Quality and Logistics Strategy in E-Supply Chains

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ABSTRACT

Emerging scholarly thoughts on quality suggest that three principal sources of customer-based value creation exist for firms operating in the online marketplace. These include a focus on delivering (1) service quality, (2) product quality, and (3) eBusiness quality. Using strategic choice theory coupled with configuration theory, a profile deviation analysis is conducted among customers of online grocery firms using the ideal "quality profile" for four logistics strategy types as the benchmark (semi extended strategy, fully extended strategy, de-coupled strategy, and centralized extended strategy). First, the findings suggest that service-, product-, and eBusiness quality-based fit with logistics strategy type is associated with performance (i.e., customers' behavioral intentions). Second, the findings support to the notion that capitalizing on the appropriately weighted quality-focus represents a strategic vehicle to create superior performance in the online business. The makeup of these "ideal" quality profiles is also discussed.

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INTRODUCTION

The last decade has seen an increased focus on information technology and eBusiness operations as method to create customer-driven value in a firm's logistics operations (e.g., Boyer and Olson, 2002; Esper, Jensen, Turnipseed, and Burton 2003; Rodrigues, Stank, and Lynch 2004; Williams, Nibbs, Irby, and Finely 1997). For example, firms such as Dell, FedEx, and Omaha Steaks use eBusiness channels to enhance the value of their supply chain operations indirectly, while firms such as Amazon, Ebay, and Ocado use eBusiness solutions to create a competitive edge in the marketplace directly. Whether eBusiness solutions are incorporated as an enhancer to other core competencies (i.e., Dell, FedEx, and Omaha Steaks) or are stressed as the core competency of the firm (i.e., Amazon, Ebay, and Ocado), eBusiness must be integrated into the firm's logistics operations as an intangible strategic resource (cf. Mentzer, Flint, and Kent 1999). This eBusiness resource has become crucial in many firms' efforts to create value in a unique, inimitable, and non-transferable way (Jensen and Meckling 1992).

While past studies have primarily applied the notion of eBusiness as a strategic resource to organizations or as a facilitator of logistics solutions (e.g., Williams et al. 1997), we seek to expand the application through a focus on the "last mile" of the supply chain in the online marketplace (e.g., Edwards, Peters, and Sharman 2001; Esper et al. 2003). In this study, a supply chain is defined as a "network of facilities and activities that performs the functions of product development, procurement of material from suppliers, the movement of materials between facilities, the manufacturing of products, the distribution of finished goods to customers, and after-market support for sustainment" (Mabert and Venkataraman 1998, p. 538). Using this definition, our focus on the "last mile" of the supply chain primarily refers to "the distribution of finished goods to customers" which is at the center of logistics operations in the supply chain. In

particular, our research effort centers on a firm's order fulfillment and logistics strategies to effectively create value for end-customers while at the same time achieving efficient supply chain operations.

The focus on the logistics component within supply chains is both theoretically interesting and practically valuable because of its increasingly important role in affecting a firm's performance (cf. Daugherty, Stank, and Ellinger 1998; Mentzer 1993; Niraj, Gupta, and Narasimhan 2001). Also, the overall complexity of supply chains (Handfield and Nichols 2003) presents an opportunity for eBusiness initiatives to create unique advantages vis-à-vis competitors (Carter and Narasimhan 1996). At the same time, a firm's ability to create value to customers can be severely impeded by a dysfunctional supply chain system (e.g., Venkatesh, Kohli, and Zaltman 1995). To reap the advantages associated with eBusiness solutions, many firms have devoted significant resources to technology initiatives for the purpose of enhancing their supply chain performance. For example, FedEx recently spent $100 million to structurally reorganize their supply chain, and UPS has spent $9 billion on IT since 1986 – both to improve supply chain performance (Farhoomand and Ng 2000).

In this study, we examine a model of customer-driven quality elements and its effect on performance (customers' behavioral intentions) in the last mile of the eBusiness-based supply chain. The theoretical foundation is composed of strategic choice theory (Child 1972), configuration theory (e.g., Doty, Glick, and Huber 1993; Miller 1997), and the theory created by the Nordic School of Services Management (e.g., Grönroos 1984; Grönroos and Gummesson 1985). These theories guide us in assimilating a set of three quality constructs (service-, product-, and eBusiness-quality) that are examined as value creation elements within different logistics strategy types (cf. Dresner and Xu 1995; Sterling and Lambert 1987; Wisner 2003).

Specifically, we empirically examine how to weight each quality focus (service, product, and eBusiness) appropriately given the particular logistics strategy adopted as the business model to achieve the greatest performance. Consistent with the logistics literature in this area, the performance outcome examined is a customer's behavioral intention to re-purchase from the eBusiness grocer (e.g., Esper et al. 2003). We now provide a theoretical integration of the relevant literature streams, followed by a discussion of the method, analysis, results, and implications that can be derived from the research.

THEORETICAL INTEGRATION

Assessing whether logistics operations are organized in ways that enable desired performance requires the simultaneous consideration of multiple characteristics (cf. Doty, Glick, and Huber 1993). Configuration theory has been used as a useful foundation to address such considerations using profile deviation analysis (e.g., Doty, Glick, and Huber 1993; Miller 1997). In our study, a configuration denotes a multidimensional constellation (e.g., Meyer, Tsui, and Hinings 1993) of three customer-based *quality* characteristics (e.g., Agarwal and Prasad 1999; Boyer and Olson 2002; Carsky, Dickson, and Canedy 1998; Mentzer, Flint, and Hult 2001; Mentzer, Flint, and Kent 1999; Parasuraman, Zeithaml, and Berry 1985). These are: service quality, product quality, and eBusiness quality.

For these quality characteristics, configuration theory posits that an ideal constellation exists that results in superior performance for a given logistics strategy. In studying quality profiles, these configurations are considered ideal because they represent complex "gestalts" of multiple, interdependent, and mutually reinforcing characteristics that enable supply chains to achieve their strategic goals (Ketchen, Thomas, and Snow 1993; Miller 1997; Vorhies and Morgan 2003). In Figure 1, we provide an illustration of four types of logistics strategies for

extending the supply chain. In Figure 2, the links between the degrees to which the quality characteristics are organized in ways that enable strategy implementation with performance is depicted.

Insert Figures 1 and 2 about here

To specify and test the relationships outlined in Figure 2, configuration theory studies draw on the literature on "strategic fit" (e.g., Doty, Glick, and Huber 1993; Venkatraman and Camillus 1984; Zajac, Kraatz, and Bresser 2000). This literature specifies that when fit among multiple variables is considered simultaneously (as in the holistic study of the relationship between quality characteristics and logistics strategy types) and the impact on criterion variables is assessed (i.e., performance), fit should be conceptualized and assessed via "profile deviation analysis" (e.g., Venkatraman 1990). Profile deviation analysis views fit between quality characteristics and strategy in terms of the degree to which the quality characteristics of a supply chain differ from those of an "ideal" profile for implementing a particular logistics strategy (Venkatraman 1990; Zajac, Kraatz, and Bresser 2000).

