ENTERPRISE SYSTEMS FOCUSED COLLECTION:

Dual Channel Supply Chains: Challenges and Opportunities in E-Fulfillment

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ABSTRACT

Over the past decade, many traditional brick-and-mortar retailers have begun selling products on the Internet. These dual-channel retailers cite increased sales and profitability as motivations for adding an online channel. This paper examines the evolving retail landscape and current state of dual-channel retailing. We identify inherent advantages and disadvantages across (1) traditional in-store only, (2) pure online, and (3) dual-channel retailers, and discuss opportunities for dual-channel retail to offset single-channel disadvantages. Industry examples provide insight into how dual-channel firms are leveraging common assets and operations (for example, locations, IT infrastructure, inventory management, and decision support systems) to improve e-fulfillment decisions in location, inventory assignment, and pickup/return. We contrast industry practices against recent academic work to provide insight into dual-channel performance.

Keywords: inventory, e-business, dual sales channel, supply chain management, enterprise systems

THE EVOLVING RETAIL LANDSCAPE

The rise of the Internet has forever changed the retailing landscape. Today, retailers must consider how their channel strategy relates to the structure of their supply chains. Traditional brick-and-mortar retail once stood alone as the predominant form of retailing, but Internet technology and enterprise systems have opened opportunities for pure online retailers as well as dual-channel retailers (often called "retailer/e-tailers") that have both online and in-store channels. The trend toward the use of technology for online retailing is clear. According to the U.S. Census Bureau, from 2000 to 2008 e-commerce as a percent of total retail sales increased from 0.8% to 3.8% (U.S. Census Bureau 2009).

In 2009, 68% of the top 100 retailers by volume sold products online (for home delivery or pickup). Table 1, which was compiled by visiting the Web sites of the 100 top retailers by 2007 sales volume, illustrates that retailers without an online presence tend to be relatively small, have target customers less likely to shop online (such as deep discounters Family Dollar and Dollar General), sell products that are too bulky and expensive to ship (such as home improvement), or offer products that are not conducive to selling over the Internet (such as fuel).

Although pure online retailers such as Amazon.com and Buy.com continue to ship directly from warehouses or manufacturers (without maintaining a storefront presence), it is now more common for Internet retailers to have both online and in-store operations. Today, more than 75 percent of online sales are generated by retailers with multiple sales channels (Johnson 2006), and 61 of the top 100 retailers enable customers to purchase products both in a store and online (see Table 1). Offline stalwarts of retailing such as Barnes & Noble, Staples,

TABLE 1: Percent of Top 100 Retailers (by 2007 Sales Volume) with In-Store and Online Sales Channels in June 2009

Category (# in Category)	# with In-Store Only	# with Online Only**	# with Both Online & Online Channels	% with Buy In-Store	% with Buy Online	% with both In-Store and Online Channels
Apparel (7)	2	0	5	100%	71%	71%
Auto Parts (2)	1	0	1	100%	50%	50%
Bedroom/Kitchen/Craft/Gift (3)	1	0	2	100%	67%	67%
Books (2)	0	0	2	100%	100%	100%
Department Store/Large Format Retailer (19)	0	3	16	84%	100%	84%
Discount/Value (4)	2	0	2	100%	50%	50%
Drug Stores (4)	0	0	4	100%	100%	100%
Electronics/Cell Phone (9)	0	1	8	89%	100%	89%
Fast Food/Restaurants (5)	3	0	2	100%	40%	40%
Fuel/Convenience Store (12)	10	0	2	100%	17%	17%
Grocery (21)	15	0	6	100%	43%	29%
Home Improvement (3)	1	0	2	100%	67%	67%
Jewelery/Eyewear (2)	0	0	2	100%	100%	100%
Office Supplies (3)	0	0	3	100%	100%	100%
Pets (1)	0	0	1	100%	100%	100%
Sporting Goods (2)	0	0	2	100%	100%	100%
Toys (1)	0	0	1	100%	100%	100%
Grand Total* (100)	35	4	61	96%	68%	61%

* Weighted by the number of retailers in each category
** Includes television and/or catalog shopping

and Wal-Mart now enable customers to purchase products over the Internet as well as in stores worldwide. The movement from pure brick-and-mortar to dual-channel retail can be seen in the history of Barnes & Noble (www.barnesandnoble.com), a formerly traditional retailer that expanded in the 1970s to reach customers by mail catalog. While developing its locations into modern day superstores, Barnes & Noble recognized the value of reaching customers with a more efficient mechanism than the print catalog. In the late 1980s, it sold books to "online" customers through a system called Trintex. As internet service providers (ISPs) became prevalent in the 1990s, Barnes & Noble sold books through ISPs Compuserv and America Online before launching www.barnesandnoble.com in 1997.

Adding a second channel can occur in different ways and for different reasons. While Barnes & Noble went from traditional in-store selling to dual-channel retail, other firms such as iparty.com, Coldwater Creek, and Harry and David have gone from catalog and/or pure online selling to adding physical store locations. The reasons for adding an online channel are also diverse. For some, online sales growth can help mitigate lackluster offline performance. Despite an in-store sales decrease of 5 percent, total sales at Office Depot for 2007 increased 3.5 percent, as online sales rose 14 percent (Brohan 2008). Similarly, The Gap reported flat overall sales in 2007, but increased online sales 23.7%. For others, a secondary channel can increase sales in the primary channel. Forrester (2007b) estimates that 16 percent of total retail sales are directly influenced by the Web, as consumers research products online and purchase them in stores. Perhaps more importantly, research

has shown that shoppers who frequently purchase from more than one of a retailer's sales channels spend as much as 50 percent more money than their single-channel counterparts (Lucas 2007, and Kumar and Venkatasan 2005). The department store Macy's has found that every dollar a customer spends online at wwwmacys.com leads to $5.70 worth of sales at a Macy's store within 10 days (The Economist 2009).

The goal of this paper is to examine the current state of dual-channel retailing to show how retailers are leveraging common assets and information across sales channels to improve their decisions in e-fulfillment (delivering physical goods to customers). To accomplish this goal, the next section examines supply chain decisions and trade-offs for dual-channel retailers, and discusses opportunities to leverage integrated channel resources and information in enterprise systems for e-fulfillment. Critical e-fulfillment decisions are then highlighted for location, allocation, and pickup and return capabilities. The following section considers where dual-channel retailers should locate their fulfillment capabilities for online sales. We then examine which of those chosen fulfillment sites should ship products purchased online, and how

leveraging information on inventory positions at the sites or temporal aggregation of outstanding online orders can affect the assignment decision. The subsequent section then considers how many of a retailer's store locations should be enabled with in-store pickup and return capabilities, and which ones. The concluding section provides future directions and practical recommendations for managers of dual-channel retail organizations.

DUAL-CHANNEL SUPPLY CHAIN MANAGEMENT

In the retail domain, companies can be classified as: (a) traditional in-store only retail (for example, Family Dollar), (b) pure online retail (Amazon.com), and (c) retail/e-tail, or dual-channel retail (Best Buy). Throughout the paper, we refer to these retail classifications as "in-store retail," "online retail," and "dual-channel retail," respectively. While the decisions faced by single-channel (either pure in-store or pure online) retailers are more familiar, those faced by dual-channel retailers that manage customer needs from two unique channels are increasingly complex.

