Information Systems and Technology Sourcing Strategies and Performance of E-Retailers

by

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ABSTRACT

The e-Retail industry has grown rapidly over the last few years and is projected to continue its upward trend as consumers shift from traditional channels to online channels. In March 2010, Forrester Research forecasted that online retail sales will grow by 10% a year for the next 5 years and e-Retail sales will amount to $249 billion by 2014. With intense competition for market share and profits, information systems and technology (IST) sourcing decisions are becoming increasingly important to e-Retail firms to support continued growth and market responsiveness. There are several aspects for e-Retailers to consider when formulating its IST sourcing strategy. Whether to choose make versus buy for technology assets and services has been addressed in both strategy and IS literature (Handfield et al. 1999, Leiblein et al. 2002, Wade and Hulland, 2004). Then there is the follow-up question of selecting a best-of-breed strategy or tighter partnership with a select group of vendors (Clemons et al. 1993, Kauffman and Tsai 2009). Few studies have looked at IST sourcing or proposed models and frameworks for evaluating IST sourcing decisions (Saarinen and Vepsalainen, 1994). Furthermore, these existing studies mainly address the antecedents of the decisions but not so much on their performance effects (Kauffman and Tsai 2009; Smith et al., 1998). The goal of this study is to extend the knowledge of IST sourcing for e-Retailers, a topic which has received limited attention (Kishore et al., 2004), by addressing a core problem: How should an e-Retailer develop and implement its IST sourcing strategy to accommodate the increase in consumer demand and IT complexity but still achieve high performance? The study

introduces two theoretical models to examine organizational factors that influence an e-Retailer's IST sourcing strategies of make versus buy and partnership versus best-of-breed. The proposed models are tested using a panel data set of 307 e-Retail firms over the period of 2006 to 2010. The study opens up the black box of internal firm operations by introducing a granular view of IST sourcing decisions at both the value chain and e-Commerce architecture levels and examining the performance impacts of these strategic choices. This in-depth look at IST sourcing has yet to be explored in the literature.

I dedicate this work to my amazing parents, Dr. Rey-Fong Tsai and Bor-Ling Lin, for their endless love, patience, guidance, and encouragement, and to my family and friends, who have supported me throughout the entire process.

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CHAPTER 1

INTRODUCTION

The e-Retail industry has grown rapidly over the last five years and is projected to continue its upward trend. In March 2010, Forrester Research forecasted that online retail sales will grow by 10% a year for the next 5 years and e-Retail sales will amount to $249 billion by 2014. As consumers shift from traditional channels to online channels, e-Commerce technologies are playing a key role in e-Retailers' strategies for competing in this fast-growing and hypercompetitive market. The demand for e-Commerce technologies points to an "arms race" in the e-Retail industry. For instance, the largest annual e-Commerce event – the Internet Retailer Conference & Exhibition which has a 2011 theme of "E-Commerce Shifts into Overdrive, the Race is On" – has focused on e-Retailers' demand for the latest technologies and services from e-Commerce solution providers (Love, 2011).

As a differentiation strategy, e-Retailers are constantly adding new features and functions to their virtual stores, including mobile commerce, dynamic imaging, social networking, site personalization, and videocasts, to enhance consumer experience. However, indiscriminate use of features on an e-Commerce store front can lead to system latency or failure, and negatively impact service delivery and user experience. Therefore, a robust and well-integrated IT infrastructure is required to support the new features and capabilities. Successful implementation of a complex IT infrastructure can help an e-Retailer meet service

objectives. For example, establishing better coordination through integrated supply management orientation can lead to an improved operating environment for both the e-Retailer and its suppliers (Shin et al., 2000). The focus on IT infrastructure is evident from recent industry surveys which show that 62% of e-Retailers will increase their technology budget in 2011, while 52.4% of respondents indicate that more investments will be made in their e-Commerce platform and the look and feel of their websites.

There are several aspects for an e-Retailer to consider when formulating its IST sourcing strategy. Whether to choose make versus buy for technology assets and services has been addressed in the literature of both strategy and IS (Handfield et al., 1999; Leiblein et al., 2002; Wade and Hulland, 2004). Most of the make versus buy studies in the literature relate specifically to IT outsourcing and, more recently, to business process outsourcing (Bardhan et al., 2006; Bardhan et al., 2007; Loh and Venkatraman, 1992; Whitaker et al., 2010). IST sourcing differs from outsourcing in that a firm is not seeking to turn over its IST functions to another firm but rather to create its IT infrastructure using technology solutions built by external vendors. Oftentimes, the firm still has full ownership of these technology assets. At the same time, because IST sourcing involves relying on technologies created by external vendors and because both sourcing and outsourcing decisions have shared concerns such as interoperability and integration between systems, we are able to leverage the outsourcing literature for our interpretation of expected IST sourcing behaviors.

An argument for why a firm should "buy" is so that it can focus on its core competencies. On the other hand, when a high degree of control is required due to competitive edge or strategic vulnerability, a firm should "make" instead (Quinn and Hilmer, 1994). While buying off-the-shelf systems speeds up implementation of new features, some firms have expressed concerns about increased commoditization of store-front features and reduced service differentiation. Other dimensions that have been proposed for evaluating IST outsourcing decisions include the extent of substitution by vendors, the strategic impact of IS applications, and business and IT cost structures (Nam et al., 1996; Loh and Venkatraman, 1992). Models have been proposed to help IS managers identify conditions under which outsourcing should be selected over internal development (Richmond et al., 1992).

Once a firm has decided to buy, then there is the follow-up question of whether the firm should pursue a *best-of-breed strategy* or tighter *partnership* with a smaller group of vendors. Under conditions of tighter partnership, a firm worries about risks of lock-in, but there are those who argue that such relationships create opportunities for noncontractible benefits, lower transaction costs, and allow a firm to benefit from integrated technology stacks (Bakos and Brynjolfsson, 1993; Clemons et al., 1993; Kauffman and Tsai, 2009). Integration plays a big role in architecture and IT infrastructure choices (Hasselbring, 2000). As noted by Rick Hassman, Director of Corporate Applications at Pella, "A bad experience with lock-in and a desire to achieve complete integration were the driving factors behind our desire to go with one vendor. It is better in terms of

time and money to have one vendor as you can form a real partnership" (Robb 2010). In the same article, Marc Barnett, Senior Manager for Solutions and Services Marketing at CDW, noted, "The more complex your technology gets, the greater the tendency to standardize and migrate to fewer vendors." Therefore, IST sourcing strategy is a timely issue, and changes in the software industry are introducing new concerns.

Drawing on the *contingency theory*, we propose two models that explore e-Retailers' IST sourcing strategies and their effects on financial and operational performance. The first model explores organizational factors that influence e-Retailers' IST sourcing strategy of *make versus buy* in enabling their value chain activities and to look at firm-level performance impacts of IST sourcing decisions that involve bundling across value chain activities. The second model evaluates organizational factors that impact e-Retailers' IST sourcing strategy of *partnership versus best-of-breed* for core services of the e-Commerce architecture and the influence of these decisions on firm performance.

Our models open up the black box of internal firm operations by introducing a granular view of IST sourcing decisions, which has yet to be explored in the literature. The *contingency theory* states that a firm's choices are dependent upon its internal and external environments, and it stresses the alignment between organization and strategy (Burns and Stalker, 1961; Lawrence and Lorsch, 1986). The contingency perspective has been explored for such contexts as Internet adoption (Teo and Pian, 2003) and IS usage and satisfaction

(Raymond, 1990). Multiple studies have confirmed the link between a firm's characteristics and its strategy. Veugelers and Cassiman (1999) examine appropriation conditions, organizational attitude, and internal R&D capabilities and know-how with a model of technology make versus buy. Armstrong and Sambamurthy (1999) investigate the relationship between various factors including strategic IT vision (i.e., automate, informate, and transform) and IT assimilation. Whitaker et al. (2010) reveal in their empirical study that firm-level properties like experience in internationalization and IT outsourcing affect a firm's likelihood to engage in onshore versus offshore business process outsourcing.

Our goal is to extend the knowledge of IST sourcing for e-Retailers, a topic which has received limited attention (Kishore et al., 2004). Few studies so far have looked at IST sourcing or proposed models and frameworks for evaluating IST sourcing decisions (Saarinen and Vepsalainen, 1994). Furthermore, these existing studies mainly focus on antecedents of the decisions but not so much on their performance effects (Kauffman and Tsai 2009; Smith et al., 1998). In this regard, our study additionally introduces new knowledge on the performance impacts of IST sourcing decisions that involve bundling across value chain activities.

The issue of complementarities between different parts of the value chain is salient in the e-Retail context. Complementary resources enable e-Retail firms to introduce new capabilities, seek synergy opportunity, and leverage existing

capabilities. From this perspective, we add to an emerging line of research that explores complementarities between different aspects of the value chain. For example, the presence of complementary effects among human resources, IT, and other firm assets and capabilities is studied by Wade and Hulland (2004). Grant (1991) asserts that firms may need to rely on sourcing of complementary resources in order to acquire new capabilities to fill existing gaps. In the airline industry, firms are observed to make complementary changes in organizational processes and business strategies in order to create value through IT (Duliba et al., 2001). Complementary effects in terms of increased return on assets and improved efficiency are found to occur when integrating e-Commerce capability with IT infrastructure (Zhu, 2004).

This research specifically addresses the following research questions to better understand the emerging issues of IST sourcing strategies among e-Retailers:

- How do organizational characteristics affect e-Retailers' IST sourcing decisions of *make versus buy* and *partnership versus best-of-breed*?
- How do the different IST sourcing choices impact firm performance?
- Do complementarity effects exist for IST sourcing decisions of e-Retail value chain activities?
- Does the choice for e-Commerce platform influence an e-Retailer's ability to partner and consolidate technologies that support the core services of its e-Commerce architecture?

The study is conducted using a panel data set of 307 firms over the period of 2006 to 2010. Our findings based on an analysis of e-Retail firms' IST sourcing decisions of make versus buy and performance reveal that firms that make transformative IT investments tend to source a smaller portion of IST for their e-Retail value chain activities than do firms that pursue automate or informate as their strategic role of IT investment. Capabilities are positively associated with IST sourcing. Firms experienced in e-Retail activities are more likely to build rather than buy their IST, and e-Retailers with a CIO are less likely to pursue IST sourcing. Our findings reveal no evidence of financial performance effects when alignment occurs between IT strategic role and IST sourcing decisions. Complementary IST sourcing of synergistic marketing and sales activities positively impacts Web sales and conversion rate, but combined sourcing of logistics, operations, and sales activities is associated with lower Web sales and conversion rate.

For our analysis of e-Retailers' IST sourcing decisions of partnership versus best-of-breed show that firms that pursue capabilities elect a best-of-breed IST sourcing strategy. As an e-Retailer's degree of sourcing increases, it is less likely to pursue partnership. Our findings also reveal that when degree of sourcing is combined with an e-Commerce platform from an external vendor, a firm is better able to achieve partnership. Finally, partnership positively impacts response time, consistency, and site downtime for the catalog service, and negatively influences response time for the reporting service.

The rest of the dissertation proposal is organized as follows. Section 2 provides a review of the background literature. Section 3 covers the theoretical model and hypotheses, followed by data and methodology in Section 4. The results and discussion for make versus buy are presented in Section 5, and Section 6 includes the results and discussion for partnership versus best-of-breed. We conclude in Section 7 with limitations and implications for research and practice.

CHAPTER 2

BACKGROUND LITERATURE

2.1 E-Retail Value Chain

To set the context and scope for this research, we begin with a typological overview of e-Business, e-Commerce, and e-Retail. E-Business is the coalescence between the Internet and supply chain integration and captures all processes involving customers, employees, vendors, and business partners (Johnson and Whang, 2002). E-Commerce, on the other hand, is a subcategory of e-Business and refers to the purchasing, selling, and exchanging of goods and services over the Internet. It includes business-to-business (B2B), business-to-consumer (B2C), consumer-to-business (C2B), and consumer-to-consumer (C2C) transactions. E-Retail, also known as eTail, focuses on the selling of retail goods and services on the Internet to consumers and refers solely to business-to-consumer (B2C) transactions of e-Commerce.

There are many types of e-Retail firms, ranging from Web only e-Retailers to traditional "brick-and-mortar" retailers that offer online store fronts (i.e., "click-and-mortar"). By transitioning to a click-and-mortar business approach and creating stronger cooperation across channels, retail chains, catalog/call centers, and brand manufacturers are able to achieve benefits including cost savings, improved differentiation, enhanced trust, and market extensions (Steinfield et al., 2002). This study focuses on the e-Retailers' IST sourcing strategies that enable the primary value chain activities of input logistics, operations, output logistics,

marketing, and sales. Straub (1999) introduces five successive activities to the e-Commerce value chain: inquiry, order/sale, payment, delivery, and service.

Integration of multiple information systems is required to support an e-Retailer's supply chain. E-Commerce, with its ability to support multiple functional areas covering marketing, purchasing, design, production, sales, distribution, human resource management, warehousing, and supplier development, is quickly altering the supply chain of retail and service operations (Gunasekaran et al., 2002). Given the close integration of e-Commerce infrastructure with the e-Retail value chain, we utilize Porter's (1985) value chain framework to develop a conceptual understanding of the e-Retailer IT infrastructure inter-relationships.

Figure 1 illustrates the value chain model proposed by Porter (1985) and the role of technology in supporting the primary activities. Highlighted in gray are the value chain activities that will be covered in our study. Technology development spans all areas of e-Commerce, thus making it critical to an e-Retailer's value chain. In essence, the *value chain* is "a model that describes a series of value-adding activities connecting a company's supply side (raw materials, inbound logistics, and production processes) with its demand side (outbound logistics, marketing, and sales)" (Rayport and Sviokla, 1996). The five primary activities of the value chain include inbound logistics, operations, outbound logistics, marketing and sales, and service. *Inbound logistics* refer to activities associated with receiving, storing, warehousing, and inventory control

of input materials. *Operations* include such value-creating activities as packaging and assembly that transform inputs into the final product. Activities like order fulfillment that focus on distributing the finished products to buyers make up *outbound logistics*. *Marketing and sales* activities relate to those that help buyers to purchase the product, which include advertising, promotion, channel relations, and pricing. Finally, *service* activities, which include customer support, installation and repair, are performed to maintain and enhance the value of the product after the sales. The primary value chain activities are facilitated by support activities of procurement, technology development, human resource management, and firm infrastructure.[1]

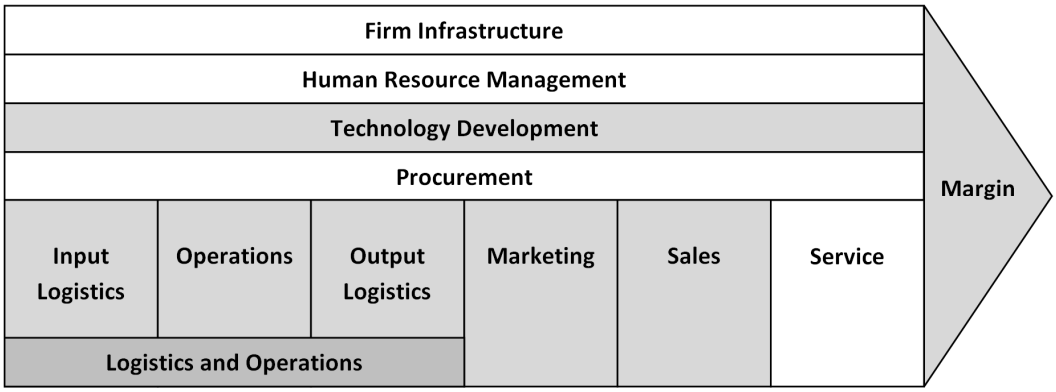

Figure 1. Value Chain: Logistics, Operations, Marketing, and Sales

Porter (1985) introduces the value chain as a model to identify the sources of competitive advantage that enable a firm to outperform its competitors, through

[1] *Procurement* refers to the function of acquiring raw materials and other inputs used in the firm's value chain. *Technology development* captures process automation and other technology development used to support the value chain activities. Activities of recruiting, hiring, and training of employees make up *human resource management*. The *firm infrastructure* consists of activities such as finance, legal, accounting, and quality management (Porter 1985).

means like using technology to perform primary and support activities better, faster, and cheaper. For e-Retailers, the possible use of technology to enable competitive advantage could mean lowering coordination cost with producers or reducing physical distribution costs with buyers. Technology development serves as the backbone for value chain success because it is the touch point for all activities. Not only does the backend IT infrastructure support the entire value chain by coordinating all activities, but all participants of the value chain ranging from suppliers to retailers to customers can interact with one another through these technologies.

