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Research Report: ZLC-2011-16
A Decision Framework for Setting an Effective Stock Policy at MedOrg Supply
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A Decision Framework for Setting an Effective Stock Policy at MedOrg Supply

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Summary

The need to have the right products in inventory is a prerequisite for the realization of a truly effective stock policy. As such, this thesis laboured to build this foundation for MedOrg Supply, an organization that supplies medical and logistics products to humanitarian field operations. The endeavour fundamentally devoted itself to designing and developing a tool that would guide MedOrg Supply in identifying the right products to stock and how these products are to be managed. At the same time, the project developed a procedure for determining the needed safety stock when constrained by the non-normality of demand distribution.

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KEY INSIGHTS

1. The developed Stocking Decision Framework is a powerful tool that identifies the right products to stock such that responsiveness is enhanced.

2. The decision model also facilitates cost efficiency by leveraging inventory tools and concepts in resolving tradeoffs.

3. The proposed alternative in calculating safety stock could improve both responsiveness and cost efficiency.

Introduction

MedOrg Supply is a supply center for some of MedOrg's mission centers as well as for other humanitarian organizations. In her evaluation of the international supply response in support of MedOrg's Haiti operation, Laura Rock Kopczak cited MedOrg Supply's order fulfilment performance measured in terms of the number of order lines received against the number of order lines shipped by month, as seen in the next graph.

2008-2010 Order lines received, shipped – M Supply (number of order lines)
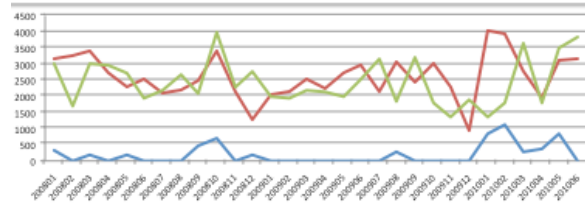
Source: *Adapted with some modification from Kopczak, L. "MedOrg European Supply Centres Evaluation", Unpublished Paper (2010)*

Legend:

Total order lines shipped	Order lines received (Haiti)	Total order lines received

In general, months during which the red line is significantly above the green line, MedOrg shipped significantly fewer order lines than it received, indicating lack of responsiveness during those months. These periods coincided with significant emergency demand. In particular, responsiveness was poor during Q1 of 2010, at the height of the Haiti emergency. While MedOrg was responsive to orders from Haiti during this time, it experienced delays in shipment of orders to regular missions.[1] In addition to this, some order lines were altogether cancelled and therefore were not satisfied. It is the goal of this thesis to help MedOrg Supply improve its ability to meet demand without disproportionately increasing associated costs.

**The Stocking Decision Framework**

Identifying which products to stock is the foundation of an effective inventory system because while an organization can have an optimal stock level and replenishment process for all items in its stock, it will inevitably fail to satisfy what is truly demanded by its customers if it doesn't hold the right products in its inventory.

The Stocking Decision Framework developed in this thesis was designed to help MedOrg Supply come up with the right inventory product mix. Because the main business objective of the organization is to be responsive to the supply needs of the field operations, the model incorporates all key drivers of responsiveness. It classifies products according to their stocking desirability using basically two main criteria: the

product's demand profile and the scalability of those items when a stock-out scenario occurs.

The decision model also incorporates some cost drivers although this was given lesser weight in order for the decision framework to reflect the organizational values of MedOrg Supply. While this can play a role in achieving cost efficiency, it is the model's application of inventory tools and concepts in dealing with tradeoffs between responsiveness and efficiency that has greater impact in cost reduction. In so doing, it minimizes inventory holding and other associated costs without harming the organization's ability to be responsive.

