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Why do Internet commerce firms incorporate logistics service providers in their distribution channels? The role of transaction costs and network strength

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Abstract

The Internet has redefined information-sharing boundaries in distribution channels and opened new avenues for managing logistics services. In the process, firms have started to incorporate new service providers in their commercial interactions with customers over the Internet. This paper studies conceptually and empirically why Internet commerce firms (ICFs) have established relationships with these providers. Focusing on logistics services in outbound distribution channels, we rely on transaction cost theory to reveal that low levels of asset specificity and uncertainty drive Internet commerce firms to establish these relationships. Moreover, we apply strategic network theory to show that Internet commerce firms seek these providers because they offer access to relationship networks that bundle many complementary logistics services. In addition, logistics service providers make these services available across new and existing relationships between the Internet commerce firms, their customers, and their vendors.

Keywords: Electronic commerce; Service operations; Logistics; Transaction costs; Strategic networks; Operations strategy; Empirical study

1. Introduction

The growth of electronic commerce has driven Internet commerce firms (ICFs) – retailers and other organizations that market products over the Web – to increasingly share market demand data with other firms so as to enrich the order fulfillment services they offer to customers (Frohlich and Westbrook, 2002). Along these efforts, ICFs have started seeking logistics service providers to tap into resources and skills that could improve their fulfillment capabilities (Dutta and Segev, 1999).

These logistics service providers are not simply variants of transportation companies, and as such, they are not to be confused with what are known nowadays as third party logistics (3PL) firms. They offer logistics services, of course, but they could also enable ICFs to leverage other distribution parties' logistical resources and skills in order to fulfill their customer orders more effectively. They may use their assets to take care of product returns, for instance, or work with established carriers on "last-mile" deliveries. Or their value may be primarily in managing order information shared among distribution parties—e.g., centralizing inventory data, especially when products are being shipped directly from upstream echelons in the distribution channel. Logistics service providers such as Parcel Direct, for instance, participate in this kind of activity to ultimately

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assist ICFs in consolidating orders for drop-shipping to their customers.

Past research has identified the relationships with these logistics service providers in offline settings and has positioned them within logistics triads (Larson and Gammelgaard, 2001) and extended-enterprise logistics systems (Stock et al., 2000). Yet, what is groundbreaking about these relationships for an ICF is that they are driven by their potential to (1) generate low transaction costs, (2) bundle complementary logistics services, and (3) expand the availability of those services across customers, vendors, and "last-mile" delivery companies, such as UPS (Amit and Zott, 2001).

The goal of this study is to conceptualize and empirically assess how these drivers shape ICF management's decisions to develop mechanisms to form and manage *dyadic* exchanges between their firms and *focal* organizations offering logistics services in outbound distribution channels. Prior literature has used the term "*governance*" to define these mechanisms (Barney, 1999, p. 138) and has delineated governance decisions through which a firm can infuse order in exchanges with a focal provider where potential conflicts threaten to undo or upset opportunities to realize economic gains (Williamson, 1999, p. 1090). These decisions center on the extent to which firms rely on a particular governance mode for a service. Since our research context focuses on outbound distribution channels, we define such *reliance* as the proportion of Internet orders for which a governance mode is used for a service supporting the fulfillment of those orders. This definition is consistent with that used by John and Weitz (1988) for distribution in an offline setting.

Our conceptualization and empirical assessment are unique because they recognize that governance in an exchange between an ICF and a focal logistics service provider is embedded within a networked structure that also comprises a broader collection of relational links among other distribution-channel members (Chen and Paulraj, 2004; Jones et al., 1997). In this context, our research is primarily concerned with ICFs' reliance on *networked governance structures*. These structures have been defined as economic forms of organization that are built on reciprocal exchange patterns, enabling firms (in this case, ICFs) to obtain resources and services through dyadic relationships with other organizations (i.e., focal logistics service providers), as well as through broader relational links where these relationships exist (Powell, 1990; Gulati, 1998).