Configuration Elements of Quality-Based Supply Chain Fit With Strategy

As depicted in Figure 1, configuration theory (e.g., Doty, Glick, and Huber 1993), strategic choice theory (Child 1972), and the quality literature (e.g., Agarwal and Prasad 1999; Boyer and Olson 2002; Carsky, Dickson, and Canedy 1998; Mentzer, Flint, and Hult 2001; Parasuraman, Zeithaml, and Berry 1985) suggest two major constructs that are relevant to understanding and assessing quality-based fit with strategy: (1) logistics strategy types and quality-based supply chain characteristics including service-, product-, and eBusiness-quality. "Strategic type pertains to the planned patterns of organizational adaptation to the market

through which a business seeks to achieve its strategic goals" (Vorhies and Morgan 2003, p. 102; cf. Conant, Mokwa, and Varadarajan 1990; Matsuno and Mentzer 2000).

Using strategic choice theory (Child 1972) as the theoretical foundation, we identify four logistics strategies as appropriate in an organization's efforts to extend their supply chains: centralized extended strategy, fully extended strategy, de-coupled strategy, and semi-extended strategy. As shown in Figure 1, the four logistics strategies differ in terms of four critical factors: customer convenience, delivery cost, picking efficiency and capital investment. Additionally, Table 1 provides an overview of the four logistics strategies to extend the supply chain, including advantages, disadvantages, and examples of companies that are currently applying these strategies successfully.

Insert Table 1 about here

For example, companies wishing to offer high levels of customer convenience deliver directly to customers. As an illustration, Office Depot delivered over $2 billion in office supplies directly to customer offices and homes in 2002. Office Depot employs a centralized extended strategy because the large volume of consumer direct sales justifies a large capital investment in order to achieve picking efficiencies. In contrast, Tesco.com also delivers directly to customer homes (over $600 million of groceries and other household items in 2002), but they utilize a fully extended strategy that involves picking orders from individual stores. This strategy allows them to minimize capital investment for what is currently a niche market (about 1.5% of their total sales) and to make a profit.

In contrast to Tesco and Office Depot, companies that want to minimize delivery costs either sub-contract with third party providers (such as DHL, FedEx, or UPS) or allow customers to pick up Internet orders at existing stores. Scores of companies follow a de-coupled strategy to

minimize delivery costs while taking advantage of high picking efficiencies. Prominent company examples of this strategy include Dell, Amazon, NetFlix, Caremark and almost any catalog retailer such as Lands End. Companies that choose to offer Internet ordering for pickup at a store do so to minimize capital investments and offer customers another channel. Companies such as REI, Best Buy, Rite-Aid and Lowes Foods have used a semi extended strategy to offer customers increased convenience at a low delivery cost and have forged stronger links with previously indifferent customers.

Based on the marketing, logistics, and supply chain literatures, three characteristics have been delineated to be critical in the formation of a multiple, interdependent, and mutually reinforcing profile that drive customers' behavioral intentions (i.e., performance) (e.g., Li and Rajagopalan 1998; Mackenzie 2000; Mentzer, Flint, and Hult 2001). These are: service-, product-, and eBusiness-quality. *Service quality* is defined as "the consumer's overall impression of the relative inferiority/ superiority of the organization and its services" (Bitner and Hubbert 1994, p. 77; cf. Mentzer, Flint, and Hult 2001). *Product quality* is defined as "the consumer's [subjective] judgment about a product's overall excellence or superiority" (Zeithaml 1988, p. 3). *eBusiness quality*, in this study, is defined as aspects of quality that are critically affected by taking orders online.

Hypothesis Development

The expectation that product-, service-, and eBusiness quality have an impact on performance for online grocery firms can be traced to the theoretical grounding offered in the works by the "Nordic School of Service Management" (NSSM) (e.g., Grönroos 1982, 1984; Grönroos and Gummesson 1985). This theory lends itself well to online business encounters signified by a considerable product component (e.g., online groceries) (Grönroos 1990). What

happens in these online encounters will have a critical impact on the perceived service-, product-, and eBusiness quality as well as customers' future behavioral intentions. *Behavioral intentions* "can be viewed as indicators that signal whether customers will remain with or defect from the company" (Zeithaml, Berry, and Parasuraman 1996, p. 33).

Based on the NSSM, the customers evaluate the online business encounter along two dimensions, a *technical* and a *functional* dimension (e.g., Grönroos 1984). Related to the technical dimension, *what* customers receive in their interactions with the firm is important to their evaluation (e.g., Zeithaml 1988). This is often thought of as the *quality* of the product delivered (i.e., the *technical quality*). It is *what* the customer is left with, when the production process and online interactions are over. Additionally, product quality has been found to have an impact on customer's behavioral intentions (Normann 1984).

However, the technical dimension will not account for a consumer's total evaluation of the online grocery encounter. Customers will also be influenced by the way in which the product – the outcome or end result of the encounter – is delivered to them. As such, customers are influenced by *how* they receive the products. This portion of the online grocery-encounter is referred to as *functional quality of the process*; it incorporates the more subjective service- and eBusiness quality associated with the encounter (cf. Grönroos 1982, 1990). Based on the NSSM, service- and eBusiness quality are very likely to be linked with customers' behavioral intentions (e.g., Boulding, Kalra, and Staelin 1999; Zeithaml, Berry, and Parasuraman 1996). In fact, the notion that customers prefer greater service- and eBusiness quality, in addition to product quality, is rather intuitive, especially if price and other tangible and intangible cost elements are held constant.

In summary, we expect that the performance of online grocery firms (measured as customers' behavioral intentions) be greater when their quality profiles are similar to those of the performance-maximizing ideal profile of a certain logistics strategy type (as illustrated in Figure 2). As such, we hypothesize that:

H_1: The more similar an online grocery firm's quality profile to that of the ideal profile for a particular supply-chain strategy type, the greater the performance of the online grocery firm.

METHOD

Data Collection and Samples

The overall sample consisted of customers of four different online/home delivery grocers. Online/home delivery grocers present an interesting area of application for the study of logistics strategy types and quality issues (service, product, and eBusiness) for two main reasons. First, logistics strategy as a research focus has become increasingly prevalent in the logistics literature (e.g., Clinton and Closs 1997). Second, logistics research on the traditional retail grocery industry has found that "firms with logistics capabilities matched to an appropriate strategy outperform those that do not" (Lynch, Keller, and Ozment 2000). This research project was supported by a grant from the National Science Foundation (NSF).