Therefore, this paper focuses on new challenges and opportunities for supply chain management

FIGURE 1: The Dual-Channel Retail Supply Chain

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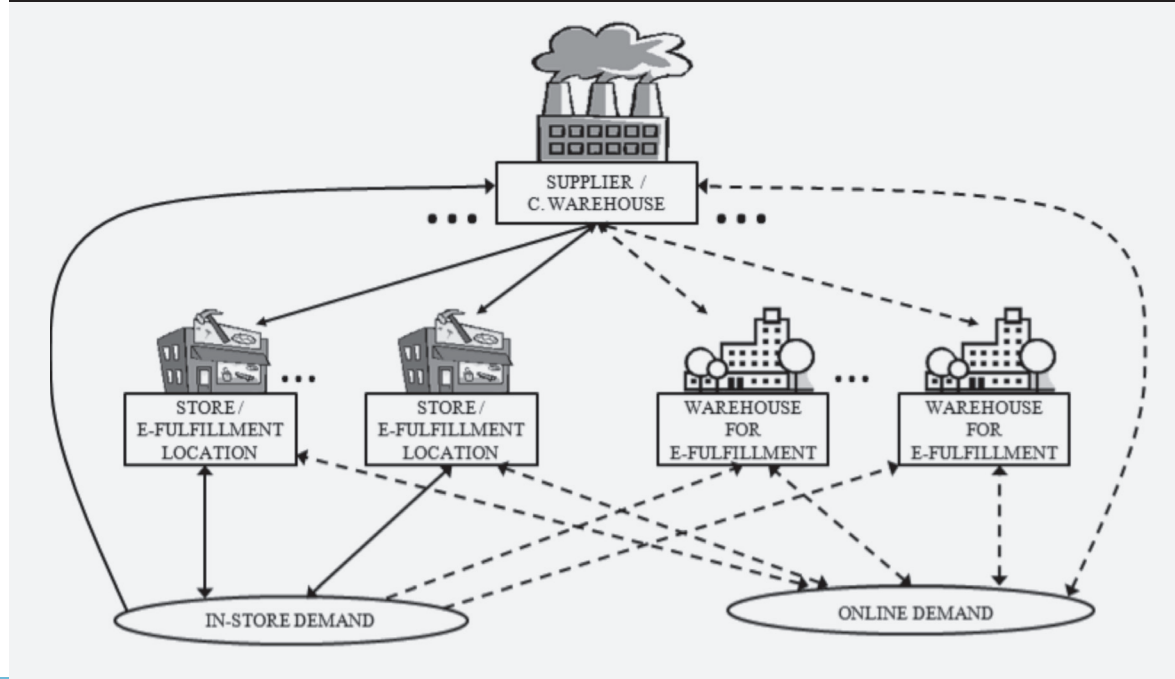
in dual-channel organizations, such as the one depicted in Figure 1 with both an online channel and "brick" locations. The multifaceted supply chain consists of store and/or e-fulfillment locations served by upper-echelon suppliers and/or central warehouses. Store locations may handle in-store and online demand (sales or returns) while suppliers or e-fulfillment warehouses may handle online demand. In Figure 1, solid lines represent material flows for a traditional in-store-only retailer while dashed lines represent potentially new material flows that could exist for a dual-channel retailer. Although we limit our scope to companies that have in-store and/or online channels, catalog retailing shares many characteristics with Internet retailing, and many retailers operate as "multichannel" organizations with store, online, and catalog channels.

Supply Chain Decisions and Trade-offs

Figure 2 illustrates how some primary supply chain decisions vary for the three retailing approaches along an in-store and online channel continuum. We highlight the primary characteristics of the three options but recognize that many retailers do not fit squarely under one label. Some dual-channel retailers such as Family Dollar operate closer to "in-store retail," whereas a dual-channel retailer such as iparty.com operates closer to the "online retail" end of the spectrum. The placement of a company on the continuum is largely determined by the percentage of sales derived from their online channel.

Network configuration for a dual-channel retailer involves placement of not only traditional store locations, but also online fulfillment sites, warehouses, and/or third-party facilities. If the organization provides pickup and return services, then locations for those services must also be configured. Transportation options for a dual-channel retailer combine each method used by its in-store and online counterparts. The dual-channel retailer must control not only inbound bulk shipments to stores and e-fulfillment centers, but also outbound individual shipments to customers. Inventory management is also more complex in a dual-channel setting. The dual-channel retailer must consider policies for in-store, warehouse, and e-fulfillment locations, as well as various order fulfillment poli-

cies (for example, which site ships to which customer) and pooling implications of online and in-store demand streams. Pricing decisions also need to consider sales that occur in-store, online, and online for in-store pickup. The organization could choose to price all channels the same, or segment customers and offer varying prices. Finally, the information technology (IT) decisions for a dual-channel retailer are more complex, as the company must effectively link the online web checkout and its associated inventory system with the point-of-sale system used in physical store locations. One approach to supply chain integration employs the information hub wherein participants' internal enterprise information systems act as spokes (Lee and Wang 2001). Failure to provide seamless integration of these systems can lead to increased stockouts and worse customer service.
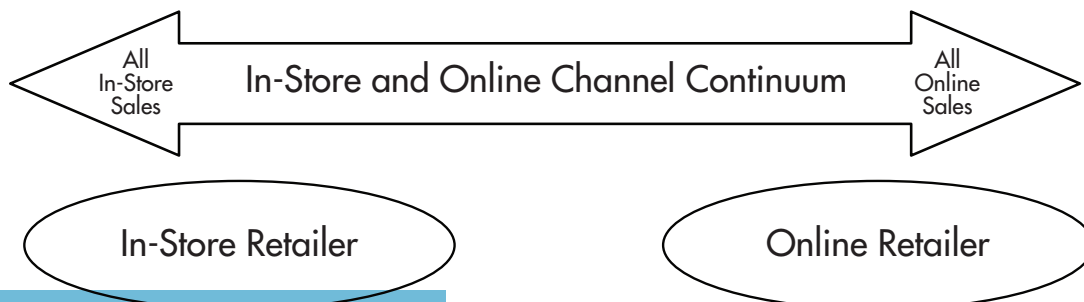
Dual-channel retailers have several options for integrating operations across their channels. These include best-of-breed niche software solutions and/or enterprise systems. Until recently, niche players such as Escalate Retail[1] and Junction Solutions[2] catered to smaller companies not targeted by major enterprise resources planning (ERP) vendors and offered more data and analytics for organizations with e-commerce, retail, and direct channels. But traditional ERP vendors such as SAP have begun deepening their options to dual-channel firms (Barry 2007). For example, SAP's "multichannel retailing software" can now maintain one set of customer data across disparate channels of stores, Internet, catalog, and phone (SAP.com). Such central repositories can be used to track customer activities across the retailer's various contact points with the consumer, including stores, the Internet, and call centers. The repositories can also monitor inventory positions across supply chain entities, including stores, warehouses, suppliers, and more. Implementation issues can vary widely, and successful integration may involve tailoring an ERP system, using niche software but foregoing some traditional ERP modules, or linking both ERP and disparate systems with special integration products (as done by SAP Netweaver).

