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Research Report: ZLC-2013-11
Centralized Demand-Supply Planning for Global Humanitarian Operations
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Centralized Demand-Supply Planning for Global Humanitarian Operations

By Rowan Veale

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Summary: This thesis builds on academic literature and industry best practice and uses action research to develop a new, more centralized demand-supply planning process for ongoing operations at AidOrg's refugee camps, based on case studies of operations in South Sudan and Ethiopia. Case study results are evaluated against a set of predefined hypotheses to investigate how the proposed planning process creates value and its generalizability to other humanitarian organizations. The new process balances predictability with responsiveness and is customizable to suit the diverse environments in which AidOrg operates.



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KEY INSIGHTS

1. The benefits of centralizing some aspects of planning while leaving others decentralized can be combined in a single planning process.
2. An MRP process can provide the flexibility to overcome operational risks, such as escalation of conflict and port/road/border closures.
3. Inventory theory applied in industry, such as the (R, Q) order policy, can be effectively applied to ongoing operations in a humanitarian context.

Introduction

AidOrg operates 135 refugee camps in 79 countries worldwide. The running of these camps depends on the timely delivery of a range of eleven items essential to refugees' lives, such as tents and blankets, collectively referred to as core relief items (CRIs). Demand for CRIs is highly unpredictable and driven by a myriad of factors that affect arrival rates of refugees at existing camps, from the evolution of conflict to rainy seasons and border closures. As the environments in which AidOrg operates include some of the world's least developed regions, supply is

exposed to a range of uncertainties that include security issues, long customs clearance times, and a lack of transportation infrastructure and capacity. Currently, demand-supply planning for long-term operations is highly decentralized to the country office and sub-office levels and performed on an ad hoc basis, raising the question of how it can be improved.

AidOrg operates separate supply chains to supply each of its two major types of operation. The first, its emergency response supply chain, relies on air freight to provide fast response to humanitarian disasters, such as earthquakes or the outbreak of civil war, anywhere in the world. The second, its supply chain for ongoing operations, is focused on supplying CRIs for new arrivals and replacement of worn out items to long-term refugee camps and, in order to reduce costs, relies primarily on surface transportation.

This research develops a demand-supply planning process for AidOrg's supply chain for ongoing operations. The planning process aims to reduce AidOrg's costs and increase availability, while at the same time standardizing planning functions at the country and sub-office levels and centralizing

aspects that can be improved through a global view of the supply network to the supply management head office. This research resulted in the writing of a new standard operating procedure (SOP) for planning, which AidOrg intends to implement in the summer of 2013.

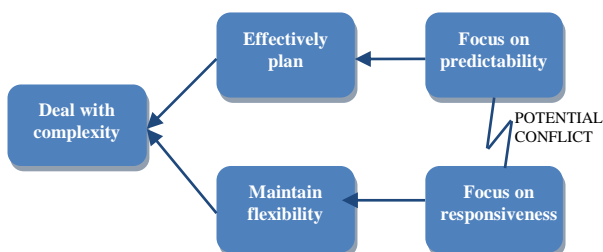
Methodology

At the beginning of this research, a conceptual framework was drawn up, describing the operational context, the challenges that were anticipated, and the elements that were expected to be required to create a centralized planning system. Due to the complexity of the environments in which AidOrg operates and the fact that participants in any planning process implemented are located in different regions across the globe, an action research approach was taken to the case study (Akkermans, Bogerd, & Doremalen, 2004). Through this approach it was possible to spend three weeks visiting a number of the locations in which AidOrg operates, including the supply management head office in Budapest and field operations in three countries, and witness the challenges faced by AidOrg personnel on a day-to-day basis. This research also draws heavily on supply chain literature related to humanitarian logistics and inventory modeling, as well as benchmarking exercises with UNICEF and IKEA, to provide insight into the management of supply chains in other humanitarian organizations and best practice in industry.