All four firms were generous with their time and allowing us access to their customers, but prefer not to be identified by name given the dynamic nature of the home delivery grocery business. While we cannot include individual sales and financial characteristics for sensitivity reasons, collectively the firms had annual online/home delivery sales of more than $150 million in 2003, an aggregate customer base of more than 100,000 customers who purchase at least once per month. The people in our final sample account for over 34,000 purchases and $4 million in home delivery sales. Each of the four online grocery firms represents one of the four logistics

strategy types illustrated in the quadrants in Figure 1 (i.e., semi extended logistics strategy, fully extended logistics strategy, de-coupled logistics strategy, and centralized extended logistics strategy). The general survey data collection principles recommended by Dillman (1978) were followed and the response rate for all four grocers met or exceeded generally accepted standards.

Semi Extended. Customers of this grocer were contacted by email and asked to fill out an online survey. One free delivery (a $4.95 value) was offered to customers as an incentive to complete the survey and customers were sent a reminder email one week after the first if they had not yet filled out the survey. A total of 1,159 customers were contacted and 396 responses were received for a response rate of 34.2%.

Fully Extended. This grocer was not comfortable providing us with any contact or past ordering information on any customers, despite our standard and repeated assurances that all information would be held in complete confidentiality. Thus, this grocer posted a link on the checkout page for orders inviting customers to opt-in and fill out the survey. No incentive for participation was offered. A total of 10,418 unique customers (14,959 total orders) were placed over a two-week period and we received 898 survey responses.

De-Coupled. Customers of this grocer were contacted by email and asked to fill out an online survey. The grocer provided baseball hats with the grocer's logo as an incentive to complete the survey – the choice of incentives was partly driven by the desire to build the company's brand given a lack of brick and mortar stores. A total of 2,000 customers were contacted and 461 responses were received for a response rate of 23.0%.

Centralized Extended. Customers of this grocer were contacted by email and asked to fill out an online survey. The grocer provided 20 pairs of movie tickets to be raffled of to customers participating in the survey and a reminder email was sent one week after the first if

customers had not yet filled out the survey. A total of 2,500 customers were contacted and 691 responses were received for a response rate of 27.6%.

Non-response bias. The extrapolation procedure suggested by Armstrong and Overton (1977) was used to assess potential non-response bias. In assessing the first quartile versus the last quartile of the respondents in each sample group (semi extended, fully extended, de-coupled, and centralized extended strategies), we found no significant difference between the early and late respondents on either of the seven summated measures in the survey (i.e., service quality, product quality, eBusiness quality, attitude toward Internet ordering, online access ability, sacrifice, and behavioral intentions). Thus, our inference is that the data are free from systematic difference bias across the early and late respondents; thus, non-response bias is not an inhibiting factor in analyzing the hypotheses.

Measures

The measures used in this study are included in the Appendix. Three categories of measures were used to assess the fit of the service-, product-, and eBusiness-quality profile with logistics strategy types and its effect on performance: (1) profile measures (i.e., service-, product-, and eBusiness-quality measures), (2) performance (i.e., customers' behavioral intentions), and (3) control variables (i.e., attitude toward Internet ordering, online access ability, and sacrifice).

Quality Profile Measures. Three measures were used to develop the ideal profiles for each strategy type, including: service quality, product quality, and eBusiness quality. Service quality was measured via ten items based on Parasuraman, Zeithaml, and Berry's (1985) ten original dimensions of service quality (reliability, understanding, responsiveness, competence, security, courtesy, access, tangibles, credibility, and communication) (cf. Gotlieb, Grewal and

Brown 1994; Mentzer, Flint, and Hult 2001). Product quality was measured via six items adapted from works by Carsky, Dickson, and Canedy (1998), Garvin (1987), and Brucks, Zeithaml, and Naylor (2000). eBusiness quality was measured via seven items adapted from Agarwal and Prasad (1999) and Boyer and Olson (2002).

Performance. Given the customer focus of our study, we opted to use customers' behavioral intentions as the performance variable. This is consistent with previous studies on logistics-based online retail phenomena (e.g., Esper et al. 2003; Keller et al. 2002). Zeithaml, Berry, and Parasuraman (1996) develop an argument that positive behavioral intentions are reflected in a firm's ability to get its customers to: (1) say positive things about them, (2) recommend them to other consumers, (3) remain loyal to them, (4) spend more with the company, and (5) pay price premiums. Similar to Cronin, Brady, and Hult (2000), we used four items to operationalize customers' behavioral intentions that are similar to the domains assessed in the first four of these five outcomes (cf. Samiee and Anckar 1998). It is important to note that although we do not have access to objective performance data, we found that the summated scale of a customer's behavioral intentions (BI) is significantly correlated with the customer's total purchases over a five-month period following the survey (the total purchase was calculated as the product of two objective data figures provided by the firms for each customer: customer's average dollar spent per purchase and the number of purchases in the five-month period following the survey) . Specifically, in the overall sample we found $r=.23$ ($p<.01$), and in the semi extended strategy segment $r=.25$ ($p<.01$), de-coupled strategy segment $r=.10$ ($p<.05$), and centralized extended $r=.31$ ($p<.01$) (due to sensitivity issues we were not able to obtain these data for the fully extended strategy sample).

Control Variables. In addition to the profile and performance measures, we included survey items to assess three constructs that have been shown to affect customers' behavioral intentions within the online shopping industry. These include measures that assess a customer's attitude toward Internet ordering (Agarwal and Prasad 1999), online access ability (Boyer and Olsson 2003), and perceived sacrifice (Dodds, Monroe, and Grewal 1991; Esper et al. 2003; Heskett, Sasser, and Hart 1990; Zeithaml 1988).

ANALYSIS AND RESULTS

Measurement Analysis and Results

The correlations among the study variables are reported in Table 2. The means, standard deviations, average variances extracted, composite reliabilities (and coefficient alphas), factor loadings, and fit indices are reported in Table 3. To ensure that the strategic fit hypothesis (H_1) can be tested without influence of the logistics strategy types, a five-step approach was used to assess the measures across the four strategy types. These steps include: (1) conducting an overall exploratory factor analysis, (2) testing the robustness of each item across the four logistics strategy types, (3) conducting a confirmatory factor analysis using the full sample (n=2,440), (4) assessing the reliability and validity of the scales, and (5) testing to ensure that common method variance does not inhibit the hypothesis testing.

Insert Tables 2 and 3 about here

Exploratory factor analysis. Given the mix of established and new scale items, we first conducted an exploratory factor analysis using SPSS 11.0 (a principal component extraction method and varimax rotation as employed). A total of seven subjective constructs involving 38 reflective scale items were assessed. In this analysis, we found two problematic items in the

behavioral intentions scale (i.e., BI4 and BI5 – marked in the Appendix with a "[2]"). The two items were deleted, leaving 36 items for subsequent analysis.

