THE EFFECT OF INVENTORY VISIBILITY AND CROSS-CHANNEL INTEGRATION ON ONLINE CHANNEL PERFORMANCE

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ABSTRACT

This study focuses on channel integration, which is defined as the degree to which a firm closely coordinates its virtual and physical channels. Due to the proliferation of channels through which firms can reach customers, the route to the market has become a key competitive battleground in many industries, with different players trying out different channels or channel combinations in an attempt to reduce costs and gain market advantage. While the practitioner literature conveys the value of strategic management of physical and virtual channels, this issue has received limited empirical examination by academic researchers. This study examines the effects of inventory data integration and cross-channel process integration on the performance of the online channel. Regarding all potential influences, only in-store returns of products purchased online has a significant effect on the performance of the online channels. Thus, firms interested in deriving value from channel integration strategy need to pay more attention to how they can streamline and coordinate cross-channel processes.

Keywords: Cross-channel processes; inventory visibility; channel performance

INTRODUCTION

In a growing number of industries, the competitive landscape has evolved from a predominantly physical marketplace to one encompassing both the physical and the electronic marketplace (Varadarajan & Yadav, 2002). The route to the market has therefore become a key competitive battleground in many industries, with different players trying out different channels or channel combinations in an attempt to reduce costs, improve customer service and satisfaction, and gain market share (Wilson and Daniel, 2007). In the literature, a channel is defined as a medium through which a firm interacts with its customers (i.e., physical location, and electronic touchpoints such as the Internet, call centers, mobile phones, kiosks, and interactive television). Given that customers now interact with a firm through multiple channels, there is greater need to effectively manage customer experience across these channels to achieve marketplace advantage (Ganesh, 2004). In this paper, we focus on the integration of the physical channel and the Internet (online) channel.
Strategic management of physical and electronic channels has garnered the interest of both practice and research (Osterlund et al., 2005). The practitioner literature conveys the value of strategic management of physical and electronic channels. The extant academic literature has approached this issue from two fronts. In the first front, researchers have done a comparative analysis of physical and electronic channels. For example, Choudhury & Karahana (2008) examine the relative advantage of electronic channels over physical channels in the context of auto insurance transactions from the perspective of the consumer. In a similar vein, Kuruzovich et al. (2008) examine online information search and channel outcomes in auto retailing. These studies suggest that electronic channels have a relative advantage over physical channels for information intensive transactions. Hulland et al. (2007) examine online channel commitment of brick-and-mortar retail firms and find that firms’ established physical distribution channels have a negative effect on commitment to online channel, but a positive effect on the performance of the online channel. The Hulland et al. (2007) study highlights issues managers grapple with in a multi-channel environment.

The second strand of academic literature examines strategic channel integration mainly through descriptive conceptual frameworks, analytical frameworks, and case studies. For example, Cappiello et al. (2004) examine data integration architectural choices in retail banking channels, ranging from partial integration to full integration. They underscore the need for full integration in order to achieve real-time enterprise data consistency. Steinfield et al. (2002) present a conceptual framework that identifies sources of synergy from channel integration, management strategies to achieve synergy, and synergy benefits. They identify common infrastructure (e.g., logistics), common operations (e.g., order processing), common marketing and sales (e.g., sales force), and common buyers as sources of channel integration synergy. They suggest developing specific goals, explicit coordination and control, and developing capabilities (e.g., alliances) as management strategies to achieve channel integration synergy. Last but not least, they identify cost savings (labor, inventory, etc), differentiation through value-added services (e.g., giving customers virtual access to their account information), improved trust (i.e., risk reduction), and market extension (e.g., new customers) as synergy benefits from channel integration.

While the second strand of academic literature has taken some steps to examine channel integration, the conceptual frameworks developed require empirical testing to uncover the key drivers of performance from channel integration. This study takes some of the initial steps to empirically examine how explicit coordination (i.e., integration) of physical and online channel affects the performance of the online channel. Specifically, we examine the following research question: What is the effect of inventory visibility and cross-channel integration on the performance of the online channel?

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1 Channel integration in the context of vertical integration of distribution channels (e.g., between manufacturer and retailer) has been examined in the marketing, management and operations literatures. However, vertical channel integration is beyond the scope of this study.
This study makes contribution to research and practice in several ways. First, it provides theoretically-grounded examination of inter-channel dependencies and how best to coordinate physical and electronic channels to manage these dependencies. Second, Steinfield et al. (2002) underscored the need for quantitative empirical work to assess the extent to which channel integration creates value. This study takes one of the first steps in that direction. Finally, for managers still grappling with how best to coordinate their physical and electronic channels, this study provides some insights. It identifies the nature of inter-channel dependencies and how best to manage them to create value.

