

PHASE TWO: Business Process Modeling

SCOPE

The project scope focuses on creating a centralised disaster management database to assist in disaster prediction, forecasting, preparedness, and response. This aligns with the MIS framework by streamlining real-time data collection and analysis to improve decision-making in disaster scenarios. The objectives are:

1. **Enable Real-Time Data Processing** to support timely disaster alerts and mitigation measures.
2. **Enhance Disaster Preparedness and Response** by providing actionable insights to governments, humanitarian agencies, and response teams.
3. **Facilitate Global Collaboration** through standardised data sharing and a centralised information system.

Expected Outcomes:

- Enhanced accuracy in disaster predictions and risk assessments.
 - Increased efficiency in coordinating and managing disaster response efforts.
 - Data-driven support for making informed decisions during disaster events.
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IDENTIFY KEY ENTITIES

In the disaster management database, the key entities and their roles within the process include:

1. Users (Emergency Planners, Data Analysts, Field Responders):

- **Role:** These users interact with the database to input, analyse, and access information related to disasters. Emergency planners use the data to prepare for disasters, analysts predict potential disaster events, and field responders access up-to-date information to guide their actions.
- **Interaction:** They interact directly with the system, both inputting raw data (e.g., current weather conditions) and retrieving processed insights (e.g., predicted disaster risks).

2. Departments (Government Agencies, Humanitarian Organisations, Weather Stations):

- **Role:** Each department provides critical data (e.g., weather reports, historical disaster data) and uses the database insights for situational awareness and response planning.
- **Interaction:** Departments supply real-time data to the database and use processed data for decision-making. For example, weather stations continuously update the database with current environmental conditions.

3. Information Systems (Database Management System, Predictive Modeling Software, Data Collection Tools):

- **Role:** This MIS component stores and manages large volumes of data from various sources, enabling predictive modelling and reporting.

- **Interaction:** The information systems allow users and departments to access, process, and analyze data. Predictive models within the system assess risk levels based on input data and historical patterns.

4. Data Elements (Disaster Type, Location, Weather Conditions, Risk Level):

- **Role:** These are the specific data points stored and analysed within the system, forming the basis for predictive models and decision-making.
- **Interaction:** Data elements are continuously updated by users and departments, while predictive algorithms analyse and update them as necessary. For instance, “Risk Level” is a data element that changes dynamically based on real-time inputs from “Weather Conditions.”

5. External Data Sources (Satellite Data, Global Disaster Networks):

- **Role:** External sources contribute supplemental data, providing global and region-specific data feeds, including satellite imagery and other remote-sensing data.
- **Interaction:** These sources supply the primary information systems with essential data points, enhancing predictive accuracy and allowing for more comprehensive disaster assessments.

Swimlane Diagram to outline the processes in the Disaster Management Database.

This figure will include a swimlane for each of the key actors or departments in the process:

Users, Departments, Information Systems, and External Data Sources.

Swim lane components: Each swimlane is used in explaining the participation of every member or sector in disaster management. The flow in every lane indicates the *duties* and *activities* of each member while the junction of lanes indicates the point where two or more members interact with each other by exchanging communication or data.

Swimlane 1:

- **Users (Emergency Planners, Data Analysts, Field Responders)**

Identify Disaster Event: Avail a window of opportunity for the input of alerts whether preliminary in nature or real-time disasters.

Request Data Analysis: Make a call to the system on duty to carry out some data period analysis or forecasting.

Review Prediction Results: Study the outcome, which entails disaster, its impact, and the area covered by each risk level.

Coordination: Liaisons with pertinent units (sister agencies) for recommendations and initiation of preparedness or response measures.

Disaster Status Update: Filing of information that deals with changes or updates during and after the disaster occurrence to minimise impact of forecast deafness in the future.

Swimlane 2:

- **Departments Government Agencies, Humanitarian Organisations, Weather Stations**

Provide Current Data Update on the present status of the atmosphere, any exterior change and any catastrophes in progress.

Check Data Accuracy Assure that the information given is available and exact to the needs of the prediction models.

Make Decisions Based on Processed Data: Get processed information that shows the level of risks and forecasted impact for planning or strategizing.

Distribute Warnings: Work with end-users to distribute appropriate forward warnings to people who are at risk.

Conduct Preparedness Actions: Execute proactive steps such as ordering evacuations based on what the system forecasts.