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[1] http://www.escalate.com

[2] http://www.junctionsolutions.com

FIGURE 2: Supply Chain Decisions for In-Store Retailers, Dual-Channel Retailers, and Online Retailers

In-Store Retailer	Dual-Channel Retailer	Online Retailer
Network Configuration • Fulfillment locations – stores	Network Configuration • Fulfillment locations for online delivery – stores, warehouses, third parties • Fulfillment locations for in-store demand – stores • Fulfillment locations for in-store pickup • Determine pickup and return capabilities	Network Configuration • Fulfillment locations – warehouses, third parties
Transportation • Inbound to stores – bulk • Outbound to customers – none	Transportation • Inbound to stores – bulk • Inbound to e-fulfillment locations – bulk • Outbound to customers – individual	Transportation • Inbound – bulk • Outbound to customers – individual

Inventory management
• Store and warehouse replenishment policy
	Inventory management
	• Store, warehouse, and e-fulfillment location replenishment policy
	• Order fulfillment policies
	  o Which site ships to which customer
	  o Which stores to offer as online pickup and/or return sites
	• Pooling of online and in-store inventory
		Inventory management
		• Warehouse and e-fulfillment location replenishment policy
		• Order fulfillment policies
		  o Which site ships to which customer

Pricing • In-store	Pricing • Across in-store, pickup, and online sales	Pricing • Online
Information Technology • Support in-store operations (point of sale system) • ERP system or niche software for single sales channel • Track customer data across stores • Data and analytics for in-store activity	Information Technology • Effective link between online (e-commerce) and in-store systems (point of sale) • ERP system, niche software, or linked disparate systems for dual sales channels • Track customer data across channels (advanced CRM) • Data and analytics for integrated in-store and online activity	Information Technology • Support online operations (e-commerce system) • ERP system or niche software for single sales channel • Track customer data across online channel • Data and analytics for online activity

All In-Store Sales ⟵ In-Store and Online Channel Continuum ⟶ All Online Sales

In-Store Retailer   Online Retailer

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The outdoor apparel retailer Cabela's has integrated its management information systems across online, in-store and catalog channels to get a single view of its customers across those channels and to better manage its direct, retail, and financial services businesses. Cabela's maintains a data warehouse with information from the retailer's online, store, and catalog operations (Chain Store Age 2008). To use its tracked data and explore customer activity, the company employs a combination of advanced analytics programs (SAS Analytics and Teradata Enterprise Data Warehouse). The programs let Cabela's mine and analyze past sales transactions to assess the impact of promotional activities across its sales channels for specific demographics. The data can be aggregated or disaggregated as needed to show correlations between spending behavior and marketing events, or to show retail assortments for individual customers, stores, or regions. This enables the company to evaluate regional- or store-specific promotional campaigns and to tailor marketing efforts to specific customers. For instance, the company can use its knowledge of a customer to personalize catalog offerings or call center support based on his or her past purchase behavior, and also can effectively schedule promotions and choose upsell offerings (Zarrello 2010, Chain Store Age 2008).

The resulting information systems help Cabela's "process customer orders, track customer data and demographics, order, monitor, and maintain sufficient amounts of inventory, facilitate vendor transactions, and provide financial reporting" across its sales channels (Cabela's Annual Report 2010). The company has also integrated the operation of its rewards program across its sales channels so that customers can check their real-time accumulated points balance online or at any of the retailer's locations, and redeem those points to purchase products and services using any of Cabela's sales channels. Similarly, online customers can check inventory availability at the Cabela's distribution center and, if desired, have available products shipped to their nearest store for pickup to avoid shipping charges. As customer orders are placed online, stock positions at Cabela's warehouse are updated in the enterprise system. Internet connectivity gives the company's suppliers, stores, and Internet/phone customers access to real-time inventory information (Coia 2005).

The choice of where to operate along the pure in-store to pure online channel continuum critically affects the retailer's costs and customer service. Table 2 shows some general trade-offs for in-store, online, and dual-channel retailers. In many respects, dual-channel retail provides the best aspects of online and in-store retailing. Customers of Best Buy can choose to purchase a product online and pick it up at a store if they want immediate availability, or can buy a product (that may not be available at a store) over the Web for home delivery if they want more variety and convenience. Even Wal-Mart's large superstores do not stock thousands of products regularly available at www.walmart.com (Bustillo and Fowler 2009). Dedicated pickup locations and the ability to check prices and inventory before driving to a store can also provide unmatched convenience for the dual-channel customer.

From the retailer's perspective, online orders provide the flexibility to manage demand across the supply chain by directing fulfillment to sites with excess inventory. But such benefits come at the price of higher IT costs for the computer infrastructure capable of tracking real-time inventory positions across store and warehouse locations. Dual-channel customers demand seamless technological integration between channels (they expect their data will transfer across channels, products will be available, and more), require higher levels of customer service, and tend to be intolerant of company mistakes such as shipping or order processing errors (Rosenblum and Kilcourse 2005). Satisfying these requirements may necessitate ERP systems, customer relationship management (CRM) systems, Web sites, IT administrators, and call centers. In addition, full channel integration may necessitate warehouse control systems and warehouse management systems to direct real-time activities and process-associated transactions at the sites. Also, as a firm's systems become more integrated, the cost associated with an unavailable ("down") system increases. According to its 2009 annual report, Best Buy relies "heavily on (its) management information systems for inventory management, distribution and other functions. If our

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TABLE 2: General Cost and Customer Service Trade-Offs for In-Store Retail, Online Retail, and Dual-Channel Retail			
	In-Store Retail	**Online Retail**	**Dual-Channel Retail**
Fixed Cost		Low	
Inventory Cost	High	Low	
Shipping Cost	Low	High	
IT Cost			High
Inventory Rebalancing Opportunities		High	High
Convenience to Customers			High
Immediate Availability of Product for the Customer	High	Low	High
Product Variety		High	High

systems fail to perform these functions adequately or if we experience an interruption in their operation, our business and results of operations could be materially adversely affected."

Despite the risks, when enterprise systems are well integrated, they can help a dual-channel merchant learn more about its customers via their online interactions. This data can be mined to help the retailer understand customer behavior and to increase sales and customer loyalty, both in stores and online. But as retailers accumulate data on customers, they also encounter privacy, security, and legal issues related to how the data are used and stored (Berendt et al. 2008).

Dual-Channel Retail Opportunities

Figure 3 shows some inherent advantages and disadvantages of single-channel retailing. Whereas online channels provide pooling and economy of scale that generates greater flexibility in inventory location, more product assortment, greater pricing flexibility, and increased purchasing power, those online channels often lack the efficient delivery benefits of traditional in-store-channels. When well implemented, dual-channel integration can leverage benefits of both channels to alleviate many single-channel disadvantages and provide a deeper mix of customer service (Wallace et al. 2004). For example, service analytics obtained from a custom-

er's online shopping patterns can provide valuable insight into that customer's payment, shipment, and return preferences. A dual-channel retailer such as Best Buy can use that knowledge to personalize contact with in-store customers through coupons for popular items or incentives for selecting online pickup.

