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Redistribution for cost minimization in disaster management under uncertainty with trapezoidal neutrosophic number

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ABSTRACT

The activity of humanitarian logistic is urgently employed in the aftermath of the disaster. The sudden shock of disaster emerges high demand in the society. In this context, this research has introduced a mathematical model for humanitarian logistic applying the fact of redistribution of resources. The model aims to minimize the total cost of whole operation and the total time for redistribution phase so as to response the emergency situation quickly. According to the model distribution of humanitarian items to the affected areas are commenced by a governing authority in the first phase. The phase of redistribution is started after a certain period of time when some areas get relief and some are still unable to recover their vulnerable condition after the disaster. The concept of redistribution, established in the logistic model is beneficial for better response in the emergency condition as it quickly redistributed the resources from the areas which are recovered to the areas still being affected. The performance of the model is analyzed with some numerical data considering the uncertain parameter in the form of a trapezoidal Neutrosophic number. The model is solved through three different techniques: Neutrosophic programming approach, goal programming, and Pareto optimal solution approach. Moreover, a comparative analysis is performed in this study among the results obtained by three different techniques which are useful for the decision maker to make a practical decision in emergency response.

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1. Introduction

In the recent year, there is an increasing attention towards the problem of mitigation and resilience of the disaster. The vast history of demolition and devastation have attracted the practitioners to show their perfect concern regarding efficient emergency logistic management. The growing concentration of disaster response is based on some calamitous events happened on the earth and ruined the living condition of people in the society. There are several such examples: Haiti earthquake (2010), the Indian Ocean Tsunami (2004), Chennai flood (2015), Nepal earthquake (2015), Typhoon Komen in India, Bangladesh and Myanmar (2015), earthquake in Ecuador (2016), flood in Kerela (2018), Assam and Bihar flood (2017) are some deadliest disaster recorded in history caused the worst condition with thousands deaths of people and damaged million dollars' worth. In prospect of large scale disaster, recovery phase can be categorized in two phases: short term and long term. The short term recovery basically focuses on the restoration of vital life support for surviving in the catastrophe. The activities of short term recovery comprises of many individual component and corresponding service such as collection of information about victims, evacuation, sheltering, feeding operation, first aid service, distribution of humanitarian items, etc. with minimum time [1]. The growing awareness of human suffering in the catastrophe, lots of humanitarian organizations come forward and give their proper response in the recovery phase following some efficient logistic plan [2–4]. According to the disaster recovery plan of state of Illinois, aforementioned emergency service have to be operated within 8 h [5]. Immediate service within 8 h of the aftermath is not probably easy for humanitarian logistic management to execute without any proper transportation plan to convey the humanitarian items to the location where it is exactly required. Therefore, this research has introduced a mathematical model for multi-objective solid transportation problem (MOSTP) for emergency service in disaster. It considers

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