

Traditionally, the role of governments during natural calamities was only limited to rescue, relief and rehabilitation. However, with changing times, components such as mitigation, preparedness and effective disaster response are increasingly becoming a part of their disaster management plans.

There is a constant need for updating these disaster plans, both qualitatively and quantitatively, for strengthening the organisation at various levels. At times, the required information is not available and sometimes if available, is obsolete and not fit to be used by the decision makers.

A lot of work has been done regarding establishing the guidelines for achieving real-time information on disasters. The United Nations Office for Disaster Risk Reduction (UNISDR) has established the Hugo Framework of Action (HFA), National Disaster Management Authority (NDMA) has created guidelines for disaster management planning (DMP) and hazard, vulnerability risk assessment (HVRA). NDMA has also made it mandatory for every state within India to create a SDMP (State Disaster Management Plan) and conduct HVRA.

A project has been initiated to conduct an HVRA for the Puducherry and Karaikal districts of the Union Territory of Puducherry. In addition to this, the project involved development of a GIS-based decision support system that is capable of assessing risk from natural hazards like cyclone, flood and drought and applying the outcomes of risk assessment for disaster mitigation, preparedness, response and recovery.

The objectives of this assignment were:

A decision support system capable of assessing risk from natural disasters has been developed for the government of Puducherry. Vital information provided by it is being used for disaster mitigation, preparedness, response and recovery

Making disaster management effective



- Developing a GIS-based repository of the building, infrastructure and demographics
- Risk mapping for major hazards such as cyclone and storm surge, flood, tsunami and drought
- Development of a Decision Support System (DSS) that helps support the HFA
- Training and capacity building of stakeholders engaged in disaster management

Solution – Development of a PDSS

The development of PDSS involved collection and collation of all the required data from various departments and other national institutes, carrying out hazard, vulnerability and risk assessment for cyclone and storm surge, tsunami, flood and drought for the study area and then integrating the HVRA model and its outcomes into a software platform for supporting mitigation, preparedness, response and recovery.

The following are the key activities that were performed by the team:

Exposure database development

RMSI conducted DGPS Survey as a part of topographic survey and collected 50 GCP points. Secondary data mainly, land use, soil, weather and disaster information was collected from various government agencies, population and household details were collected from census, planning and statistical department, administrative boundaries were captured up to cadastral level, livestock information was collected at village level from the Animal Husbandry Department, land use/ layers overlaid with cadastral maps to delineate the built-up area were developed, all the above mentioned data was processed for creating GIS layers. Finally, all the processed data was incorporated into a GIS database.

Hazard, vulnerability and risk model development

Deterministic hazard models for tsunami, cyclone and storm surge, flood and drought were developed to estimate the intensity of the hazard at the village level. Vulnerability functions were developed for all types of exposure elements incorporated in the exposure

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database. Finally, RMSI created an approach for estimating the risk of various exposure elements utilizing the hazard and vulnerability models.

Development of DSS

The primary objective of the decision support system is to provide a straight forward and hassle free means to utilize the outcome of risk assessment for mitigation, preparedness, response and recovery. To achieve the same, the foremost requirement was to ensure that a consistent and up-to-date exposure dataset for the region under consideration is embedded into the framework of the DSS.

As a next step, the hazard and vulnerability models were integrated into the DSS so that the entire risk assessment engine could be used for achieving the above said objective.

Building on top of the risk assessment engine, four focused modules were developed to support mitigation, preparedness, response and recovery.

Response and recovery module

This module provides a user the ability to analyze the impact of any impending disaster event on the districts of Puducherry and Karaikal to help plan the response and then track the recovery. For example, if a Cyclone approaches Puducherry then Indian Meteorological Department (IMD) forecasts the track information on their website (<http://www.imd.gov.in/section/nhac/dynamic/cyclone.htm>) – through their Regional Specialized Meteorological Center (RSMC). On their website, IMD publishes longitude, latitude, time intervals and other details in the form of a map and table. PDSS response and recovery module provides



the user with a functionality to enter these details into the system.

Once the user enters the details, they can analyze the impact of the cyclone on the two districts of Puducherry and Karaikal. This analysis automatically generates a map with the given 'Event Name' and 'Analysis Name' with GIS layers having information like affected people, households and infrastructure. In parallel a 'Cyclone Analysis Report' showing loss and other details for the selected parameters is generated.

A similar analysis can be run for other hazards such as tsunamis, floods and storm surges.

The module also provides the user, the ability to update the status on ground regarding the recovery of the damaged households, infrastructure and people moving back into their homes from shelters in the DSS. This helps keep the DSS up-to-date with all the real time recovery information that is used to generate the disaster "Situation Report" at any given time.

Mitigation module

PDSS mitigation module facilitates users to use existing disaster information to gauge the impact of the disasters and use that to define and test the possible mitigation measures for maximum benefit in term of losses reduced. The information

provided in this module includes:

- Hazard zones for cyclones, floods, tsunamis and droughts
- Ability to modify structural characteristics of the households
- Analyze the impact of the disaster on the households
- Perform Cost-Benefit analysis on the basis of user modified options

Based on the hazard and exposure selected, loss is calculated and a 'Mitigation Analysis Report' is generated which can be exported to a pdf format.

PDSS Cost-Benefit Analysis tool enables users to compare analysis results in case, hazard and exposure have changed. It can also give an insight as to how the same intensity event can cause different losses if the structures are different.

Preparedness module

This module is responsible for activities before a disaster strikes. It provides users the ability to define, view, and query the following information, based on the user-selected area at the available resolution.