The remainder of this paper is organized as follows. The next section discusses the theoretical foundation and hypotheses of the study. Then we present the methodology, data analysis, and a discussion on implications of the results from the study, its limitations, and directions for future research.

**THEORETICAL FOUNDATIONS & HYPOTHESES**

We draw from coordination theory (Malone and Crowston, 1994) to explain the types of inter-channel dependencies and coordination mechanisms to manage them. Coordination theory (Malone & Crowston, 1994) is an outgrowth from Thompson’s (1967) work on interdependence and coordination mechanisms. Thompson (1967) argued that different types of interdependencies within a firm need different coordination mechanisms to achieve efficiency and effectiveness of firm operations. Thompson (1967) identified three types of interdependence: pooled, sequential, and reciprocal interdependence and standardization, planning, and mutual adjustment as coordination mechanisms to manage them, respectively. The types of interdependence, coordination mechanisms, and corresponding concepts in this study are summarized in Table 1, which is adapted from Malone & Crowston (1994) and Sikora & Shaw (1998).

<table>
<thead>
<tr>
<th>Type of Interdependence</th>
<th>Description</th>
<th>Examples in this Study</th>
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<tbody>
<tr>
<td>Pooled Interdependence</td>
<td>Various activities share a common resource</td>
<td>Sharing of data and inventory between physical and Internet channel</td>
</tr>
<tr>
<td>Sequential Interdependence</td>
<td>Activities are constrained by need to complete them in a certain order</td>
<td>Ordering online but processing payment and pickup at the store</td>
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<td></td>
<td>(sequential and synchronous ordering)</td>
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<tr>
<td>Reciprocal Interdependence</td>
<td>Each activity supplies mutual needs or offsets mutual lacks of the other</td>
<td>In-store pickup of products ordered online, in-store product returns, and examining a</td>
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<tr>
<td></td>
<td>activity</td>
<td>product in the physical store and then ordering it online.</td>
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**TABLE 1.** Types of Interdependence
Pooled interdependence arises when essentially independent departments, channels, or organizations use a common resource (e.g., when physical and electronic channels draw upon the same customer information and inventory data). Since the various entities draw from the same resource, this type of interdependence is also known as resource interdependence (Sikora & Shaw, 1998). Thompson (1967) suggested that pooled interdependencies are well managed by standardization and shared mechanisms to orchestrate transactions. Standardization improves performance per unit cost, by reducing coordination costs; while resource pooling minimizes duplication of resources, resulting in reduced costs. In this study, we focus on resource pooling whereby the physical and online channel share common inventory data. We refer to this type of channel integration as data integration. Data integration provides real-time inventory visibility across the two channels.

Sequential interdependence arises due to temporal ordering of activities (Sikora & Shaw, 1998). In some cases, certain activities cannot be started until others are completed (the problem of sequencing) or a certain group of activities have to be performed at the same time (the problem of synchronization). For example, the concept of customer service life cycle typically involves sequential interdependence of customer activities from requirements determination to fulfillment (Saeed & Grover, 2005). Synchronization problem arises for example when, in the event of processing customer order, there is need to simultaneously check inventory for availability to guarantee filling the order. In fact, most of the operational processes, such as inventory management, order processing, and logistics attempt to streamline sequential and synchronous processes for efficiency. While Thompson (1967) suggested that sequential interdependence is better managed by plan, in the context of this study, we argue that sequential interdependence can be managed through process integration between the physical and electronic channel. For example, customers could order a product online but then process payment and pick it up at the store. This is consistent with recent literature that, for instance, in supply chain context views greater integration as a mechanism to align sequential transactions (e.g., Wang et al., 2007).

Reciprocal interdependence occurs when two entities mutually reinforce each other through complementary mechanisms, which offset the weaknesses in each entity. For example, on one hand, allowing customers to pick up from the store products they order online offsets the lack of immediate gratification inherent in the online channel. On the other hand, customers can physically examine and try products in the store and then later order them online (especially if the online channel provides price discounts), offsetting the lack of physical touch in the online channel. Furthermore, the online channel could alleviate the information problems of the physical channel because it is a lot easier to evaluate product information and compare products online than in the store. Thompson (1967) suggested that reciprocal interdependencies are better managed by mutual adjustment. In the context of this study, we propose that reciprocal interdependence, like sequential interdependence, can be managed by process integration between the physical and online channel.

In summary, we propose two coordination mechanisms to manage dependencies between the physical and electronic channels: data integration and process integration. Data integration is a
coordination mechanism to manage pooled interdependence, making it possible for the physical and online channel to share data. Specifically, we examine inventory data integration, which provides real-time inventory visibility across the two channels and facilitates online real-time inventory check. Process integration is a coordination mechanism to manage both sequential and reciprocal interdependence. For process integration, we examine cross-channel fulfillment processes, specifically, the ability to pickup from the store products ordered online and in-store product returns. Figure 1 presents the proposed research model.

