Ecommerce (Omnichannel) Supply Chain Design

What retailers, distributors and manufacturers must know

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Supply Chain Management

So You are, or Want to Begin Selling Online
The purpose of this white paper is to give you a complete picture of ecommerce and omnichannel supply chain design. It will help you with the decisions you need to make when considering how to participate in the ecommerce economy. *Some key decisions are highlighted in italics.*

First, What is Omnichannel?
If you are getting into ecommerce, you need to know about omnichannel as it is the current and future wave of how retailers, distributors and manufacturers will sell online.

Omnichannel is the logistics system that leverages all assets to fulfill in-person and online (ecommerce) orders. Omnichannel companies use stores, warehouse locations, and the inventory in both, to improve customer service by delivering quickly, while maximizing profit. The key omnichannel decision is "how you will fulfill online orders to take advantage of all assets in a network."

Optimizing Tradeoffs of Omnichannel Ecommerce Fulfillment
Tell a businessperson that they will need to deal with a tradeoff, and they will typically see it as a negative. However, tradeoffs represent an optimization opportunity. The tradeoffs you need to be aware of in omnichannel fulfillment is speed of delivery (and subsequent market share) versus inventory + facility cost.

More Fulfillment Locations = Faster Delivery and Higher Market Share
Speed in online order fulfillment is **the** critical design criteria for omnichannel companies. The percentage of customers who want same-day or next day delivery without paying a premium is growing. In our research we have found that speed directly translates into market share. Figure 1 shows ecommerce market share based on speed of delivery for a sporting goods omnichannel retailer [1].

Market Share vs Delivery Days at Different Market Share Sensitivities
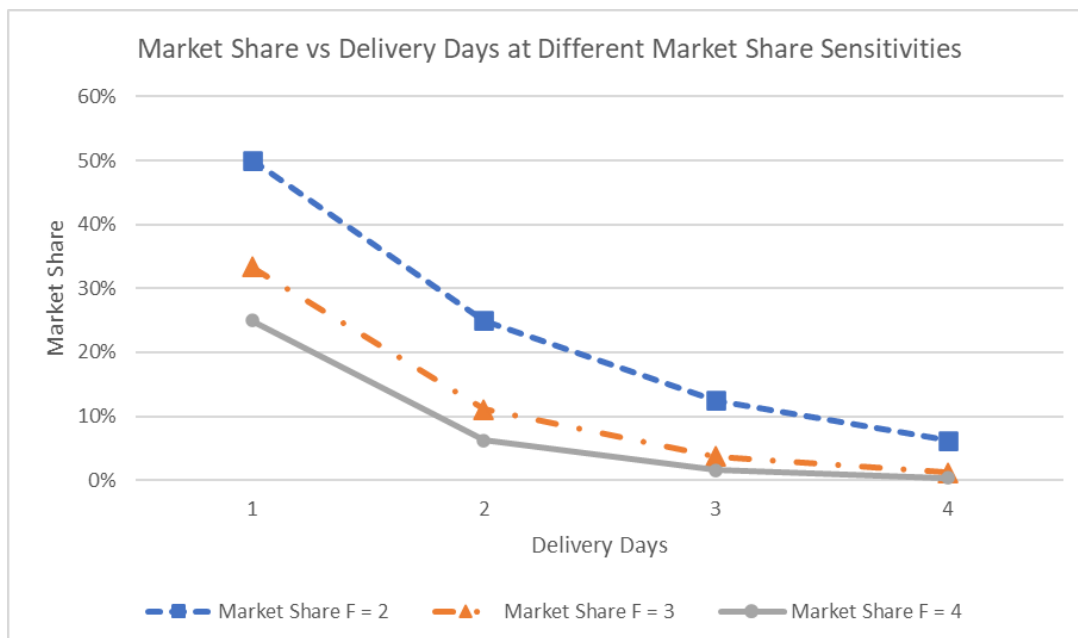
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Figure 1: Market Share versus Delivery Days at Different Market Share Sensitivities [1]

More Fulfillment Locations = Higher Costs
Being closer to customers and delivering online orders faster means shipping from more locations, including stores, branches and warehouses. However, the more locations you use, the more complexity you add to your business processes. The simplest, and most labor-efficient option to fulfill an order is to use warehouses. However, they may be far away from customers. Stores are close to customers but they are not set up for efficient picking, often have inventory inaccuracies and do not have space for packing/shipping online orders.

Your job is to balance speed and market share versus costs to maximize your ecommerce profit.

