Chapter 2
Designing Valid Humanitarian Logistics Scenario Sets:
Application to Recurrent Peruvian Floods and Earthquakes

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ABSTRACT

Literature about humanitarian logistics (HL) has developed a lot of innovative decision support systems during the last decades to support decisions such as location, routing, supply, or inventory management. Most of those contributions are based on quantitative models but, generally, are not used by practitioners who are not confident with. This can be explained by the fact that scenarios and datasets used to design and validate those HL models are often too simple compared to the real situations. In this chapter, a scenario-based approach based on a five-step methodology has been developed to bridge this gap by designing a set of valid scenarios able to assess disaster needs in regions subject to recurrent disasters. The contribution, usable by both scholars and practitioners, demonstrates that defining such valid scenario sets is possible for recurrent disasters. Finally, the proposal is validated on a concrete application case based on Peruvian recurrent flood and earthquake disasters.

DOI: 10.4018/978-1-7998-3805-0.ch002

INTRODUCTION

A variety of approaches, ranging from analytical models and theories to case studies, have been considered to manage risks during disaster operations. In the field of Humanitarian Logistics (HL), mathematical programming is the most frequently used research methodology (Galindo and Batta, 2013). While the use of optimization tools and algorithms has been shown to have a great potential to improve disaster management practices, they are rarely used in the field (Laguna Salvadó *et al.*, 2015; Laguna Salvadó *et al.*, 2016). Hence, the lack of an easy-to-use and established approach to risk assessment means that in practice, decision-makers often refer to their experience and intuition, which can lead to a range of biases and loss of performance (Comes, 2016). As demonstrated by (Charles et al., 2016), this statement is mainly due to research works that frequently use fictitious scenarios and data compensating for the lack of information. This approach fails to validate whether decision support systems can be successfully applied in the actual context of disaster relief (Charles et al., 2016). Real cases, or at least realistic ones, with accurate data are necessary to enable practitioners to be confident with the results of scholar and to start to use them concretely in the field. This chapter tackles this issue by suggesting an innovative methodology able to generate valid and realistic scenario sets on future disaster trends as suggested by (Galindo and Batta, 2013; Pedraza-Martinez and Van Wassenhove, 2013). We therefore develop a series of requirements that are designed to support researchers in producing valid and plausible scenarios for their quantitative decision support systems that are tailored to fit the needs and standards of field-based decision-makers. Basically, such systems should be able to support HL decisions such as location-allocation, routing or inventory management for instance.

When referring to disasters, most of us will intuitively refer to mega-disasters such as Indonesia's tsunami in 2004, Haiti's earthquake in 2010, Japan's earthquake / tsunami in 2011 or Nepal's earthquake in 2015. Although all those cases have had dramatic consequences, they are far from typical for disaster response. Ferris *et al.* (2013) define the notion of "recurrent disaster" as "*the repeated occurrence of a unique natural hazard in the same geographical region*". Since 2000, each year, more than 400 disasters have been recorded in the disaster database EM-DAT (http://www.emdat.be). More than 90% of those disasters recur in the same regions: cyclones in the Caribbean, earthquakes in the Pacific Ring of Fire or floods in South-Eastern Asia. In this chapter, we focus on recurrent disasters, which constitute the great majority of disasters.

To conduct empirically grounded work that enables HL practitioners to analyse the implications of their HL decisions (such as planning, routing, allocating…), we suggest using a scenario-based approach. Scenario based reasoning has been advocated