Should You Take the

VIRTUAL

Fulfillment Path?

At first glance, the decision to use virtual inventory to fill online orders seems a no-brainer. Why hold goods in anticipation of orders if you can get someone else to do it for you? But upon closer examination, virtual order fulfillment proves to be something less than the silver bullet. The guidelines offered here will help both pure-play and brick-and-mortar companies determine which fulfillment path—virtual or traditional—is right for their online business.

By Taylor Randall, Serguei Netessine, and Nils Rudi

Over the past five years, many companies have experimented with combining information technologies (such as electronic data interchange, enterprise resource planning, and the Internet) and sophisticated distribution techniques (hub-and-spoke configuration and cross docking) to create innovative supply chain structures. Perhaps the most striking development in this space is the dramatic increase in virtual order fulfillment, which is accomplished by the technique called drop shipping. With drop shipping, the retailer passes orders straight through to a wholesaler or manufacturer, which then ships products directly to customers with the retailer's label on the package. The retailer itself holds no inventory.

This arrangement creates what we term a virtual supply chain. The virtual model has proven particularly popular among Internet retailers. Today, 30 percent of pure-play Internet retailers use drop shipping as the primary means of order fulfillment, compared with 5 percent of multi-channel retailers.[1]

At first glance, the advantages of the virtual supply chain appear overwhelming. To illustrate, thriving CD retailer Spun.com avoided an $8 million investment in inventory by using the fulfillment capabilities of the wholesale distributor Alliance Entertainment Inc.[2] Competitor

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Virtual vs. Traditional Inventory

To put the discussion in context, it's useful to compare flows in the traditional and virtual supply chains. First, consider order flow and information flow in the traditional supply chain. The product is dispatched from the wholesaler and passes through the retailer on the way to customers. Information about demand for the product flows in the opposite direction—from the customers to the retailer and then to the wholesaler. Interestingly, some Internet companies, such as Amazon.com, CDNow.com, and Barnes & Noble.com, actually use a traditional supply chain as the primary mechanism for delivering goods to consumers. These companies hold inventory at their own warehouses or at retail stores, and then fill orders from these locations.

In the virtual supply chain, demand information still passes from the customer to the retailer to the wholesaler. In most cases, however, the retailer simply forwards the order as soon as it arrives so that information distortion is minimal. Unlike the traditional approach, however, in the virtual chain, physical goods bypass the retailer and are delivered directly to the customers. Spun.com, Value America, and Zappos.com (which bills itself as "The Web's Most Popular Shoe Store") are examples of Internet retailers that use the virtual supply chain as the primary mechanism for delivering goods to consumers. (The two different models are contrasted visually in Exhibit 1.)

Benefits of Choosing Virtual Inventories

For a retailer, the choice between a virtual and a traditional fulfillment channel involves complex trade-offs of costs and benefits. Let's start by examining the benefits a retailer gains by using virtual inventories for order fulfillment.

■ **Reduced investment in inventory and fulfillment capabilities.** When entering a new metropolitan market, Internet grocery retailer Webvan faced an upfront investment

CDNow, by contrast, which owns its inventory and fulfillment capabilities, has declared bankruptcy because it is unable to cover its costs of doing business. Yet other real-life examples fail to provide such clear-cut evidence of the virtual supply chain's comparative advantages. Online retailer Value America, for example, declared bankruptcy citing in part an inability to fill customer orders from virtual stocks.[3] Value America's chief competitor, Amazon.com, on the other hand, has aggressively invested in fulfillment capabilities and continues to garner high ratings for service. Most importantly, the online retail giant recently posted its first quarterly profit.

These contradictory examples prompted us to investigate the following questions: When should retailers hold inventory, and when should they adopt a virtual inventory model using the fulfillment capabilities of a drop shipping partner? To find the answers, we gathered data from 54 publicly traded Internet retailers. Through interviews and statistical analysis, we gained insights into the costs and benefits of using virtual inventory structures and identified those conditions that would allow companies to benefit from such structures. We also examined the implications of making the wrong fulfillment decision.

in inventory and equipment of between $50 million and $100 million per warehouse. Yet generating the volume required to justify this investment turned out to be impossible. So Webvan, like many other Internet grocery retailers, was forced to declare bankruptcy. On the other hand, Spun.com invests nothing in infrastructure. The CD retailer essentially borrows the infrastructure and inventory of its wholesaler partner, Alliance Entertainment Inc. In addition to reducing inventory, this approach brings a related advantage: Spun.com can concentrate more fully on core competencies like customer acquisition and product presentation.