Equivalence of the item loadings across strategy samples. To test the robustness of the survey items across the logistics strategy types, we conducted a multi-sample CFA using the input matrices from each of the four groups (i.e., semi extended, fully extended, de-coupled, and centralized extended samples) using LISREL 8.71 (Jöreskog et al. 2000). Specifically, we examined the robustness of each item loading across the groups by constraining appropriate β estimates to be equal and then different across the four groups. Then we evaluated whether the $\Delta\chi^2_{(\Delta df=3)}$ was significant (Jöreskog et al. 2000). The results indicated that of the remaining 36 items, two product quality and one eBusiness quality items were significantly different ($p<.05$) across the four samples (i.e., PQ4, PQ5, and EQ1 – each of those questions are marked in the Appendix with a "[3]"). The three items were deleted, leaving 33 items for subsequent analysis.

Confirmatory factor analysis (CFA). The next step in the analysis of the measurement properties was to conduct a CFA on the remaining 33 items using the full sample (n=2440). The model fits were evaluated using a series of indices. The DELTA2 index (Bollen 1989), the relative noncentrality index (RNI)(McDonald and Marsh 1990), and the comparative fit index (CFI) (Bentler 1990) have been shown to be most stable fit indices by Gerbing and Anderson (1992). Hu and Bentler (1999) suggested that the Tucker-Lewis index (TLI) (Tucker and Lewis 1973) and the root mean square error of approximation index (RMSEA) (Steiger and Lind 1980) be added in evaluating CFA and SEM analyses. Using this series of fit indices, the CFA resulted in DELTA2, RNI, CFI, and TLI all being .95, and RMSEA = .08 (χ^2 = 6,452.17, df = 413). Thus, the measurement structure of 7 factors and 33 items produced excellent fit statistics.

Reliability and validity assessments. Within the CFA setting, composite reliability was calculated using the procedures outlined by Fornell and Larcker (1981) based on the work of Werts, Linn, and Jöreskog (1974). The formula specifies that:

$$CR_{\eta} = \frac{(\sum \lambda \gamma_{\mathrm{i}})^2}{(\sum \lambda \gamma_{\mathrm{i}})^2 + (\sum \varepsilon_{\mathrm{i}})},$$

where CR_{η} = composite reliability for scale η; λ_{yi} = standardized loading for scale item γ_i, and ε_i = measurement error for scale item γ_I (coefficient alphas are also included in Table 3 for comparison). Additionally, the parameter estimates and their associated t-values were examined along with the average variance extracted for each construct (Anderson and Gerbing 1988). Average variance extracted was calculated using the following formula:

$$V_{\eta} = \frac{\sum \lambda \gamma_{\mathrm{i}}^{\ 2}}{\sum \lambda \gamma_{\mathrm{i}}^{\ 2} + \sum \varepsilon_{\mathrm{i}}},$$

where V_{η} = average variance extracted for η; λ_{yi} = standardized loading for scale item γ_i, and ε_i = measurement error for scale item γ_i. The composite reliabilities for the seven scales ranged from .69 to .95 (coefficient alphas ranged from .68 to .94), the factor loadings ranged from .41 to .93 ($p < .01$), with average variances extracted ranging from 43.7 to 70.7 percent. In addition, the 33 purified items were found to be reliable and valid when evaluated based on each item's error variance, modification index, and residual covariation. Also, the skewness and kurtosis results of each item indicated that the data were normally distributed.

Discriminant validity was assessed by calculating the shared variance between pairs of constructs and verifying that it was lower than the average variances extracted for the individual constructs (Fornell and Larcker 1981). Shared variance was calculated as:

$$\gamma^2 = 1 - \psi,$$

where γ^2 = shared variance between constructs, and with the diagonal element of ψ indicating the amount of unexplained variance. Since η and ε were standardized, γ^2 was equal to the squared correlation between the two constructs. In all but one case (i.e., the behavioral intentions scale), the average variances extracted were higher than 50 percent (cf. Fornell and Larcker 1981) (ranging from 43.7 to 70.7 percent; see Table 2). The shared variances between pairs of all possible scale combinations indicated that the variances extracted were higher than the associated shared variance in all cases (see Table 2 for shared variances and Table 3 for average variances extracted).

In the interest of thoroughly examining discriminant validity, we conducted one additional test of discriminant validity (e.g., Anderson 1987; Bagozzi and Phillips 1982). This test entailed analyzing all possible pairs of constructs in a series of two-factor CFA models using LISREL 8.71. Each model was run twice – once constraining the ϕ coefficient to unity and once freeing this parameter. A χ^2-difference test was performed on the nested models to assess if the $\Delta\chi^2$ was significantly lower for the unconstrained models (Anderson and Gerbing 1988). The critical value ($\Delta\chi^2_{(\Delta df=1)} > 3.84$) was exceeded in all cases. Thus, the seven constructs and their purified 33 indicators were found to be reliable, valid, and robust across samples.

Testing for potential common method bias. Before moving on to the hypothesis testing, we conducted an examination of potential common method variance problems. We used Harmon's One-Factor test to examine common method bias (e.g., Podsakoff and Organ 1986). As such, the 33 remaining items were factor analyzed via SPSS 11.0 with a principal component extraction method and varimax rotation to examine if one single factor would emerge and/or if one general factor would account for most of the covariance in the variables. Using a varimax rotation, the factors had variances explained ranging from 4.45 to 21.99 percent. Without

rotation, the first factor explained 34.29 percent of the total 71.01 percent. Thus, our inference is that common method bias does not appear to be an inhibiting factor in this study.

Hypothesis Testing and Results

In the testing of H_1, we followed the literatures on configuration theory (e.g., Doty, Glick, and Huber 1993; Miller 1997) and profile deviation analysis (e.g., Drazin and Van de Ven 1985; Venkatraman and Prescott 1990). The data were standardized (mean-centered) to remove the effects of different measurement units and potential multicollinearity (e.g., Gresov 1989; Jaccard and Turrisi 2003).

The first step in the profile deviation analysis was to identify ideal quality-based profiles that could be used as the benchmark against which the fit of all profiles in the sample with logistics strategy type could be examined (e.g., Doty, Glick, and Huber 1993; Vorhies and Morgan 2003). To identify the ideal profiles in each strategy type, we examined the frequencies of the performance variable (customers' behavioral intentions) coupled with the general guidelines in profile deviation studies of selecting about 10 percent of the performers to be included in the ideal profile (e.g., Venkatraman and Prescott 1990). For each logistics strategy, we selected a cut-off point within the top 10 percent of the performers where a significant drop-off in performance was apparent (this resulted in a range of 16 to 70 cases being included in each ideal profile).