But adding a new channel, particularly an online one, is not for the faint of heart. Competition on the Web is fierce. Instead of competing with geographically diverse local retailers (each miles apart), online retailers compete with companies around the globe (each a mouse click away). Before it went bankrupt, Circuit City competed for online customers against not only Best Buy and Amazon.com, but also against innumerable mom-and-pop Internet shops and eBay product sellers. Obviously, many of Circuit City's competitors did not face the same overhead, taxes, and labor costs that Circuit City incurred. In January 2009, the CEO of Growth Ventures Group attributed Circuit City's bankruptcy in part to a nonviable business model with high overhead costs. Although more than half of electronics sales had moved online by the time of Circuit City's bankruptcy, the company failed to effectively compete on price, partly because the high costs of maintaining its physical stores (Kavilanz 2009). Best Buy was somewhat more buffered as the industry leader and because its successful Geek Squad business helped the company differentiate itself on factors other than cost.

We have mentioned several synergies that exist for dual-channel retailers. Figure 3 summarizes opportunities they can pursue to offset disadvantages faced by their single-channel counterparts. For example, a pure online retailer such as iparty.com that moves toward dual-channel retailing can leverage its new brick locations by letting consumers purchase products online and pick them up (or return them) to a nearby store. This enables the firm to offer quicker response and lower shipping charges than its pure online competitors. Conversely, an in-store retailer such as Jones Apparel Group that adds an online channel can assign online orders across stores to effectively rebalance inventory positions or let consumers check stock positions online before driving to the store (Fowler and Dodes 2010).

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FIGURE 3: Opportunities for Dual-Channel Retail to Offset Single-Channel Disadvantages

Advantages

- Proximity of stores to customers
- Personal touch selling
- Convenience factor of quick response

Advantages

- Online channel provides access to geographically diverse customers
- Internet sales provide opportunity to pool online inventories across locations and time
- Economies of scale due to fewer fulfillment sites and bulk handling
- Less overhead
- Opportunity to learn more about customers through online transactions

Disadvantages

- Sales must be handled at point of sale
- Cost structure (e.g., store assets, overhead, etc.) tends to be higher than that of pure online retailers

Disadvantages

- Response time
- Delivery costs
- Difficult to ship some products
- Large IT investment
- Pure e-tailing has fewer barriers to entry
- Privacy issues on how data is used

Selling online provides opportunity to:

Selling in-store provides opportunity to:

Opportunities

- Use online sales to balance inventory positions
- Attract customers by giving personal touch to online buying
- Increase in-store revenue by web-influenced sales
- Pool in-store and online inventories
- Use online shopping patterns to personalize in-store contact
- Provide better service

Opportunities

- Improve availability by letting customers pickup online purchases at store locations
- Reduce shipping costs to customers by allowing in-store pickup and return of online purchases
- Sell products less conducive to online selling
- Pool in-store and online inventories
- Provide better service

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Several authors (de Koster 2002, Lummus and Vokurka 2002) cite e-fulfillment—delivering physical goods to the customer—as one of the most critical and expensive operations for Internet sellers. For a dual-channel retailer, e-fulfillment activities include locating online fulfillment capability, choosing which sites ship which online sales, and determining if and where to position pickup and/or return capabilities. Zhang et al. (2010) conducted interviews with several Fortune 500 companies and identified five categories of potential synergies for retailers with multiple sales channels, including the opportunity for sharing common assets and operations.

WHERE TO LOCATE ONLINE FULFILLMENT CAPABILITIES?

Dual-channel retailers have many options for locating their online fulfillment capabilities, including outsourced sites, dedicated company-owned facilities, and existing retail store or warehouse locations. For example, Amazon.com handles online sales from a combination of its 16 distribution centers and various suppliers in North America. But an online sale at the dual-channel retailer Best Buy can be fulfilled at one or more of the company's nine U.S. distribution centers, picked up at (or conceivably sent from) any of its 923 U.S. retail store locations, or shipped directly from one of the company's suppliers (as of March 1, 2008; Best Buy Annual Report 2009). Safeway.com may ship grocery orders placed in San Francisco from any of its 19 store locations in the city (www.safeway.com).

As the number of a company's online fulfillment locations increases, so does the complexity of its supply network. IT systems can be used to manage this complexity and help retailers leverage common assets and operations across their channels. But IT systems that support the decision to outsource or use internal resources ("in-sourcing") must be selected appropriately to ensure product availability and customer service.

Given all the possible options for handling online orders, how should a dual-channel retailer handle online fulfillment? Here are breakdowns of four main options:

Outsourcing

Handling online fulfillment via suppliers or third-party distributors lets a company increase its product offerings with less inventory risk. This hedge against demand variability has led retailers such as Kmart and J.C. Penny to embrace the practice for certain high-value or slow-moving SKUs. For example, Nordstrom.com uses drop shipping for slow-moving footwear to provide high assortment of styles and sizes to its online customers. The company can accomplish this without holding excessive inventory because not all footwear displayed online is held in Nordstrom's warehouses (Chopra and Meindl 2010). But outsourcing online fulfillment capabilities can reduce profit margins and diminish control over customer information. The dual-channel retailer must have a high level of trust in the outsourcing firm and establish that its IT capabilities are sufficient to maintain high levels of customer service and product availability. Even in the best scenario, outsourcing can lead to higher customer shipping costs if online orders are divided across multiple suppliers or distributors.

In-Sourcing—Warehouse Fulfillment

Another option for dual-channel retailers is to handle online fulfillment in house at existing or dedicated warehouses. Such centralized in-sourcing increases the opportunity to pool (aggregate) online inventory at fewer locations. Automation at central facilities can also improve productivity in order fulfillment and reduce the cost of handling online sales. L.L. Bean used its centralized, state-of-the-art order fulfillment center to ship more than 16 million packages in 2008 (www.llbean.com). But it may cost more to ship time-sensitive or bulky items from distant warehouse locations than from relatively nearby stores. Further, a significant investment may be required to build new dedicated online fulfillment facilities—L.L. Bean spent $38 million on its facility—or to provide existing warehouses (designed to ship pallets of goods to a finite number of stores) with capabilities to handle small shipments to a large number of online customers.

In the past, the outdoor apparel retailer Cabela's relied on legacy, direct-to-consumer IT systems

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capable of handling only individual items. Integrating its order fulfillment system across in-store and online channels required upgrading the IT system so that warehouses could "send one package instead of two" to replace a store's inventory. Implementing the new supply chain solution enabled products for Cabela's stores and online site to be shipped through the same distribution centers (Coia 2005).

In-Sourcing—Store Fulfillment

A third option for online fulfillment is to handle Internet orders at some or all of the retail store locations. Because retail sites are often closer to online customers, this strategy tends to reduce the cost of shipping online sales. Such "last mile" benefits have induced a number of retailers specializing in online groceries (Albertson's and Safeway), home improvement (Home Depot), and auto parts to let their stores do "double duty" as warehouses for online order fulfillment. Although this strategy permits increased pooling of in-store and online inventory, it comes at the cost of higher unit handling costs and provides less online inventory pooling than if all Internet sales were handled centrally. Further, maintaining e-fulfillment capabilities at the retail sites may incur significant fixed costs.

