The Impact of Assured Supply Inventory Policies.

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Summary: This research presents a case study of a distribution center in a fast food restaurant supply chain where the replenishment policy is “Never Run Out.” Supply chain costs and configurations at the distribution center are analyzed, and alternative supply chain strategies are suggested. These results are incorporated into a total relevant cost analysis, and applied to the decision between alternative transportation modes.

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KEY INSIGHTS
1. “Never Run Out” is a common and intuitive approach to assuring supply, but it increases costs and limits supply chain flexibility.
2. Distribution center cost analysis needs to consider the impact of transportation cost per unit, lead time, and lead time variability.
3. The use of ratios in analyzing alternatives can highlight parameter sensitivity and support decision-making.

The QSR market is highly competitive, and switching costs for customers are low. Therefore, the Express Fast Food strategy emphasizes attracting and retaining customers by providing an excellent experience. The dominant belief within the company is that a stockout of any item, in any one of Express Fast Food’s restaurants, will result in customers not having their expectations met at the crucial moment of truth when an order is placed. Stockouts in a restaurant are therefore thought to erode the value of the company’s brand, in addition to reducing sales.

Each Express Fast Food restaurant is supported by a multi-echelon supply chain, where products follow a linear distribution path. As shown in Figure 1, a restaurant orders inventory replenishments from a regional distribution center. The distribution center orders replenishments from hubs and from manufacturers. Hubs act as mixing centers to lower transportation costs for low volume items, while medium and high volume items are shipped to distribution centers directly from manufacturers. The distribution centers, hubs, and manufacturers, are all

Express Fast Food has a complex supply chain which serves over 13,000 quick serve restaurant (QSR) locations in the U.S. The QSR format, where customers eat inside, but table service is not provided, provides three fourths of the revenue within the United States fast food industry. This industry generated over $50 billion during 2006.
owned and operated by third party supply chain partners. Transportation is coordinated by a single partner firm, which in turn contracts the services of third party logistics providers.

Figure 1. Supply chain illustration.

In order to ensure customer expectations for product availability are met, while minimizing the need to actively manage third party operations, Express Fast Food has provided a simple rule for all of their upstream supply chain partners: “Never run out.” This mandate, sometimes referred to within the supply chain as the “assured supply policy,” is assumed to encourage suppliers, hubs, and distribution centers to maintain enough inventory to satisfy normal demand, plus additional inventory as buffer against uncertainty. This is typical of supply chains in which each echelon maintains cycle stock to meet forecasted demand between replenishments and safety stock to compensate for variability in both supply and demand. Cycle stock is the amount of inventory on hand that results from placing orders in batches. Safety stock is the average level of net stock just before a replenishment order arrives. The implication of this Never Run Out approach is that inventory is the preferred method for responding to uncertainty. If followed strictly, it seems reasonable to assume that it would eliminate the potential for stockouts. But this approach has shortcomings.

In cases where more than one mode of transportation or source of replenishment is available, the critical tradeoff is often between the cost of transportation and the cost of holding inventory in the distribution center and the pipeline. The never run out rule forces management to focus attention on the amount of inventory on hand. However, a better approach would be for management to establish a desired level of service using statistical models, and then select alternatives that achieve the service level at the lowest total cost.

Once the desired service level has been established there are three variables which are likely to shift the decision toward one alternative or the other. These are the per unit cost for transportation, the order lead time, and the lead time variability. By incorporating these parameters into a total relevant cost analysis, it is possible to compare alternative sources and modes of transportation. The ratios of each alternative’s parameters will identify the magnitude of their differences, and the sensitivity of total costs to changes in each parameter.

This approach is illustrated in the comparison of trucking versus rail as a transportation mode for a single product-supplier-distribution center combination. The analysis shown in Figure 2 demonstrated that trucking and rail produced an equivalent total relevant supply chain cost when the ratio of transportation cost per unit for Mode 1 to Mode 2 is about 6. This ratio, referred to as $\Delta$, shows both the ranges in which each mode is more cost effective, and the sensitivity of total relevant supply chain cost to changes in transportation cost.

Figure 2. Total relevant cost (log) as a function of $\Delta$.

The primary finding of this research is that instructing suppliers to never run out of inventory is a common and intuitive approach to assuring supply, but it can increase costs and produce low service levels. The body of supply chain management research and practice show that it is better to measure customer service level at the end of the supply chain, based on actual demand, and then use inventory as one option in order to meet the target service level. Supply cannot be efficiently assured simply by increasing safety stock levels at distribution centers.

Attempting to assure supply by maintaining high inventory levels sounds rational, but there are fundamental problems which must be considered. Chief among these are imperfect information, the laws of probabilities, and a mismatch between the approach and the goal. First, it is difficult to enforce a
never run out policy because it relies on the accuracy of data, the interpretation of information, and the timing of transactions. It does not appear that the information systems and processes in place currently at Express Fast Food can produce the information required. While it is possible to make assumptions in order to perform an analysis, it may be dangerous to use these assumptions as the basis for making routine decisions of this scale. If performance can’t be measured reliably, then it is hard to comply with requirements, and to enforce them. Second, even if the never run out approach does work, it will generate extra inventory at each echelon. The more echelons, and the more variability there is in the transportation between them, the more extra inventory it will add to the supply chain. This increased inventory does reduce the probability of a stockout, but you can never achieve a stockout probability of zero. Therefore, no amount of safety stock is enough to entirely eliminate the possibility of a stockout. Finally, Never Run Out measures inventory levels at all of the echelons in the supply chain, but the only echelon that ultimately matters is at the restaurant. It is entirely possible that a distribution center could run out of a product for a day or more without causing any stockouts in a restaurant.

To achieve the ultimate goal of not running out at the customer interface, it is necessary to engineer and manage a supply chain which will produce a statistically high level of service. This means that metrics other than distribution center inventory levels are needed in order to optimally match supply and demand at the lowest possible cost. Some metrics that may help to improve management and decision-making throughout the supply chain include real-time demand and inventory levels at the restaurant, percentage of perfect orders received by each partner, on time deliveries, and lead time variability. Access to this data could yield significant improvements to the efficiency of the supply chain and savings from reductions in inventory. However, it will also require the introduction of additional information technology systems, and a willingness on the part of all of the partners to comply with common data collection and sharing practices.

Constraints such as seasonality or lot sizing can force supply chain partners to stockpile inventory, and in those cases the increased safety stock required in order to take advantage of lower transportation costs may not increase the amount of inventory on hand. Where these constraints are not present, it is better to rely on lean supply chain strategies to minimize inventory and reduce costs at each echelon. Four options that should be considered before increasing safety inventory are the use of forward warehouses, multiple suppliers, alternative transportation, and lateral transfers.

Proper utilization of a portfolio of supply chain strategies can produce an agile, adaptable, and aligned supply chain which enables the enterprise to provide the desired level of service to customers at the lowest total landed cost.