In testing the hypothesis (H_1), we calculated the mean scores of the top performers for each logistics strategy type on the three constructs of service-, product-, and eBusiness quality to form an ideal quality profile (Venkatraman 1989; Vorhies and Morgan 2003). For the cases excluded from the top performers, we calculated the Euclidian distance of each case from the

ideal quality profile (EDQ) for its logistics strategy type across the three quality dimensions (e.g., Drazin and Van de Ven 1985; Venkatraman 1990). The following formula was used:

$$EDQ = \sqrt{\sum_{j}^{N} (X_{sj} - \overline{X}_{ij})^2} \ ,$$

where X_{sj} = the score for a customer case on the j^{th} dimension, $\overline{X}_{ij}$ = the mean for the ideal profile along the j^{th} dimension, and j = the number of profile dimensions (i.e., 1, 2, and 3).

These calculations result in a profile deviation score that represents the degree to which the quality profile is similar to that of the ideal profile for each strategic type and performance variable. The profile deviation score was then regressed, using the OLS method, on each of the performance variables. We also included three control variables, i.e., attitude toward Internet ordering, online access ability, and sacrifice – see the Appendix for the scale items). For H_1 to be supported, the results should indicate that deviation from the ideal quality profile is negatively related to the performance variable for each of the logistics strategy types (e.g., Drazin and Van de Ven 1985; Gresov 1989).

Prior to analyzing the hypothesis, it was important to validate two assumptions regarding our strategy type conceptualization (e.g., Vorhies and Morgan 2003). First, configuration theory (e.g., Doty, Glick, and Huber 1993) coupled with research on strategy types (e.g., Conant, Mokwa, and Varadarajan 1990; Slater and Olson 2000) assumes that any one of the logistics strategy types can lead to superior performance. As such, we examined, via analysis of variance tests (ANOVA), that performance variations between cases in our dataset were not simply a function of strategy type. The ANOVA results revealed no significant differences between the four logistics strategy groups on the performance variables. Second, we compared performance outcomes of deviation from two different ideal quality profiles, one developed from cases of the

same strategic type and one developed regardless of the strategy type (e.g., Venkatraman 1990; Vorhies and Morgan 2003). The results indicate that calibrating ideal quality profiles within strategy type produces greater beta coefficients (Cohen et al. 2003) and greater explanatory power (Chow 1960) in the regression models.

Table 4 reports the standardized regression results for quality-based profile fit with strategic type and its effect on performance. Table 5 summarizes the means and standard deviations for the ideal quality profiles based on the particular logistics strategy type (as well as provides the scores for the average cases for each strategy type). The results for the control variables – attitude toward Internet ordering, online access ability, and sacrifice – are also included in Table 4. One hypothesis, involving four profile-deviation regression models, was tested in this study; this represents hypothesized linkages for the performance variable and logistics strategy types (semi extended, fully extended, de-coupled, and centralized extended).

Insert Tables 4 and 5 about here

Additionally, for each hypothesized model tested, we also examined an alternative "non-ideal" model, where the "average performers" (those cases at the median on the performance scale) were selected from each strategy group to form the "average benchmark" model used to create profile deviation scores. In all model comparisons involving H_1, we found that the results support the notion that calibrating ideal quality profiles within strategy type produces stronger profile deviation coefficients (Cohen et al. 2003) and greater explanatory power (Chow 1960) than the average benchmark cases (note that the ideal profiles also achieve higher mean scores than the average profiles; see Table 5). Also, for all models, the Variance Inflation Factors (VIF) were lower than 1.80, indicating that multicollinearity does not inhibit the analysis (Mason and Perreault 1991).

H_1 predicted that the more similar the quality profile to that of the ideal profile for its logistics strategy type, the greater is its performance (measured as customers' behavioral intentions). Using OLS regression, the results show a significant, negative effect of the quality ideal profile for semi extended (β = -0.26, $p < .01$, Adjusted R^2 = 0.32), fully extended (β = -.041, $p < 0.01$, Adjusted R^2 = 0.41), de-coupled (β = -0.43, $p < 0.05$, Adjusted R^2 = 0.37), and centralized extended (β = -0.41, $p < 0.01$, Adjusted R^2 = 0.37) strategy types with performance as the criterion variable. Thus, H_1 was supported. Additionally, sacrifice (SAC), as a control variable, was significant in all four equations. However, the control variable of online access ability (OAA) was significant in only the centralized-extended strategy model, while attitude toward Internet ordering (ATT) did not affect performance in the four equations.

DISCUSSION AND IMPLICATIONS

The purpose of this study was to advance the literature on what drives customers' behavioral intentions in the last mile of the supply chain. Our specific focus is on identification of the composition of an ideal quality profile that drives superior performance in each of four logistics strategy types (LST). LST is defined by (1) direct and indirect delivery methods and (2) store-based and distribution center-based order fulfillment methods (see Figure 1), and include the following four strategies: semi extended strategy, fully extended strategy, de-coupled strategy, and centralized extended strategy.

Strategic choice theory (Child 1972), the Nordic School of Services Management (Grönroos 1982, 1984; Grönroos and Gummesson 1985), and configuration theory (e.g., Miller 1997) served as the foundation for the integration of logistics strategy types, quality elements, and assessment method. The profile-deviator predictor, together with three control variables (attitude toward Internet ordering, online access ability, and sacrifice), explained between 32%

and 41% of the variance in performance (i.e., customers' behavioral intentions) (See Table 4). These values are similar to other configuration studies (e.g., Doty, Glick, and Huber 1993; Vorhies and Morgan 2003). A number of interesting implications can be derived from the results of each logistics strategy type.

Semi Extended Strategy

In the analysis of the semi extended strategy type, we find that the quality-based profile deviation predictor had a beta = -.26 (t-value = 4.35). The profile-deviator predictor – together with the control variables of attitude toward Internet ordering, online access ability, and sacrifice – explained 32% of the variance in performance (customers' behavioral intentions) (See Table 4). In examining the ideal quality profile in Table 5, we find that service quality and eBusiness quality appear to be the most critical quality elements in achieving superior performance, with product quality lower on the importance scale for customers. Thus, in the logistics strategy role signified by indirect delivery of products and a store-based order fulfillment method, the *functional* component of the NSSM theory (e.g., Grönroos 1984) appears to be the most critical for performance implications. As such, the functional quality of the process is more important to customers than what customers receive in their interactions with the firm (i.e., the *technical* dimension of the NSSM). Best Buy, Circuit City, Lowes Foods, REI, Sears Canada, Rite-Aid, and Walgreens are examples of firms using the semi extended logistics strategy to achieve superior performance.

