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Designing the Distribution Network in a Supply Chain

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P.VIDYA
Assistant Professor - SOMS, VELS University, Chennai.

L.UMA MAHESWARI
Professor, Department of Management Studies, VELS University, Chennai

ABSTRACT *This paper describes a framework for designing the distribution network in a supply chain. Various factors influencing the choice of distribution network are described. The different choices of distribution networks and their relative strengths and weaknesses were discussed. The paper concludes by identifying distribution networks that are best suited for a variety of customer and product characteristics.*

INTRODUCTION

Distribution refers to the steps taken to move and store a product from the supplier stage to a customer stage in the supply chain. Distribution is a key driver of the overall profitability of a firm because it directly impacts both the supply chain cost and the customer experience. Good distribution can be used to achieve a variety of supply chain objectives ranging from low cost to high responsiveness. As a result, companies in the same industry often select very different distribution networks. Dell distributes its PCs directly to end consumers, while companies like Hewlett Packard and Compaq distribute through resellers. Dell customers wait several days to get a PC while customers can walk away with an HP or Compaq PC from a reseller. Gateway opened Gateway Country stores where customers could check out the products and have sales people help them configure a PC that suited their needs. Gateway, however, chose to sell no products at the stores, with all PCs shipped directly from the factory to the customer. In 2001, Gateway closed several of these stores given their poor financial performance. Apple Computers is planning to open retail stores where computers will be sold. These PC companies have chosen three different distribution models. How can we evaluate this wide range of distribution choices? Which ones serve the companies and their customers better? W.W. Grainger, an MRO distributor, stocks about 100,000 skus that can be sent to customers within a day of the order being placed.

FACTORS INFLUENCING DISTRIBUTION NETWORK DESIGN:-

At the highest level, performance of a distribution network should be evaluated along two dimensions:

1. Customer needs that are met
2. Cost of meeting customer needs. The customer needs that are met influence the company's revenues, which along with cost decide the profitability of the delivery network.
3. While customer service consists of many components, we will focus on those measures that are influenced by the structure of the distribution network. These include:

- Response time
- Product variety
- Product availability
- Customer experience
- Order visibility
- Returnability

DESIGN OPTIONS FOR A DISTRIBUTION NETWORK

We will discuss distribution network choices in the context of distribution from the manufacturer to the end consumer. When considering distribution between any other pair of stages, such as supplier to manufacturer, many of the same options still apply.

There are two key decisions when designing a distribution network:

1. Will product be delivered to the customer location or picked up from a preordained site?
2. Will product flow through an intermediary (or intermediate location)?

Based on the choices for the two decisions, there are six distinct distribution network designs that are classified as follows:

1. Manufacturer storage with direct shipping
2. Manufacturer storage with direct shipping and in-transit merge
3. Distributor storage with package carrier delivery
4. Distributor storage with last mile delivery
5. Manufacturer / distributor storage with costumer pickup
6. Retail storage with customer pickup

We now describe each distribution option and discuss its strengths and weaknesses.

MANUFACTURER STORAGE WITH DIRECT SHIPPING

In this option, product is shipped directly from the manufacturer to the end customer, bypassing the retailer (who takes the order and initiates the delivery request). This option is also referred to as drop shipping. All inventories are stored at the manufacturer. Information flows from the customer, via the retailer, to the manufacturer, while product is shipped directly from the manufacturer to customers. In some instances like Dell, the manufacturer sells directly to the customer. Online retailers such as eBags and Nordstrom.com use drop shipping to deliver goods to the end consumer. eBags does not hold any inventory of bags and has them drop shipped directly from the manufacturer to the customer. Nordstrom carries some products in inventory while using the drop-ship model for slow moving footwear. W.W. Grainger also uses drop shipping to deliver slow moving items that are not carried in inventory. The biggest advantage of drop shipping is the ability to centralize inventories at the manufacturer.

MANUFACTURER STORAGE WITH DIRECT SHIPPING AND IN-TRANSIT MERGE

Unlike pure drop shipping where each product in the order is sent directly from each manufacturer to the end customer, in-transit merge combines pieces of the order coming from different locations so that the customer gets a single delivery. When a customer orders a PC from Dell along with a Sony monitor, the package carrier picks up the PC at the Dell factory, the monitor at the Sony factory and merges the two together at a hub before making a single delivery to the customer.

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DISTRIBUTOR STORAGE WITH CARRIER DELIVERY

Under this option, inventory is not held by manufacturers at the factories but is held by distributors/retailers in intermediate warehouses and package carriers are used to transport products from the intermediate location to the final customer. Amazon.com as well as industrial distributors like W.W.Grainger use this approach combined with drop shipping from a manufacturer. Relative to manufacturer storage, distributor storage will require a higher level of inventory because the distributor / retailer warehouse aggregates demand uncertainty to a lower level than the manufacturer. From an inventory perspective, distributor storage makes sense for products with somewhat higher demand. Both Amazon and Grainger only stock the medium to fast moving items at their warehouse with slower moving items stocked further upstream. In some instances, postponement can be implemented with distributor storage but it does require that the warehouse develop some assembly capability.