Making these Decisions with Growing Online Demand
Online demand is experiencing a steady increase of its share of total retail and wholesale sales. Because it is still in a growth phase, retailers, distributors and manufacturers need to make decisions about omnichannel logistics without knowing when online demand growth will slow. Will online demand grow to 100% of sales and stores become obsolete? In 2020 online sales soared due to the COVID-19 pandemic. However, will it plateau as people visit stores again, or grow… and how fast? Companies must model different scenarios and make the best possible decision given this uncertainty.

Choosing an Omnichannel Network Design: SFW, SFS, SFWSB, SFW+S
There are four omnichannel fulfillment designs.
- Ship-from-warehouse (SFW) uses warehouses that both replenish stores and fulfills online demand. SFW is the simplest omnichannel fulfillment design because centralization creates economies of scale.
- Ship-from-store (SFS) uses brick-and-mortar stores to fulfill online demand. The advantage of using stores is greater inventory utilization and proximity to customers.
- Ship-from-warehouse-with-store-backhaul (SFWSB) looks at the inventory across stores and warehouses that are in the same market as one inventory. If an item for an online order is in the store, that item is backhauled to the warehouse where all online orders are fulfilled. SFWSB's advantage is combining the simplicity of SFW with greater inventory availability.
- SFW+S allocates the online order to the location that is closest to the customer and has the inventory needed on-hand. SFW+S requires a robust order allocation system and rules of how much to use stores versus warehouses, the importance of distance and inventory minimums.

A graphic of each channel design is shown on the next page [2].

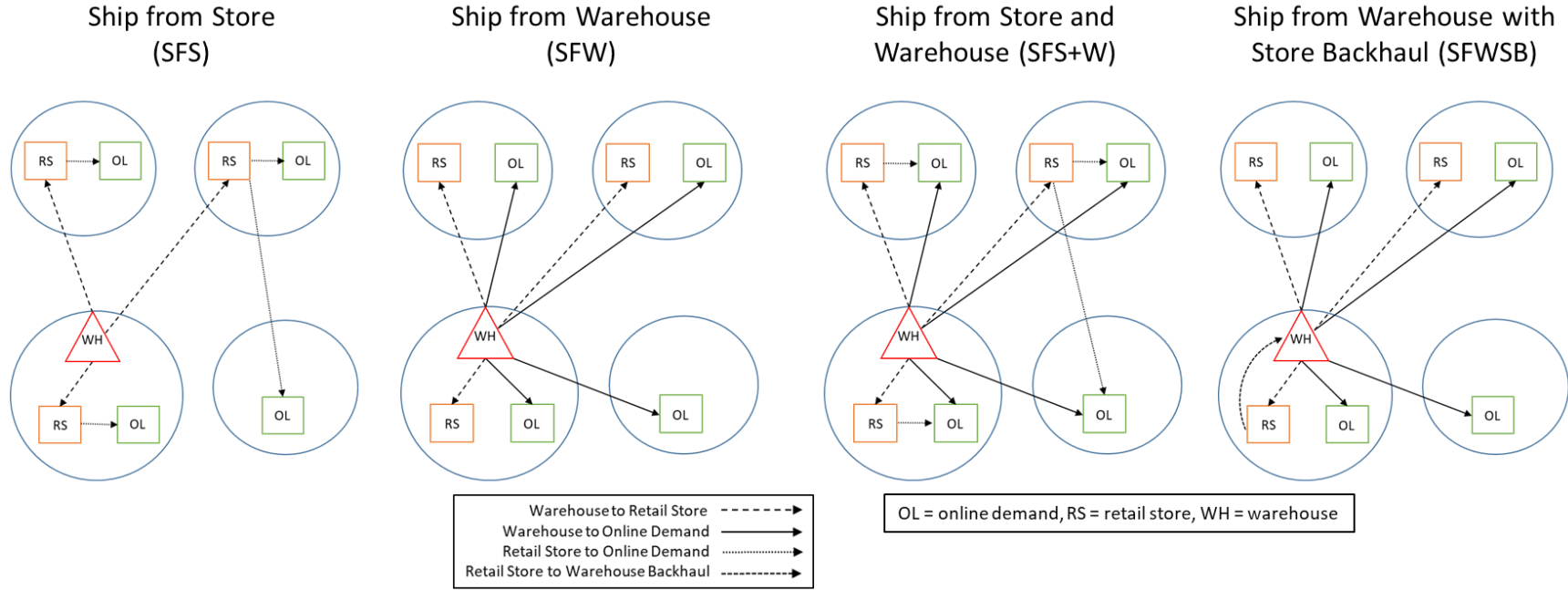*You need to choose one of these designs for your online order fulfillment.*

Figure 2: Different Omnichannel Designs [2]

Other Trends You Need to Know about in Ecommerce Fulfillment

Buy-Online-Pickup-In-Store (BOPS): A Customer Inventory Reservation System
In the last few years Wal-Mart and others have implemented BOPS. This saves people the work of shopping and saves the retailer the expense of shipping the order. However, the real benefit of this system to consumers seems to be as an inventory reservation system. People use it to reserve an item in a store to ensure it is on-hand, so they don't have the hassle of an item being stocked-out when they go to the store.