■ **Wider product selection.** From punk rock to Rachmaninoff, Alliance Entertainment provides more than 200,000 different CD choices to its 15,000 or so retailers (including Spun.com). Retail partners of Alliance have access to the wholesaler's entire inventory.

■ **More predictable product availability.** Product availability often depends on the retailer's ability to predict demand. Yet random demand fluctuations make accurate forecasting difficult and often result in missed sales. If a wholesaler, such as Alliance Entertainment, provides products to multiple retailers, demand across the retailers is pooled, which smoothes demand fluctuations. This translates to more predictable patterns and higher service levels.

A virtual supply chain is not without its costs and risks—the loss of profit margin being one of the most significant.

■ **Lower costs due to economies of scale.** The wholesaler handles much larger quantities of products than does the retailer. The result is lower overall handling and warehousing costs.

■ **Lower transportation costs.** In the traditional supply chain, the retailer may pay two separate transportation costs—the first to acquire goods from the wholesaler, the second to ship goods to the customer. In the virtual supply chain, on the other hand, the only transportation cost is for shipping product from the wholesaler to the customers. Furthermore, the wholesaler might be able to lower shipping and handling costs by exploiting economies of scale.

Costs of Virtual Inventories

Though it can deliver a number of important benefits, a virtual supply chain is not without its costs and risks. These are among the most prominent.

■ **Loss of product margin.** Wholesalers take a percentage of the product cost in payment for fulfillment services and exposure to inventory risk. These markups typically range from 10 to 15 percent of the regular wholesale price. Some retailers may find this expense unacceptable.[4]

■ **Loss of control that could negatively affect service quality.** We've noted two circumstances where giving up control of inventory can lead to poor service quality. In the first case, service deficiencies often occur because the retailer *lacks information transparency with its wholesalers.* One of our colleagues recently ordered an expensive golf club via a virtual Internet golf retailer. "The price was outrageously low," she reported. Unfortunately, the retailer had no idea that its fulfillment partner lacked the inventory to fill demand—there was no information transparency between the two. Six weeks later our colleague reluctantly paid full retail price for that same club at the golf shop down the street.
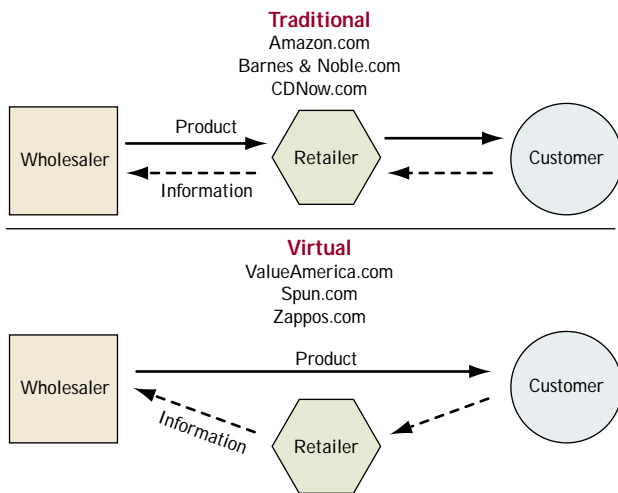
The transparency problem is not new. Long before the arrival of the Internet, retailers that adopted a virtual inventory approach complained about the lack of information transparency between themselves and their fulfillment partners. In fact, historically only a small fraction of all catalog sales orders have been drop-shipped. Most were shipped from existing inventory at the retailer's warehouse or distribution center. Internet technology, coupled with sophisticated inventory systems, provides solutions to the coordination problem—but sometimes at great expense. A Norwegian retail executive, for example, recently complained that he could not justify the investment to coordinate inventory between his own warehouses, much less the investment to coordinate inventory with his customers.

Service quality in the virtual supply chain also can be compromised because of *exposure to rationing.* Rationing usually occurs when a supplier cannot fill product demand and must apportion products among customers. Of course, rationing behavior exists in both the traditional and virtual fulfillment models. But the exposure to rationing is far greater in the latter because a virtual retailer does not hold inventory safety stocks.