A series of five hypotheses related to the value of a centralized demand-supply planning process were constructed, ready for validation by the case studies. For example, a potential issue identified with the planning process was the predictability vs. responsiveness dilemma (Ptak & Smith, 2011), as illustrated in the following diagram:

Predictability vs. Responsiveness:

The Planning Dilemma

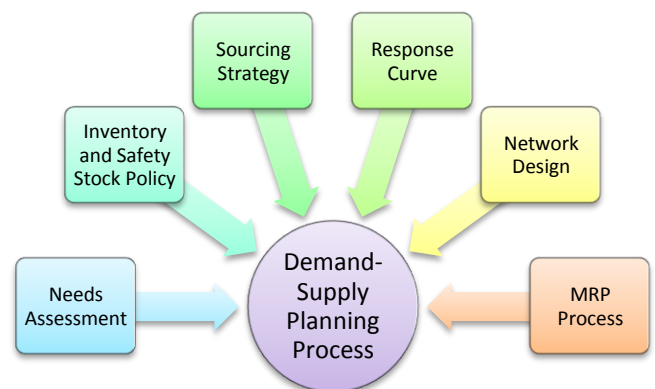


It was hypothesized that, through a combination of advance planning and close monitoring and adjustment to the situation on the ground, the planning process could effectively deal with this

tradeoff and provide both predictability and responsiveness. By validating the hypotheses through case studies demonstrating their accuracy, it was expected that conclusions could be drawn as to the value of a centralized planning process to AidOrg and generalized to other humanitarian organizations.

The Planning Process

Based on the original conceptual framework and the research performed, six distinct planning modules, each focusing on a different aspect of the overall planning process, were developed, as illustrated in the following diagram:



The planning process is performed over two years – the year prior to that being planned, during which supply and demand are analyzed and strategic decisions are taken, and the planned year itself, during which the strategy is adjusted as the year proceeds. Each of the six modules and their usages are described below.

Needs Assessment: At AidOrg, forecasting demand for CRIs is carried out by Programs officers and is beyond the scope of this research. However, the process developed by this research standardizes the format in which demand forecasts are passed to Supply officers and requires that forecasts for both the likely scenario and an alternative scenario (for example, the occurrence of a natural disaster) are provided.

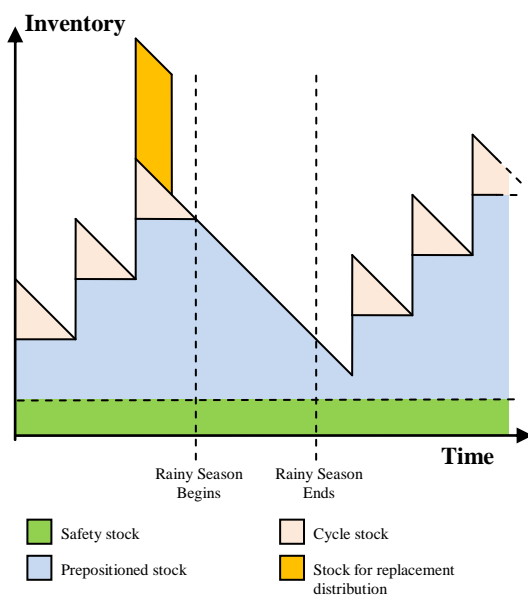
Network Design Strategy: A series of simple rules were developed to determine where inventory should be stored in each country and in which locations, either in-country or in other warehouses in the region, safety stocks should be pooled for possible alternative scenarios identified in the needs assessment process. This facilitates inventory pooling of safety stock, reducing holding and working capital costs, while maintaining availability.

The Response Curve: Each location produces a list of potential suppliers, their lead times, and

associated costs. This list is maintained and used as a reference if a stock out occurs and allows the supply officer to see all available supply options at a glance.

Sourcing Strategy: Locations that pool inventory or have high demand for CRIs are supplied directly from suppliers, which may be global or local suppliers, or other sources of CRIs, such as donations. For each location, a preferred primary source of CRIs, such as a low-cost supplier in Asia with long lead times, and a preferred secondary source, such as a nearby regional stockpile that can top-up inventory in the event that long lead times or other factors prevent the primary supplier from meeting demand, are selected. This multi-supplier strategy was adapted from techniques employed at IKEA.

Inventory and Safety Stock Policy: As all countries and locations are unique, a one-size-fits-all approach to inventory policy is not appropriate. Therefore, the planning process provides a menu of different inventory policies and the supply officer selects the most appropriate one for the situation. For example, in a location with high demand, the (R, Q) policy may be selected as it allows transportation costs to be minimized by shipping in full container loads. Safety stocks and required warehouse capacities are also calculated at this stage. The following graph illustrates the maximum stock level in a worst-case scenario at an AidOrg warehouse, and the different types of inventory held:



The diagram illustrates that inventory is highest just before a rainy season, when large quantities have been prepositioned, and, in this case, a distribution is about to be performed. To reduce capacity requirements, the process recommends that