The substantial impacts of IT architecture and decisions on the value chain activities have been noted in the literature. For instance, the adoption of electronic data interchange (EDI) combined with the use of continuous replenishment processes to reengineer business processes has been found to improve inventory levels and warehouse stockouts by 50 to 100% (Clark and Hammond, 1997). The integration of Internet communication and supply chain enhances collaboration between firms and their suppliers (Frohlich and Westbrook, 2001), improves performance in manufacturing (Frohlich and Westbrook, 2002), and offers a far less costly mode of communication for the parties involved (Evans and Wurster, 1999). For example, a supplier that is linked via the Internet to its distributor can automatically replenish goods that are running low. The adoption of supply chain management systems has been shown to strengthen value co-creation between buyer and supplier and result in *IT-enabled competitive advantage* against their competitors (Subramani, 2004).

In addition to the impacts on supply chain activities, the activities related to the business-to-consumer (B2C) portion are just as important. With the B2C part of the value chain becoming digital, firms have the opportunity to integrate the entire value chain and include their customers as part of the value creation process (Smith et al., 2000). We observe several examples of this. While Amazon stocks inventory of products, it also lets its customers become suppliers by giving them the ability to sell their own products through the Amazon Marketplace. Other companies like Snapfish and Shutterfly allow consumers to design their own products such as greeting cards, photo mugs, and calendars. Firms can enhance customer relationship by using the build-to-order supply chain management strategy, which involves the use of IT to meet customer requirements (e.g., providing a Web-based platform for placing orders and following up on their status) (Gunasekaran and Ngai, 2005). Utilizing technology to engage consumers in online transactions can bring about various intangible benefits such as loyalty. For example, creating an e-Commerce site that supports customization, contact interactivity, community, and convenience can foster e-loyalty of consumers in the B2C marketplace (Srinivasan et al., 2002).

2.2 E-Commerce Architecture

Zwass (1996) captures the complex enterprise of e-Commerce using a three-level hierarchical framework with infrastructure at the lowest level, followed by services, and then products and structures. The *infrastructure* consists of all the hardware, software, databases, and telecommunications required to

establish the technological infrastructure for e-Commerce. The *services* level, which provides the business with infrastructure of e-Commerce, includes secure messaging and service enablement. *Products and structures* of e-Commerce are focused on consumers, B2B relationships, and inter-organizational electronic hierarchies.

Building the appropriate e-Commerce architecture and IT infrastructure is instrumental to e-Retail success. Niederman et al. (1991) describe architecture as the technological blueprint or high-level map of the information requirements of a firm. Earl (1989) asserts that the architecture provides a "framework for analysis, design and construction of the IT infrastructure" and directly affects infrastructure flexibility. The architecture is also the "technology framework which guides the organization in satisfying business and management information needs." Venkatraman (1991) proposes that firms view the value and role of IT infrastructure in three different ways: independent, reactive, or interdependent. In an *independent perspective,* the development of infrastructure takes place outside the strategic context and is seen as a cost center and as a means to achieve cost savings through centralization. Firms with a *reactive perspective* see IT infrastructure as a tool for strategic initiatives, for satisfaction of a business activity, and for immediate benefits in the short run. For firms with an *interdependent perspective,* the IT infrastructure is viewed as a strategic resource that is in constant flux and is modified to align with their strategy.

To illustrate the complexity of an e-Retailers' IT environment, they generally have systems including customer relationship management, business intelligence, supply chain management, content management, e-Commerce platform, and Web analytics, among others. Successful implementation of a complex IT infrastructure enables a firm to achieve efficient operations, improved employee productivity, and better inventory utilization (Gunasekaran and Ngai, 2004), all of which can contribute to an e-Retailer's performance. Hasselbring (2000) discusses the importance of IS integration in e-Commerce and specifies 3 architecture layers for IS integration: "(1) *business architecture layer* defines the organizational structure and the workflows for business rules and processes; (2) *application architecture layer* defines the actual implementation of the business concepts in terms of enterprise applications; and (3) *technology architecture* layer defines the information and communication infrastructure." To be effective in e-commerce, it is necessary that there is fluidity in the flow of information, and information systems of dissimilar organizations are able to interoperate (Yang and Papazoglou, 2000).

Larsen (2000) notes that component-based enterprise frameworks should be applied to e-business solutions to achieve productivity, quality, extensibility, and thus, provide the agility firms need to respond to rapidly changing e-Commerce business models. Service-oriented architecture uses basic services or components, which are comprised of "necessary roles and functionality for the consolidation of multiple services (Papazoglou and Georgakopoulos, 2003)." We take into account this component-based framework in constructing our study and

utilize the SOA e-Commerce Architecture (Figure 2) proposed by Elastic Path (Bustos, 2008) in our study. The three core services captured in our study are boxed in red. They are content, catalog, and reporting.

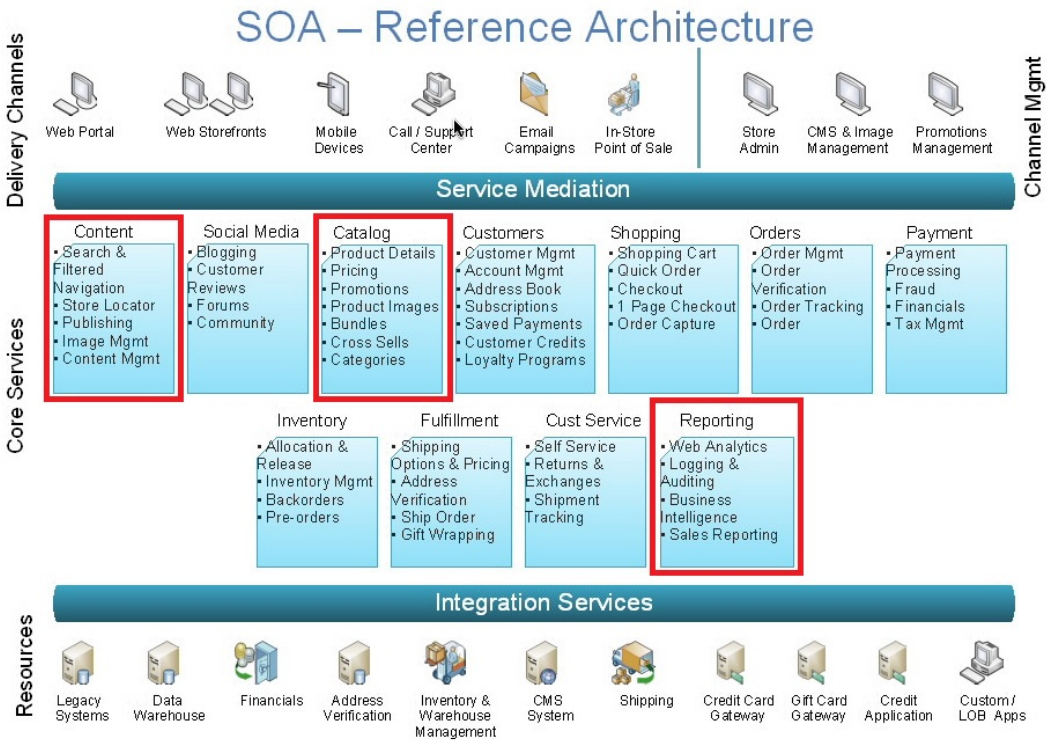

Figure 2. E-Commerce Architecture: Content, Catalog, and Reporting

2.3 Make versus Buy IST Sourcing Strategy

The decision to “make” or “buy” materials, assets, or solutions is a classic acquisition problem, and it has been explored in multiple contexts. Kogut and Zander (1992) propose that a firm should evaluate three elements in its decision-making process for make versus buy: its present ability to perform the task, the learning curve that is involved in developing specific capabilities, and the value of

these capabilities to create new markets for the firm. Therefore, the experience of a firm and its need to acquire features and capabilities should be factored into its evaluation process for make versus buy. The need to reduce time to market also motivates firms to buy rather than make (Handfield et al., 1999). Buying systems solutions confers benefits such as the ability to leverage a vendor's expertise, greater flexibility in acquiring new technologies and systems, avoidance of coordination inefficiencies, compression of product development lifecycle time, and sharing of risks related to technology developments among a firm's suppliers (Leiblein et al., 2002; Quinn and Hilmer, 1994). However, the decision to source from an outside vendor can also introduce its own risks, including loss of critical skills, development of wrong skills, decline in cross-functional capabilities, and handover of control to the vendor.

The answer to the question of whether to make or buy is not always obvious but oftentimes complicated. Quinn and Hilmer (1994) recommend that firms invest their resources in their core competencies and outsource other non-core activities for which they have neither a critical need nor special capabilities. Firms vary in terms of their competency focus and hence differ in their choices of which business solutions to outsource as opposed to which ones to insource. Quinn and Hilmer (1994) further note that most companies target two or three value chain activities that are deemed most critical to future success. Teece (1986) presents multiple factors for a firm to consider when deciding if it should integrate or contract for *complementary assets* related to technological innovation. The factors he recommends include whether the appropriability regime is weak,

whether specialized assets are necessary for profitable commercialization, and how other relevant players like imitators or competitors are positioned.[2] There is evidence that firms may elect to concurrently source, i.e., simultaneously making and buying similar goods or services (Parmigiani, 2007). This suggests that the make versus buy decision is not a simple dichotomous choice but lies on a continuum, especially when all value chain activities are weighed for implementation.

While outsourcing decisions can be considered distinct from make versus buy decisions, they are still related from a conceptual perspective. Thus, some of the recommendations in the IT outsourcing literature are still relevant in a make versus buy context. Lacity and Willcocks (1998) conduct in-depth case studies on IT sourcing of firms in the United States and United Kingdom and propose five best practices for yielding higher success rates and achieving cost savings when sourcing IT: (1) focus on selective outsourcing rather than total outsourcing or total insourcing, (2) ensure collective decision-making among senior managers, (3) evaluate both external and internal bids, (4) choose short-term contracts over long-term ones, and (5) use detailed fee-for-service contracts. For a firm that chooses to outsource its IT functions and connect multiple vendors across a network, it is important to establish an IT governance structure where an IT expert such as a CIO is instrumental in decision-making (Nolan and McFarlan, 2005). Feeny and Willocks (1998) indicate that IT leaders determine the values and

[2] *Appropriability regime* is defined as "environmental factors, excluding firm and market structure, that govern an innovator's ability to capture the profits generated by an innovation" (Teece, 1986, p. 287).

culture of the IS function within a firm, and effective IT leaders develop plans to manage the interdependencies that exist among structures and processes and to address challenges that arise accordingly. Thus, strategic IT leadership of a firm could be a key contributor of its IST sourcing decisions.

2.4 Partnership versus Best-of-Breed IST Sourcing Strategy

When a firm elects to outsource or procure its information systems and technology, it has the option to pursue a best-of-breed or partnership procurement strategy. *Best-of-breed* occurs when a firm elects to build a customized suite of applications by acquiring and integrating different technologies from different vendors (Light et al. 2001). Some firms explain that this approach allows them to choose the most capable and efficient source (Lacity and Willcocks 1998). *Partnership* happens when a firm decides to partner with a small number of vendors or in the extreme case, just one vendor (Clemons et al. 1993).

For firms such as e-Retailers that use ERP systems, the question of partnership or best-of-breed comes up frequently. For example, Colgate-Palmolive decided to go with an all-in-one solution from SAP because they believed that an integrated environment provides systems robustness which outweighs the risk of relying on only one vendor, while Boeing Commercial Airplane Group chose the best-of-breed approach (Stefanou 2001). For the procurement of ERP systems, Stefanou (2001) notes that there are benefits to both strategies: (1) all-in-one (single vendor partnership) offers consistent integrated processes, upgrades compatibility, lower cost, simpler implementation, and easier

maintenance; and (2) best-of-breed delivers enhanced functionality, flexibility, possible competitive advantage, widely tested extended applications, and reduced dependency on one vendor.

The benefits of partnering with a small group of vendors have been widely discussed in the IS literature. Bakos and Brynjolfsson (1993) argue that *noncontractible benefits*, such as a higher level of responsiveness from the vendor and collaborative innovation, become available in a tighter partnership. An example of a noncontractible benefit for an e-Retailer is having the ability to suggest future product features to its vendor. Such features may be productized and supported at no additional costs to the firm. Having a smaller group of vendors can also reduce external coordination and transaction costs, both of which play a major factor in a firm's procurement decisions (Clemons and Row 1992).

Some firms may choose to partner with just one vendor. Kauffman and Tsai (2009) reveal that *unified procurement*, which involves the acquisition of all related technology products and services from a single vendor, can allow a firm to transfer certain technology risks to its vendor and in some instances, even improve its bargaining power. The concerns that firms have for single-vendor partnership is that such a choice may subject them to higher opportunism risk, which generally arise in a lock-in situation. Clemons et al. (1993), however, note that standards and their ability to reduce switching costs can decrease the chances of vendor lock-in. Since vendors today are pressured to deliver standards-based solutions, e-Retailers have the flexibility to swap out their vendor and technology

should it no longer meet their business objectives. Another benefit of the unified procurement strategy is that it further simplifies principal-agent relationship because a firm only has to manage the one vendor, and the vendor is accountable for any issues that occur. Williamson (1981) declares that disputes are easier to resolve in a bilateral exchange. The strength of SAP's ERP solution has made the firm a popular partner vendor for many firms (Gargeya and Brady 2005).

CHAPTER 3

THEORETICAL MODELS AND HYPOTHESES

3.1 Contingency Factors in the IS Literature

The *contingency theory* suggests a fit between strategy and performance; therefore, firms achieve better performance when their strategies are aligned with their organizational structures and environmental conditions (Venkatraman and Prescott, 1990). In the IS literature, factors that have been studied in relation to the contingency perspective include firm size, structure, maturity, resources, knowledge, IS sophistication, technology, and environment (Raymond, 1990; Weill and Olson, 1989). Findings from multiple studies support the influence of contingency factors on a firm's IT strategy and technology adoption decision.

Sambamurthy and Zmud (1999) explore the influence of reinforcing, conflicting, and dominating contingencies on firms' choices of IT governance modes including centralized, decentralized, and federal. Teo et al.'s (1997) of Internet adoption in Singapore reveal that organizational and technology factors hold more weight than environmental factors in driving Internet adoption among Singapore companies. In another study on contingency factors and Internet adoption, Teo and Pian (2003) find that a proactive business technology strategy is positively associated with the level of Internet adoption, which is found to influence a firm's competitive advantage. Barki et al. (2001) develop a contingency model of software project risk management and evaluate the importance of fit between risk exposure and risk management in achieving

positive performance. Our study brings together the combined knowledge on contingency from the strategy, supply chain, and IS literature to look at determinants of make versus buy and partnership versus best-of-breed IST sourcing decisions and the effects of these choices on firm performance.

Hofer (1975) proposes two assumptions for exploring the *contingency theory of business strategy*: (1) less complex variables are required for the development of a business strategy and (2) a firm must achieve success at the business level in order to reach success at the corporate level. This leads us to propose a two-stage IST sourcing model for our study. First, we look at the factors that influence IST sourcing decisions, followed by the performance effects of these decisions.

We explore IST sourcing strategies from two different views: (1) make versus buy from a value chain and vertical perspective based on value chain activities, and (2) partnership versus best-of-breed from an e-Commerce architecture and horizontal perspective of core services. When choosing technology at the value chain level, the focus is on delivering value for the business and on improving financial performance. When evaluating technology sourcing at the architecture level, the emphasis is on streamlining and achieving better operational performance. Refer to Figure 3 for a comparison of how the two studies differ.