If you're a distributor, this has a name, "will-call." If you are a retailer you need to think about the tradeoffs of giving this convenience to your customers versus the increasing costs and complexities of your own people picking items off shelves as customers are in the store doing the same thing.

Dark Stores
An interesting strategy, as less people shop in brick-and-mortar stores, is for companies to convert their retail (light) stores to mini-warehouses that can fulfill online orders or serve as BOPS locations. Dark stores allow retailers, or pure ecommerce companies, keep an assortment of high-velocity items very close to customers for same-day delivery. The light stores are converted into dense storage and picking layouts, so they are more efficient and have lower operating costs due to their less desirable locations. As with much of ecommerce, Amazon started this strategy by purchasing closed K-Marts and converted them to dark stores.

I think soon, grocery retailers and many other companies selling a wide merchandise assortment are going to set up dark stores or convert light to dark stores. *This is a tough decision that requires detailed cost versus benefit modeling.*

Next Day, then Same Day, now Next Hour Shipping
A supply chain researcher once said that "the internet killed distance then mobile brought it back." Back when ecommerce first arose, no one cared where the warehouse was located. However, when people started shopping on their phones, suddenly there was a need for immediate satisfaction. Ecommerce supply chain strategies are now focused on fulfilling orders with same day or even same hour delivery. Amazon teased us with the potential for drone deliveries from their warehouses. This seems to have been premature but the need to provide immediate delivery is a problem all companies need to solve.

Ultra-fast delivery could be the great advantage of having stores or branches. They are already close to customers and form an inventory and delivery network.

Again, this is a tough decision that requires detailed cost versus benefit modeling. What will you gain in market share? Or will you just make existing sales cost more for you to fulfill because existing customers switch to same day when they don't need this service?

Order Allocation/Assignment (distributed order management)

Another problem that needs to be solved when implementing omnichannel supply chain is what site to use to fulfill an individual order. A simple algorithm is to use the closest location to the customer. Because it is simple, it is also fast and can be done almost immediately after receiving the order. However, it has been shown to be ineffective because of inventory considerations. Would you ship from a site that is closer if you were taking the last item out of the store or ship from a site is farther way that has more inventory? What about the probability of multiple items on a single order and the potential for costly split shipments (shipping one order from multiple locations) – would this affect your order allocation decision? Instead, a model that considers all of these issues, and is fast, is needed to optimize both customer experience and cost.

You need to consider distributed order management software to automate this complex decision.

Omnichannel Warehouse Operations

In the "good old days" warehouses were designed for specific functions. They either processed pallets or packages. However, for a retailer to have two warehouses that are designed for each specific function causes extra inventory and doubles facility costs. Instead, companies are designing omnichannel warehouses that blend full pallet, mixed pallet and package operations in one facility. This requires innovative layouts, sophisticated processes and use of different types of equipment including forktrucks, reach-trucks, stock-pickers, vertical lift modules and other robotics.

There is a cost to having many different types of warehouse operations in one facility. But it is the way most omnichannel companies are headed because it is lower total cost than building dedicated facilities.

Omnichannel for Manufacturers and Distributors

An important new topic is omnichannel for manufacturers and industrial distributors. Instead of having to put a store on Amazon, or using Amazon for fulfillment, manufacturers and their industrial distributors are teaming up to create a network of warehouses and branches that can fulfill online orders quickly and efficiently. I don't think either a manufacturer or distributor can "go it alone" in the battle against Amazon. Manufacturers control the product and brand, and have a global view of demand. Distributors, with their warehouses and (possibly more importantly) branches can provide same-day delivery in focused geographies.

Manufacturers need to set up agreements on profit-sharing in a different way than traditional wholesaling so they get broad geographic coverage of their products, at a deeper level than wholesalers (distributors) may be willing to carry. Distributors need to shift from a model where they only deliver large items and have customers pick up smaller items from their branch to an efficient pick/pack/ship operation at all facilities.

Significant and difficult changes will be required for manufacturers and distributors to embrace omnichannel. However, the alternative is for Amazon to own the customer supply chain.

References

[1] Millstein, M.A. and Campbell, J.F. 2018. "Total Hockey optimizes omnichannel facility locations." *Interfaces* 48(4):1-17.

[2] Millstein, M.A., Bilir, C., Campbell, J.F. 2022. "The effect of optimizing warehouse locations on omnichannel designs." *European Journal of Operational Research,* 301:576-590.