■ **Encroachment on customers.** Information transparency is a double-edged sword. On the one hand, you need to share information to fill customer orders. But on the other, what retailer wants its customer information shared with the wholesaler, who could easily decide to deal directly with the customer? Allstate Insurance recently told its agents that the services they performed would be cut back and that the company would be selling directly to customers. The creation of a centralized system containing all customer information enabled Allstate to make such a move. For the agents, the information system initially seemed to represent a great technological opportunity to upgrade service and increase sales. Those agents now find themselves in a legal battle to block

EXHIBIT 1

The Two Fulfillment Models

Traditional
Amazon.com
Barnes & Noble.com
CDNow.com

Virtual
ValueAmerica.com
Spun.com
Zappos.com

Allstate from bypassing them and serving customers directly. The centralized information system did assist agents with service, but it also allowed Allstate to collect and control valuable data on customers.[5]

Choosing a Supply Chain Structure

Our study of 54 companies found that successful Internet retailers identified several important conditions that influence the trade-offs between traditional and virtual inventory structures. By carefully analyzing those conditions before making any investment decision, retailers can more effectively determine which supply chain structure—traditional or virtual—is right for them.

Higher sales volume favors the traditional structure. The larger your sales revenues and operations, the easier it is to justify big investments in order to cost effectively increase product selection and to achieve high product availability on your own. We observed a tendency among large retailers to invest in their own capabilities. Amazon, for example, justified its huge investments in fulfillment based in part on plans to grow and dominate the Internet retail space. On the other hand, smaller retailers like Spun.com leverage the size of their wholesale partners to achieve the same product selection offering. But in return, they must give up significant product margin.

High need for order consolidation favors the traditional structure. Virtual structures lose their luster when customers require order consolidation and suppliers are fragmented. Imagine ordering groceries online, then having 35 different packages arrive at your door. One for peanut butter, one for milk, one for soap ... with a $5 shipping charge for each order! This extreme scenario can play out when customers order multiple items but the retailer chooses to outsource its fulfillment capabilities to fragmented wholesalers that do not

stock complete product lines. Virtual inventories provide little benefit in product categories, such as grocery, where consolidation of orders is necessary but impossible to accomplish from a few consolidated wholesalers. This challenge, however, does create a window of opportunity for transportation companies that can provide value-added services like cross docking and order consolidation from multiple drop shippers. For example, UPS combines a computer system drop shipped from Dell with a monitor drop shipped from Sony into a single order that is delivered to the customer's door.

Lack of small-order fulfillment capabilities among wholesalers favors the traditional structure. When deciding whether or not to adopt a virtual approach, one large jeweler realized that few wholesalers had the capability to fill small orders. This realization justified the jeweler's investment in fulfillment capabilities. We noted that many early entrants into Internet retailing tended to invest in their own fulfillment capabilities. A big reason for this was the lack of capable fulfillment partners. As small-order fulfillment technology became more common, manufacturer and wholesale capabilities to ship small orders improved. However, in many industries—durable goods being one of them—manufacturers still do not possess adequate small-order capabilities.

High demand volatility favors the virtual structure. When demand volatility is great, retailers face high inventory risk. In such conditions, we find that companies tend to use wholesale fulfillment partners. When that partner serves multiple retailers with the same stock, random and normally occurring demand fluctuations can be smoothed, resulting in better service to customers. Companies like Alliance Entertainment and Fingerhut, the popular catalog retailer, provide such services for thousands of retail clients.

High product variety favors the virtual structure. The virtual inventory structure benefits companies making the strategic decision to offer high product variety through a partnership arrangement. As it was making preparations to go online, brick-and-mortar retailer CircuitCity estimated that Internet shoppers expected to see around 55,000 movie titles. Yet a typical CircuitCity store only carried between 500 and 3,000 titles. To meet customer expectations on product variety, the company decided to partner with an outside company and fill movie orders made at CircuitCity.com through virtual inventories.[6]

In evaluating the different approaches, companies should know that they also can pursue a hybrid arrangement, such as owning a portion of inventory but drop shipping certain products to enhance the product line. Through such a structure, many companies find that they can reap the benefits of a virtual inventory approach without exposure to all of the perils. Yet in pursuing the hybrid approach, they need to make ful-

fillment decisions on an item-by-item basis, mindful of the conditions discussed here. The following example provides a case in point. For its online channel, Kmart stocks some of the most popular CD titles internally while virtually fulfilling others by drop shipping.[7] Drop shipping often is used in hybrid supply chains to enhance product selection and to provide a backup in case the traditional channel cannot deliver the goods in a timely manner.