Integrated Approach

In practice, many dual-channel retailers use a combination of location options. For example, Jones Apparel Group Inc. uses inventory management software to leverage its large store networks and centralized distribution hubs to ship online orders. Online fulfillment responsibilities for incoming orders can be handled at locations throughout the supply chain. "Not only can customers' orders be routed to the closest store, or the one with the largest inventory of the item ordered, but store clerks can process online orders during slow periods on the floor." (Fowler and Dodes 2010). The integrated strategy has been successful for Jones Apparel. After the company began shipping from its Nine West and Anne Klein stores in 2008, Jones Apparel's president of e-commerce concluded that the firm could "improve our customer service, and probably greatly improve our revenue." Today, 30 percent to 50 percent of orders are shipped directly from the company's stores (Fowler and Dodes 2010).

Other retailers such as Cabela's take a different approach to locating their e-fulfillment capacity. Although its fulfillment operations are relatively centralized at distribution centers, Cabela's uses its integrated IT systems (described earlier) to effectively leverage inventory at its stores for online fulfillment. An integrated order management and fulfillment system provides the company's suppliers, stores, and internet/phone customers with access to inventory information as if the information were in a single database. If part of an online order is located at a store, that portion can be returned to the distribution center, combined with the rest of the order, and shipped in one package to the customer, improving the customer experience and reducing cost (Coia 2005).

For Nordstrom, the additional flexibility of alternate fulfillment locations increases product availability to online shoppers. Recently, the retailer began to display stock from both warehouses and stores on its Web site. If a product is available anywhere in the stores or warehouses, it is available for online purchase and shipment. "If the Web warehouse was out of that bag, it did not matter. Inventory from Nordstrom's 115 regular stores is also included. Maybe there was just one handbag left in the entire company, sitting forlornly in the back of the Roosevelt Field store — it would be displayed online and store employees would ship it to the Web customer." (Clifford 2010).

These examples illustrate some processes dual-channel retailers are employing to leverage their supply chain locations for online fulfillment. But location decisions are seldom static and constantly evolve with the growth of a retailer's channels. Many dual-channel retailers have experienced significant relative growth in their online sales over the last decade. For example, Barnes & Noble, which launched its online channel in 1997, grew online sales from 0.5 percent of total sales in fiscal year 1997 to 10.3 percent in 2008 (Barnes & Noble Annual Report 1998, 2009).

Such growth may require expanding fulfillment capabilities to support dual-channel operations. Recent research provides insight into how the percentage of sales occurring online affects the

FIGURE 6: General Relationship between %
Online Demand and Optimal Average
Number of Online Fulfillment Sites

% On-line Demand vs. # E-Sites
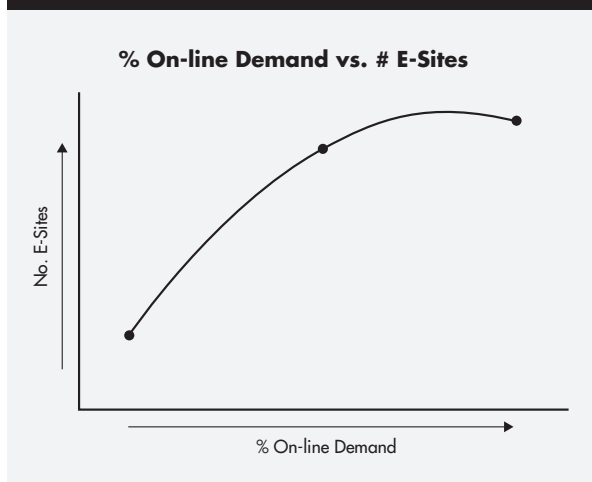
number of sites a dual-channel retailer should set
up for e-fulfillment. In general, as the fraction of
a firm's demand occurring online increases from
zero, the optimal average number of e-fulfillment
sites opened first increases and then (potentially)
decreases (see Figure 4). The rationale is that when
the fraction of online demand is low, fixed operat-
ing cost dominates, resulting in fewer e-fulfillment
sites. As the fraction of online demand increases,
the transportation cost savings from opening more
e-fulfillment sites more than offsets the additional
fixed operating cost. As a result, more e-fulfillment
sites tend to be opened. But when the fraction of
online demand is high, organizations have the maxi-
mum potential to pool online inventories. At some
point, the incremental pooling plus setup savings (of
one fewer e-fulfillment site) may be greater than the
incremental transportation savings of maintaining an
e-fulfillment site (Bretthauer et al. 2010).

WHICH SITES SHOULD SHIP WHICH ONLINE SALES?

At first glance, the distinction between a tradition-
al retailer and its dual-channel counterpart may
appear minimal. What makes order fulfillment at
a traditional mom-and-pop bookseller different
from that of its dual-channel competitor Barnes
& Noble? One major difference is that Barnes &
Noble must choose which sites ship which of the

company's online sales. The decision reflects an
inherent difference between in-store and online
demand: In-store demand must be handled at
its point of sale. If a traditional store runs out of
a particularly hot-selling title, that sale is lost or
backordered. Conversely, online demands can be
handled by any fulfillment location in or out of
the supply chain, including a store, a regional ware-
house, a supplier, or a third-party vendor.

Each time an online sale occurs, Barnes &
Noble must determine which site(s) will fulfill the
order and determine the timing and/or sequence in
which goods are picked. Similar choices are made
by dual-channel grocers. For example, Tesco.com's
fulfillment model has evolved from in-store pick-
ing at its 300 U.K. stores to leveraging several exist-
ing large stores as fulfillment hubs. Store locations
are chosen so that no delivery trip is more than
25 minutes. Enterprise systems determine picking
start times and sequences to reduce disturbances
to customers due to the clustering of picking carts
and to avoid excessive picking during peak shop-
ping hours (Enders and Jelassi 2009). Because the
physical locations of inventory are hidden from
online customers, stock for online sales can be "vir-
tually pooled" regardless of where it is located. This
enables online demand in one region to be met
from inventory at a site in another region. Today,
dual-channel retailers such as Barnes & Noble
incorporate varying levels of real-time information
to specify which location will handle each Internet
sale. Policies range from static assignment, which
specifies in advance the locations responsible for
handling online sales from each region, to dynamic
assignment, in which online fulfillment responsi-
bilities are determined in real time for each incom-
ing online sale. Each policy has strengths and
weaknesses. For example, companies such as Petco
and Staples assign responsibilities for online sales
immediately and to the closest fulfillment location
that has available stock (Malykhina and Sullivan
2005; www.petco.com), while others such as Jones
Apparel Group leverage inventory management
software to dynamically evaluate stock positions
at their sites before determining where to route an
online order (Fowler and Dodes 2010).

