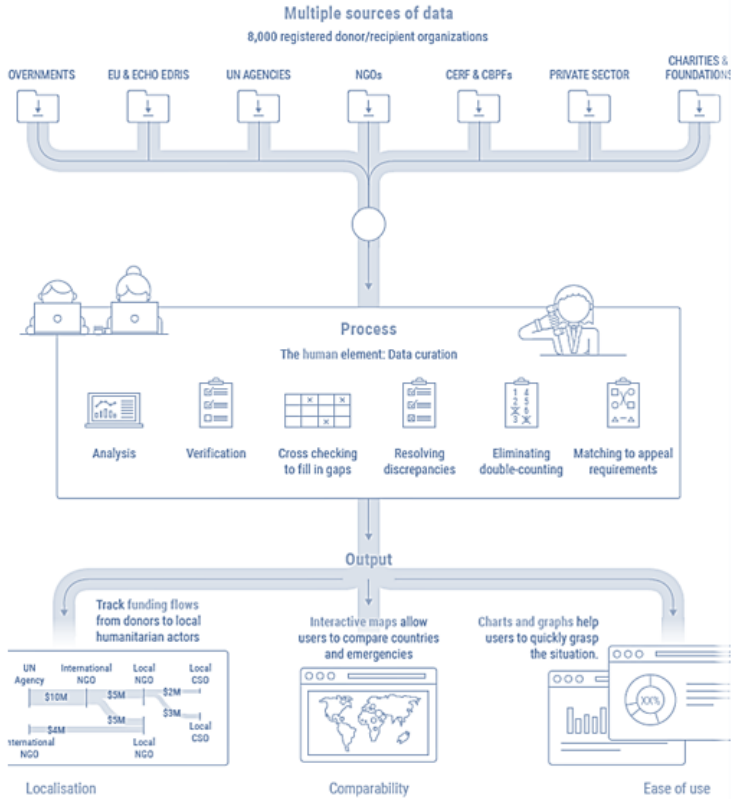



IPC & Humanitarian Aid


IPC vs. FEWS Escalation Timing

# UN OCHA FTS Data Curation Process

- Globally comparable, continuously updated data for coordination and decision-making.
- Verifies accuracy through triangulation and cross-checking.
- Tracks funding allocation and utilization, especially for inter-agency plans.
- Promotes transparent, evidence-based humanitarian coordination.




FTS Process