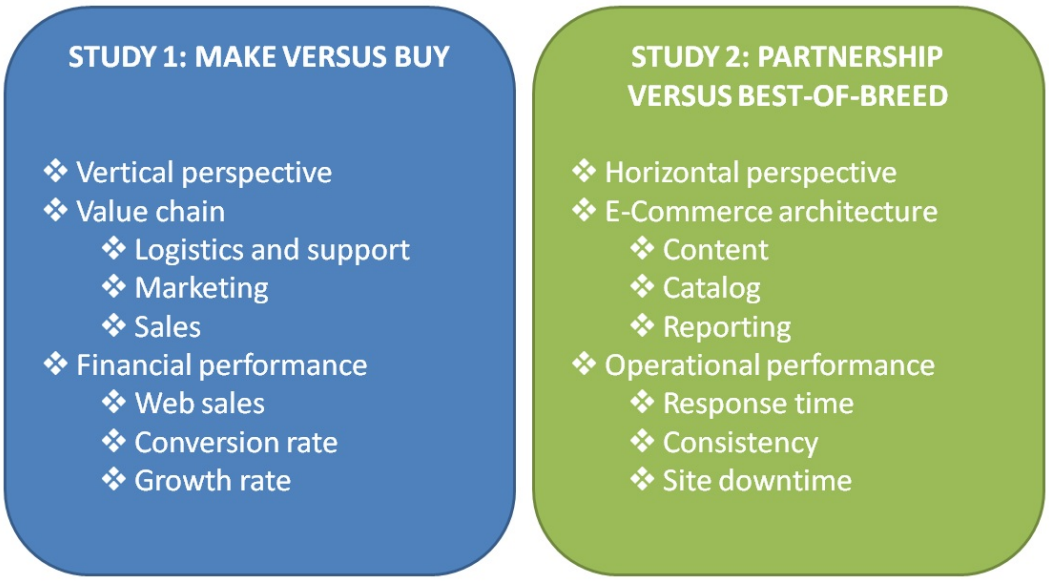

Figure 3. Make vs. Buy and Partnership vs. Best-of-Breed

3.2 Contingency and the Value Chain

Previous studies have applied the contingency perspective to supply chain problems. Flynn et al. (2010) explore from a contingency perspective the performance impact of customer, supplier, and internal integration and their interactions. Guide Jr. et al. (2003) leverage the contingency theory to understand factors that influence production planning and control for closed-loop supply chains. Germain et al. (2008) study supply chain process variability using the contingency theory and examine the association between formal control and supply chain process variability and financial performance. Johnson et al. (2002) evaluate the relationship between the strategic role of purchasing and the form of team used in a supply chains.

In our two-stage IST sourcing model for the e-Retail value chain as shown in Figure 4, we examine four organizational factors: *experience*, *capabilities*, *IT strategic role*, and *strategic IS/IT management*, all of which are expected to influence e-Retailers' make versus buy IST sourcing strategy for their value chain activities. Then we examine the performance impacts of make versus buy and bundling across value chain activities by evaluating the effects of *complementary IST sourcing*. In the following subsection, we explicitly review the literature pertaining to each construct in Figure 4 and elucidate its hypothesized relationship with sourcing decisions and performance.

Figure 4. Research Model of Make vs. Buy

Arguments have been made that firms should retain their core competencies when determining which elements of the business to outsource. Prahalad and Hamel (1990) provide three tests for identifying a firm's core competencies: a core competence (1) offers possible access to wider markets, (2) contributes significantly to the perceived customer benefits of the end product,

and (3) is not easily imitable by competitors. The e-Commerce experience of an e-Retailer can be a strong indicator of whether the core competence of the firm is technology-based. Competent IT skill base, as defined by experience, is critical for a firm's effective integration of systems and optimization of technology investments (Duncan, 1995). Slaughter and Ang (1996) find that technology-oriented companies are more likely to insource and build expertise within the firm to develop the IT products and services required to achieve competitive advantage. Bharadwaj's (2000) case studies on Amoco and Wal-Mart reveal that early implementation of a technology enables a firm to hone its IT capability and place it ahead of other firms on the learning curve, which supports the importance of knowledge assets as proposed by the resource-based view. Because of the rapidly changing pace of the e-Retail industry, firms that lack the experience may not have the time to play catch up, making buying the logical choice. This leads to our first hypothesis on technology-based core competence:

> H1. Technology-Based Core Competence Suggests Make Strategy.
> *An e-Retailer's e-Commerce experience has a negative association with the degree of IST sourcing for its e-Retail value chain activities.*

E-Commerce firms, unlike traditional retail firms, face new challenges related to differences in customer types, operations of order fulfillment, service quality expectations, and logistical requirements (Johnson and Whang, 2002). E-Retailers must be able to adapt quickly on the technology front because the

industry is rapidly evolving with changes in consumer demands and preferences. Zhu (2004) finds that the integration of e-Commerce capabilities and functionalities with a firm's IT infrastructure has a positive impact on firm performance. A way for firms to acquire flexibility and gain IT functions and resources quickly is through outsourcing (Agarwal and Sambamurthy, 2002). McLellan et al.'s (1995) case study of the banking industry reveals that banks, through outsourcing vendors, are able to acquire new technologies and the associated capabilities at a faster pace and a more reasonable cost. Cheon et al. (1995) propose that firms leverage outsourcing to fill gaps in IT capabilities and those that pursue aggressive strategies in fulfilling resource gaps will outsource more. Consequently, we posit the following hypothesis:

> H2. E-Commerce Capabilities Link with the Buy Strategy. *An e-Retailer's e-Commerce capabilities have a positive association with the degree of IST sourcing for its e-Retail value chain activities.*

IT strategic role is defined as the shared, aspired state of the role that IT is expected to play in the firm, and it includes three categories: automate, informate, and transform (Schein, 1992). For *automate,* the role of IT is to replace inefficient human labor with information technology. For *informate,* IT is used to provide information to higher and lower levels of the organization to aid decision-making and empower employees with relevant information and knowledge. Finally, for *transform,* IT is used to alter the structure and competitive forces of the industry

or market segment where the firm operates or competes. Firms with the transform vision for IT have the strongest relationship between knowledge and systems of knowing (Armstrong and Sambamurthy, 1999). For an ERP implementation, firms with a transform vision will allocate more slack resources to the ERP projects since they view it as a critical organizational resource (Ke and Wei, 2008). Additionally, firms that use IT in a transform strategic role are prone to introduce radical business models to gain competitive advantage (Dehning et al., 2003). This suggests that they generally take higher risks with IT innovations, such as making their own solutions rather than purchasing commoditized off-the-shelf products. Therefore, we hypothesize the following for firms with a transform vision:

> H3. Transform Firms Elect the Make Strategy. *E-Retailers with the transform IT strategic role have a lower degree of IST sourcing than automate or informate firms.*

Strategic IS/IT leadership is critical to the success of e-Commerce firms. E-Commerce firms encounter unique challenges related to IT architecture and capabilities, and the CIO plays an important role in addressing these problems. Strategic IS/IT leaders such as the CIO provide technical insight and expertise to shape an organization's e-strategy. For example, a firm with a chief e-Commerce officer (CeCO), to lead the e-business initiatives and oversee all aspects of the e-business value chain, is more likely to establish an organizational structure for a valiant virtual approach (Pinker et al., 2002). Senior IS managers are also known

to possess the *"empire builder" syndrome* where a desire for power and more resources drives them to build a large IT organization (Gurbaxani and Whang, 1991). Political skills, which involve self-serving behaviors to enhance one's position and build a power base, have a strong impact on managerial effectiveness and success (Pavett and Lau, 1983). The way for a CIO to create a large IT organization is to produce in-house. Therefore, the presence or absence of a strategic IS/IT leader like a CIO can influence a firm's IST sourcing decisions. Thus, we propose the following hypothesis:

> H4. Strategic IS/IT Leader Chooses Make Strategy. *An e-Retailer that has a strategic IS/IT leader of CIO has a lower degree of IST sourcing for its e-Retail value chain activities.*

A study on the relationship of IT strategic role and firm value reveals that IT investment types provide different implications for firm performance (Dehning et al., 2003). Tanriverdi and Ruefli (2004) concur that the performance effects of complementarities can be better understood if one distinguishes different types of complementarities and the roles of IT in realizing them. Anderson et al. (2006) explore the interaction of industry median Y2K spending with the strategic role of IT and find strong positive value implications of Y2K spending in industries where IT was playing a transforming role. Another study shows that firms with transform IT strategic roles are more able to achieve positive changes in market value (Dehning et al., 2003). Better firm performance is achieved when there is alignment or fit between IT strategic role and technology investment choices.

Multiple studies on IT projects have confirmed the importance of strategic fit in achieving high firm performance (Nidumolu, 1996; Barki et al., 2001). Since firms with a transform vision are expected to make, as hypothesized in H3, this leads us to postulate that transform firms that choose to buy and hence have a misfit will show poorer performance:

> H5a. Buy Strategy for Transform Firms Results in Poorer Performance. *There is lesser positive association between performance and the degree of IST sourcing for e-Retailers with a transform IT strategic role than for automate or informate firms.*

Teece (1986) stresses the importance of acquiring complementary assets and argues that incumbents' possession of such assets can discourage new entrants from competing. Tripsas (1997) finds that commercial performances of incumbents and new entrants are influenced by the balance and integration of three factors: investment, technical capabilities, and specialized complementary assets. He also finds that incumbents with access to complementary assets are able to sustain a high level of commercial performance. However, not all studies on complementary assets show positive firm performance. Swink and Nair (2007) find mixed results for manufacturing performance in their exploration of complementary effects of processes and technologies, design-manufacturing integration, and advanced manufacturing technologies. Harrison et al. (2001) argue that in order to achieve success when integrating complementary resources, firms must seek potential synergy and understand what actions are necessary to

achieve it. Although specific empirical evidence for sourcing complementarities between value chain activities is scant, certain primary activities in e-Retail value chain have strong alignment possibilities. For example, Porter (1985) groups marketing and sales into a single activity to recognize the potential benefits of coordinating the decisions in the two value chain activities. Manufacturing studies also stress the tight interrelationship between marketing and sales (Hayes and Wheelwright, 1984). In the context of technology sourcing, coordinated decisions across different value chain activities can enable an e-Retail firm to better exploit internal capabilities. When sourcing decisions are consistent across value chain activities, they enable scaling of operations from both perspectives of internal development (i.e., make) and external sourcing (i.e., buy). Recognizing the potential of synergy, we propose the following hypothesis:

> H5b. IST Sourcing Complementarities Contribute to Better Performance. *IST sourcing complementarities in value chain activities positively impact e-Retailer performance.*

3.3 Contingency and the E-Commerce Architecture

Several IS studies have looked at the importance and value of a firm's IT architecture and infrastructure and how the contingency perspectives ties into a firm's IT investment choices. In King and Sethi's (1999) study on the design of information systems and its impact on a firm's transnational strategy, five IS organizational, strategic, architectural, and personnel dimensions are explored: configuration of value chain activities, coordination of value chain activities,

centralization, strategic alliances, and marketing integration. Several variables including organizational characteristics have been evaluated in studies of SISP (Lederer and Sethi, 1996), which is defined as "the process of identifying a portfolio of computer-based applications that will assist an organization in executing its business plans and realizing its business goals (Lederer and Sethi, 1988, p. 446)." The benefits of IT infrastructure investments are further confirmed in Chatterjee et al.'s (2002) study, where IT infrastructure investment was found to positively impact the market value of a firm. For e-Commerce, tying the appropriate complementarity with the IT infrastructure can lead to positive performance such as cost reduction, sales per employee, and inventory turnover (Zhu 2004).

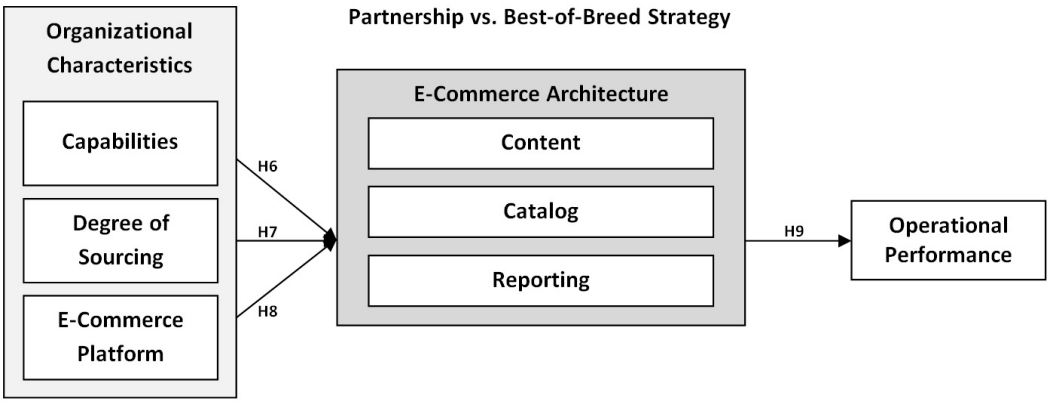

Figure 5. Research Model of Partnership vs. Best-of-Breed

In our two-stage IST sourcing model for the e-Commerce architecture as shown in Figure 5, we study three organizational characteristics: *capabilities*, *degree of sourcing*, and *e-Commerce platform*, all of which are expected to influence e-Retailers' partnership versus best-of-breed IST sourcing strategy for

the core services of their e-Commerce architecture. Then we examine the performance impacts of partnership versus best of breed on firm performance. We review the literature pertaining to each construct in Figure 5 and explain its hypothesized relationship with sourcing decisions and performance.

Mendelson (2000) emphasize the importance of *clockspeed* and the ability for firms to reshape their building blocks into the *information-age architecture*, in order to achieve market success. In a fast-faced and information-rich environment such as the e-Commerce industry, firms experience rapid technological change. Therefore, it is of no surprise that e-Retailers are continuously adding new capabilities and functionalities to its existing architecture. The resource-based view supports the importance and positive impacts of organizational resources and capabilities (Wernerfelt, 1984). Therefore, the focus on capabilities and competition can outweigh the benefits of sourcing continuously from the same vendor. One of the key advantages of choosing the best-of-breed IST strategy is that it enables a firm to bring together industry leading solutions (Stefanou, 2001). Consequently, firms are less likely to partner, so we posit the following:

> H6. Capabilities Achieved Through Best-of-Breed. *An e-Retailer's e-Commerce capabilities have a negative association with the consolidation ratio for its e-Commerce core services.*

Building on the previous hypothesis, in order to add capabilities quickly, a firm will need to acquire new IT assets and expand its IT infrastructure. These types of changes can introduce several challenges such as development time, data

integration, and inability to standardize (Ulrich, 1995). Data integration can be a costly endeavor in numerous ways: losses in local autonomy and flexibility and changes in system design and implementation cost (Goodhue et al., 1992). These costs can drive a firm to avoid such projects. Furthermore, firms that desire and pursue standardization are known to avoid adoption of a better technology because of compatibility issues (Farrell and Saloner, 1995; Farrell and Saloner, 1996). As a result, firms that are focused on competing and growing their IT assets quickly may therefore shy away from consolidation efforts. This leads us to hypothesize the following:

> H7. Growth in Technology Sourcing Hinders Partnership. *An e-Retailer's degree of sourcing for its e-Commerce architecture has a negative association with the consolidation ratio for its e-Commerce core services.*

With an e-Commerce platform, a firm has the option of choosing to develop it in-house or to acquire it from an external vendor. Selection of a platform can have long-term ramifications. Properties of the IT platform affect the cost and value of technological innovation for different firms and provide firms with varying degrees of infrastructure flexibility (Duncan, 1995). Flexibility impacts an e-Retailer's ability to respond quickly to industry changes and to adapt, develop, and extend its IT solutions to meet business requirements. There has been a rise in management interest in IT infrastructure flexibility (Byrd and Turner, 2000). Vendor solutions are increasingly standardized, sharable and

reusable, and a powerful IT platform can reduce the time to market for new products and avoid redundant and duplicate facilities (Weill, 1993). Therefore, we propose the following hypothesis:

> H8. Vendor Platform Supports Partnership. *E-Retailers with a vendor acquired e-Commerce platform, compared to a platform developed in-house, have a higher consolidation ratio for its e-Commerce core services.*

The partnership IST sourcing strategy differs from best-of-breed in that a firm tries to limit the number of outsourcing vendors. Davenport et al. (2004) explain that in the case of selecting a best-of-breed outsourcing strategy, firms are faced with the challenge of integrating enterprise systems from disparate best-of-breed vendors. E-Commerce firms must pay attention to integration challenges since multiple information systems are required to support their value chain. Grover et al. (1996) proclaim that partnership mediates the relationship between outsourcing and success, and in this instance, success equates to the organizational advantage, both tangible and intangible, gained from outsourcing. Kauffman and Tsai (2009) asserts that when partnering with a single vendor that offers fully integrated enterprise solutions, firms can decrease the risks and costs associated with integration. Data integration enables a firm to achieve operational success, hence the importance of developing an information architecture (Niederman et al., 1991). Tighter integration and interconnectivity also improves transactional efficiency, allowing for faster and more informed decision-making

and reducing errors, all of which contribute to decrease in operation costs (Zhu 2004) and business process improvement (Bhatt 2000). Knowing the value of partnership, we posit the following:

> H9. Partnership Results in Higher Performance. *IST consolidation ratio for e-Commerce core services positively impacts e-Retailer performance.*

CHAPTER 4

DATA AND METHODOLOGY

4.1 Data Collection

For this study, we collected data from Internet Retailer's Top500Guide.com. Internet Retailer is a monthly national business magazine first launched in March 1999. It has more than 43,000 subscribers consisting of senior executives primarily from retail chains, independent stores, catalogs, virtual merchants, and brand-name manufacturers and wholesalers/distributors. The Top 500 Guide provides an annual ranking of the largest e-Retailers in the United States and Canada based on annual online sales. The top 500 firms account for a sizable portion of the e-Retail market share. For example, the firms for 2007 represent approximately 61 percent. We used the ranking lists from 2007-2011 to construct a panel data set of 307 firms for the period of 2006-2010.