Swimlane 3:

- **Information Systems - DBMS, Predictive Models and Data Collection methods**

Collect Data: Get primary objective data from both remote sites and inland departments.

Store Data: Store safely disaster data along with historical and ongoing data.

Run Predictive Models: Keep records and predict incoming data to calculate levels of risks involved and the degree of likely disasters.

Output Results: Return users/departments' requests in a decision-making manner.

Data Integrity: Update the estimate files with fresh numbers to enhance the reliability of the estimates.

Swimlane 4:

- **Satellite Data Global Disaster Networks External Data Feeds**

Data Analysis and Collection: Collect data from various external sources, such as satellite images and seismic events.

Forward the Data to Information System: Feed data into the hosting partner's repository.

Allow Real Time Updates: Incentivize the interventions to let the data move without any hindrance, in order to maximise the processing and analysis of such data as seamlessly as possible.

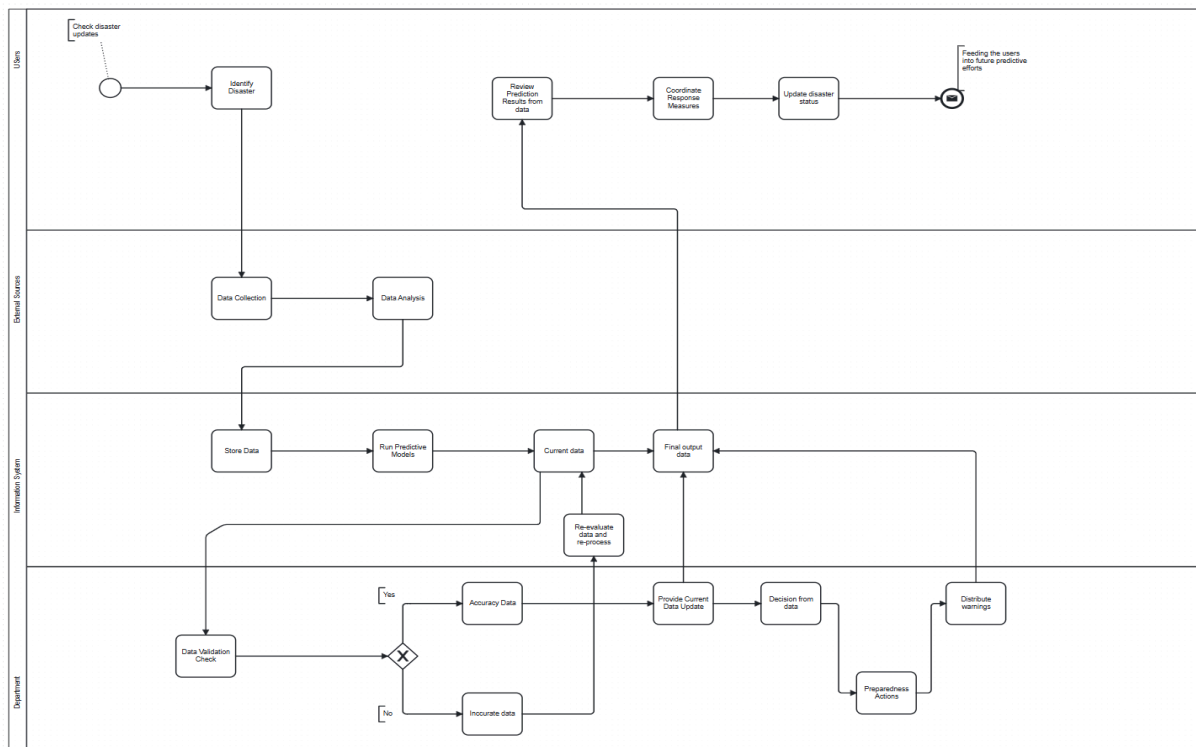
Collaboration for Standardised Data: Work with the respective departments to find out if all the data will have uniform measures and formats for a complete integration.

Process Mapping with BPMN with Explanations

Following are some of the key BPMN elements that can be used for disaster management processes:

- Pools and Swimlanes: Usually segregated into four lanes, representing Users, Departments, Information Systems, and External Data Sources.
- Start and End Events: Represent the start and the end of a particular process using circles.
- Tasks (Activities): Located inside the rectangle, each is labeled on the tag, for example, "Collect Data," "Run Predictive Models," ... etc.