Fully Extended Strategy

In the analysis of the fully extended strategy type, we find that the quality-based profile deviation predictor had a beta = -.41 (t-value = 11.85). The profile-deviator predictor – together with the control variables of attitude toward Internet ordering, online access ability, and sacrifice

– explained 41% of the variance in performance (customers' behavioral intentions) (See Table 4). In examining the ideal quality profile in Table 5, we find that service quality is the most critical element of the ideal profile, followed by eBusiness quality and product quality. Thus, in the logistics strategy role signified by direct delivery of products and a store-based order fulfillment method, service quality, as a dimension of the *functional* component of the NSSM theory (e.g., Grönroos 1984) appears to be the most critical for performance implications. As such, the functional quality of the process (in particular service quality) is more important to customers than the products they receive from the firm (i.e., the *technical* dimension of the NSSM). However, moving from being an average performer on product quality to a top performer is more difficult than achieving high levels of service- and eBusiness quality (see Table 5). Tesco, Grainger, Sainsbury, Albertsons, and America Fresh are examples of firms using the fully extended logistics strategy to achieve superior performance.

De-Coupled Strategy

In the analysis of the de-coupled strategy type, we find that the quality-based profile deviation predictor had a beta = -.43 (t-value = 9.22). The profile-deviator predictor – together with the control variables of attitude toward Internet ordering, online access ability, and sacrifice – explained 37% of the variance in performance (customers' behavioral intentions) (See Table 4). In examining the ideal quality profile in Table 5, we find that eBusiness quality is the most critical element of the ideal profile, followed by service quality and product quality. Thus, in the logistics strategy role signified by indirect delivery of products and a distribution center-based order fulfillment method, eBusiness quality, as a dimension of the *functional* component of the NSSM theory (e.g., Grönroos 1984) appears to be the most critical for performance implications. As such, the functional quality of the process (in particular eBusiness quality) is more important

to customers than what they "take home" in the form of products (i.e., the *technical* dimension of the NSSM). Amazon, Dell, FreshDirect, NeFlix, Lands' End L.L. Bean, Drugstore.com, Caremark, and Omaha Steaks are examples of firms using the de-coupled logistics strategy to achieve superior performance.

Centralized Extended Strategy

In the analysis of the centralized extended strategy type, we find that the quality-based profile deviation predictor had a beta = -.41 (t-value = 10.47). The profile-deviator predictor – together with the control variables of attitude toward Internet ordering, online access ability, and sacrifice – explained 37% of the variance in performance (customers' behavioral intentions) (See Table 4). In examining the ideal quality profile in Table 5, we find that service quality is the most critical element of the ideal profile, followed by eBusiness quality and product quality. Thus, in the logistics strategy role signified by direct delivery of products and a distribution center-based order fulfillment method, service quality (i.e., the *functional* component of NSSM theory) appears to be the most critical for performance implications. As such, the functional quality of the process (in particular service quality) is more important to customers than the actual products (i.e., the *technical* dimension of the NSSM). However, moving from being an average performer on product quality to a top performer appears to be a very significant task compared with making the same moves with respect to service- and eBusiness quality (see Table 5). Interestingly, in our study, firms opting for a centralized extended strategy approach have to achieve almost perfect service quality results (mean = 6.96, as perceived by its customers) (see Table 5) as well as a rather high level of eBusiness quality. Thus, the centralized extended strategy, which represents the newest form of grocery delivery, is signified by perhaps the toughest logistics operations to achieve of the four strategy types. Office Depot, Ocado,

Grocery Gateway, PublixDirect, OfficeMax, and RoomstoGo are examples of firms using the centralized extended logistics strategy to achieve superior performance.

CONCLUSION

While the roles of service- and product-quality in traditional bricks-and-mortar firms have been researched extensively for at least the last two decades, identifying the important quality constructs and their roles relative to chosen logistics strategies of eBusiness-based firms has received scant research attention. This study offers an important step toward closing the gap between what we know about the "last mile" of supply chains and what we need to know regarding customers' quality perceptions. Our model drew on three theoretical traditions (i.e., strategic choice theory, configuration theory, and the Nordic School of Services Management) to guide our identification of high performing supply chains implementing a given logistics strategy in the eBusiness marketplace. These high performers were used to calibrate all other cases relative to these ideal profiles. Three quality characteristics were identified as critical in the formation of a multiple, interdependent, and mutually reinforcing quality profile. These are: service quality, product quality, and eBusiness quality. Looking to the future, recent trends suggest that firms will increasingly look to integrate logistics operations with marketing and supply chain activities as a tool to increase effectiveness. If so, our results suggest that quality initiatives will play a key role in the relative success of eBusiness firms.

TABLE 1
Overview of Logistics Strategies for Extending the Supply Chain

	Advantages	Disadvantages	Examples
Semi Extended Strategy	• Low fixed investment cost • Increased foot traffic in stores • Opportunities for impulse buys • Dual channel marketing • Low delivery cost	• High picking costs • Inventory tracking is difficult • High risk of stock-outs • High risk of substitutions • Low customer convenience	• Best Buy • Circuit City • Lowes Foods • REI • Sears Canada • Rite-Aid • Walgreens
Fully Extended Strategy	• Low fixed investment cost • Halo effect • Dual channel marketing • High customer convenience	• High picking costs • Inventory tracking is difficult • High risk of stock-outs • High risk of substitutions • High delivery cost	• Tesco • Grainger • Sainsbury • Albertsons • America Fresh
De-Coupled Strategy	• Aggregated Inventory • Low picking costs • Specialized fulfillment • Dedicated fulfillment • Fresher product • Faster inventory turns • Ability to manufacture to order • Ability to assemble to order • Low risk of stock-outs • Low risk of substitutions • Low delivery cost	• Low customer visibility • Low brand awareness • High fixed investment cost • Long lead time	• Amazon • Dell • FreshDirect • NetFlix • Lands' End • LL Bean • Drugstore.com • Caremark • Omaha Steaks
Centralized Extended Strategy	• Aggregated Inventory • Low picking costs • Specialized fulfillment • Dedicated fulfillment • Fresher product • Faster inventory turns • Ability to manufacture to order • Ability to assemble to order • Low risk of stock-outs • Low risk of substitutions	• High delivery cost • Low customer visibility • Low brand awareness • High fixed investment cost • Long lead time	• Office Depot • Ocado • Grocery Gateway • PublixDirect • OfficeMax • RoomstoGo

TABLE 2
Correlations and Shared Variances (n=2,440)

	SQ	PQ	IQ	ATT	OAA	SAC	BI
SQ	–	.24	.10	.02	.08	.08	.18
PQ	.49	–	.16	.04	.10	.20	.28
EQ	.32	.40	–	.07	.35	.27	.14
ATT	.14	.21	.26	–	.05	.10	.07
OAA	.28	.32	.59	.23	–	.16	.08
SAC	.29	.45	.52	.31	.40	–	.28
BI	.43	.53	.37	.26	.29	.53	–

Notes: All correlations are significant at the $p<.01$ level.
Correlations are included below the diagonal.
Shared variances are included above the diagonal.