The Stocking Decision Framework developed in this thesis is visually represented below:
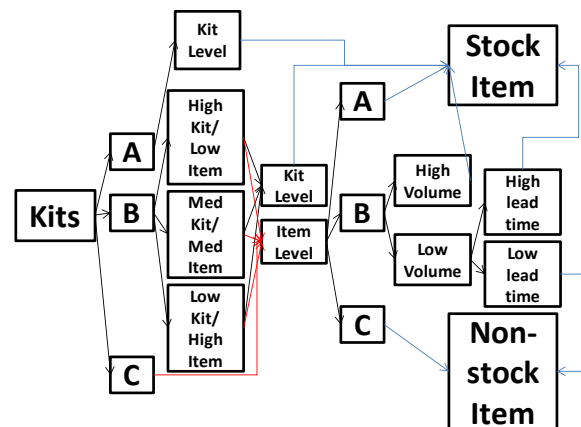
To better understand the decision process, note must be given to the two types of products that the organization maintains: component items and kits. Component items, such as aspirin and syringes, are the most basic unit that MedOrg Supply holds. A group of component items designed for a particular purpose is what is known as a kit, examples of which are cholera and surgical kits. The decision process takes a top-down approach in that it first tries to segment kits and then moves on to the component item level while guiding the user on how to manage those same stock items.

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[1] Conversation with Laura Rock Kopczak. Graph provided by Laura Rock Kopczak.

Approach to Determining Safety Stock Level: An Alternative to the Current Policy

The current policy on safety stock assigns a uniform level across the board in the sense that an average month's worth of demand is used as buffer against uncertainty. (For products that experience high demand variability, two month's worth of consumption is used). Because each product experiences varying uncertainties, it can be that certain products may need more or less than a month's worth of demand as a safety stock. This necessitates the need to revisit the current policy.

Because the distribution of the demand is anything but normal, the standard safety stock formula could not be used and therefore an alternative way of computing safety stock was explored.

The proposed alternative method looks at historical demand and from this data set, develops a frequency table. The needed inventory during replenishment period is determined by taking the corresponding demand range whose cumulative frequency is at least equal to the desired service level. Safety stock is the difference between this demand and the average demand during lead time. This method is believed to improve the current policy on safety stock. Instead of applying a uniform stock level across the board, the alternative proposal assigns varying safety stock based on the probability of a demand occurring during the replenishment period and the service level that the organization wants to deliver. This procedure now has a basis that is more robust than just merely looking at the average demand.
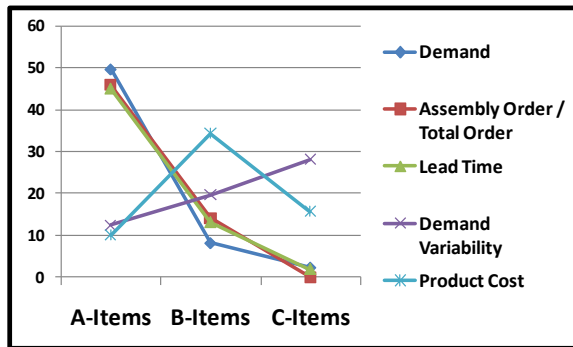
Results

A total of 373 kits and 4488 component items were segmented using the Stocking Decision Framework as the segmenting tool. For kits, 106 were identified as A-kits, 151 as B-kits and 116 as C-kits. For component items, 1102 items were classified into A-category, 1985 as B-items, and 1401 items were clustered as C-group. The graph below shows the general collective characteristics of the ABC kits.
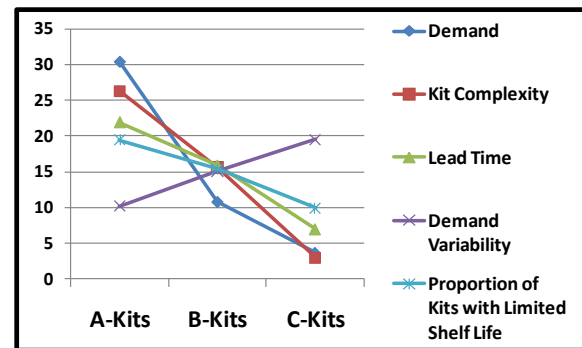
As shown in the graph, A-kits exhibit the highest and most stable demand. Having the longest lead time and the highest complexity, they are the most inflexible in terms of scalability. On the contrary, C-kits have the least and most unstable demand. They are also the easiest to produce when a stock-out occurs, being the simplest to assemble and having the shortest lead time. B-kits exhibit intermediate characteristics between these two extremes. The proportion of kits with limited shelf life seems to have been embodied by the ABC clusters in a way that is contrary to what was hoped for. To minimize losses from scrapping of expired inventory, it was desired to hold kits that don't have limited shelf life. This desire was not satisfied. The reason could be either or both of these two reasons: the weight given to this factor was less compared to the other factors and the other factors collectively scored high