- Data Objects: Inputs/outputs are represented with the use of a document icon called Data Object, which means data is being processed therein.
- Sequence Flows: Arrows in the form of dashes show how activities or tasks flow on any project in terms of sequence.
- Gateways or Decisions: This is represented in a form of diamond shape and represents instances where a decision has to be made, for example, if data is accurate at the said level.



Links for references: <https://demo.bpmn.io/new>,

1. Start Event (Users)

- **Element:** Start Event (Circle)
- The process begins with the **Users** initiating a disaster event.
- **Task:** "Identify Disaster Event"
 - **Element:** Activity (Rectangle)
 - **Action:** Users input preliminary or real-time data related to disaster alerts.

2. Data Collection from External Sources (External Data Sources)

- **Task:** "Data Analysis and Collection"
 - **Element:** Activity (Rectangle)
 - **Action:** External Data Sources collect data, such as satellite images or weather reports.
- **Sequence Flow:** Connects from the **Start Event** to this task, indicating that data is now being collected.

3. Forward Data to Information System (External Data Sources)

- **Task:** "Forward Data to Information System"
 - **Element:** Activity (Rectangle)
 - **Action:** External data is fed into the Information System.

4. Data Storage and Processing (Information Systems)

- **Task:** "Store Data"
 - **Element:** Activity (Rectangle)

- **Action:** Information Systems store raw and historical data securely.
- **Task:** "Run Predictive Models"
 - **Element:** Activity (Rectangle)
 - **Action:** Predictive models run forecasts, assessing risk levels based on stored data.
- **Task:** "Output Results"
 - **Element:** Activity (Rectangle)
 - **Action:** Processed data and prediction results are made available to Users and Departments.

5. Data Accuracy Check (Departments)

- **Gateway:** Data Validation Check
 - **Element:** Gateway (Diamond)
 - **Action:** Departments verify the accuracy and relevance of the processed data.
 - **Decision Flow:**
 - **If Accurate:** Continue to the next steps in Users and Departments.
 - **If Inaccurate:** Data is re-evaluated and processed again in the Information Systems.

6. Analyze and Act on Predictions (Users)

- **Task:** "Review Prediction Results"
 - **Element:** Activity (Rectangle)
 - **Action:** Users assess prediction results and identify potential areas impacted by the disaster.

- **Task:** "Coordinate Response Measures"
 - **Element:** Activity (Rectangle)
 - **Action:** Users coordinate with other departments for a structured response.

7. Preparedness and Response (Departments)

- **Task:** "Provide Current Data Update"
 - **Element:** Activity (Rectangle)
 - **Action:** Departments supply real-time updates to the Information System.
- **Task:** "Make Decisions Based on Processed Data"
 - **Element:** Activity (Rectangle)
 - **Action:** Departments analyze processed data to make informed decisions.
- **Task:** "Distribute Warnings"
 - **Element:** Activity (Rectangle)
 - **Action:** Warnings are issued to the public or targeted at-risk groups.
- **Task:** "Conduct Preparedness Actions"
 - **Element:** Activity (Rectangle)
 - **Action:** Departments prepare and implement response measures, like ordering evacuations.

8. End Event (Users)

- **Task:** "Update Disaster Status"
 - **Element:** Activity (Rectangle)
 - **Action:** Users update the disaster status to refine predictive algorithms and response strategies for future events.

- **End Event:**
 - **Element:** End Event (Circle)
 - Marks the conclusion of the process flow, with updated disaster data feeding into future predictive efforts.

AIM OF DATABASE

The MIS-based disaster management process model aims to address high levels of response, real-time efficient decision-making, and coordination between departments. Each swimlane illustrates an alternate entity in the partnership for disaster management:

- Users - Emergency Planners, Data Analysts-Initiate processes to detect the occurrence of disaster events and analyze predictive results
- Departments - Government Agencies, Humanitarian Organizations - Implement response actions at the level of ensuring data integrity
- Information Systems - Core in storing data, predictive modeling, and providing results to users to support their decision-making.

These external sources provide the fundamental real-time data on weather and environmental conditions that are needed for accurate prediction. Significance of the Process in Relation to MIS
This process has given an indication of how MIS will benefit by ensuring there is centralization of data management and integrity as well as more informed decision-making in disaster management.

- ★ The model further clearly denotes workflows and decision points to enable:
 - Informed Decision Making: Real-time data and predictive analytics augment emergency preparedness.

- Organisational Goal Alignment: Aligning the department and data flow in the MIS process facilitates the goals of lessening disaster events impact, raising public safety levels, and improving interagency coordination.