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Inventory management of perishable items in long-term humanitarian operations using Markov Decision Processes

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Abstract

Humanitarian organizations often rely on donations of goods to keep their operations running for a long period. However, the donation of perishable goods, such as food and medicine, is a great challenge for logistic managers of such organizations, since deteriorated items may impose a threat to the population, if used incorrectly, and a huge cost for humanitarian operations, due the difficulties underlying their disposal policies. This paper aims at developing a decision making model for inventory management of perishable goods for long term humanitarian operations, using Markov Decision Process. Our model allows managers to ensure that the goods in the inventory are proper for consumption without necessarily keeping track of individual expiration dates for each item in the inventory. To illustrate the approach, we propose experiments to demonstrate how different shelf lives can affect the optimal ordering policies of critical perishable goods, such as blood packs or medicine, in humanitarian operations.

Keywords: Humanitarian Logistics, Long Term Humanitarian Operations, Markov Decision Processes, Optimization

1. Introduction

Long-term projects are an important part of the operations of a humanitarian aid organization. Commonly called continuous aid work operations, they arise when people are exposed to disasters such as war and civil war (Afghanistan, Yemen, Congo, Syria, etc.), political insurrection (Syria), droughts (Ethiopia, Pakistan, etc.) and extreme poverty (Liberia, Sudan, etc.). In such cases, people affected by the disasters are at considerable risk and the need for humanitarian assistance is clear. That includes a wide range of services from medical assistance and shelter to basic daily supplies like water, food, sanitation and hygiene products.

The uncertainty of supplying these needs in long-term humanitarian operations is high, since the supply is strongly dependent on donations of goods such as water, food and medical supplies. Furthermore, 90% of the crises affected people live in developing countries that often cannot

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