To give a comparison of the sales volume of the 307 firms with the total sales volume for the US e-Retail market, we have provided in Figure 6, Forrester Research's (www.forrester.com) US Online Retail Forecast for 2009 to 2014. It shows the forecasted sales volume for the US e-Retail market at $155.2 billion for 2009 and $172.9 billion for 2010. In our data set, the sales volume of the 307 firms totaled $101.5 billion for 2009, $111.3 billion for 2010, and $131.2 billion for 2011. Therefore, these firms comprise a lion's share of the e-Retail market, and our findings should apply to the majority, if not all, of the market.

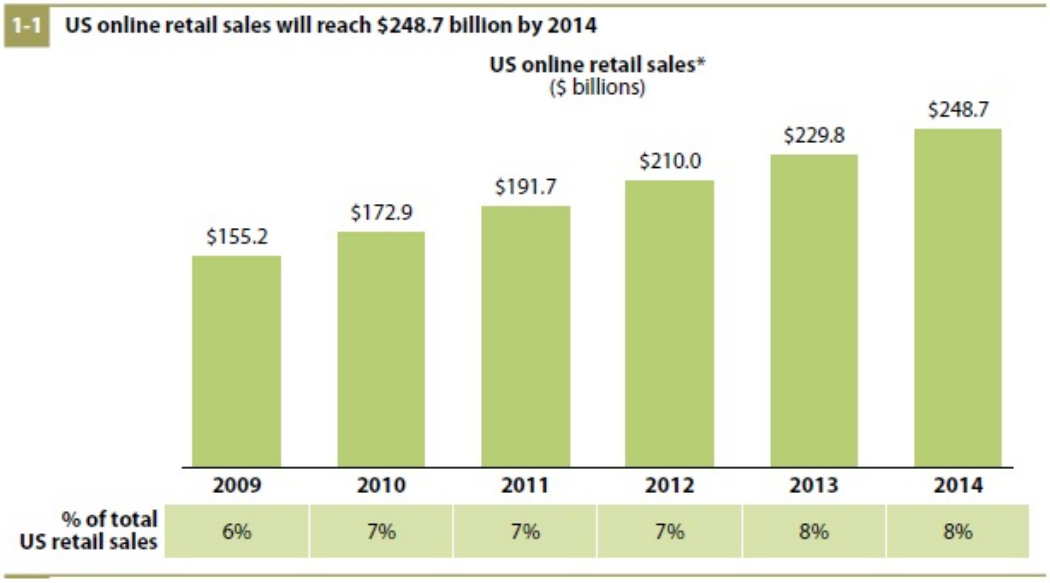

Figure 6. Forrester Research US Online Retail Forecast for 2009 to 2014

Each firm in our sample falls into one of four merchant types: catalog/call center, brand manufacturer, retail chain, and Web only. The firms also belong to one of the following merchandiser categories: apparel/accessories, automotive parts/accessories, books/music/video, computers/electronics, flowers/gifts, food/drug, hardware/home improvement, housewares/home furnishings, jewelry, mass merchant, office supplies, specialty/non-apparel, sporting goods, and toys/hobbies. Table 1 displays the breakdown of the firms by merchant type and merchandiser category.

Table 1. E-Retailers by Merchant Type and Merchandiser Category

MERCHANT TYPE	NUMBER OF FIRMS	PERCENTAGE
Catalog/call center	56	18.24%
Brand manufacturer	31	10.10%
Retail chain	109	35.50%
Web only	111	36.16%
Total	307	100%
MERCHANDISER CATEGORY	**NUMBER OF FIRMS**	**PERCENTAGE**
Apparel/accessories	77	25.08%
Automotive parts/accessories	2	0.65%
Books/music/video	18	5.86%
Computers/electronics	36	11.73%
Flowers/gifts	7	2.28%
Food/drug	12	3.91%
Hardware/home improvement	11	3.58%
Housewares/home furnishings	47	15.31%
Jewelry	8	2.61%
Mass merchant	21	6.84%
Office supplies	8	2.61%
Specialty/non-apparel	29	9.45%
Sporting goods	18	5.86%
Toys/hobbies	13	4.23%
Total	307	100%

For each firm, Internet Retailer supplies data for financial, operations, customer satisfaction, marketing, and firm performance. It also provides data on the vendors used, shopper profile, website features and functions, payment systems, social networks used, site search capabilities, shopping engines and marketplaces used, and customer service features offered by the firms. Internet Retailer compiles data of retailers' Web traffic from comSource Inc. and Nielson Online, and Web sales data from each company. In cases where data were not available for Web sales, Internet Retailer estimated the values based on traffic and

assumed conversion rate for that retailer's category as well as analyst interviews. Other related data are estimated using comScore, Nielsen Online, or Internet Retailer sources. For other figures like the conversion rate and average ticket, Internet Retailer researchers used category data and analyst interviews to formulate estimates. The retailers have opportunities to review and respond to their estimates. To determine if a firm has a CIO, we searched the Jigsaw database and cross-checked the information using the corporate websites, Internet search, and LinkedIn.

4.2 Variable Definitions

The variables are grouped into four categories: organizational characteristics, environmental factors, make versus buy strategy for the value chain, and firm performance. Table 2 lists the variables and their descriptions. For organizational characteristics, the variables are SKU, monthly visits, IT strategic role, experience, capability index, and CIO. *SKU* refers to the total stock-keeping units of the firm for the year. We took the natural logarithm of this number and used it as a control variable for the complexity of product mix (Bendoly et al., 2007). *Monthly visits* refer to the average monthly visitors for the year. We took the natural logarithm of this number and used it as a control variable. *IT strategic role* classifies the role of IT investments for each e-Retailer based on its merchant type. The variable shows a value of 1 for automate, 2 for informate up/down, and 3 for transform (in actual estimation, a dummy variable would be created and used for each corresponding type). To determine the IT strategic role for each

merchant type, we applied the method used by Chatterjee et al. (2001) and Dehning et al. (2003). We designed and sent the instrument shown in Appendix A to a panel of 3 judges, composed of IS scholars. Each judge was requested to code each merchant type as automate, informate up/down, or transform. All of them coded catalog/call center as automate, brand manufacturer and retail chain as informate up/down, and web only as transform. We used this categorization to assign IT's strategic role for each e-Retailer. *Experience*, which indicates the number of years since the e-Retailer launched its website and established its online store, measures the e-Retailing proficiency of each firm.

To create a value for *capability index*, which reflects the intensity of the capabilities of the firm relative to other firms, we first took the ratio of 1 (if the firm has the feature) over the total number of firms that have the same feature and summed up such ratios for 27 features (Appendix B shows the complete list of e-Retailer features and functions). This ratio sum number is then normalized to a value between 0 and 1. To note the presence of a strategic IS/IT leader within the firm, we used the variable *CIO*, which received a value of 1 if the position exists and 0 otherwise. IT strategic role, experience, and capability index also serve as control variables in the second stage of our hypothesis testing on performance impacts. The variable *eCommPlatform* has a value of 1 if the e-Retailer's platform is sourced from one of the top 2 vendors for the year, 2 for other vendors, and 3 for a platform developed in-house.

Table 2. Variables

VARIABLE	OPERATIONALIZATION	DESCRIPTION
Organizational Characteristics		
SKU (natural logarithm)		Natural logarithm of the total number of stock-keeping units (SKU)
Monthly visits (natural logarithm)		Natural logarithm of monthly average visitors for the year
IT strategic role	Role of IT investment	1 = automate, 2 = informate up/down, and 3 = transform
Experience	e-Retail proficiency	Number of years since e-Retailer launched its website and online store
Capability index	Capabilities	Intensity of the capabilities of the firm relative to other firms
CIO	Strategic IS/IT leader	1 if firm has a Chief Information Officer
eCommPlatform		1 = top 2 vendors, 2 = other vendors, 3 = In-house
Environmental Factors		
Year		1 = 2006, 2 = 2007, 3 = 2008, 4 = 2009, and 5 = 2010
Merchandiser category		1 = 448, 2 = 453, 3 = 451, 4 = 454, 5 = 443, and 6 = others
Make versus Buy Strategy for the Value Chain		
Content delivery	Logistics and Operations	1 if technology is sourced, 0 otherwise
Content management		1 if technology is sourced, 0 otherwise
Site design		1 if technology is sourced, 0 otherwise
Web analytics		1 if technology is sourced, 0 otherwise
Web hosting		1 if technology is sourced, 0 otherwise
Web performance monitoring		1 if technology is sourced, 0 otherwise
Degree of sourcing logistics and operations		Ratio of sourced to total IST for logistics and operations
Affiliate marketing	Marketing	1 if technology is sourced, 0 otherwise
Email marketing		1 if technology is sourced, 0 otherwise

Search engine marketing		1 if technology is sourced, 0 otherwise
Degree of sourcing marketing		Ratio of sourced to total IST for marketing
Rich media	Sales	1 if technology is sourced, 0 otherwise
Site search		1 if technology is sourced, 0 otherwise
E-Commerce platform		1 if technology is sourced, 0 otherwise
Order management		1 if technology is sourced, 0 otherwise
Fulfillment		1 if technology is sourced, 0 otherwise
Degree of sourcing sales		Ratio of sourced to total IST for sales
Degree of sourcing all	All	Ratio of sourced to total IST for all technologies in the value chain
Partnership versus Best-of-Breed for the e-Commerce Architecture		
Degree of sourcing all	All	Ratio of sourced to total IST for all technologies in the e-Commerce architecture
Content delivery	Content	Count of unique (u) and total sourced (n)
Content management		Count of unique (u) and total sourced (n)
Site design		Count of unique (u) and total sourced (n)
Site search		Count of unique (u) and total sourced (n)
Rich media		Count of unique (u) and total sourced (n)
Affiliate marketing	Catalog	Count of unique (u) and total sourced (n)
E-mail marketing		Count of unique (u) and total sourced (n)
Search engine marketing		Count of unique (u) and total sourced (n)
Web analytics	Reporting	Count of unique (u) and total sourced (n)
Web performance monitoring		Count of unique (u) and total sourced (n)
Degree of sourcing	All	Ratio of sourced to total IST for all
Consolidation ratio content	Content	Ratio of unique vendors to total sourced technologies for content
Consolidation ratio catalog	Catalog	Ratio of unique vendors to total sourced technologies for catalog

Consolidation ratio reporting	Reporting	Ratio of unique vendors to total sourced technologies for reporting
Consolidation ratio all	All	Ratio of unique vendors to total sourced technologies for all
Firm Performance		
Web sales (natural logarithm)	Financial	Natural logarithm of total Web sales for the year
Conversion rate		Percentage visitors who take desired action
Growth rate		Percentage change in growth of Web sales from the previous year
Response time	Operational	Time in seconds taken by the website server to respond to a user's request
Consistency		0 = Poor, 1 = Fair, 2 = Good, 3 = Excellent
Site downtime (natural logarithm)		Percent of time that the website is inaccessible

Table 3. Descriptive Statistics and Correlations

	VARIABLE	N	MEAN	S.D.	1	2	3	4
Organizational Characteristics								
1	ln(SKU)	1187	10.129	2.419	1.000			
2	ln(Monthly visits)	1534	14.337	1.404	0.308	1.000		
3	IT strategic role	1535	2.179	0.716	0.127	-0.091	1.000	
4	Experience	1445	9.460	2.769	0.065	0.127	-0.182	1.000
5	Capability index	1479	0.288	0.174	0.232	0.391	-0.089	0.131
6	CIO	1535	0.098	0.297	0.040	0.174	-0.107	0.083
7	eCommPlatform	1535	2.281	0.725	0.103	-0.039	0.183	0.006
Environmental Factors								
8	Year	1535	2008	1.415	0.062	0.079	0.000	0.511
9	Firm category	1535	3.309	1.951	0.054	-0.045	0.082	-0.004
Make versus Buy Strategy for the Value Chain								
10	DS Logis & Ops	1532	0.564	0.247	-0.103	0.023	-0.094	-0.082
11	DS Marketing	1520	0.658	0.317	-0.023	0.124	-0.176	0.034
12	DS Sales	1518	0.548	0.330	-0.195	0.048	-0.212	-0.053
13	DS All (value chain)	1533	0.580	0.226	-0.154	0.073	-0.203	-0.139
Partnership versus Best-of-Breed for the e-Commerce Architecture								
14	DS All (architecture)	1532	0.611	0.230	-0.087	0.133	-0.222	-0.051
15	CR Content	1515	0.618	0.244	0.025	-0.154	0.224	-0.017
16	CR Catalog	1515	0.472	0.237	0.005	-0.127	0.111	-0.069
17	CR Reporting	1495	0.554	0.245	0.009	-0.086	0.064	-0.096
18	CR All	1533	0.330	0.163	0.081	-0.105	0.200	-0.015
Firm Performance								
19	ln(Web sales)	1535	18.103	1.434	0.237	0.763	-0.160	0.239
20	Conversion rate	1495	0.044	0.143	-0.048	-0.009	-0.019	-0.012
21	Growth rate	1535	0.165	0.263	-0.082	-0.017	0.110	-0.359
22	Response time	1525	3.952	2.602	-0.093	-0.209	0.100	-0.203
23	Consistency	1525	1.839	0.770	0.034	0.160	-0.124	0.055
24	ln(Site downtime)	1356	-1.856	1.241	-0.021	-0.114	-0.055	0.075
Note: Correlations significant at $p < 0.05$ in boldface								

5	6	7	8	9	10	11	12	13	14
Organizational Characteristics									
1.000									
0.050	1.000								
-0.056	-0.031	1.000							
Environmental Factors									
0.075	0.099	0.023	1.000						
0.051	-0.004	0.113	0.000	1.000					
Make versus Buy Strategy for the Value Chain									
0.095	0.015	0.016	0.016	-0.110	1.000				
0.150	0.013	0.100	0.100	-0.147	0.303	1.000			
0.181	0.001	0.004	0.004	-0.143	0.469	0.341	1.000		
0.181	0.007	0.042	0.042	-0.172	0.793	0.619	0.843	1.000	
Partnership versus Best-of-Breed for the e-Commerce Architecture									
0.179	0.019	-0.323	0.074	-0.129	0.776	0.713	0.621	0.905	1.000
-0.212	-0.021	0.268	-0.095	-0.019	-0.466	-0.304	-0.521	-0.582	-0.650
-0.179	0.005	0.118	-0.191	0.113	-0.255	-0.584	-0.240	-0.418	-0.484
-0.200	0.044	0.007	-0.212	0.005	-0.203	-0.181	-0.152	-0.228	-0.246
-0.168	-0.006	0.259	-0.113	0.057	-0.460	-0.459	-0.490	-0.595	-0.653
Firm Performance									
0.404	0.150	0.110	0.029	0.036	0.177	0.084	0.106	1.000	0.189
-0.002	-0.004	-0.090	0.011	-0.015	0.055	-0.060	-0.030	-0.045	-0.009
-0.068	-0.011	-0.286	0.012	-0.006	-0.026	-0.026	-0.030	0.057	-0.035
-0.096	-0.010	0.011	-0.407	0.082	-0.098	-0.025	-0.078	-0.089	-0.111
0.064	-0.014	0.000	0.003	-0.018	0.043	0.058	0.041	0.052	0.084
-0.0140	-0.008	-0.015	0.152	0.017	-0.038	0.058	-0.008	0.000	0.013
Note: Correlations significant at $p < 0.05$ in boldface									

15	16	17	18	19	20	21	22	23
Organizational Characteristics								
Environmental Factors								
Make versus Buy Strategy for the Value Chain								
Partnership versus Best-of-Breed for the e-Commerce Architecture								
1.000								
0.364	1.000							
0.183	0.290	1.000						
0.795	0.663	0.334	1.000					
Firm Performance								
-0.253	-0.198	-0.162	-0.201	1.000				
0.055	0.044	0.040	0.046	0.057	1.000			
0.033	0.025	0.060	0.045	-0.045	0.006	1.000		
0.154	0.136	0.150	0.183	-0.254	0.026	0.207	1.000	
-0.096	-0.003	-0.054	-0.081	0.191	-0.020	-0.060	-0.466	1.000
-0.012	-0.078	0.030	-0.022	-0.086	-0.001	-0.115	0.072	-0.252
Note: Correlations significant at $p < 0.05$ in boldface								

Under environmental factors, we have the variables year and firm category. *Year*, which serves as a control variable, shows the year value of 2006, 2007, 2008, 2009, or 2010 (in actual estimation, a dummy variable would be created and used for each corresponding year). *Merchandiser category* refers to the industry of the firm based on the types of products it sells and also acts as a control variable. It has a value of 1 for e-Retailers with a NAICS (www.naics.com) code starting with 448 (clothing, shoe, and jewelry stores), 2 for 453 (florists, office supplies, specialty, and gift stores), 3 for 451 (sporting goods, hobby, toys, and books), 4 for 454 (mass merchant), 5 for 443 (computer and electronics), and 6 for others.

