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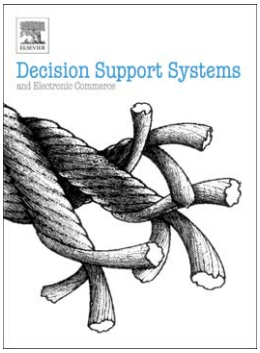

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ACCEPTED MANUSCRIPT

A Hybrid Decision Support System for Managing Humanitarian Relief Chains

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Abstract

Decisions regarding location, allocation and distribution of relief items are among the main concerns of the Humanitarian Relief Chain (HRC) managers in response to no-notice large-scale disasters such as earthquakes. In this paper, a Hybrid Decision Support System (HDSS) consisting of a simulator, a rule-based inference engine, and a knowledge-based system (KBS) is developed to configure a three level HRC. Three main performance measures including the coverage, total cost, and response time are considered to make an explicit trade-off analysis between cost efficiency and responsiveness of the designed HRC. In the first step, the simulator calculates the performance measures of the different configurations of the HRC under generated number of disaster scenarios. Then, the rule-based inference engine attempts to build the best configuration of the HRC including facilities' locations, relief items' allocation and distribution plan of the scenario under investigation based on calculated performance measures. Finally, the best configuration for each scenario is stored in the KBS as the extracted knowledge from the above analyses. In this way, the HRC managers can retrieve the most appropriate HRC configuration in accordance with the realized post-disaster scenario in an effective and timely manner. The results of a real case study in Tehran demonstrate that the developed HDSS is an effective tool for fast configuration of HRCs using stochastic data.

*Keywords***:** Decision support system; Humanitarian relief chain; Rule-based simulator; Knowledge-based system; Integrated relief prepositioning and distribution.

1. Introduction

The growing trend of natural and man-made disasters has led to considerable increase in the number of studies in the context of Humanitarian Relief Chain (HRC) management in recent years. Since quick response to the urgent needs of the affected people is critical for the effective management of HRCs, scholars have developed different decision models for managing HRCs. Fritz Institute [1] reported that lack of a system for monitoring and managing the relief aids in 2004 Southeast Asia tsunami led to large-scale shortages of relief items and medical personnel.

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