To fulfill the goal of this study, Section 2 positions our research in the strategic- and operations-management literatures. Also, it develops the theoretical foundation and hypotheses that articulate a decision-making framework for ICF reliance on networked governance structures for logistics services. Section 3 discusses methodological issues pertaining to the data collection and the operationalization of the constructs developed as part of the theoretical framework presented in Section 2. We analyze the empirical results in Section 4. Finally, we conclude in Section 5 with a presentation of findings, academic and practical contributions, and future research opportunities stemming from our study.

2. Theoretical framework

Because networked governance structures are based on linkages among interdependent firms (Powell, 1990), they constitute an alternate form of exchange (Spulber, 1996) that expands two traditional forms: perfectly competitive markets and vertically integrated hierarchies (Williamson, 1975). Theoretically, decisions to adopt such exchanges rest on costs potentially incurred by ICFs when they establish market-based linkages with focal providers to manage – i.e., plan, organize, operate, and control – logistics services (Madhok, 2002). However, these decisions are also linked to scale, skills, and resources that ICFs may obtain in broader networks of services and entities accessible through their relationships with focal providers (Doz and Hamel, 1998; Gulati, 1998).

Consequently, our assessment of these decisions integrates two distinct theoretical perspectives: *transaction cost theory* and *strategic network theory*. Transaction cost theory helps us understand how efforts and risks in establishing links with focal logistics service providers are related to expenditures that impact ICFs' reliance on these specialists. Through strategic network theory, and in accordance with its definition, we can establish how the access offered by focal logistics service providers to networked governance structures shapes ICFs' relationships with the providers (Granovetter, 1973).

This integration adds to extant literature that has independently relied on transaction cost and strategic network theories to conceptualize similar phenomena at a strategic level (e.g., Eccles, 1981; Katz and Shapiro, 1985; Granovetter, 1992; Jones et al., 1997). The integration builds on work by Amit and Zott (2001), who used exploratory case studies to apply these theories to an Internet setting and concluded that neither of these theories can fully explain by itself value creation across different governance structures present in Internet business models. Therefore, Amit and Zott (2001) posit that transaction cost and strategic network

theories complement each other in explaining the emergence of governance structures in Internet settings.

Individually, transaction cost theory focuses on an exchange between two parties (e.g., an ICF and a focal logistics service provider) as a discrete event that is valuable by itself, as it reflects the choice of the most efficient governance form and hence contributes to lower the exchange costs incurred by one of the parties, i.e., the ICF. Strategic network theory complements transaction cost theory because it considers the individual dyadic exchange collectively with other relational links that may accompany that exchange (Amit and Zott, 2001). This does not mean, however, that strategic network theory would become the dominant research view, thus rendering transaction cost theory irrelevant. By articulating a framework necessary to define the choice regarding the most efficient governance form in the exchange between an ICF and its focal provider, transaction cost theory would actually pave the way for strategic network theory to define whether resources and services available through other links surrounding the ICF–provider exchange would confirm or modify that choice (Amit and Zott, 2001).

Within operations management, our assessment of these theories answers calls by researchers to offer a better understanding of (1) decision-making mechanisms behind the development of relationships between firms (Mabert and Venkataramanan, 1998) and (2) managerial decisions concerning logistics operations in inter-firm relationships (Grover and Malhotra, 2003). As a result, our research contributes to the operations-management literature because it offers a more detailed understanding as to why firms, in this case ICFs, utilize alternative structures to incorporate solution specialists, in general, and logistics service providers, in particular, into their distribution channels.

Moreover, in studying decisions about the management of inter-firm exchanges, our research conceptualization follows that introduced by Choi et al. (2001) and Choi and Hong (2002), who advocated that operational decisions around inter-organizational exchanges be positioned within larger networks of firms. However, by focusing on logistics services necessary to carry out the fulfillment of customer orders, we extend those conceptualizations from a manufacturing context to a service setting. This allows us to study not only cost considerations, but also value-adding parameters in decisions to incorporate networked governance structures to connect with other distribution-channel members.

Our assessment of decisions by ICF management to form networked governance structures also contributes to literature in service operations management. With the advent of Internet commerce, experts predicted that greater opportunities for information interaction between ICFs and other distribution-channel members would lead to greater efficiency in the performance of distribution-channel services (Benjamin and Wigand, 1995). In theory, this efficiency would inevitably compel ICFs to lower their prices to compete with other organizations. Otherwise, ICFs would likely succumb to price-aggressive competitors who would be able to offer these same services to customers at relatively lower costs (Giaglis et al., 2002).