DISTRIBUTOR STORAGE WITH LAST MILE DELIVERY

Last mile delivery refers to the distributor / retailer delivering the product to the customer's home instead of using a package carrier. Webvan, Peapod, and Alberston's have used last mile delivery in the grocery industry. Unlike package carrier delivery, last mile delivery requires the distributor warehouse to be much closer to the customer, increasing the number of warehouses required. Distributor storage with last mile delivery requires higher levels of inventory than all options other than retail stores, because it has a lower level of aggregation. From an inventory perspective, warehouse storage with last mile delivery is suitable for relatively fast moving items where disaggregation does not lead to a significant increase of inventory. Staple items in the grocery industry fit this description. Transportation costs are highest using last mile delivery. This is because package carriers aggregate delivery across many retailers and are able to obtain better economies of scale than available to a distributor / retailer attempting last mile delivery. Delivery costs (including picking and transportation) can be as high as $30-$40 per home delivery in the grocery industry. Last mile delivery may be somewhat cheaper in dense cities. Transportation costs may also be justifiable for bulky products where the customer is willing to pay for home delivery.

MANUFACTURER OR DISTRIBUTOR STORAGE WITH CONSUMER PICKUP

In this approach, inventory is stored at the manufacturer or distributor warehouse but customers place their orders online or on the phone and then come to designate pickup points to collect their orders. Orders are shipped from the storage site to the pickup points as needed. Examples include 7dream.com operated by 7 Eleven Japan, which allows customers to pick up online orders at a designated store. A B2B example is W. W. Grainger where customers can pick up their order at one of the Grainger retail outlets. In the case of 7dream.com, the order is delivered from a manufacturer or distributor warehouse to the pickup location. In the case of Grainger, some items are stored at the pickup location while others may come from a central location. 7 Eleven has distribution centers (DC) where product from manufacturers is cross-docked and sent to retail outlets on a daily basis. A retailer delivering an online order can be treated as one of the manufacturers with deliveries cross-docked and sent to the appropriate 7 Eleven outlet. Serving as an outlet for online orders allows 7 Eleven to improve utilization of its existing logistical assets. Inventory costs using this approach can be kept low with either manufacturer or distributor storage to exploit aggregation. Grainger keeps its inventory of fast moving items at pickup locations, while slow moving items are stocked at a central or warehouse, or in some cases the manufacturer.

RETAIL STORAGE WITH CUSTOMER PICKUP

In this option, inventory is stored locally at retail stores. Customers either walk into the retail store or place an order online or on the phone, and pick it up at the retail store. Examples of companies that offer multiple options of order placement include Albertsons.com. Albertsons uses part of the facility as a grocery store and part of the facility as an online fulfillment center. Customers can walk into the store or order online. A B2B example is W. W. Grainger where customers can order online, by phone, or in person and pick up their order at one of the Grainger retail outlets.

SELECTING A DISTRIBUTION NETWORK DESIGN

A network designer needs to consider product characteristics as well as network requirements when deciding on the appropriate delivery network. The various networks considered earlier have different strengths and weaknesses. Only niche companies will end up using a single distribution network.. An excellent example of a hybrid network is W.W. Grainger that combines all the above options into its distribution network. The network, however, is tailored to match the characteristics of the product or the needs of the customer. Fast moving and emergency items are stocked locally and customers can either pick them up directly or have them shipped depending upon the urgency. Very slow moving items are typically drop shipped from the manufacturer and involve a longer lead time. Another hybrid network is Amazon where some items are stocked at their warehouse while other slow moving items may be drop shipped from distributors or publishers.

CONCLUSION

We now revisit the questions raised at the beginning of the chapter. In the computer industry today, customization and high product variety seem to be valued by the customer. PCs are assembled at few sources by a company but with high variety of end product. At present IBM's decision to stop selling many slow moving configurations at retail stores would appear better than that of Gateway to open retail stores. Gateway has created a network of retail stores but is not exploiting any of the supply chain advantages such a network offers because no products are sold there. To fully exploit the benefits of the retail network it would make sense for Gateway to sell their standard configurations (likely to have high demand) at the retail stores with all other configurations drop shipped from the factory (perhaps with local pickup at the retail stores if it is economical). Apple has decided to open some retail stores (fewer than Gateway) and actually carry product for sale at these stores. If Apple uses these retail stores to sell the fast moving items and display the configurable items (which can be drop shipped), it will be a good use of their retail network. Finally, intermediaries such as distributors add value to a supply chain between a supply stage and a customer stage if there are many small players at the customer stage, each requiring a small amount of the product at a time. The value added increases if distributors carry products from many manufacturers. Improvement in supply chain performance occurs for the following reasons:

- Reduction in inbound transportation cost because of truckload shipments from manufacturers to distributor
- Reduction in outbound transportation cost because the distributor combines products from many manufacturers into a single outbound shipment
- Reduction in inventory costs because distributor aggregates safety inventory rather than disaggregating at each retailer
- A more stable order stream from distributor to manufacturer (compared to erratic orders from each retailer) allows manufacturers to lower cost by planning production more effectively
- By carrying inventory closer to the point of sale, distributors are able to provide a better response time than manufacturers can
- Distributors are able to offer one stop shopping with products from several manufacturers

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