Based on those conditions that influence the choice of supply chain, we have classified companies according to whether they are making rational or irrational order-fulfillment choices. We reasoned that companies making irrational choices would find themselves on the wrong side of key economic trade-offs. According to our classification, over 10 percent of the companies we examined made irrational supply chain choices. After controlling for factors such as financial distress, company size, and company age, we examined the probability of bankruptcy in our rational and irrational companies. We found that companies making irrational supply chain choices were twice as likely to go bankrupt as companies that made rational supply chain choices.

Application to Brick-and-Mortars

So far, we have used Internet companies as the primary examples in this discussion. Yet brick-and-mortar companies, also, can successfully pursue both drop shipping and hybrid approaches. A large integrated tire manufacturer, for example, recently analyzed the cost structure of its traditional supply chain in light of recent advances in its logistics infrastructure and information technology. Under its traditional supply chain setup, tires moved from a factory to regional warehouses to retail stores. The costs of this chain were compared to an alternative approach whereby tires were sent directly from the factory to the retail customers via UPS. The comparison showed that for many products the virtual supply chain could deliver the tires to the customer more economically than the traditional chain.[8] The consultants who conducted this analysis recommended that the tire company shift these products to a virtual supply chain, citing potential cost savings in the millions of dollars.

In certain situations, it makes sense to ship the product directly to the customer's home rather than having the customer take physical possession at the retail outlet. Retail operations at airports are good examples. An air traveler is rarely willing to carry an extra weight for the duration of the trip. So by offering to ship the product directly to the customer's residence, the airport retailer may make its products much more attractive to customers. Further, shelf space is notoriously expensive at airports, making it costly for the stores to carry large inventories. By limiting the products in

stock to display-only samples and stocking the rest centrally in a warehouse, the retailer could achieve some important benefits in terms of wider product selection and lower inventory carrying costs.

Finally, Staples Inc., together with several other brick-and-mortar retailers, has adopted a dual strategy of holding inventory at the store and drop shipping out-of-stock items directly to customers.[9] As part of this initiative, Staples and the other retailers are installing in-store Internet kiosks that allow customers to place orders for items not found in physical inventory.

The issues discussed in this article can help supply chain professionals develop an intuitive understanding of the basic trade-offs between inventory structures. Such intuition is the starting point in the decision-making process. The next step is to formulate more formal, quantitative models of the decision. For example, a company choosing a virtual structure over a traditional option gives up some margin to its fulfillment partner but forgoes the fixed costs of a warehouse. By comparing the fixed investment in warehouses against projected sales scenarios, the company can better determine whether a virtual inventory approach is the right one. Quantitative models formalize the trade-offs and allow companies to see which of those trade-offs are most critical in their particular situation.

The more you quantify trade-offs, the less of a guessing game the inventory decision becomes.[10] Yet deciding between virtual and traditional inventory structures will always be a high-stakes proposition—one in which companies risk customer loyalty, large investments, and ultimately market success.

Footnotes

[1] "The State of eRetailing 2000," supplement to *eRetailing World*, March 2000.

[2] "Cheap Tricks," *Forbes*, Feb. 21, 2000, p. 116.

[3] "The American Dream Gone Bad," *The Industry Standard*, Aug. 28, 2000, pp. 71-73.

[4] Scheel, N. *Drop-shipping as a Marketing Function*. Quorum Books, 1990.

[5] "Good Riddance," *Forbes*, Feb. 5, 2001.

[6] "What's in Store," *Wall Street Journal Special Report: e-Commerce*, July 15, 2002.

[7] "Will BlueLight Attract Big Sales in Cyberspace?'' *Apparel Industry Magazine*, September 2000.

[8] Presentation by Deloitte and Touche Consulting, University of Utah, 2000.

[9] "Staples Joins Kiosk Retailers," *Computerworld*, Feb. 5, 2001.

[10] For an example of such quantitative analysis, see the research paper by S. Netessine and N. Rudi, "Supply Chain Choice on the Internet," available at http://www.netessine.com.