In terms of make versus buy strategy for the value chain, we established a *degree of sourcing* variable for each of the three different primary activities of the value chain being studied: logistics and operations, marketing, and sales. For each firm, we first counted the total number of sourced vendor technologies for each activity and then divided the number by the total number of technologies for each firm in order to obtain the percentage of sourced technologies. The highest number of sourced vendor technologies is 6 for *logistics and operations* (i.e., content delivery, content management, site design, Web analytics, Web hosting, and Web performance monitoring), 3 for *marketing* (i.e., affiliate marketing, email marketing, and search engine marketing), and 5 for *sales* (i.e., rich media, site search, e-Commerce platform, order management, and fulfillment). To classify each of the 14 technologies to the value chain activity of logistics and operations, marketing, or sales, we referred to the Consumer Products Process

Classification Framework, which enabled us to map each technology to a process (IBM, 2008). The technologies that fall under marketing are intended to support the development of marketing strategy and the development and management of marketing plans. The sales technologies are meant to support the development of trade customer sales strategy and the development and management of sales plans. The logistics and operations technologies are used to deliver products and services, which captures five processes: support supply chain planning, procure materials and services, produce/manufacture/deliver product, deliver service to customer, and manage logistics and warehousing.

The degree of sourcing variable was also used for studying partnership versus best-of-breed. However, only one variable was created for all of the technologies sourced for core services. The technologies covered by *content* include content management, content delivery, site design, site search, and rich media. *Catalog* includes affiliate marketing, e-mail marketing, and search engine marketing, and *reporting* captures Web analytics and Web performance. To classify each of the 10 technologies to the core services of content, catalog, and reporting, we referred to the SOA – Reference Architecture published by Elastic Path, a solutions provider of enterprise ecommerce platform (Bustos, 2008). While Elastic Path defines 11 core services for the e-Commerce architecture (content, social media, catalog, customers, shopping, orders, payment, inventory, fulfillment, customer service, and reporting), we focus on content, catalog, and reporting in our study.

To determine the *partnership level* or *consolidation ratio* based on the number of technologies procured, we counted the number of *unique* vendors for a firm (u) as well as the number of technologies it sourced (n) and computed the value as $(n - u + 1)/n$. For example, among the 10 technologies across the three core services, if an e-Retailer firm was found to source 8 of them from 3 unique vendors (and hence make the remaining 6 in-house), then the partnership variable will be computed as $(8 - 3 + 1)/8 = 0.75$. Firms that chose to build in-house were counted as a single vendor. Consolidation ratios were defined for content, catalog, and reporting.

To assess financial performance, three variables were used: Web sales, conversion rate, and growth rate. The variable, *Web sales,* represents the natural logarithm of a firm's total Web sales for the year. *Conversion rate* captures the percentage of visitors who perform the desired action, whether the action is buying a product, filling out a form, or some other goal of the web page. *Growth rate* shows the percentage change in growth of Web sales from the previous year. Three variables were also captured to measure operational performance: response time, consistency, and site downtime. *Response time* represents the time in seconds taken by the website server to respond to a user's request. The *consistency* rating takes into account differences in the speed of web page delivery across multiple visits and the frequency a retail site is unavailable because of downtime. *Site downtime* refers to the percent of time that the website is inaccessible. To obtain its value, we begin with site availability and

transformed it using the formula $ln(100 * (1 - site\ availability))$. Table 3 provides the descriptive statistics and the correlation matrix.

4.3 Make versus Buy Model Specification

I introduce the first-stage and second-stage estimation models for studying the *make versus buy* IST sourcing strategy. Our sample of firms is drawn from a larger population, which suggests the random effects model is more appropriate (Greene, 2008). We further verify this by running the Breusch and Pagan Lagrange Multiplier test and the Hausman Specification test whose results support the use of the random effects model. In the random effects model, the standard error estimates adjust for the within-firm correlation in the repeated measurements of the dependent variable.

To study the factors that influence make versus buy, we in the first stage established a regression model for the dependent variable, *degree of sourcing*, for each of the three value chain activities of logistics and operations ($DS\_LogisOps_{it}$), marketing (DS_Mktg_{it}), and sales (DS_Sales_{it}). This gives us three models for degree of sourcing:

$$DegreeSourcing_{it} =$$
$$\beta_0 + \beta_1 lnSKU_{it} + \beta_2 lnMonthlyVisits_{it} + \beta_3 Experience_{it} +$$
$$\beta_4 CapbilityIndex_{it} + \beta_5 CIO_{it} + \beta_6 Year\_2006_{it} + \beta_7 Year\_2007_{it} +$$
$$\beta_8 Year\_2008_{it} + \beta_9 Year\_2009_{it} + \gamma_1 ITStrageticRole\_Automate_i +$$
$$\gamma_2 ITStrageticRole\_Informate_i + \gamma_3 MerchadiserCategory\_448_i +$$
$$\gamma_4 MerchadiserCategory\_453_i + \gamma_5 MerchadiserCategory\_451_i +$$

$$\gamma_6 MerchadiserCategory\_454_i + \gamma_7 MerchadiserCategory\_443_i +$$

$$\alpha_i + \varepsilon_{it}$$

The parameters β_0 to β_9 and γ_1 to γ_7 are to be estimated. The subscripts i and t index the firm and the year, respectively. The two error terms are α_i, which is a time-invariant firm i random effect, and ε_{it}, which is different for each firm at each point in time.

In the second stage, we first evaluated the effects of IT strategic role and total degree of sourcing on firm performance. Then we looked at the impacts of make versus buy decisions and complementary IST sourcing on firm performance. We have three models based on the different financial performance measures for the three dependent variables: Web sales ($lnWebSales_{it}$), conversion rate ($ConversionRate_{it}$), and growth rate ($GrowthRate_{it}$). The first estimation model for firm performance based on IT strategic role is as follows:

$$PerformanceMetric_{it} = \beta_0 + \beta_1 PerformanceMetric_{i(t-1)} + \beta_2 lnSKU_{it} +$$

$$\beta_3 lnMonthlyVisits_{it} + \beta_4 Experience_{it} + \beta_5 CapabilityIndex_{it} +$$

$$\beta_6 DS\_All_{it} + \beta_7 ITStrageticRole\_Automate * DS\_All_{it} +$$

$$\beta_8 ITStrageticRole\_Informate * DS\_All_{it} + \beta_9 Year\_2007_{it} +$$

$$\beta_{10} Year\_2008_{it} + \beta_{11} Year\_2009_{it} +$$

$$\gamma_1 ITStrageticRole\_Automate_i + \gamma_2 ITStrageticRole\_Informate_i +$$

$$\gamma_3 MerchadiserCategory\_448_i + \gamma_4 MerchadiserCategory\_453_i +$$

$$\gamma_5 MerchadiserCategory\_451_i + \gamma_6 MerchadiserCategory\_454_i +$$

$$\gamma_7 MerchadiserCategory\_443_i + \alpha_i + \varepsilon_{it}$$

The parameters β_0 to β_{11} and γ_1 to γ_7 are to be estimated. The subscripts i and t index the firm and the year, respectively. The two error terms are α_i, which is a time-invariant firm i random effect, and ε_{it}, which is different for each firm at each point in time.

The second estimation model for firm performance, which accounts for complementary IST sourcing, is as follows:

$$PerformanceMetric_{it} = \beta_0 + \beta_1 PerformanceMetric_{i(t-1)} + \beta_2 lnSKU_{it} + \beta_3 lnMonthlyVisits_{it} + \beta_4 Experience_{it} + \beta_5 CapabilityIndex_{it} + \beta_6 DS\_Mktg_{it} + \beta_7 DS\_Sales_{it} + \beta_8 DS\_LogisOps_{it} + \beta_9 DS\_Mktg * DS\_Sales_{it} + \beta_{10} DS\_Mktg * DS\_LogisOps_{it} + \beta_{11} DS\_Sales * DS\_LogisOps_{it} + \beta_{12} Year\_2007_{it} + \beta_{13} Year\_2008_{it} + \beta_{14} Year\_2009_{it} + \gamma_1 ITStrageticRole\_Automate_i + \gamma_2 ITStrageticRole\_Informate_i + \gamma_3 MerchadiserCategory\_448_i + \gamma_4 MerchadiserCategory\_453_i + \gamma_5 MerchadiserCategory\_451_i + \gamma_6 MerchadiserCategory\_454_i + \gamma_7 MerchadiserCategory\_443_i + \alpha_i + \varepsilon_{it}$$

The parameters β_0 to β_{14} and γ_1 to γ_7 are to be estimated. The subscripts i and t index the firm and the year, respectively. The two error terms are α_i, which is a time-invariant firm i random effect, and ε_{it}, which is different for each firm at each point in time.

4.4 Partnership versus Best-of-Breed Model Specification

I use the same two-stage estimation models introduced in the previous section for studying the *partnership versus best-of-breed* IST sourcing strategy. To study the factors that influence partnership versus best-of-breed, we in the first stage established a regression model for the dependent variable, *consolidation ratio*, for each of the three core services of content ($CS\_Content_{it}$), catalog ($CS\_Catalog_{it}$), and reporting ($CS\_Reporting_{it}$). This gives us three models for consolidation ratio:

$$ConsolidationRatio_{it} = \beta_0 + \beta_1 lnSKU_{it} + \beta_2 lnMonthlyVisits_{it} + \beta_3 Experience_{it} + \beta_4 CapbilityIndex_{it} + \beta_5 CIO_{it} + \beta_6 DegreeSourcing_{it} + \beta_7 eCommPlatTop_{it} + \beta_8 eCommPlatOther_{it} + \beta_9 Year\_2006_{it} + \beta_{10} Year\_2007_{it} + \beta_{11} Year\_2008_{it} + \beta_{12} Year\_2009_{it} + \gamma_1 ITStrageticRole\_Automate_i + \gamma_2 ITStrageticRole\_Informate_i + \gamma_3 MerchadiserCategory\_448_i + \gamma_4 MerchadiserCategory\_453_i + \gamma_5 MerchadiserCategory\_451_i + \gamma_6 MerchadiserCategory\_454_i + \gamma_7 MerchadiserCategory\_443_i + \alpha_i + \varepsilon_{it}$$

The parameters β_0 to β_{12} and γ_1 to γ_7 are to be estimated. The subscripts i and t index the firm and the year, respectively. The two error terms are α_i, which is a time-invariant firm i random effect, and ε_{it}, which is different for each firm at each point in time.

In the second stage, we evaluated the effects of consolidation on a firm's performance. The three models are based on the operational performance measures for the dependent variables: response time ($ResponseTime_{it}$), consistency ($Consistency_{it}$), and site downtime ($lnSiteDowntime_{it}$). The estimation model is as follows:

$$PerformanceMetric_{it} = \beta_0 + \beta_1 PerformanceMetric_{i(t-1)} + \beta_2 lnSKU_{it} + \beta_3 lnMonthlyVisits_{it} + \beta_4 Experience_{it} + \beta_5 CapabilityIndex_{it} + \beta_6 DegreeSourcing_{it} + \beta_7 eCommPlatTop_{it} + \beta_8 eCommPlatOther_{it} + \beta_9 CR\_Content_{it} + \beta_{10} CR\_Catalog_{it} + \beta_{11} CR\_Reporting_{it} + \beta_{12} Year\_2007_{it} + \beta_{13} Year\_2008_{it} + \beta_{14} Year\_2009_{it} + \gamma_1 ITStrageticRole\_Automate_i + \gamma_2 ITStrageticRole\_Informate_i + \gamma_3 MerchadiserCategory\_448_i + \gamma_4 MerchadiserCategory\_453_i + \gamma_5 MerchadiserCategory\_451_i + \gamma_6 MerchadiserCategory\_454_i + \gamma_7 MerchadiserCategory\_443_i + \alpha_i + \varepsilon_{it}$$

The parameters β_0 to β_{14} and γ_1 to γ_7 are to be estimated. The subscripts i and t index the firm and the year, respectively. The two error terms are α_i, which is a time-invariant firm i random effect, and ε_{it}, which is different for each firm at each point in time.

CHAPTER 5

MAKE VERSUS BUY RESULTS AND DISCUSSION

5.1 Results

Table 3 provides the descriptive statistics and the correlation matrix. In testing for multicollinearity, we checked the variance inflation factor (VIF) for all independent variables and confirmed that all of the values are below 10 (Greene, 2008). We further ran the Durbin-Watson test for autocorrelation and White's test for heteroscedasticity. The Durbin-Waton statistics are close to 2, which indicate that the errors are uncorrelated. The regression diagnostics of the White's test reveal that the data are not subject to heteroscedasticity problem. To account for potential endogeneity between firm performance and IST sourcing decision, we included previous year's firm performance (*t*-1) as a control in our model and used cross-lagged model for our analysis since OLS regression could produce biased estimates.

Table 4 reports the first-stage analysis results for factors that influence make versus buy. Model 1 shows the degree of sourcing results for the logistics and operations activity ($DS\_LogisOps_{it}$), Model 2 for the marketing activity (DS_Mktg_{it}), Model 3 for the sales activity (DS_Sales_{it}), and Model 4 for all activities (DS_All_{it}).

To test Hypothesis H1, we refer to the coefficient estimate for $Experience$ in each of the models. For Model 1 (logistics and operations), the

coefficient estimate (β_3 = -0.0200, *p*-value = 0.0004) is negative and significant. We see similar results of a negative and significant coefficient estimate (β_3 = -0.0168, *p*-value = 0.0320) for Model 3 (sales) and Model 4 (all) (β_3 = -0.0167, *p*-value = 0.0012). This indicates that for the activities of logistics and operations, and sales, Hypothesis H1 is supported as a negative relationship exists between experience and the degree of IST outsourcing. The same results apply for all activities. These findings suggest that an e-Retailer with more e-Commerce experience is found to have a lower degree of IST sourcing for the two e-Retail value chain activities of logistics and operations as well as sales, and for all activities considered together.

To test Hypothesis H2, we refer to the coefficient estimate for $CapabilityIndex$ in each of the models. For Model 1 (logistics and operations), the coefficient estimate (β_4 = 0.1089, *p*-value = 0.0137) is positive and significant. This result reveals that for the logistics and operations activity, Hypothesis H2 is supported and a positive relationship exists between e-Commerce capabilities and the degree of IST sourcing. Model 2 (marketing) shows similar results of positive and significant coefficient estimates (β_4 = 0.1530, *p*-value = 0.0139), and the same is found for Model 3 (sales) (β_4 = 0.1150, *p*-value = 0.0214) and Model 4 (all) (β_4 = 0.1240, *p*-value = 0.0003). Similar to the logistics and operations activity, Hypothesis H2 is also supported for the marketing, sales, and all activities of the e-Retail value chain.

To test Hypothesis H3, we refer to the coefficient estimates for $ITStrategicRole\_Automate$ and $ITStrategicRole\_Informate$. When comparing IT strategic roles of Automate and Informate to IT strategic role of Transform in Model 1 (logistics and operations), coefficient estimates for Automate (γ_1 = 0.0890, *p*-value = 0.0154) and Informate (γ_2 = 0.0766, *p*-value = 0.0153) are both positive and significant. For Model 2 (marketing), coefficient estimates for Automate (γ_1= 0.1272, *p*-value = 0.0018) and Informate (γ_2 = 0.1418, *p*-value = <.0001) are again both positive and significant. Model 3 (sales) also shows the same significant and positive association for Automate (γ_1 = 0.1899, *p*-value = 0.0002) and Informate (γ_2 = 0.1870, *p*-value = <.0001) with the degree of IST sourcing. We observe similar results for Automate (γ_2 = 0.1281, *p*-value = 0.0001) and Informate (γ_2 = 0.1236, *p*-value = <.0001) in Model 4 (all). Hypothesis H3 is thus supported by all the models. This suggests that for all three activities of the e-Retail value chain, an e-Retailer with the transform IT strategic role, when compared with automate or informate firms, have a lower degree of IST sourcing.