Labels: SQ = service quality
PQ = product quality
EQ = eBusiness quality
ATT = attitude toward Internet ordering
OAA = online access ability
SAC = sacrifice
BI = behavioral intentions

TABLE 3
Basic Statistics and Confirmatory Factor Analysis Results (n=2,440)

Variable	Mean	Standard Deviation	Variance Extracted	Composite Reliability	Coefficient Alpha	Factor Loadings
SQ	5.22	1.25	60.0%	.94	.94	.57 to .85
PQ	3.65	1.28	50.8%	.79	.80	.41 to .88
EQ	4.77	1.38	68.0%	.93	.92	.68 to .93
ATT	4.93	1.20	70.7%	.88	.88	.77 to .90
OAA	5.27	1.02	60.0%	.75	.68	.75 to .80
SAC	4.58	1.52	60.0%	.80	.77	.41 to .92
BI	5.51	1.04	43.7%	.69	.70	.50 to .78

Fit Statistics

χ^2	6,452.17
Degrees of Freedom	413
DELTA2	.95
RNI	.95
CFI	.95
TLI	.95
RMSEA	.08

TABLE 4
Quality Profile Fit with Logistics Strategies and Performance: Standardized Regression Results

Predictor Variables	Criterion Variable: Performance			
	Beta	**t-value**	**Significance**	**Variance Inflation Factor**
Semi Extended Strategy (n=394)				
Quality Profile Deviation[1]	-.26	4.35	<.01	1.80
Attitude Toward Internet Ordering	.07	1.39	.17	1.14
Online Access Ability	-.02	.42	.68	1.39
Sacrifice	.37	6.69	<.01	1.49
R^2 = .32				
F-value = 40.60, p<.01				
Fully Extended Strategy (n=896)				
Quality Profile Deviation[1]	-.41	11.85	<.01	1.63
Attitude Toward Internet Ordering	.05	1.62	.11	1.09
Online Access Ability	.02	.55	.59	1.47
Sacrifice	.29	8.39	<.01	1.59
R^2 = .41				
F-value = 140.28, p<.01				
De-Coupled Strategy (n=461)				
Quality Profile Deviation[1]	-.43	9.22	<.01	1.35
Attitude Toward Internet Ordering	.03	.71	.48	1.09
Online Access Ability	.02	.53	.59	1.27
Sacrifice	.26	5.59	<.01	1.34
R^2 = .37				
F-value = 58.04, p<.01				
Centralized Strategy (n=689)				
Quality Profile Deviation[1]	-.41	10.47	<.01	1.51
Attitude Toward Internet Ordering	.09	2.60	.01	1.18
Online Access Ability	-.06	1.67	.10	1.32
Sacrifice	.27	6.89	<.01	1.48
R^2 = .37				
F-value = 90.24, p<.01				

TABLE 5
Mean Scores of Ideal and Average Quality Profile Variables

Quality Characteristics	Ideal Profile Scores		Average Profile Scores		Difference in Mean Scores for Ideal and Average Performers	
	Mean	Std. Dev.	Mean	Std. Dev.	Δ Mean	Significance
Semi Extended Strategy						
Service Quality	6.77	.54	6.25	.82	0.52	p<.01
Product Quality	6.53	.56	5.74	1.01	0.79	p<.01
eBusiness Quality	6.73	.48	5.92	1.07	0.81	p<.01
Fully Extended Strategy						
Service Quality	6.82	.30	6.01	.95	0.81	p<.01
Product Quality	6.41	.78	5.23	1.14	1.18	p<.01
eBusiness Quality	6.60	.69	5.82	1.14	0.78	p<.01
De-Coupled Strategy						
Service Quality	6.57	.62	5.77	1.04	0.80	p<.01
Product Quality	6.22	.64	5.30	.94	0.92	p<.01
eBusiness Quality	6.69	.68	6.34	.76	0.35	p<.05
Centralized Extended Strategy						
Service Quality	6.96	.07	6.15	.76	0.81	p<.01
Product Quality	6.55	.46	5.05	.94	1.50	p<.01
eBusiness Quality	6.79	.51	5.95	.94	0.84	p<.01