Research suggests that dynamic policies like
those in place at Jones Apparel Group and Nord-

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strom can reduce system cost (holding, backorder, and transportation) by as much as 8.2 percent over the optimal static policy ("store j ships online orders to ZIP codes A, B, and C") by reducing the likelihood that stores with low inventory levels will incur an expensive lost sale when a nearby e-fulfillment location with excess inventory can ship the product. Further, strategically postponing the online fulfillment decision (accumulating sales) can reduce inventory costs (that is, holding and backorder cost) at the fulfillment sites by 14 percent over the common practice of instantaneous (dynamic) allocation of online sales responsibilities to e-fulfillment locations (Mahar et al. 2009a, Mahar and Wright 2009). However, such benefits come at the cost of additional IT infrastructure, inventory management, and decision support systems capable of monitoring available inventory and/or temporally aggregating outstanding online orders across multiple channels and fulfillment locations. Additionally, although postponing online shipments can reduce costs for the company, it does so at the expense of customer service, potentially alienating customers who are not used to delivery delays.

Over the past decade, dual-channel retailers have placed a renewed focus on channel integration. Today, many of these retailers are trying to leverage information their new systems provide via dynamic-type policies. Recent academic work suggests the popularity of dynamic policies will continue to increase with the growth of online sales, because the magnitude of the benefit of such policies is a function of the percentage of sales occurring online. Specifically, as the percentage of sales occurring online increases, the benefit of dynamic assignment over the optimal static policy first increases then decreases. Intuitively, when all demand occurs from the in-store channel, no online inventory can be virtually pooled, so dynamic and static assignment rules perform equally. As the percentage of demand occurring online increases further, online inventories positioned across the stores can cover more in-store safety stock needs (while maintaining the benefit of completely pooled online inventories) under a dynamic assignment policy. At some point, however, positioning additional online inventory at the stores does little

to further reduce expected in-store backorders. Beyond this point, there is less marginal benefit from applying dynamic assignment because there are fewer expected in-store backorders.

HOW MANY STORES SHOULD HAVE PICKUP AND/OR RETURN CAPABILITIES, AND WHICH ONES?

Another e-fulfillment decision exclusive to dual-channel retailers involves identifying physical locations where customers can pick up or return their Internet purchases. These pickup/return options combine the advantages of in-store and online retail (shown in Figure 3) into a service package that only the dual-channel retailer can provide. By enabling customers to pick up or return orders purchased online at retail store locations, dual-channel organizations effectively leverage their "brick" stores to offset disadvantages inherent for their single-channel counterparts.

Dual-channel retailers have different reasons for providing the pickup option. Wal-Mart is using its thousands of physical stores to strengthen its online position. The company lets customers pick up products purchased online at service desks at the front of some of its stores, and has introduced drive-through windows where shoppers can pick up Internet orders in several test markets (Bustillo and Fowler 2009). The strategy lets the discounter leverage its existing distribution network to pass shipping savings to customers who may make additional purchases while at the stores.

In practice, in-store pickup doesn't always mean customer can get their items immediately (Xiong 2003). Stores that let a customer purchase a product online and pick it up at a store provide varying levels of service. For example, online customers of Wal-Mart and Radio Shack can have products shipped to a store for pickup free of charge. But the time when these items are made available for pickup varies widely. Office Depot lets customers pick up in about two hours, Hy-Vee grocery requires four hours, while Radio Shack may require a three-to eight-day wait. Table 3 provides a breakdown of in-store pickup and return services at the top 100 retailers as of June 2009. To date, dual-channel retailers offer in-store return of online purchases more often than in-store pickup.

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TABLE 3: Percent of Top 100 Retailers with In-store Pickup and Return Services

Category (# in Category)	% with Buy Online Pickup at Store	% with Buy Online Return to Store
Apparel (7)	0%	57%
Auto Parts (2)	0%	50%
Bedroom/Kitchen/Craft/Gift (3)	0%	33%
Books (2)	50%	100%
Department Store/Large Format Retailer (19)	26%	79%
Discount/Value (4)	25%	0%
Drug Stores (4)	0%	75%
Electronics/Cell Phone (9)	56%	67%
Fast Food/Restaurants (5)	20%	20%
Fuel/Convenience Store (12)	0%	0%
Grocery (21)	38%	38%
Home Improvement (3)	33%	33%
Jewelery/Eyewear (2)	0%	50%
Office Supplies (3)	67%	100%
Pets (1)	0%	0%
Sporting Goods (2)	0%	50%
Toys (1)	0%	100%
Grand Total* (100)	24%	48%

* Weighted by the number of retailers in each category

TABLE 4: Companies with Store Inventory Information Online but No In-Store Pickup

Category	Number	% of Category
Auto Parts	2	100%
Books	1	50%
Department Store/Large Format Retailer	3	16%
Drug Stores	1	25%
Home Improvement	1	33%
Toys	1	100%

Table 3 illustrates that pickup options are prevalent for office supply and electronics but not for pet stores, bedroom/kitchen, sporting goods, apparel, and drug stores. In some categories, dual-channel retailers without in-store pickup have found other ways to leverage their physical store assets.

For example, Table 4 shows that nine of the top 100 retailers do not offer in-store pickup but do provide store inventory information on their Web sites. Such partial channel integration is used by AutoZone to let online customers check product availability at their local store via the company's proprietary electronic catalog and store management system (AutoZone Annual Report 2011). This capability may be a sign of organizations providing greater channel integration in the future.

Increasing levels of pickup availability coincide with additional IT complexity. To commit to an online pickup order, the dual-channel retailer must ensure that products are available when the customer arrives. This requires that the IT systems for each store offering pickup be connected with the company's online system. For example, Sears implemented an IT system that constantly monitors how fast items are selling and the likelihood that an in-store shopper will pick up a product before it can be retrieved for an online order (Wagner 2008). This precise monitoring of up-to-the-minute in-store demand is used to transmit accurate data back to an online system that tells the customer if in-store pickup is available. It is important that Sears not commit to an in-store pickup if the company is unsure it can fulfill the order. To provide the best customer service, Sears dedicates employees at each of its stores to in-store pickup. These employees have wireless devices that immediately notify them if an in-store pickup order has arrived. They are instructed to immediately pull the items on the order from stock to minimize the chance that a customer shopping in the store may pick up the last one of an item.

In 2004, approximately 45 percent of sales at Sears.com were picked up in stores. Three years later, a Forrester Research (2007a) study surveyed online retailers with in-store pickup options and reported that approximately one-third of orders (31 percent) placed on Web sites are picked up in stores. Another study (Walker et al. 2009) concluded that in-store pickup can boost online sales, particularly among consumers who have not purchased online before. The option has proved popular with consumers who value the convenience of checking inventory positions before visiting a store and picking up orders with less hassle (shorter lines, no

salesperson to deal with, product is ready at arrival) than with traditional retail shopping. In-store pickup also provides flexibility to avoid high shipping costs and long package carrier delivery lead times commonly associated with online shopping.

Many companies (Lowe's Food Stores, Sears, Best Buy) also have dedicated pickup locations solely for in-store pickup to treat those customers with a different service process than offline customers who simply go to the store to purchase. Other companies such as Office Depot make it easier for customers to return products purchased online to brick-and-mortar stores instead of requiring returns via mail (Spencer 2003).