leaving this factor's influence to be diluted significantly.

The graph below shows the group characteristics of the component items relative to its ABC segment.

The result yielded the same insight. Component items with high and stable demand, difficult to produce and whose unavailability could jeopardize other critical operations are classified as A-items. On the other hand, those that exhibit the opposite of these characteristics are clustered as C-items. And finally, those that embody the intermediate of these characteristics are grouped as B-items. Again, as in the case of kits, the only cost element (in this case the product cost) was not manifested by the items in the manner that was hoped for.

To showcase how the alternative proposal in computing safety stock could be used and how it may impact the performance of MedOrg Supply, a certain kit (KSURBDRE3--), was used as an example. If the current policy is applied, the safety stock for the kit would have been 50 units. The alternative proposal yielded a safety stock level of only 22 units to satisfy the desired service level. In this case, the current policy results in overstocking.

Conclusion

An ideal stock item is one that has the highest and most stable demand and at the same time is the most difficult to scale up when a stock-out occurs. It was noted that products classified as A-stock by the decision framework have exactly these kinds of characteristics. Products having the lowest and highly unstable demand and are the easiest to produce are ideally the kind of items that can be procured to order. Again, the decision model has properly identified these types of kits and component items and segmented them as C-stock. Finally, the decision framework has correctly identified those items that lie in between the two extremes and classified these items as B-stocks. As such, the designed Stocking Decision Framework proved to be a powerful decision support tool that can help MedOrg Supply identify the right products to stock – the kind of inventory product mix that can boost its ability to be responsive. Because the tool leverages the tradeoffs between responsiveness and efficiency, it also helps MedOrg Supply to achieve cost efficiency without harming its ability to react quickly to demand.

On safety stock policy, it was demonstrated that MedOrg Supply has the potential to reduce the level of safety stock without undermining the desired service level if the proposed alternative is implemented. Definitely, there may be cases in which safety stock will be higher than the current level, but this only shows the weakness of the current policy – it holds more on items where it needs to hold less while holding less on products that it needs to hold more.

Recommendation

Because operational dynamics change over time, the usage of the Stocking Decision

Framework is advised to be done annually as part of yearly inventory planning or as frequently as possible when the need arises. The decision framework is envisioned to be a dynamic decision support tool and therefore the user has the flexibility to change the parameters that are currently working within it as he sees fit. As such, the model may evolve over time to reflect the changes that inevitably will occur as time passes by.

The proposed safety stock calculation, though elegant and reliable as it is, may not be easily usable. It is acknowledged that the procedure is manual and therefore may not be practical to be used on thousands upon thousands of products. Its applicability is indeed a challenge. Therefore, a way to develop an application needs to be done.

To fully realize an optimal inventory policy, designing a robust operating system for inventory management has to be carried out. Unfortunately, because time prevented us from fully exploring this phase, a second thesis may be conducted in the future to continue this project from where it was left. Crafting a robust forecasting methodology, developing a tool that will calculate optimal stock level, designing a replenishment & review policy as well as ordering policy are work that has yet to be carried out.

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