FIGURE 1
Logistics Strategies for Extending the Supply Chain

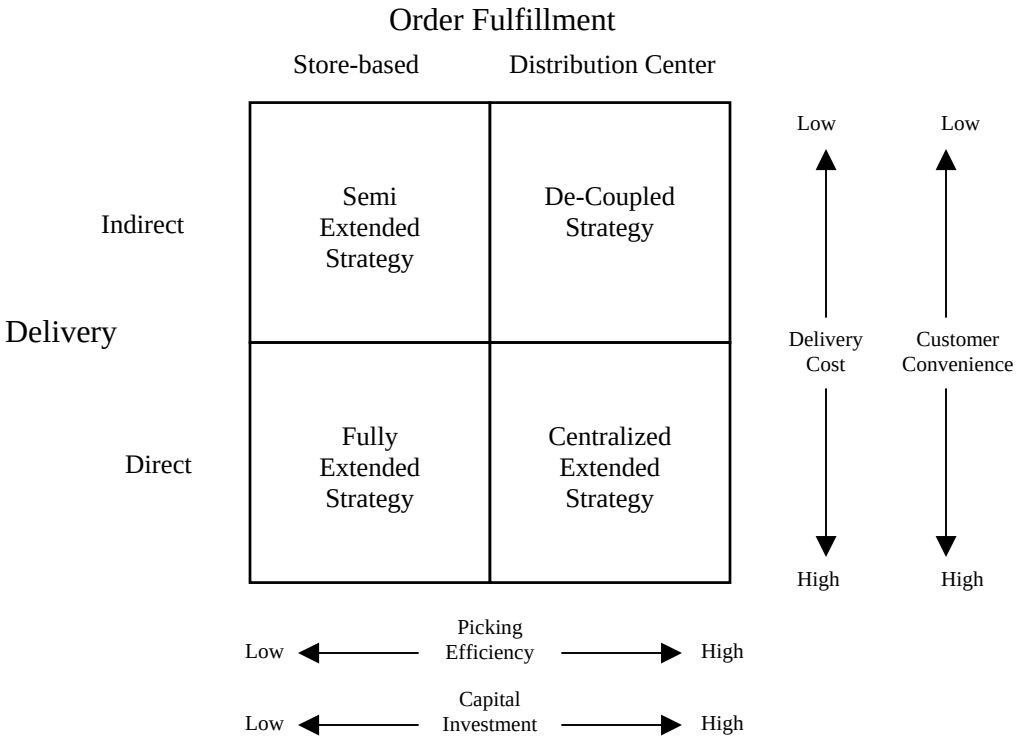
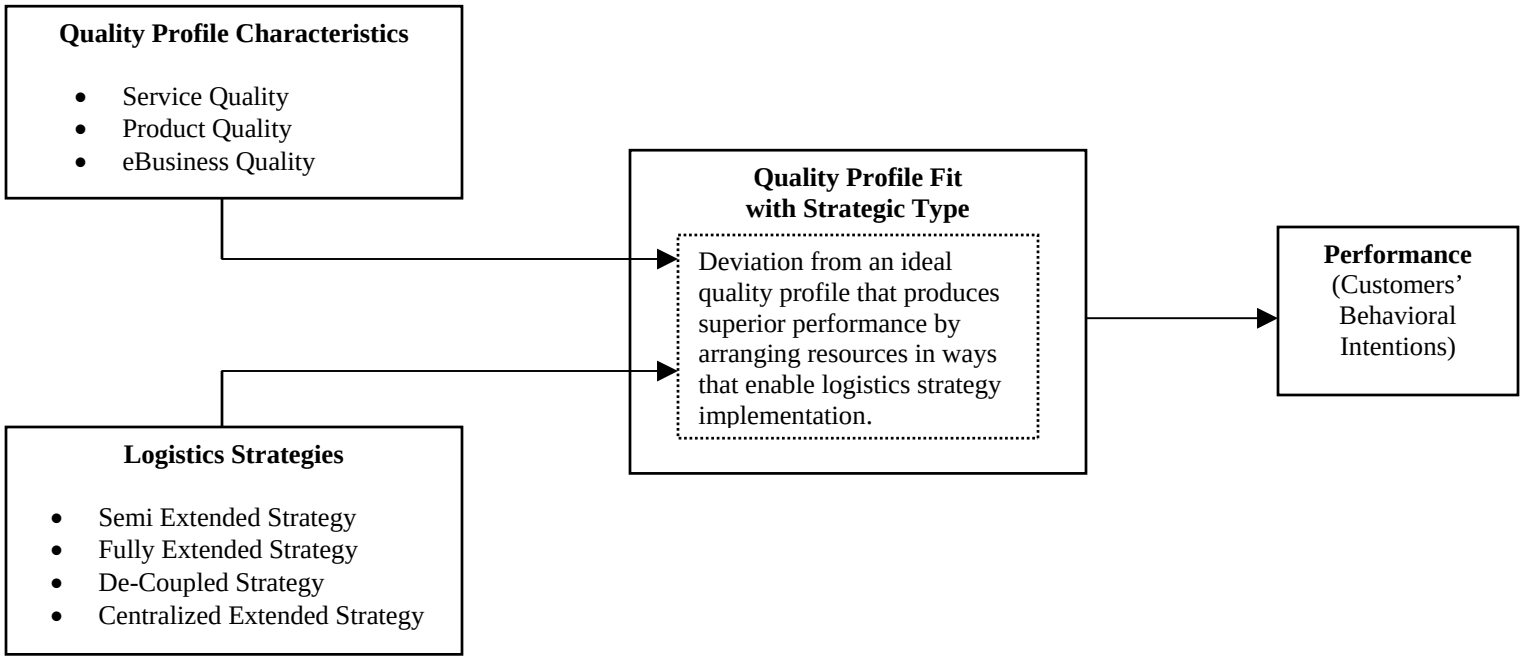


FIGURE 2
Quality Fit with Logistics Strategies and Its Relationship with Performance



APPENDIX
Measures and Sources[1]

Service Quality (SQ) (Adapted from Gotlieb et al. 1994; Parasuraman et al. 1985)

SQ1	XYZ Company's employees are reliable in providing the service I expect.
SQ2	XYZ Company's employees are understanding of my service needs.
SQ3	XYZ Company's employees are responsive to my service requests.
SQ4	XYZ Company's employees are competent in providing expected service.
SQ5	I feel secure in my service encounters with XYZ Company's employees.
SQ6	XYZ Company's employees are courteous in providing me service.
SQ7	XYZ Company's employees are accessible to answer my questions.
SQ8	The tangible aspects of XYZ Company's service (appearance of delivery vans, staff, products, etc.) are excellent.
SQ9	XYZ Company has good credibility in providing the service I need.
SQ10	I can easy communicate with XYZ Company regarding my service needs.

Product Quality (PQ) (Adapted from Brucks, Zeithaml, and Naylor 2000; Carsky et al. 1998; Garvin 1987)

PQ1	XYZ Company has prestigious (high quality) products.
PQ2	XYZ Company has an excellent assortment of products.
PQ3	XYZ Company's products are among the best.
PQ4	XYZ Company has a sufficient range of product choices (I can get what I want).[3]
PQ5	The products are the same quality as I can get in the store.[3]
PQ6	The number of substitutions or out of stock items is reasonable.

eBusiness Quality (EQ) (Adapted from Agarwal and Prasad 1999; Boyer and Olson 2002)

EQ1	It is easy for me to remember how to perform tasks using XYZ Company's website.[3]
EQ2	It is easy to get XYZ Company's website to do what I want it to do.
EQ3	My interaction with XYZ Company's website is clear and understandable.
EQ4	Overall, I believe that XYZ Company's website is easy to use.
EQ5	The site is easy to navigate.
EQ6	The site has a logical sequence of steps for completing an order.
EQ7	The XYZ Company's web site is easy to search.

Attitude Toward Internet Ordering (ATT) (Adapted from Agarwal and Prasad 1999)

ATT1	I like using Internet ordering.
ATT2	Internet ordering is fun to use.
ATT3	Internet ordering provides an attractive ordering method.

Online Access Ability (OAA) (Adapted from Boyer and Olson 2002)

OAA1	I can get on the site when I want to.
OAA2	The site loads quickly (I don't have to wait long for new material).

Sacrifice (SAC) (Adapted from Dodds et al. 1991; Heskett et al. 1990; Zeithaml 1988)

SAC1	XYZ Company's prices are low on the products that they offer.
SAC2	The time needed to make a purchase from XYZ Company is low.
SAC3	The effort required to make a purchase from XYZ Company is low.

Customers' Behavioral Intentions (BI) (Adapted from Cronin et al. 2000; Zeithaml et al. 1996)

BI1	I would classify myself as a loyal customer of XYZ Company.
BI2	I do not expect to switch to another online grocer to get better service in the future.
BI3	I would continue to shop with XYZ Company even if I had to pay more.
BI4	I would complain to other customers if I experienced a problem with XYZ Company's service.[2]
BI5	I would complain to XYZ Company's employees if I experienced a problem with their service.[2]

Notes: [1]All items used a 7-point Likert-type scale ranging from "strongly disagree" to "strongly agree."
[2]Item deleted after the exploratory factor analysis.
[3]Item deleted after the item-level analysis across the four strategy groups.

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