To test Hypothesis H4, we refer to the coefficient estimate for CIO in each of the four models. For Model 2 (marketing) only, the coefficient estimate (β_4 = -0.0755, *p*-value = 0.0177) is negative and significant. Therefore, we find evidence of CIO effect on the degree of IST sourcing for the marketing activity only. The result supports Hypothesis H4, which states that an e-Retailer that have a strategic

IS/IT leader of CIO has a lower degree of IST sourcing for its marketing e-Retail value chain activity.

Tables 5, 6, 7, and 8 report the second-stage estimation results of the effects of alignment between IT strategic role and make versus buy, plus complementary IST sourcing decisions on firm performance. The performance metrics used are Web sales ($WebSales$) for Model 1, conversion rate ($ConversionRate$) for Model 2, and growth rate ($GrowthRate$) for Model 3. To test Hypothesis H5a, we refer to the coefficient estimates of interaction terms of *DS_All×ITStrategicRole_Automate* and *DS_All×ITStrategicRole_Informate* in Table 5, and we find limited evidence that alignment between IT strategic role and IST sourcing decisions result in better performance effects. The only case where we find support is for growth rate from the degree of sourcing and the IT strategic role of informate (β_8 = 0.1263, *p*-value = 0.0197).

In testing for complementary effects, we employed the same method used by Tiwana (2008) and Lance (1988), which uses residual centering procedure to correct the problem of partial coefficient distortion faced in the simultaneous analysis of main effects and interaction terms due to their correlation. This involves a two-stage procedure: (1) regress each product term (e.g., *DS_Mktg×DS_Sales*) on its components, and (2) apply resulting residual instead of the interaction term in the model. The results are presented in Tables 6, 7, and 8. We first show the main effects results, followed by the residual centered interaction terms entered sequentially (Steps 1.1-1.3, 2.1-2.3, and 3.1-3.3).

To test Hypothesis H5b, which explores the effects of complementary IST sourcing of e-Retail value chain activities on firm performance, we refer to the coefficient estimates of $DS\_Mktg * DS\_Sales$, $DS\_Mktg * DS\_LogisOps$, and $DS\_Sales * DS\_LogisOps$. For Model 1.3 (Web sales), the coefficient estimate (β_9 = 0.1460, *p*-value = 0.0600) is positive and significant for $DS\_Mktg * DS\_Sales$, and similar results apply for Model 2.3 (conversion rate) for $DS\_Mktg * DS\_Sales$ (β_9 = 0.0303, *p*-value = 0.0127). These results support H5b, which states that complementary IST sourcing of synergistic value chain activities like marketing and sales positively impacts a firm's performance because the two functions are closely linked and typically performed together. Surprisingly, we see opposite results when a similar sourcing approach is used for the combination of value chain activities logistics and operations with sales activities in Model 1.3 (Web sales) with a negative and significant coefficient estimate (β_9 = -0.1786, *p*-value = 0.0861) for $DS\_Sales * DS\_LogisOps$. Similar results are observed for Model 2.3 (conversion rate) with a negative and significant coefficient estimate (β_9 = -0.0552, *p*-value = 0.0006) for $DS\_Sales * DS\_LogisOps$. Table 9 summarizes the results of our hypotheses.

Table 4. Factors on Degree of Sourcing for E-Retail Value Chain Activities

VARIABLE	MODEL 1 (Logistics & Operations)	MODEL 2 (Marketing)	MODEL 3 (Sales)	MODEL 4 (All)
Intercept	0.6831*** (0.1225)	0.5249*** (0.1501)	0.6281*** (0.1550)	0.6519*** (0.1042)
lnSKU	-0.0008 (0.0047)	-0.0046 (0.0058)	-0.0043 (0.0059)	-0.0041 (0.0040)
lnMonthlyVisits	0.0044 (0.0079)	0.0135 (0.0102)	0.0002 (0.0094)	0.0048 (0.0064)
Experience	-0.0200*** (0.0056)	-0.0079 (0.0062)	-0.0168* (0.0078)	-0.0167** (0.0051)
CapabilityIndex	0.1089* (0.0441)	0.1530* (0.0621)	0.1150* (0.0499)	0.1240*** (0.0345)
CIO	-0.0089 (0.0218)	-0.0755* (0.0317)	-0.0286 (0.0243)	-0.0234 (0.0168)
Base Year: 2010				
Year_2006	-0.0894*** (0.0252)	-0.0116 (0.0305)	-0.0810* (0.0335)	-0.0763*** (0.0222)
Year_2007	-0.0887*** (0.0205)	-0.3210*** (0.0258)	-0.0812** (0.0265)	-0.1369*** (0.0177)
Year_2008	-0.0624*** (0.0168)	-0.0413† (0.0229)	-0.0578** (0.0207)	-0.0569*** (0.0140)
Year_2009	-0.0375** (0.0128)	-0.0319† (0.0187)	-0.0215 (0.0146)	-0.0303** (0.0101)
Base Type: Transform				
ITStrategicRole_Automate	0.0890* (0.0367)	0.1272** (0.0406)	0.1899*** (0.0508)	0.1281*** (0.0334)
ITStrategicRole_Informate	0.0766* (0.0315)	0.1418*** (0.0352)	0.1870*** (0.0434)	0.1236*** (0.0285)
Base Category: Others				
MerchandiserCategory_448	0.0486 (0.0394)	0.0897* (0.0436)	0.0737 (0.0546)	0.0679† (0.0359)
MerchandiserCategory_453	-0.0258 (0.0429)	0.0712 (0.0475)	0.0070 (0.0595)	0.0077 (0.0391)
MerchandiserCategory_451	-0.0361 (0.0429)	-0.0107 (0.0474)	0.0758 (0.0594)	0.0132 (0.0390)
MerchandiserCategory_454	-0.1127† (0.0583)	-0.0005 (0.0651)	0.0508 (0.0803)	-0.0296 (0.0528)
MerchandiserCategory_443	-0.0485 (0.0449)	-0.0279 (0.0496)	-0.0048 (0.0624)	-0.0316 (0.0410)
Likelihood Ratio χ^2	775.11	403.94	1043.83	1002.80
p-value	<0.0001	<0.0001	<0.0001	<0.0001
Note: Significant at † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses				

Table 5. IT Strategic Role and IST Sourcing on Performance

VARIABLE	MODEL 1 (Web Sales)	MODEL 2 (Conversion Rate)	MODEL 3 (Growth Rate)
Intercept	0.3586***	0.0192	0.0215
	(0.0959)	(0.0133)	(0.0669)
PerformanceMetric_Lag	0.9662***	0.0203***	0.4655***
	(0.0075)	(0.0056)	(0.0207)
lnSKU	-0.0003	-0.0004	-0.0010
	(0.0029)	(0.0005)	(0.0023)
lnMonthlyVisits	0.0377***	-0.0001	0.0141 **
	(0.0077)	(0.0009)	(0.0045)
Experience	-0.0064*	0.0027***	-0.0036
	(0.0028)	(0.0004)	(0.0022)
CapabilityIndex	-0.0561	-0.0284***	-0.0399
	(0.0421)	(0.0067)	(0.0335)
DS_All	-0.0493*	0.0075*	-0.0420*
	(0.0233)	(0.0037)	(0.0186)
Base Type: Transform			
ITStrategicRole_Automate	-0.0894†	0.0141†	-0.0630
	(0.0512)	(0.0082)	(0.0409)
ITStrategicRole_Informate	-0.0492	-0.0051	-0.0873**
	(0.0415)	(0.0067)	(0.0333)
*DS_All** *ITStrategicRole_Automate*	0.1186	-0.0135	0.0746
	(0.0825)	(0.0131)	(0.0658)
*DS_All** *ITStrategicRole_Informate*	0.0772	-0.0033	0.1263*
	(0.0676)	(0.0109)	(0.0541)
Base Year: 2010			
Year_2007	0.0366†	0.0123***	-0.0416*
	(0.0197)	(0.0031)	(0.0161)
Year_2008	-0.0441*	0.0044	-0.0946***
	(0.0190)	(0.0030)	(0.0154)
Year_2009	-0.0926***	0.0027	-0.1038***
	(0.0174)	(0.0028)	(0.0139)
Base Category: Others			
MerchandiserCategory_448	0.0294	-0.0112***	0.0141
	(0.0191)	(0.0030)	(0.0152)
MerchandiserCategory_453	-0.0170	0.0032	-0.0107
	(0.0206)	(0.0034)	(0.0165)
MerchandiserCategory_451	-0.0086	-0.0152***	0.0021
	(0.0210)	(0.0033)	(0.0163)
MerchandiserCategory_454	0.0167	-0.0075	0.0052
	(0.0293)	(0.0047)	(0.0234)
MerchandiserCategory_443	-0.0471*	-0.0206***	-0.0287†
	(0.0213)	(0.0034)	(0.0170)
R-Square	98.26%	19.68%	48.12%
Note: Significant at † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses			

Table 6. Make vs. Buy and Complementary Sourcing on Web Sales

VARIABLE	MODEL 1 MAIN EFFECTS	MODEL 1.1 INTERACTION TERMS
Intercept	0.3130*** (0.0925)	0.3182*** (0.0925)
lnWebSales_Lag	0.9664*** (0.0076)	0.9666*** (0.0076)
lnSKU	-0.0009 (0.0029)	-0.0007 (0.0029)
lnMonthlyVisits	0.0391*** (0.0077)	0.0383*** (0.0077)
Experience	-0.0063* (0.0028)	-0.0064* (0.0028)
CapabilityIndex	-0.0652 (0.0420)	-0.0661 (0.0420)
Make versus Buy and Complementary IST Sourcing		
DS_Mktg	-0.0120 (0.0245)	-0.0109 (0.0245)
DS_Sales	-0.0245 (0.0254)	-0.0213 (0.0255)
DS_LogisOps	-0.0037 (0.0314)	-0.0027 (0.0314)
*DS_Mktg*DS_Sales*		0.0812 (0.0649)
DS_Mktg DS_LogisOps*		
DS_Sales DS_LogisOps*		
Year Dummies (Base Year: 2010)		
Year_2007	0.0363† (0.0206)	0.0380† (0.0207)
Year_2008	-0.0436* (0.0191)	-0.0445* (0.0191)
Year_2009	-0.0921*** (0.0175)	-0.0929*** (0.0175)
IT Strategic Role Dummies (Base Type: Transform)		
ITStrategicRole_Automate	-0.0225 (0.0182)	-0.0240 (0.0182)
ITStrategicRole_Informate	-0.0064 (0.0161)	-0.0081 (0.0161)
Merchandiser Category Dummies (Base Category: Others)		
MerchandiserCategory_448	0.0254 (0.0192)	0.0252 (0.0192)
MerchandiserCategory_453	-0.0149 (0.0208)	-0.0139 (0.0208)
MerchandiserCategory_451	-0.0083 (0.0213)	-0.0082 (0.0213)
MerchandiserCategory_454	0.0202 (0.0297)	0.0229 (0.0298)
MerchandiserCategory_443	-0.0480* (0.0214)	-0.0467* (0.0214)
R-Square	98.26%	98.26%
Note: Significant at † $p < 0.1$, $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses		

MODEL 1.2	MODEL 1.3
INTERACTION TERMS	
0.3194*** (0.0926)	0.3282*** (0.0926)
0.9660*** (0.0076)	0.9640*** (0.0077)
-0.0007 (0.0029)	-0.0012 (0.0030)
0.0391*** (0.0078)	0.0410*** (0.0079)
-0.0064* (0.0028)	-0.0063* (0.0028)
-0.0699† (0.0422)	-0.0655 (0.0423)
Make versus Buy and Complementary IST Sourcing	
-0.0118 (0.0246)	-0.0187 (0.0249)
-0.0205 (0.0256)	-0.0211 (0.0255)
-0.0023 (0.0314)	0.0086 (0.0320)
0.1097 (0.0747)	0.1460† (0.0776)
-0.0728 (0.0944)	-0.0225 (0.0987)
	-0.1786† (0.1039)
Year Dummies (Base Year: 2010)	
0.0365† (0.0208)	0.0381† (0.0207)
-0.0456* (0.0192)	-0.0436* (0.0192)
-0.0934*** (0.0175)	-0.0931*** (0.0175)
IT Strategic Role Dummies (Base Type: Transform)	
-0.0247 (0.0182)	-0.0251 (0.0182)
-0.0086 (0.0161)	-0.0095 (0.0161)
Merchandiser Category Dummies (Base Category: Others)	
0.0254 (0.0192)	0.0306 (0.0195)
-0.0134 (0.0208)	-0.0091 (0.0210)
-0.00815 (0.0213)	-0.0055 (0.0213)
0.0239 (0.0298)	0.0253 (0.0298)
-0.0453* (0.0215)	-0.0424* (0.0216)
98.26%	98.27%
Note: Significant at † $p < 0.1$, $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses	

Table 7. Make vs. Buy and Complementary Sourcing on Conversion Rate

VARIABLE	MODEL 2 MAIN EFFECTS	MODEL 2.1 INTERACTION TERMS
Intercept	0.0204 (0.0125)	0.0210† (0.0126)
ConversionRate_Lag	0.0195*** (0.0055)	0.0192*** (0.0055)
lnSKU	-0.0004 (0.0005)	-0.0004 (0.0005)
lnMonthlyVisits	-0.0001 (0.0009)	-0.0002 (0.0009)
Experience	0.0026*** (0.0004)	0.0025*** (0.0004)
CapabilityIndex	-0.0289*** (0.0066)	-0.0290*** (0.0066)
Make versus Buy and Complementary IST Sourcing		
DS_Mktg	0.0177*** (0.0038)	0.0177*** (0.0038)
DS_Sales	0.0005 (0.0040)	0.0008 (0.0040)
DS_LogisOps	-0.0035 (0.0050)	-0.0034 (0.0050)
*DS_Mktg*DS_Sales*		0.0072 (0.0103)
DS_Mktg DS_LogisOps*		
DS_Sales DS_LogisOps*		
Year Dummies (Base Year: 2010)		
Year_2007	0.0161*** (0.0033)	0.0163*** (0.0033)
Year_2008	0.0044 (0.0030)	0.0043 (0.0030)
Year_2009	0.0027 (0.0028)	0.0027 (0.0028)
IT Strategic Role Dummies (Base Type: Transform)		
ITStrategicRole_Automate	0.0056* (0.0028)	0.0055† (0.0029)
ITStrategicRole_Informate	-0.0075** (0.0025)	-0.0076 (0.0026)
Merchandiser Category Dummies (Base Category: Others)		
MerchandiserCategory_448	-0.0127*** (0.0030)	-0.0127*** (0.0030)
MerchandiserCategory_453	0.0008 (0.0033)	0.0009 (0.0033)
MerchandiserCategory_451	-0.0156*** (0.0033)	-0.0156*** (0.0033)
MerchandiserCategory_454	-0.0098* (0.0047)	-0.0096* (0.0047)
MerchandiserCategory_443	-0.0213*** (0.0033)	-0.0212*** (0.0034)
R-Square	21.45%	21.49%
Note: Significant at † $p < 0.1$, $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses		

MODEL 2.2	MODEL 2.3
INTERACTION TERMS	
0.0197 (0.0125)	0.0185 (0.0125)
0.0193*** (0.0055)	0.0186*** (0.0054)
-0.0004 (0.0005)	-0.0006 (0.0005)
0.0000 (0.0009)	0.0002 (0.0009)
0.0025*** (0.0004)	0.0025*** (0.0004)
-0.0307*** (0.0066)	-0.0295*** (0.0066)
Make versus Buy and Complementary IST Sourcing	
0.0173*** (0.0038)	0.0150*** (0.0039)
0.0011 (0.0040)	0.0009 (0.0040)
-0.0033 (0.0050)	-0.0002 (0.0050)
0.0194 (0.0118)	0.0303* (0.0121)
-0.0312* (0.0147)	-0.0145 (0.0154)
	-0.0552*** (0.0161)
Year Dummies (Base Year: 2010)	
0.0155*** (0.0033)	0.01603*** (0.0033)
0.0038 (0.0030)	0.0044 (0.0030)
0.0024 (0.0028)	0.0025 (0.0027)
IT Strategic Role Dummies (Base Type: Transform)	
0.0051† (0.0029)	0.0049† (0.0028)
-0.0079** (0.0025)	-0.0082** (0.0025)
Merchandiser Category Dummies (Base Category: Others)	
-0.0125*** (0.0030)	-0.0108*** (0.0030)
0.0011 (0.0033)	0.0025 (0.0033)
-0.0154*** (0.0033)	-0.0141*** (0.0033)
-0.0091† (0.0047)	-0.0088† (0.0046)
-0.0207*** (0.0034)	-0.0200*** (0.0033)
21.91%	22.99%
Note: Significant at † $p < 0.1$, $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses	