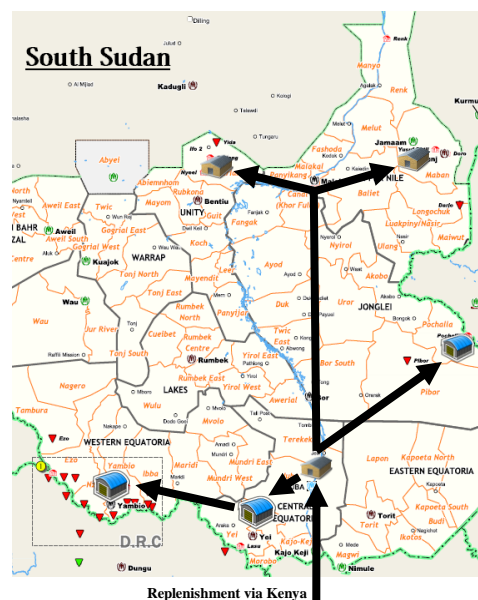
inventory for the replacement distribution be shipped to the location on the day of distribution, negating the need for it to be stored in the warehouse.

MRP Process: Benchmarking with IKEA demonstrated the value of computer software in allowing an organization to adapt quickly to demand fluctuations. As such, once the planned year has begun, MRP (or DRP) software is used to plan material requirements in each location on a monthly basis and to ensure that orders are placed in time to meet demand. The software dramatically increases responsiveness, as, whenever inputs, such as lead times or demand forecasts, change, it can instantly recalculate inventories and orders.

Case Studies

The countries selected for the case studies were South Sudan and Ethiopia. These countries were chosen for two reasons. Firstly, based on an analysis of population trends and budget spend, AidOrg has identified them, together with Kenya, Chad and the Democratic Republic of the Congo, as being two of the five countries that could benefit most from improved planning. Secondly, operations in the two countries face very different sets of challenges, demonstrating the flexibility of the planning process and its adaptability to different operational contexts.

South Sudan is one of the most challenging countries in which AidOrg operates, due to a range of factors such as rainy seasons that effectively isolate the camps with the highest new arrival rates for half the year, long customs clearance times that average approximately two months, and a chronic lack of transportation infrastructure. The following map of South Sudan depicts AidOrg warehouses and the transportation routes between them:



Applying the demand-supply planning process to South Sudan showed that very high levels of safety stock were required to be held in-country, as, due to the long customs clearance times, fast replenishment in the event of a sudden influx of refugees was not possible. In addition, while inventory could be pooled at Juba for camps in the south, high levels of inventory had to be prepositioned at camps in Upper Nile and Unity in the north in preparation for the rainy season, during which replenishment by road, even from Juba, is not possible. In the case of a stock out, the only back-up supply option with a short lead time is air freight from AidOrg's regional stockpiles in Nairobi and Dubai, for which customs clearance procedures can be waived. However, as air freight is extremely expensive, maintaining high quantities of safety stock is cheaper than keeping lower quantities and risking stocking out.

Ethiopia is a very different country, with 10 day customs clearance times, well-maintained roads that negate the impact of rainy seasons and multiple potential locations for pooling safety stock and emergency replenishment, including the central warehouse in Addis Ababa and the Nairobi regional stockpile. Ethiopia's supply network topology is shown on the following map:



Conclusions

In this work, a complete demand-supply planning solution has been developed for AidOrg using an action research methodology, facilitated by case studies. Due to the incorporation of general rules and menus of options, flexibility is provided to overcome the myriad of factors that influence supply and demand in the complex, fast-changing environments in which humanitarian organizations operate. In addition, the planning process

centralizes aspects of planning that benefit from a view of the entire supply network while leaving aspects, such as needs assessment, that benefit from local knowledge, decentralized.

By using case studies to validate a series of hypotheses, the potential benefits of implementing centralized demand-supply planning in ongoing humanitarian operations are analyzed and the results of the work generalized. In particular, the case studies demonstrate that a combination of advance planning and an MRP process, used to create responsiveness, can reduce costs while maintaining availability, thus mitigating the planning dilemma presented in Ptak & Smith, 2011. The application of techniques learnt through benchmarking with IKEA, such as multi-supplier strategies, and from supply chain literature, such as the (R, Q) order policy, illustrate the relevance of these techniques to the humanitarian sector. These insights provide a basis for planning in ongoing humanitarian operations, an area in which very little research currently exists, as most literature on humanitarian supply chains focuses exclusively on emergency response.

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