**FIGURE 1.** Research Model

**Data Integration and Online Channel Performance**

For multichannel retailers with traditional physical stores and assets as well as online operations, a single data source can facilitate seamless integration. It provides retailers and customers with inventory visibility across channels and helps to drive the most appropriate fulfillment from both the shopper and retailer perspectives, best matching demand with supply (Hulland et al., 2007). For customers, uncertainty about the availability of the product they are interested in can undermine a firm’s desire to convert them from browsers to buyers. By providing online real-time inventory availability check, customers can have peace of mind, which may improve their likelihood to buy from the online channel. Ordering a product which may be out of stock can exacerbate the problem of delayed gratification inherent with the online channel since the customer will have to wait for an extended period of time. On the other hand, online real-time inventory check provides customers with useful information about the stock levels of different products, enabling them to make purchase decisions quickly.

Therefore, we present the following hypothesis:

**H1:** Provision of online real-time inventory check for customers is positively associated with performance of the online channel.
Process Integration and Online Channel Performance

The physical stores of clicks and mortar stores can serve as pickup and delivery points for goods ordered on-line. This results in costs savings for the company and in reduced risk for online buying for the customer (Steinfield et al., 2002). If customers pick up products from the store, the firm saves the cost of distribution/delivery. If items ordered on-line are shipped to stores, cost savings accrue from the ability to aggregate multiple orders and combine such shipments with regular stock replenishment shipments. One of the perceived risks of online purchases is the fear of potential fit costs (Bakos, 1997). Fit costs are costs associated with making the wrong product choice when making online purchases, resulting in direct monetary loss if the customer is stuck with product after purchase and also due to the inconvenience of having to ship the product back. Fit costs can be high for the online channel due to the inability to physically examine or “try” the product. Fit costs may be mitigated when customers pick up from the store products ordered online (ex ante fit costs), or when they return to the store products ordered online (ex post fit costs). Furthermore, in-store pickups and returns provide the added convenience and flexibility, minimizing the negative effects of delayed gratification and product return costs. We argue that providing in-store product pickups and returns should enhance customers’ willingness to purchase from the online channel, which ultimately leads to improved performance of the online channel. Therefore, we propose the following hypotheses:

**H2:** Provision of in-store pickup for products ordered online is positively associated with performance of the online channel.

**H3:** Provision of in-store returns for products ordered online is positively associated with performance of the online channel.

**RESEARCH METHODS**

To empirically test the model developed in this study, we sought an industry that uses multiple channels to do business and interact with customers, as well as where IT has had a significant impact. The retail industry fitted these requirements since multi-channel retailers abound and the industry has undergone significant transformations over the past 25 years. Some of the developments include the introduction of increasingly sophisticated technologies such as point-of-sale scanner, computer-based systems for inventory management, Internet sales channel, RFID and other technologies for shelf management, and the industry is also beginning to experiment with digitized list-price tags in stores that may soon offer dynamic pricing capabilities similar to those offered by the Internet. The online channel offers retailers new opportunities to interact with customers and given the level of maturity of e-tailing, it provides an appropriate setting for us to test our hypotheses.

We use secondary data for analysis. We obtained these data from Internet Retailer Magazine’s 2012 Edition of the Top 500 Guide to online retailers. The Top 500 Guide provides data on the top 500 leading Internet retailers in terms on online sales revenue. The 2012 edition contains 2011 data on whether a given company had implemented data integration (online real-time inventory check) and process integration (in-store product pickup and returns).
It also contains sales data for past 3 years (2009-2011). The guide includes four types of companies: retail chain, web only, catalog/call center, and consumer brand manufacturer. Since we are interested in integration between physical and online channel, the sample used in the analysis includes retail chain companies only (i.e., clicks and mortar companies). These companies have an extensive physical store infrastructure, making the evaluation of the effect of channel integration on online channel performance possible. The sample used in analysis consists of 120 companies that had complete data for the variables used in the analysis. Whether a given company has implemented data integration and process integration or not is recorded in the data using dichotomous categorical scale (Yes/No). To facilitate empirical analysis, we coded these categories as dummy variables with Yes = 1 (i.e., denoting that a given company has implemented data integration and/or process integration), and No = 0 (i.e., denoting that a given company has not implemented data integration and/or process integration). We use average sales growth of the online channel over the 3-year period (2009-2011) to measure the performance of the online channel. We also use two control variables: firm size and average ticket (i.e., how much customers spend online, on average). We measured firm size using the total number of online stock keeping units (SKUs) maintained by a given company. We chose to use this variable because Wells & Gobeli (2003) propose that digitized process range (i.e., the extent to which digitized processes enable a firm to offer customers a value proposition consisting a breadth of products and services) is one of the critical dimensions of e-business strategy. Furthermore, customers often view the online channel as a source for bargain products. Thus, we control for the effect of average ticket (related to product price) on the performance of the online channel. 2011 data was used for the control variables.

