A Proposed Framework for Incorporating Big-Data Technology in National Crisis Management Center

Magdy M. Kabeil
Al-Yamamah University, Saudi Arabia

Ahmad M. Kabil
University of Wisconsin – Whitewater, USA

INTRODUCTION

Along with the major development in many aspects of life, the current millennium has brought for several countries significant crises of different kinds and various degrees (Farazmand, 2014). The increasing jeopardizing to crises calls for a transformational change in countries' capability to manage crises. Crises may be natural or manmade. It may be on organizational or national levels.

The main measure of merit in crisis management is the ability to allocate all relevant capabilities to be the most effective on the right points at the right times over all crisis phases (Kabil & Kabeil, 2014 & 2011). On such measure, the national crisis management currently faces two critical challenges. The first is the high pace of crisis scenario relative to the corresponding management decision cycles. The second critical challenge is the large scale of volume, variety, and velocity of pertinent data.

However, if we record a crisis scenario on a video recorder and replay it in slow motion, we will see the crisis features very similar to a regular problem's features. On the other side, if a National Crisis Management Center (NCMC) can provide the decision makers with the capabilities that allow them to feel, recognize, abstract, comprehend, analyze, and decide faster, then the crisis management processes will be as manageable as the regular problem management processes.

The Big-Data Technology (BDT) as an accurate representation of real life could be used in both ways, to understand the real life and to control it. Fast cycles of understanding and controlling real life situations are the key functions of national crisis management.

This chapter presents a framework for incorporating BDT in traditional conceptual designs of NCMC. The updated conceptual design is validated using the Analytical Hierarchy Process (AHP) and the Quality Function Deployment (QFD) technique. The conceptual design provides a system that is responsive to decision makers' need in developing their own crisis management centers. The initial stages and steps required for implementing the conceptual design in a country are given.

BACKGROUND

The quality of decision, such as any other engineering product, is built from the very beginning all through the decision processing cycle (Davern et al. 2008). The generic decision cycle in crisis management context starts with data gathering that is processed further to higher levels of information, knowledge, intelligence, wisdom, and decision. Decisions are implemented through a Command, Control, Communication, Computer, Intelligence, Surveillance, and Reconnaissance

DOI: 10.4018/978-1-5225-2255-3.ch174

(C4ISR) System to move a real-world-situation to be more suitable for the next decision or action (Kabil & Kabeil 2014). The model has been updated in response to the evolution of BDT as depicted in Figure 1.

There are several definitions of the term "Big-Data." Perhaps the most popular definition is based upon the IBM's differentiation that is based on 3 attributes of the 3 V words, Volume, Variety, and Velocity (IBM, 2016; Sagiroglu & Sinanc 2013). Leverage the traditional "Data" concepts and technologies to "Big-Data" ones affects all higher levels of the model.

One of the most important implications of using BDT in crisis management is crisis crowdsourcing. Developing more new technologies capable of collecting, communicating and disseminating individuals information on macro scales has led to more forms of crowdsourcing in crisis management (Kahl et al., 2012). Recent research efforts on crisis crowdsourcing address new issues around using information and communication technologies to engage and coordinate with the wider public during crisis management. The Crisis Crowdsourcing Framework defined by Liu (2014) uses the same traditional information-gathering six dimensions of why, who, what, when, where, and how to identify the interaction mechanisms that should be considered by designers of crisis crowdsourcing systems.

On the "Where" dimension, the geographically oriented Big-Data could be provided using Location-Based Services (LBS). The LBS could be used to locate living entities or objects across telecommunication networks. Several technologies are utilized by LBS for knowing where an information device is geographically located. Examples of technologies used for LBS are the Global Positioning Satellites (GPS), Assisted Global Positioning Satellites (AGPS), Cell Identification (Cell ID), Broadband Satellite Network (BSN), Radio Frequency Identification (RFID), and Near-Field Communication (NFC).

Ma (2011) proposes a real-time LBS that can enable hospitals treating victims during a disaster relief scenario. The author analyzes how a network of hospitals can use such LBS to handle medical aspects of disaster relief. He suggests a framework for following available hospitals capability, allocating victims among hospitals, tracking patients who are in-transit from one hospital to another, and developing strong collaborative network of personnel across all areas of the hospitals service. The emerging technology of smart watches with embedded sensors to recognize objects and forearm gestures expands the use of such appli-

Figure 1. From data to decision