Table 8. Make vs. Buy and Complementary Sourcing on Growth Rate

VARIABLE	MODEL 3 MAIN EFFECTS	MODEL 3.1 INTERACTION TERMS
Intercept	-0.0321 (0.0639)	-0.0288 (0.0640)
GrowthRate_Lag	0.4682*** (0.0208)	0.4676*** (0.0208)
lnSKU	-0.0015 (0.0024)	-0.0015 (0.0024)
lnMonthlyVisits	0.0161*** (0.0044)	0.0158*** (0.0044)
Experience	-0.0038† (0.0022)	-0.0038† (0.0022)
CapabilityIndex	-0.0433 (0.0335)	-0.0438 (0.0335)
Make versus Buy and Complementary IST Sourcing		
DS_Mktg	-0.0043 (0.0195)	-0.0037 (0.0196)
DS_Sales	-0.0157 (0.0203)	-0.0142 (0.0204)
DS_LogisOps	0.0001 (0.0251)	0.0006 (0.0251)
*DS_Mktg*DS_Sales*		0.0400 (0.0520)
DS_Mktg DS_LogisOps*		
DS_Sales DS_LogisOps*		
Year Dummies (Base Year: 2010)		
Year_2007	-0.0430* (0.0169)	-0.0420* (0.0169)
Year_2008	-0.0948*** (0.0155)	-0.0952*** (0.0155)
Year_2009	-0.1038*** (0.0140)	-0.1041*** (0.0140)
IT Strategic Role Dummies (Base Type: Transform)		
ITStrategicRole_Automate	-0.0242† (0.0145)	-0.0250† (0.0146)
ITStrategicRole_Informate	-0.0150 (0.0129)	-0.0159 (0.0130)
Merchandiser Category Dummies (Base Category: Others)		
MerchandiserCategory_448	0.0102 (0.0153)	0.0101 (0.0153)
MerchandiserCategory_453	-0.0092 (0.0167)	-0.0087 (0.0167)
MerchandiserCategory_451	0.0019 (0.0166)	0.0019 (0.0166)
MerchandiserCategory_454	0.0049 (0.0238)	0.0063 (0.0239)
MerchandiserCategory_443	-0.0293† (0.0172)	-0.0287† (0.0172)
R-Square	47.73%	47.77%
Note: Significant at † $p < 0.1$, $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses		

MODEL 3.2	MODEL 3.3
INTERACTION TERMS	
-0.0414 (0.1795)	-0.0434 (0.1674)
0.5210 (0.5080)	0.5259 (0.4769)
-0.0011 (0.0055)	-0.0011 (0.0057)
0.0147† (0.0079)	0.0147† (0.0079)
-0.0027 (0.0110)	-0.0026 (0.0105)
-0.0340 (0.0462)	-0.0332 (0.0432)
Make versus Buy and Complementary IST Sourcing	
-0.0003 (0.0217)	-0.0011 (0.0245)
-0.0145 (0.0218)	-0.0145 (0.0218)
-0.0007 (0.0258)	0.0005 (0.0263)
-0.0177 (0.1023)	-0.0144 (0.1211)
0.1253 (0.0966)	0.1322 (0.0814)
	-0.0210 (0.1576)
Year Dummies (Base Year: 2010)	
-0.0494 (0.0930)	-0.0501 (0.0886)
-0.1015† (0.0599)	-0.1018† (0.0579)
-0.1040*** (0.0215)	-0.1041*** (0.0210)
IT Strategic Role Dummies (Base Type: Transform)	
-0.0214 (0.0259)	-0.0213 (0.0254)
-0.0120 (0.0328)	-0.0119 (0.0319)
Merchandiser Category Dummies (Base Category: Others)	
0.0103 (0.0175)	0.0110 (0.0161)
-0.0068 (0.0365)	-0.0060 (0.0320)
0.0036 (0.0242)	0.0043 (0.0215)
0.0053 (0.0259)	0.0056 (0.0255)
-0.0260 (0.0484)	-0.0253 (0.0443)
46.13%	46.06%
Note: Significant at † $p < 0.1$, $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses	

Table 9. Results of Hypotheses for Make vs. Buy

DEGREE OF SOURCING			
HYPOTHESIS	LOGISTICS & OPERATIONS	MARKETING	SALES
H1. Technology-Based Core Competence Suggests Make Strategy	Supported	Not Supported	Supported
H2. E-Commerce Capabilities Link with the Buy Strategy	Supported	Supported	Supported
H3. Transform Firms Elect the Make Strategy	Supported	Supported	Supported
H4. Strategic IS/IT Leader Chooses Make Strategy	Not Supported	Supported	Not Supported
PERFORMANCE			
HYPOTHESIS	WEB SALES	CONVERSION RATE	GROWTH RATE
H5a. Buy Strategy for Transform Firms Results in Poorer Performance	Not Supported	Not Supported	Partially Supported
H5b. IST Sourcing Complementarities Contribute to Better Performance	Partially Supported	Supported	Not Supported

5.2 Discussion

For e-Retailers, choosing make versus buy for information systems and technologies that support their primary value chain activities remains a challenge, as they must compete in a fast-growing yet extremely competitive customer service-oriented industry. Our theoretical model of e-Retailer IST sourcing strategy sheds light on organizational characteristics that influence e-Retailers' make versus buy IST sourcing decisions for value chain enablement and on the effects of such decisions on firm performance.

Consistent with *a priori* expectations, we find that firm experience influence e-Retailers' make versus buy decisions for IST sourcing. We find that more experienced e-Retailers with an earlier e-Commerce launch date have a lower degree of IST sourcing and thus are inclined to develop their own IST solutions in-house to support their value chain activities. This is understandable, as e-Retailers with an earlier launch date have become more experienced in handling e-Commerce transactions, and they have accumulated the know-how over the years to build IT solutions in-house. Less experienced firms without the e-Commerce expertise are inclined to source IST assets for their value chain activities from outside providers because the learning curve required to build internally is too steep. It would be much more difficult and costly for them to staff and develop the skills required for creating such solutions, not to mention delayed launch time and greater risks in doing so.

Our findings that capabilities are positively associated with a higher degree of IST sourcing suggest that an arms race may be present among e-Retailers. IST sourcing provides e-Retailers with a fast way to acquire new capabilities. Technology vendors are able to provide a portfolio of off-the-shelf industry solutions that can be implemented in a matter of weeks or even days. Since e-Commerce is evolving quickly, e-Retailers must be able to keep up with the changing pace of technology in order to offer the latest capabilities in a timely fashion on their online platform. Customers have high expectations for the service-oriented e-Retail industry. Not only do they expect an online store to be appealing visually, easy to navigate, secure, and quick in processing transactions,

they also seek high quality images or videos, site personalization, social networking, and other interactive capabilities. As Mobile Evangelist Herman Ng of Keynote Systems indicates, “Given that online retail in general is a highly competitive sector, it is absolutely critical for any retailer to know that their mobile site user experience is at least comparable to their competitors’, if not better” (Siwicki, 2010). For e-Retailers, being able to quickly add features such as Web analytics to gain additional insights into customer purchasing behaviors and patterns can greatly enhance their competitive advantage.

Depending on the strategic role of IT being used, e-Retailers that either automate or informate are found to have a higher degree of IST sourcing and rely more on vendors to provide solutions for their value chain activities than e-Retailers that transform. Firms that use IT in a transform strategic role are prone to introduce radical business models to gain competitive advantage A possible explanation is that transformation requires more dramatic changes to business processes and more efforts invested in value chain activities, so e-Retailers that use IT to strategically transform themselves are expected to consider these changes and investments core competencies and choose to develop the required transformation tasks internally. On the other hand, e-Retailers that use IT to simply automate existing business processes or pass information up and down the chain of command in the organizational hierarchy are likely to consider these IT tasks routine and non-core, making them suitable targets for sourcing.

We find partial evidence that e-Retailers with a strategic IS/IT leader of

CIO are less likely to buy, as this result was found only for the marketing activity. At the outset, this finding suggests that sourcing decisions are contingent on broader organization-related issues as opposed to the presence or absence of IT leadership. Even when an IT leader (i.e., CIO) is present, perhaps the decision of make versus buy for a CIO is mainly driven by his/her preference, experience and constraints. Some CIOs have strong vendor relationships that they can leverage, and successful partnerships with these vendors can prompt them to maintain a sourcing strategy. CIOs must also manage their own individual agendas along with stakeholder needs. In some instances, they may encounter time and budget constraints that make sourcing the better choice. On the other hand, for those CIOs who strive to maintain IT staffs in an effort to better control the outcome of IT initiatives, their preference would be to make in-house. Another concern that CIOs may have about sourcing is that by adopting commercially available solutions, they would be stifling innovation and eroding their firms' long-term competitive advantage.

In terms of impacts on firm performance, there is no evidence to show that alignment between IT strategic role and IST sourcing decisions result in any financial performance effects. Studies that have explored firm-level performance impact of outsourcing reveal the difficulty in finding direct significant impact of outsourcing on firm performance. Gilley and Rasheed (2000) explain that this could be because the effects of outsourcing are at the functional level, so we should find ways to study this phenomenon at an even more granular level than value chain activities. Strategy related to fit, however, usually occurs at a higher

level. Our results, however, do show that complementary IST sourcing of synergistic value chain activities like sales and marketing positively impacts Web sales and conversion rate but not growth rate. Marketing and sales decisions often go hand in hand for organizations, and similar sourcing strategies should be applied to both value chain activities in order for the synergy to take effect. O'Leary-Kelly and Flores (2002) note that various studies assert that a link exists between integration of marketing and sales-based decisions and organizational performance. Our findings suggest that integration of complementary IST sourcing decisions and synergistic value chain activities results in positive performance impacts. When similar IST sourcing strategy is applied to value chain activities of sales and logistic and operations, lower Web sales and conversion rate are observed. Higher IST sourcing for a firm's logistics and operations activity may cause the firm to lose out on long-term growth.

CHAPTER 6

PARTNERSHIP VS. BEST-OF-BREED RESULTS AND DISCUSSION

6.1 Results

In testing for multicollinearity, we checked the variance inflation factor (VIF) for all independent variables and confirmed that all of the values are below 10 (Greene, 2008). We further ran the Durbin-Watson test for autocorrelation and White's test for heteroscedasticity. The Durbin-Waton statistics are close to 2, which indicate that the errors are uncorrelated. The regression diagnostics of the White's test reveal that the data are not subject to heteroscedasticity problem. To account for potential endogeneity between firm performance and partnership decision, we included previous year's firm performance (t-1) as a control in our model and used cross-lagged model for our analysis since OLS regression could produce biased estimates.

Table 10 reports the first-stage analysis results for factors that influence partnership. It provides the results for Hypothesis H6, Hypothesis H7, and Hypothesis H8. Model 1 shows the partnership results for the content service ($CR\_Content_{it}$), Model 2 for the catalog service ($CR\_Catalog_{it}$), Model 3 for the reporting service ($CR\_Reporting_{it}$), and Model 4 for all three services (CR_All_{it}).

To test Hypothesis H6, we refer to the coefficient estimate for $CapabilityIndex$ in each of the models. For Model 2 (catalog), the coefficient

estimate (β_4 = -0.1093, *p*-value = 0.0110) is negative and significant. This result reveals that for the catalog service, Hypothesis H6 is supported and a negative relationship exists between e-Commerce capabilities and partnership. Model 3 (reporting) shows similar results of negative and significant coefficient estimates (β_4 = -0.1509, *p*-value = 0.0018). Similar to the catalog service, Hypothesis H6 is also supported for the reporting service.

To test Hypothesis H7, we refer to the coefficient estimate for $DegreeSourcing$ in each of the models. For Model 1 (content), the coefficient estimate (β_3 = -0.4870, *p*-value = <.0001) is negative and significant. We see similar results of a negative and significant coefficient estimate (β_3 = -0.3263, *p*-value = <.0001) for Model 2 (catalog), (β_3 = -0.1868, *p*-value = <.0001) Model 3 (reporting) and Model 4 (all) (β_3 = --0.3109, *p*-value = <.0001). This indicates that for the core services of content, catalog, and reporting, Hypothesis H7 is supported as a negative relationship exists between degree of sourcing and partnership. Similar results are observed when all services are combined. These findings suggest that an e-Retailer with higher degree of sourcing is found to have a lower consolidation ratio and thus, choosing a best-of-breed strategy.

To test Hypothesis H8, we refer to the coefficient estimates for $eCommPlatTop$ and $eCommPlatOther$. When comparing the combined effect of degree of sourcing and a vendor e-Commerce platform of either a top 2 or other, to the combination of degree of sourcing and an in-house e-Commerce platform on partnership, we found that Hypothesis H8 is supported for the core

services of catalog and reporting. The coefficient estimate for $eCommPlatTop$ (β_9 = 0.03742, p-value = 0.0489) in Model 2 (catalog) is positive and significant. Model 3 (reporting) shows the same positive and significant results for $eCommPlatOther$ (β_{10} = 0.02957, p-value = 0.0802). These results suggest that e-Retailers that choose a vendor e-Commere platform compared to in-house development have a higher degree of consolidation.

Table 11 reports the second-stage estimation results of the effects of partnership on firm performance. The performance metrics used are response time ($ResponseTime$) for Model 1, site consistency ($SiteConsistency$) for Model 2, and site downtime ($lnSiteDowntime$) for Model 3. To test Hypothesis H9, which tests the effects on consolidation on performance, we refer to the coefficient estimates of $CR\_Content$, $CR\_Catalog$, $CR\_Reporting$, and CR_All in each of the models. For Model 1 (response time), the coefficient estimate (β_9 = -0.9852, p-value = 0.0157) is negative and significant for Catalog and positive and significant for Reporting (β_9 = 0.9957, p-value = 0.0014). For Model 2 (consistency), the coefficient estimate (β_9 = 0.3939, p-value = 0.0193) is positive and significant for Catalog. For Model 3 (site downtime), the coefficient estimate (β_9 = -0.9000, p-value = 0.0045) is negative and significant for Catalog. The results reveal that for the service catalog, Hypothesis H9, which suggests that consolidation results in better performance, is supported for all three performance measures of response time, consistency, and site downtime. Table 12 summarizes the results of our hypotheses.