Such pickup and return options let online customers avoid high shipping costs and long package carrier lead times. Although commonly used, these potential areas of synergy have received little attention in the literature. This lack of guidance has led dual-channel retailers to adopt all-or-nothing strategies. That is, many organizations either set up all store locations to offer pickup and returns of online sales, or they set up no stores for this task. The extent of a firm's in-store pickup and return operations is largely dependent on the level of its cross-channel IT infrastructure. For instance, Best Buy has fully integrated its inventory systems for online and in-store sales, and offers in-store pickup at all locations. The retailer's 780 U.S. stores are supported with Unix systems integrated with transaction-processing systems from Retek; financial planning packages from Oracle; and demand planning, replenishment planning, transportation management, and supply chain management software from i2 (Malykhina, 2005). (Retek has since been acquired by Oracle, and i2 by JDA Software). SAP provides the core ERP platform and SAP for Retail solutions for Best Buy's international and emerging businesses (Best Buy 2007). Walgreens, on the other hand, has invested less in enterprise systems. While customers can place orders online, they still have to pay for them after they arrive at the local store. In a similar offering, Barnes & Noble offers in-store reservation from its Web site, but does not enable the customer to purchase online and pick up the order in the store. Barnes & Noble managers found that online customers who wanted to pick up an order at the store mainly just wanted to make sure the book was in stock before traveling to the store. That is, customers were less concerned with being able to pay for items online.

Practically, dual-channel retailers seeking to assess how many (and which) of their store locations should handle in-store pickups and online returns must consider costs and benefits to both the firm and the online customer (Mahar et al. 2012). Adding pickup or return capabilities at a store will affect fixed operating, inventory (holding and backorder), transportation, and IT costs at the site. Tracking and updating inventory positions at the fulfillment locations also requires system connectivity and the Internet. But pickup and return options may benefit the customer economically (by avoiding high transportation costs) and temporally (by avoiding long carrier delivery lead times) (Mahar et al. 2009b).

CONCLUSIONS AND RECOMMENDATIONS

Dual-channel retailing is still in its infancy. Practitioners and researchers are still trying to understand the dynamics and challenges of this dual-channel environment. It is clear that dual-channel retailing is here to stay, and companies not considering the appropriate actions to manage in-store and online channels will be left at a competitive disadvantage. Fortunately, IT can provide the necessary backbone to support collaboration within a dual-channel supply chain. Information hubs in a company's data network can instantly process and forward relevant information between multiple organizations or supply chain entities (Lee and Whang 2001). This is particularly useful for dual-channel retailers integrating internal information systems with suppliers and between sales channels. Such a central hub permits integrated and synchronous information exchange between J.C. Penny and its apparel supplier, TAL. The integrated information is leveraged by TAL's vendor-managed inventory system to perform manufacturing, packaging, and shipping activities. This, in turn, has reduced stockouts and virtually eliminated inventory storage of TAL apparel in J.C. Penny's regional warehouses (Lee et al. 2004).

Dual-channel retail leaders are already using IT and enterprise systems to leverage their store

and online assets for synergy in e-fulfillment. For example, IT systems providing transparent inventory information across the supply chain enable the sporting goods retailer Cabella's to handle online sales at warehouse and store locations. Other retailers such as Jones Apparel Group leverage inventory information from IT infrastructure, inventory management, and decision support systems to efficiently direct online fulfillment responsibilities. Still others such as Best Buy have fully integrated inventory management systems across their sales channels to let customers access store inventories and pickup or return online sales at any store location.

Research has begun to emerge in the dual-channel retail area, and some interesting results are available that confirm industry practice. Recent studies have shown how system cost can be reduced by optimizing a set of e-fulfillment locations or allocating online fulfillment responsibilities. Obviously, demand allocation necessitates accurate inventory records across potential fulfillment locations. Technologies such as radio frequency identification (RFID) are helping many retailers such as Wal-Mart know what has been delivered to their stores and warehouses. When this information is coupled with enterprise systems and point-of-sale data, the retailer gains a more accurate view of what is on store shelves or in the backroom (Hardgrave et al. 2008). Demand signals are regularly updated in a centralized information store and drive predetermined analytics and reports via demand signal management (Gartner 2010). At Wal-Mart, the system automatically generates pick lists identifying items in the backroom for associates to move to the sales floor. Such information is critically important to dual-channel retailers, particularly those that handle sales and/or returns for both channels out of the same locations. Anecdotal evidence suggests that such efficient methods of managing and tracking inventory will become increasingly important as more customers demand service options for in-store pickup and return of online sales.

Despite the recent research on e-fulfillment and the role of enterprise systems in dual-channel retail, existing studies only scratch the surface of the complexity of these systems. As the trends toward channel integration continue and the benefits of

dual-channel retailing become more apparent, companies that are not offering such services can learn from those who are to keep competitive pace.

There are several implications for managers of dual-channel organizations. First, they can take advantage of virtual inventory pooling opportunities made possible by the two demand channels (in-store and online). The presence of the two channels offers a unique opportunity for online orders to be fulfilled from a number of e-fulfillments sites or local stores. This flexibility has benefited organizations by limiting the total holding, backorder, and transportation costs at the sites. IT systems can be used to manage complexity associated with more potential online fulfillment locations. Effectively coordinating online sales across multiple supply chain entities requires enterprise system connectivity. Supply chain members need to be electronically linked to inventory management software capable of accessing inventory positions at those sites.

Second, dual-channel managers should take advantage of specialized shipping strategies for online sales made possible by dual-channel retail, such as dynamically assigning which location handles each shipment and delaying the shipment of select online orders. By postponing order fulfillment and assignment, companies can better understand their inventory positions before making decisions. Dynamic assignment requires management information systems that monitor and update inventory positions and demand forecasts at the online fulfillment locations. Such systems are available now (for example, SAP ERP software coupled with SAP for Retail) and techniques like demand pattern analysis promise more accurate, up-to-date demand prediction by sensing and analyzing downstream point-of-sale data (Gartner 2010).

Third, dual-channel managers can take advantage of in-store pickup and return opportunities for online sales. These services have been well received by dual-channel consumers. Consumers benefit with better service, more convenience, and shorter wait times for buying or returning a product. Pickup and return options place a heavy burden on the interconnectivity across a dual-channel retailer's supply chain entities and channels. Here again, enterprise systems, in combination with event management and point-of-sale systems capable of

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tracking incoming and outgoing shipments and/or orders, are needed to monitor and track inventory positions in real time at the stores for both in-store and online sales. Enterprise systems also provide a platform through which that information can be accessed by all the pickup and return locations. The systems must also coordinate pickup operations at retail stores and verify particular online sales that are returned to retail outlets.

Fourth, dual-channel managers need to understand the benefits and costs associated with setting up and maintaining an enterprise system capable of providing systemwide information availability and real-time information availability. The technical requirements for integration of online and in-store systems must be met to ensure that consumers receive high-quality service through both channels.