- Past disaster events in a geographic location
- Available temporary shelter in an area

The development of PDSS involved collection and collation of all the required data from various departments and other national institutes, carrying out hazard, vulnerability and risk assessment for cyclone and storm surge, tsunami, flood and drought for the study area.

- Equipments available
- Available resources
- Contractor list and their status
- Transportation facility available
- Backup power and water supply availability
- Food and clothing
- Evacuation plan
- Details and status of emergency exercise and training
- Details of available warning system and their status
- All available information related to households and infrastructure

Training and capacity building

As part of the project, various stakeholders and officials from the revenue and other allied departments were trained by RMSI on the use of DSS. To ensure a proper knowledge transfer to the key users, RMSI planned and implemented a 3-stage training module. Training details are given in table 1.

Benefits

- A cyclone risk model is developed that helps users assess the impact of possible storms and test the effectiveness of possible mitigation options thereby helping in deciding on the

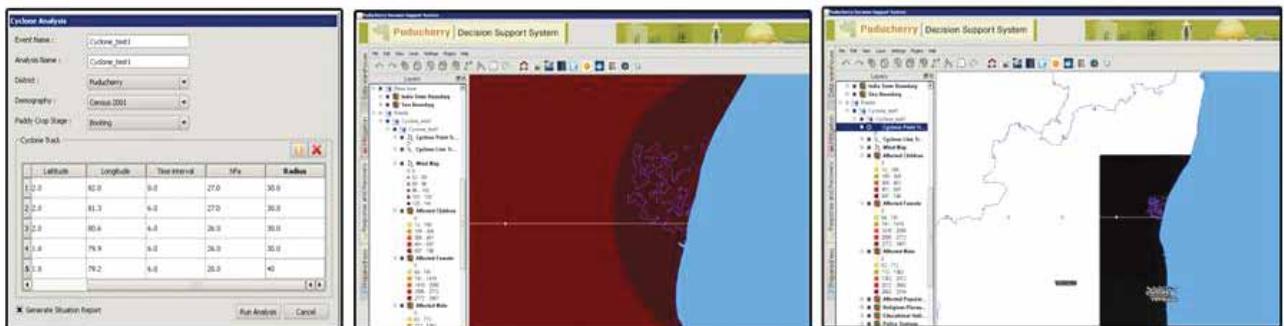


Figure 1: Response and Recovery Module

S. No.	Training Type	For whom	Duration/Maximum participants
1.	Functional Training on PDSS application	Key User Group (Senior officials from various departments/ NGOs)	One day/ 15
2.	Functional and usage training of PDSS application	End user group from Department of Revenue, Puducherry and Karaikal	One day/ 15
3.	Functional training of entire PDSS application	EOC Center Staff from Puducherry and Karaikal	One day/ 15

Deterministic hazard models for tsunami, cyclone and storm surge, flood and drought were developed to estimate the intensity of the hazard at the village level.

- Availability of trained man power on hazard risk assessment
- Easy to mainstream disaster risk reduction at all levels in the government decision making

Technologies used

- Deterministic modeling using stochastic simulations, vulnerability and loss analyses, and exposure development
- Open source GIS libraries and PostgreSQL/ Postgis – open source GIS database
- Total station and DGPS survey
- Social survey and PRA (Participatory Rural Appraisal) techniques

Future direction

PDSS has been successfully implemented for Puducherry and Karaikal districts of UT of Puducherry. The application has been well used and well appreciated by the officials of Government of Puducherry. The project has now been extended to the remaining two districts of Puducherry i.e. Mahe and Yanam.

The present version of PDSS is a desktop application. In future, Government of Puducherry plans to extend it to a Web-based application for wider use of the community. 

right kind of mitigation options to apply.

- A decision support system has been installed in the Emergency Operation Center of Puducherry to help them assess the risk from disasters, plan the resources for responding to approaching hazard events, monitor the recovery and produce current situation reports

instantaneously at any time for information dissemination during disaster time

- There is no license fee involved for PDSS hence client can distribute any number of copies of PDSS to respective departments
- Easy maintenance and enhancement of building, infrastructure and demographics data

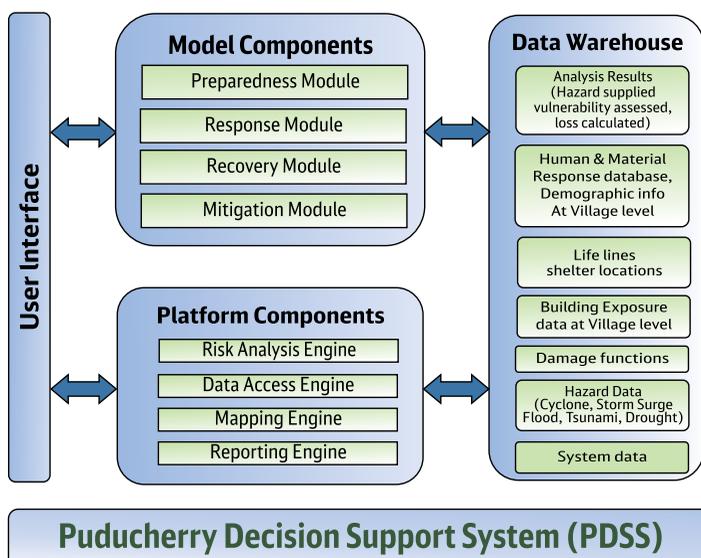


Figure 2: PDSS Architecture - A smart client application

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