Table 10. Factors on Partnership for Core Services of the E-Commerce Architecture

VARIABLE	MODEL 1 (Content)	MODEL 2 (Catalog)
Intercept	1.0575*** (0.1013)	0.8032*** (0.1141)
lnSKU	0.0025 (0.0039)	-0.0012 (0.0044)
lnMonthlyVisits	-0.0093 (0.0066)	-0.0101 (0.0074)
Experience	-0.0006 (0.0044)	0.0026 (0.0050)
CapabilityIndex	-0.0493 (0.0380)	-0.1093* (0.0429)
CIO	-0.0165 (0.0189)	0.0268 (0.0213)
DegreeSourcing	-0.4870*** (0.0304)	-0.3263*** (0.0342)
Base Platform: In-house		
eCommPlatTop	-0.0226 (0.0168)	0.0374* (0.0190)
eCommPlatOther	-0.0103 (0.0133)	0.0095 (0.0151)
Base Year: 2010		
Year_2006	0.0398† (0.0205)	0.1214*** (0.0230)
Year_2007	-0.0096 (0.0174)	0.0536** (0.0196)
Year_2008	-0.0004 (0.0142)	0.0299† (0.0160)
Year_2009	0.0027 (0.0111)	0.0120 (0.0125)
Base Type: Transform		
ITStrategicRole_Automate	-0.0787** (0.0291)	-0.0297 (0.0327)
ITStrategicRole_Informate	-0.0613* (0.0253)	0.0081 (0.0284)
Base Category: Others		
MerchandiserCategory_448	0.0416 (0.0310)	-0.0537 (0.0348)
MerchandiserCategory_453	0.0797* (0.0337)	-0.0628† (0.0378)
MerchandiserCategory_451	-0.0004 (0.0336)	-0.0098 (0.0378)
MerchandiserCategory_454	-0.0118 (0.0459)	-0.0095 (0.0516)
MerchandiserCategory_443	-0.0126 (0.0353)	-0.0087 (0.0396)
Likelihood Ratio χ^2	538.18	575.84
p-value	<.0001	<.0001
Note: Significant at † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses		

MODEL 3 (Reporting)	MODEL 4 (All)
0.6431*** (0.1177)	0.5903*** (0.0656)
-0.0020 (0.0045)	-0.0004 (0.0025)
-0.0045 (0.0078)	-0.0051 (0.0043)
0.0048 (0.0048)	0.0011 (0.0029)
-0.1509** (0.0482)	-0.0151 (0.0246)
0.0061 (0.0245)	0.0209† (0.0122)
-0.1868*** (0.0378)	-0.3109*** (0.0192)
Base Platform: In-house	
0.0057 (0.0215)	-0.0177 (0.0109)
0.0296† (0.0169)	-0.0142 (0.0086)
Base Year: 2010	
0.1651*** (0.0237)	0.0446*** (0.0132)
0.0798*** (0.0208)	-0.0051 (0.0112)
0.0274 (0.0178)	0.0106 (0.0092)
0.0179 (0.0146)	0.0051 (0.0072)
Base Type: Transform	
-0.0472 (0.0316)	-0.0537** (0.0188)
0.0406 (0.0277)	-0.0294† (0.0163)
Base Category: Others	
0.0118 (0.0336)	0.0084 (0.0200)
0.0180 (0.0365)	0.0125 (0.0218)
0.0459 (0.0365)	0.0267 (0.0218)
0.0953† (0.0500)	0.0316 (0.0297)
-0.0289 (0.0381)	0.0064 (0.0228)
375.42	533.28
<.0001	<.0001
Note: Significant at † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses	

Table 11. Partnership on Operational Performance

VARIABLE	MODEL 1 (Response Time)	MODEL 2 (Consistency)
Intercept	5.5122*** (0.9100)	0.7112† (0.3705)
PerformanceMetric_Lag	0.2903*** (0.0292)	0.2542*** (0.0336)
lnSKU	-0.0650* (0.0265)	0.0026 (0.0110)
lnMonthlyVisits	-0.1688** (0.0511)	0.0223 (0.0211)
Experience	0.0147 (0.0255)	0.0025 (0.0105)
CapabilityIndex	-0.1985 (0.3954)	0.2741† (0.1643)
DegreeSourcing	-0.5154 (0.4281)	0.1155 (0.1773)
CR_Content	-0.4130 (0.5246)	-0.0103 (0.2171)
CR_Catalog	-0.9852* (0.4069)	0.3939* (0.1680)
CR_Reporting	0.9957** (0.3097)	-0.1386 (0.1284)
CR_All	1.0149 (1.0182)	-0.1514 (0.4203)
Base Platform: In-house		
eCommPlatTop	-0.0563 (0.1911)	0.0922 (0.0792)
eCommPlatOther	0.2520† (0.1404)	-0.1177* (0.0579)
Base Year: 2010		
Year_2007	0.1374*** (0.1758)	0.0805 (0.0770)
Year_2008	-1.0369 (0.2172)	0.5123*** (0.0729)
Year_2009	0.1568 (0.1612)	-0.0986 (0.0687)
Base Type: Transform		
ITStrategicRole_Automate	-0.2416 (0.1681)	0.1803 (0.0700)
ITStrategicRole_Informate	-0.2406 (0.1519)	0.0175 (0.0626)
Base Category: Others		
MerchandiserCategory_448	-0.4120* (0.1776)	0.0534 (0.0734)
MerchandiserCategory_453	-0.0271 (0.1942)	-0.0842 (0.0807)
MerchandiserCategory_451	0.2898 (0.1919)	-0.1147 (0.0799)
MerchandiserCategory_454	-0.4824† (0.2745)	0.0732 (0.1137)
MerchandiserCategory_443	0.0784 (0.1998)	-0.0824 (0.0828)
R-Square	24.06%	19.62%
Note: Significant at † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors are in parentheses		

MODEL 3 (Site Downtime)
0.0740 (0.6654)
0.1962*** (0.0394)
0.0033 (0.0202)
-0.1070** (0.0385)
0.0032 (0.0201)
0.3648 (0.2900)
-0.0349 (0.3291)
-0.3907 (0.4087)
-0.9000** (0.3158)
0.1529 (0.2392)
1.2137 (0.7976)
Base Platform: In-house
-0.2328 (0.1484)
-0.0331 (0.1034)
Base Year: 2010
-0.1537 (0.1410)
-0.1486 (0.1376)
0.6482*** (0.1211)
Base Type: Transform
0.1468 (0.1280)
0.07162 (0.1133)
Base Category: Others
-0.1238 (0.1321)
-0.2112 (0.1484)
-0.1389 (0.1457)
-0.3417 (0.2153)
0.1349 (0.1497)
14.98%

Table 12. Results of Hypotheses for Partnership vs. Best-of-Breed

DEGREE OF SOURCING			
HYPOTHESIS	CONTENT	CATALOG	REPORTING
H6. Capabilities Achieved Through Best-of-Breed	Not Supported	Supported	Supported
H7. Growth in Technology Sourcing Hinders Partnership	Supported	Supported	Supported
H8. Vendor Platform Supports Partnership	Not Supported	Supported	Partially Supported
OPERATIONAL PERFORMANCE			
HYPOTHESIS	RESPONSE TIME	CONSISTENCY	SITE DOWNTIME
H9. Partnership Results in Higher Performance	Partially Supported	Supported	Supported

6.2 Discussion

In a hypercompetitive industry such as e-Retailing, how do firms adapt their IT architecture and infrastructure to enable rapid growth and deliver services to meet the needs of customers? In Section 6, we explored organizational characteristics that influence e-Retailers' partnership versus best-of-breed IST sourcing strategy. We also examined the effects of these decisions on firm performance.

Our results show that firms that pursue capabilities elect the best-of-breed strategy. The more capabilities the firm has, the lower its degree of partnership. Competition drives firms to acquire and offer new capabilities that differentiate them from competitors. Therefore, it is of no surprise that an e-Retailer's focus, when choosing a solution, is to adopt one that enables it to compete the best rather than a solution that is already available in an existing vendor's portfolio. In this

instance, constructing the IT architecture with industry leading solutions is of higher priority than consolidation. Firms that are focused on capabilities are not as concerned with streamlining their IT architecture. On the other hand, firms that pursue consolidation would have a slower rate of functionality growth since adding new functions quickly will introduce complexity to the existing IT architecture. Recent IT industry changes such as standardization and modularity of solutions can also help to support adoption of the best-of-breed strategy.

Our findings that degree of sourcing is negatively associated with partnership suggest that when there is rapid growth in technology assets, firms are not necessarily concerned with partnership. As noted by Straub (1999), a best practice for e-Commerce firms is to "[Look] ahead by focusing on value-added applications, not necessarily the easiest ones to put up." Again, the emphasis is on meeting market demands and needs of the customers. Furthermore, the recent emergence of pre-built integrations for e-Commerce solutions from firms such as OrderDynamics is helping to reduce some of the complexity and costs associated with integration. Steven Berkovitz, On-Demand Platform Architect at OrderDynamics, states, "[OrderDynamics] H.I.V.E. reinforces our vision of enabling continual growth for our Clients by providing already built integrations with the best eCommerce solutions and tools available (Order Dynamics, 2012)." In this case, the number of vendors for an e-Retailer may not be decreasing, but the effort required to put the IT infrastructure together has been simplified.

E-Retailers that choose a sourced e-Commerce platform over building one

in-house are better able to achieve partnership. While choosing in-house development for an e-Commerce platform can enable an e-Retailer to differentiate itself from its competitors by not using an off-the-shelf solution, it can at the same time limit the firm's ability to consolidate. Vendors recognize that a wide portfolio of technology solutions is required to support e-Commerce; therefore, vendors will strive to offer a variety of solutions. However, the e-Retail industry changes quickly, so firms will prefer technologies that enable fast implementation and time to market. Vendors, in order to be competitive, will build integration components for their products. Additionally, vendors are in a better position to scan the market and develop standardized solutions. The richness of capturing market requirements is better for vendors. An area of caution for e-Retailers that elect to go with a vendor solution for its e-Commerce platform is that they may be gradually moving towards a lock-in model.

With regard to the effects of partnership on performance, we find that partnership leads to better operational performance for catalog. This is across all three performance dimensions. The expected results may not have showed up for content and reporting because catalog is most closely aligned with operations. While these dimensions are important to user experience, would a customer really notice them? The more important question is how do improvements in operational performance impact a firm's long-term IT costs and financial performance? For reporting, we observed an inverse relationship between response time and partnership. This suggests that for certain core services such reporting that is highly data intensive, a firm may derive no benefits from consolidation.

CHAPTER 7

CONCLUSION

Our study provides two key implications for research and practice. The complexity of the value chain and e-Commerce architecture requires a different way of looking at IST sourcing. Previous studies have not considered the possibility that IST sourcing strategies could differ for various activities of the value chain or for core services of the e-Commerce infrastructure, and a one-size-fits-all IST sourcing strategy may not be appropriate for these e-Retailing contexts. Hence, future research involving IST sourcing should be studied at a more granular level. Our theoretical models can serve as a launching pad for researchers who are interested in studying IST sourcing strategies. In our study, we have explored make versus buy IST sourcing of e-Retailers from a vertical perspective by looking at three primary activities of the value chain: logistics and operations, marketing, and sales. Additionally, we examined partnership versus best of breed IST sourcing strategy from a horizontal perspective by examining three core services of the e-Commerce architecture: content, catalog, and reporting. We further studied the effects of these IST sourcing decisions on firm performance, looking at both financial as well as operational metrics.

A second implication is that we have gained more awareness of the organizational factors that influence IST sourcing decisions for the e-Retail value chain and e-Commerce architecture. Our findings related to the e-Retail value chain suggests that there is a technology arms race in the e-Retail industry, and

less experienced e-Retailers are relying on vendors to launch and maintain their online business in order to remain in the game. The e-Retailers that use IT to simply automate or inform also show a preference of buying over making, while the ones that use IT to transform tend to develop their solutions in-house. One thing to note is that firms employing a higher degree of IST sourcing also have greater reliance on their vendors for enabling their e-Retail value chain. This may not be the best long-term strategy because these firms may face higher transaction costs in the long run.

In the same study, our evaluation of complementary IST sourcing reveals that different performance impacts occur depending on the combination of value chain activities that are chosen for outsourcing. We have explored three combinations of complementary IST sourcing across the activities of logistics and operations, marketing, and sales. It would be interesting to include other activities including service into the mix and observe how they impact firm performance. For managers, our findings related to complementary IST sourcing are especially helpful and may motivate them to rethink their IST sourcing strategies for their value chain enablement. Our results show that an increase in the degree of sourcing for marketing and sales is associated with an increase in Web sales, but the amount is not substantial. Where a firm observes a strong effect is in the conversion rate. One unit increase in the degree of IST sourcing for marketing and sales results in a 0.03% increase in conversion rate, which is a sizable change considering the average conversion rate for our sample is 0.04%. Therefore, managers should consider complementary IST sourcing for synergistic activities.

At the same time, they should also reduce their expectations from adopting similar IST sourcing strategy for less synergistic value chain activities like logistics, operations, and sales since such approach is found to result in lower Web sales and conversion rate. A possibility for such results is that synergistic activities are in essence more tightly connected and hence should be better coordinated by simultaneous sourcing. Another aspect to consider is that it may not be a good idea for e-Retailers to acquire their logistics and operations IST assets from external vendors. After all, these activities represent core functions within their businesses, and the e-Retail firms may be losing competitive advantage by selecting a buy strategy for IST solutions used for logistics and operations. We would need more evidence to further support this claim.

Our findings on IST sourcing for the e-Commerce architecture reveal that increase in capabilities and technology assets can hinder a firm's ability to partner, a strategy that is shown to lead to better operational performance. The question that an e-Retailer should ask itself in this case is do improvements in operational performance enable it to be more competitive or is it more important for the firm to provide the capabilities and experience that its customers desire? Which option is more important for long-term growth? There are tradeoffs to be made when deciding between a partnership and a best-of-breed IST sourcing strategy. Furthermore, the results also suggest that firms that plan to move towards a partnership strategy in the future should begin with a vendor-acquired e-Commerce platform rather than one developed in-house. In-house development can limit an e-Retailer's ability to adopt and integrate with other vendor solutions.

For managers, knowing the strategies that are being employed by similar firms and competitors in their industries can provide insights on the decisions they should make. The question that arises here is: how do environmental factors contribute to IST sourcing decisions? The contingency theory suggests that there are always internal as well as external sources at work. At this point, we have not explored any industry characteristics. For example, can we expect to see mimicking behavior from other firms when it comes to IST sourcing strategies? And how is maturing of the e-Commerce industry and consolidation across vendors and solutions impacting IST sourcing decisions? Both of these are areas that warrant exploration in the future.

One limitation of this study is that our sample of firms is composed of the top 500 e-Retailers list; therefore, our results may not be representative of medium and poorer performers. Additionally, our results of e-Retail industry firms may not be generalizable for other industries. The data also prevented us from being able to divide the technologies for logistics and operations into input logistics, operations, and output logistics, which would have given us a more granular list of value chain activities to study. These are the challenges one typically encounters when studying complex systems like e-Retailer value chains that span across multiple functions.

Another limitation is that in our effort to maximize the number of firms studied, we restricted ourselves to using the organizational characteristics provided by Internet Retailers. It would be insightful to perform a follow-up study

on publicly-traded firms with a broader set of firm specific variables and see if similar results can be obtained.

For our study on the e-Commerce architecture, there are several other core services that we did not explore such as social media, payment, fulfillment, and orders. Would the results observed still hold for these other services? We have the opportunity, in future research, to study IST sourcing strategies for other core services. Another interesting area to explore is complementary IST sourcing strategy for core services that are aligned such as content and catalog.

Another interesting perspective for future research is to examine how a particular technology's importance weighs into a firm's overall performance. Our degree of IST sourcing is derived based on equal weights for the various technologies, although different technologies can add different values to the e-Retail value chain and hence carry different weights. Therefore, it may be more critical to acquire certain IST assets than others. In this instance, different objective or subjective weights should be assigned to various technologies to determine the value of the sourced assets for different e-Retailers. Along the same line, how do capabilities correlate with the technologies studied? Are certain technologies providing more value since they deliver capabilities that allow e-Retailers to compete more effectively?

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APPENDIX A

IT STRATEGIC ROLE OF MERCHANT TYPE

The below instrument was sent to 3 IS scholars.

- Automate: companies that use IT to automate human labor generally invest in IT in order to improve the efficiency of existing business processes.
- Informate-up and informate-down: companies that involve the use of IT to induce decision-making and decision-taking at, respectively, higher and lower organizational levels and provide data/information to empower management and employees.
- Transform: companies that use IT to introduce radical business models that disrupt industry practices (e.g., bypassing select value chain participants) and market structures (e.g., creation of new market spaces) as a means to position themselves more favorably within an industry. They alter traditional ways of doing business by redefining business processes and relationships.

For each e-Retailer type below, classify as automate, informate or transform based the definitions above:

TYPE	DEFINITION	EXAMPLES	STRATEGIC IT ROLE
Catalog / Call Center	Historically, goods are sold primarily by phone or via mail-order catalog	• Crutchfield Corp. • American Girl LLC • L. L. Bean Inc. • HSN Inc. • ShopNBC.com	
Brand Manufacturer	Markets a good or family of goods under its own brand name and sells products to consumers through a direct channel	• Adidas Inc. • HP Home & Office • Callaway Golf • Coach Inc.	
Retail	Sells goods to consumers through both online and physical store	• Staples Inc. • Office Depot Inc. • Walmart.com • OfficeMax Inc. • Sears Holding Corp.	
Web Only	Pure online merchant and only sells goods and services over the Internet	• Amazon.com Inc. • Newegg Inc. • Netflix Inc. • eBags.com • Overstock.com Inc.	

APPENDIX B

E-RETAILER FEATURES AND FUNCTIONS

The following list of e-Retailer features and functions is used to derive the *capability index* variable.

- Affiliate Program
- Auction
- Catalog Quick Order
- Coupons/Rebates
- Customer Reviews
- Daily/Seasonal Specials
- E-mail a Friend
- Enlarged Product View
- Frequent Buyer Program
- Mapping
- Mobile Commerce
- Online Circular
- Online Gift Certificates
- Outlet Center
- Pre-Orders
- Product Comparisons
- Product Customizations
- Registry
- Site Personalization
- Social Networking
- Store Locator
- Syndicated Content
- Top Sellers
- Videocasts
- Wish List
- Advanced Search
- What's New