Fifth, dual-channel managers need to be cautious about offering additional services such as in-store pickup before the company is ready to provide a high level of service. Offering these services before a company is operationally and technically prepared can create a worse customer service scenario.

Each of these recommendations should be considered in the context of a particular dual-channel retailer's demand characteristics because the fraction of demand occurring online and the variability of in-store demand are key parameters of dual-channel decisions.

REFERENCES

Autozone. 2011. 2010 *Annual Report*.

Barnes & Noble. 1998. 1997 *Annual Report*.

Barnes & Noble. 2009. 2008 *Annual Report*.

Barry, C. 2007. "The ERP Edge." *Multichannel Merchant* (July). http://multichannelmerchant.com/opsandfulfillment/erp_edge.

Berendt, B., S. Preibusch, and M. Teltzrow. 2008. "A Privacy-Protecting Business Analytics Service for On-Line Transactions." *International Journal of Electronic Commerce* 12 (3): 115-150.

Best Buy. 2007. "Best Buy Selects SAP to Integrate International, Emerging Business Information." Press release. http://cimdata.com/ newsletter/2007/46/03/46.03.06.htm.

Best Buy. 2009. 2008 *Annual Report*.

Best Buy. 2010. 2009 *Annual Report*.

Bretthauer, K., S. Mahar, and M.A. Venkataramanan. 2010. "Inventory and Distribution Strategies for Retail/E-Tail Organizations." *Computers and Industrial Engineering* 58: 119-132.

Brohan, M. 2008. "The Top 500 Guide." *Internet Retailer*. http://www.internetretailer.com/article.asp ?id=26556

Bustillo, M., and G. Fowler. 2009. "Walmart sees stores as online edge." *Wall Street Journal-Eastern Edition* (December 15): B1.

Cabela's. 2010. 2009 *Annual Report*.

Chain Store Age. 2008. "Cabela's Expands Analytical Capabilities." *Chain Store Age* 84 (6): 48.

Chopra, S., and P. Meindl. 2010. Supply chain management: *Strategy, planning and operation*. 4th ed. Upper Saddle River, NJ: Prentice Hall.

Clifford, S. 2010. "Nordstrom Links Online Inventory to Real World" *New York Times-New York Edition* (August 24): B1.

Coia, A. 2005. "How Cabela's is maximizing fulfillment efficiency." *Apparel* 46 (10): 35-36.

De Koster, M.B.M. 2002. The logistics behind the enter click. In: A Klose & LN Van Wassenhove (Eds), *Quantitative Approaches to Distribution Logistics and Supply Chain Management*. Springer, Berlin. p. 131-148

Enders, A., AND T. Jelassi. 2009. "Leveraging multichannel retailing: The experience of Tesco.com." *MIS Quarterly Executive* 8 (2): 89-100.

Forrester Research. 2007a. "The state of retailing online 2006."

Forrester Research. 2007b. "The web's impact on in-store sales: US cross-channel sales forecast, 2006 to 2012."

Forrester Research. 2009. "Multichannel: In-store pickup gains importance."

Fowler, G., AND R. Dodes. May 20, 2010. Retailers Tap Stores to Speed Online Orders. *Wall Street Journal* (Online).

Gartner. 2010. "Hype Cycle for Supply Chain Management."

Hardgrave, B., S. Langford, M. Waller, and R. Miller. 2008. "Measuring the impact of RFID on out of stocks at Wal-Mart." *MIS Quarterly Executive* 7 (4): 181-192.

Johnson, C. 2006. "The state of online—or multichannel—retailing 2006." Presented at the National Retail Federation. New York, NY.

Kavilanz, P. 2009. "Circuit City to Shut Down." *CNNMoney* (January 26). http://money.cnn.com/2009/01/16/news/compaines/circuit_city/.

Kumar, V., and R. Venkatasan. 2005. "Who are the multichannel shoppers and how do they perform? Correlates

www.manaraa

of multichannel shopping behavior." *Journal of Interactive Marketing* 19 (2): 44–62.

Lee, H., A. Farhoomand, and P. Ho. 2004. "Innovation through supply chain reconfiguration." *MIS Quarterly Executive* 3 (3): 131-142.

Lee, H., and S. Whang. 2001. "E-business and supply chain integration." Presented at the Stanford Global Supply Chain Management Forum, SGSCMF- W2-2001.

Lucas, P. 2007. "Come Back Here." Internet Retailer. http://www.internetretailer.com/internet/marketing-conference/87134-come-back-here.html.

Lummus, R.R., and R.J. Vokurka. 2002. "Making the right e-fulfillment decision." *Production and Inventory Management Journal* 43 (1/2): 50-55

Mahar, S., K. Bretthauer, and M.A. Venkataramanan. 2009a. "The value of virtual pooling in dual sales channel supply chains." *European Journal of Operational Research* 192: 561-575.

Mahar, S., P. Salzarulo, and P.D. Wright. 2012. "Using Online Pickup Site Inclusion Policies to Manage Demand in Retail/E-Tail Organizations." *Computers and Operations Research*. doi: 39 (5): 991-999.

Mahar, S., P. Wright and K. Bretthauer. 2009b. "An Analysis of Goodwill for Allowing In-Store Pickups and Returns in Retail/E-Tail Organizations." University of North Carolina Wilmington. Under Review.

Mahar, S., and P.D. Wright. 2009. "The Value of Postponing Online Fulfillment Decisions in Retail/E-Tail Organizations." *Computers and Operations Research* 36 (11): 3,061-3,072.

Malykhina, E. 2005. "Best Buy Bolsters Supply Chain." *Information Week*. http://www.informationweek.com/news/59300926

Malykhina, E., and L. Sullivan. 2005. "Retailers take stock." *Information Week* 1025: 20-22.

Rosenblum, P., and B. Kilcourse. 2005. *The Multi-Channel Retail Benchmark Report. Where Is the True Multi-Channel Retailer?* Boston, MA: The Aberdeen Group.

Spencer, J. 2003. "'I Ordered That?' Web Retailers Make It Easier to Return Goods." *Wall Street Journal-Eastern Edition* 242 (46): D1-D2.

2009. "Bleak Friday." *The Economist* (November 28)

U.S. Census Bureau. Retail Indicators Branch, 05/15/09.

Wagner, M. 2008. "Driving Sales." *Internet Retailer* (March): http://www.internetretailer.com/2008/02/28/driving-sales.

Walker, B.W, C. Johnson, AND B. McGowan. 2009. "Multichanel: In-store pickup gains importance." Forester Research.

Wallace, D.W., J.L. Giese, and J.L. Johnson. 2004. "Customer retailer loyalty in the context of multiple channel strategies." *Journal of Retailing* 80: 249-263.

Xiong, C. 2003. "Online stores try new pitch; Retailers urge internet shoppers to pick up purchases in person; Making sure the shoe fits." *Wall Street Journal-Eastern Edition* (November 19): D1.

Zarrello, C. 2010. "2010 Influentials." *Retail Information Systems News* (March).

Zhang, J., J. Irvin, T. Steenburgh, P. Farris, T. Kushwaha, and B. Weitz. 2010. "Crafting integrated multichannel retailing." Harvard Business School. Working paper 09-125.

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