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# Developing a Decision Support System for Disaster Management: Case study of an Indonesia volcano eruption

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## Abstract

Disaster Management activities often focus on specific tasks (e.g. evacuation, logistic or coordination) and are confined to one specific DM phase (e.g. Preparedness or Response). New awareness about an external change, be it environmental or organisational, typically act as a trigger for such focussed activities. A variety of views or stakeholders are also involved in those activities, and their various concerns get often intertwined. This work advocates the use of a Decision Support System (DSS) that can be deployed as a single access point. Such a system requires a sufficient amount of representative knowledge, and facilities to avail the knowledge to the appropriate stakeholders in an appropriate form. With the multitude of stakeholders and their varying knowledge requirements, the system will need to present the knowledge differently according to the stakeholders needs in their decision making process. Such processes can vary, e.g. whether for policy making or for operational real time responses. This paper presents a hybrid of knowledge elicitation and retrieval mechanisms, some are top down and others are bottom up. The mechanisms make use of the Meta Object Facility (MOF) to structure and present the knowledge appropriately according to different interests and roles. A case study of the recent Mt. Agung volcano eruption in Bali Indonesia is successfully used to demonstrate the efficacy of the mechanisms proposed and the resultant DSS.

Keywords: Disaster Management, Decision Support System, Knowledge Management, DSS Development Process

## 1 Introduction

Disasters and their resultant economic losses are on the increase (Tatham *et al.*, 2017). Disaster Management (DM) is the systematic attempt to reduce their impact (Coppola, 2011). A key DM objective is to achieve resiliency (Blackman *et al.*, 2017), that is: (1) a capability of bouncing back from unforeseen stress; and/or (2) capability to adapt to the situation. Resiliency is essentially determined by the level to which the affected communities have the necessary resources and ability to manage them during the disaster situations (UNISDR, 2012). Decision Support Systems have a key role to play, but mechanisms to create them in a way to account for the holistic nature of DM decisions remain challenging (Leskens *et al.*, 2014; Rosenzweig & Solecki, 2014).

DM decision making processes are typically initiated by governmental authorities (e.g.: National Disaster Management Agency (BNPB) in Indonesia or State Emergency Services (SES) in Australia). The processes can be either reactive (bottom up) or proactive (top down). Reactive processes aim to pursue particular objectives in response to a dynamic environment. In such event driven processes, the objective is to bounce back as soon as possible from the impact caused by a disaster event. For instance, whenever it is perceived that a volcano is going to erupt, this becomes a trigger for authorities to undertake all the necessary activities to ensure that all the available resources are in place to protect lives in affected areas e.g. evacuate inhabitants to a safer place. Evacuation activities need to be typically guided by knowledge from Disaster Management Plans (DISPLAN) or Situation Reports (SITREP). A DISPLAN typically contains best practice based on empirical knowledge and is used a guide for stakeholders in a timely fashion (Santiago *et al.*, 2016). A SITREP contains real time knowledge of how a situation is unfolding on the ground and is critical for first responders. Both types of documents equip various stakeholders with empirical and crucial knowledge elements in a disaster event. These elements in such communications should also be in a context-aware format. They need to be accessed directly by the roles that

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