RESULTS AND DISCUSSION

Figure 2 presents empirical findings from the study. Despite Wells & Gobeli’s (2003) speculation that digitized process range could be a critical dimension of e-business strategy, our control for firm size using a firm’s online number of SKUs appears to have no significant effect on sales growth of the online channel. Unless a firm works on creating cross-selling opportunities, a breadth of products per se in the online channel may not improve its performance. On the other hand, average ticket (a proxy for product price) appears to have a negative effect on the sales growth of the online channel. Online shoppers may indeed be bargain hunters.

Turning to empirical test of our hypotheses, only the third hypothesis is supported. Real-time inventory check and in-store pickup of products ordered online don’t have a significant effect on online sales growth. Although the estimated coefficient is not statistically significant, it is noteworthy that the negative sign for the real-time inventory check coefficient is contrary to our hypothesis. This is partially consistent with Hulland et al. (2007) study that found that firms with established physical distribution channels had less commitment to online channel. In our case, it could be that when customers do online real-time inventory check, they may prefer to buy the items from any nearby physical store that carries the product. In this sense, the
Inventory Integration

In-Store Pickup

In-Store Returns

Real-Time Inventory Check

Inventory Visibility

Firm Size

Online Channel Performance

Average Ticket

1.665

6.057

-2.878

-4.154

R² = 0.114, F statistic = 2.948 (p = 0.015); * p < 0.01; N = 120.

In support of our third hypothesis, we find that relationship between in-store product returns and the performance of the online channel is positive and statistically significant. Perceived risk and the expectation of losses associated with online purchase inhibit purchase behavior (Featherman & Pavlou, 2007). It appears that allowing customers to return to the store products they purchased online alleviates the expectation of losses associated with online purchases, and makes customers more willing to purchase products online. In-store product returns make it more convenient for customers to dispose of products that they perceive to not have met their need, instead of having to mail back those products. Transaction costs are higher in the latter case. Thus, in-store returns is a channel integration strategy that engenders greater trust in the online channel. This type of channel integration strategy is especially critical for B2C retailers that deal with more ephemeral customer relations. They can leverage their physical outlets to accept product returns, which reduces buyer risk and builds trust (Steinfield et al., 2002).
CONCLUSION

This study examines channel integration, which is defined as the degree to which a firm closely coordinates online and physical channels. It is presumed that channel coordination or integration provides a greater and deeper mix of customer service, thereby enhancing the seller’s overall value proposition (Wallace et al., 2004). We examined two types of integration between physical and online channel: data integration and process integration, and their effect on the performance of the online channel. Data integration facilitates inventory visibility across the two channels, which enables customers to do real-time inventory check when making product purchases. While we didn’t find a significant effect of inventory data integration on the performance of the online channel, it is advisable for companies to invest in maintaining consistent data across the physical and online channels. Separate data and IT systems can make it difficult to view or share data across channels, which can lead to inaccurate orders and poor fulfillment rates.

Process integration between the physical and online channel, most especially letting customers return to the store products purchased online can create synergy, which improves the performance of the online channel. This results from mutual interdependence whereby the physical channel offsets some of the weaknesses of the online channel. While it can often make sense to operate the channels separately, particularly where online sales are a significant proportion of the total, our results suggest that clicks and mortar retailers need to focus on improving channel integration, especially integrating fulfillment processes between the physical and electronic channels.

While we obtained some interesting results, we also wish to acknowledge some of the limitations of our research. First, we examined only the benefits the online channel receives when it is integrated with the physical channel. We did not examine the effect of channel integration on the performance of the physical channel. This could help paint a complete picture about whether complementarity or cannibalization happens when firms integrate their physical and electronic channels. Companies such as Barnes and Noble have been ambivalent about channel integration in the past for fear of channel cannibalization (i.e., one channel just taking business away from the other channel without creating incremental business value). Future research should examine how channel integration impacts the performance of either channel. Second, we didn’t differentiate between different types of products in our analysis. Past research has shown that perceived risk may vary by product type (e.g., search goods vs. experience goods). It would be interesting to know whether effects of data and process integration vary by product type. Future research could integrate product type into empirical analysis of the performance effects of channel integration.
REFERENCES