In fact, Dell Computers and other ICFs have succeeded at increasing the efficiency of their distribution channels by offering wide product variety at low prices. However, evidence suggests that other ICFs have chosen not to rely exclusively on low prices to compete and instead have obtained price premiums by offering services with the support of providers in areas such as logistics (Maltz et al., 2004). After all, through logistics services, providers can add value to Internet transactions by allowing customers to obtain exact product specifications that match their needs (Boyer et al., 2002). Moreover, Internet customer satisfaction (Thirumalai and Sinha, 2005), loyalty (Heim and Sinha, 2001), and, thus, willingness to ultimately pay price premiums (Rabinovich and Bailey, 2004) are likely to be related to the availability of those services.

This phenomenon may explain why logistics service providers have become important in many Internet markets (Giaglis et al., 2002): the efficiency gains that ICFs have obtained in their distribution channels, appear to be accompanied by value-adding services that logistics providers can offer to customers (Burton and Mooney, 1998; Adelaar, 2000; Van der Heijden, 1996). Consider the case of Swiss Colony, an ICF of specialty-food items serving U.S. customers, half of which require time-definite order delivery during the end-of-the-year holidays. To reach its market, Swiss Colony has relied in the past on logistics service providers, such as R.R. Donnelley. These logistics providers operate networks of consolidation facilities throughout the U.S., thus allowing the ICF to quickly compile its holiday orders and place them at bulk distribution centers. These centers are operated by the U.S. Postal Service and allow for timely and economical distribution to customer destinations. While incorporating R.R. Donnelley and other logistics service providers into its distribution channel has added a layer of complexity to its exchanges with customers, Swiss Colony has obtained a high level of fulfillment quality in the operations that the U.S. Postal Service performs on its behalf (Voyles, 2003).

Nevertheless, despite the advantages they could obtain from incorporating networked governance structures similar to those put in place by Swiss Colony, not all ICFs are equally positioned to access these structures and tap into their benefits. Unfortunately, the service operations management literature has not yet examined this issue. Addressing this literature gap requires us to focus on transaction-cost and strategic-network theories in order to isolate drivers shaping ICFs' reliance on networked governance structures for logistics services.

2.1. Transaction cost theory and ICFs' reliance on networked governance structures for logistics services

Coase's (1937) research on transaction cost theory has been traditionally used to identify boundaries separating firms engaged in the execution of logistics services (e.g., Maltz, 1993). In extending this research to examine the formation of linkages between ICFs and focal providers within networked structures, we rely on research by Powell (1990) to chart boundaries defined by transaction costs. These costs depend on coordination efforts in the exchange between the parties involved in the logistics services. Moreover, these costs depend on the minimization of risks resulting from the unforeseen evasion of agreed upon terms and responsibilities by one of these parties.

To model these costs, we build on Williamson's (1975) work on transaction cost analysis. In so doing, we consider the design of mechanisms to manage exchanges in distribution channels as a function of two unique attributes that determine cost efficiency: asset specificity and uncertainty.

2.1.1. Asset specificity and uncertainty in the context of ICFs' logistics services

Asset specificity refers to the transferability of investments that support a given transaction between a firm and the provider of a good or service and to the accessibility to alternative providers with the knowledge and resources needed to make a particular good or service available (Williamson, 1985). Asset specificity arises when either the firm or the provider makes an investment which is useless outside the relationship (Maltz, 1994). Furthermore, asset specificity surfaces when there is a limited usefulness for knowledge and resources beyond a particular transaction or exchange between a firm and a provider (Grover and Malhotra, 2003).

For logistics services in distribution channels, asset specificity can be further defined at the firm (e.g., the ICF) level, as well as at the transaction and product levels, in terms of the goods exchanged between ICFs and their customers (Heide and John, 1988; John and Weitz, 1988). An ICF, for instance, may compete exclusively through specialized resources and knowledge for their logistics services (ICF-level asset specificity). Consider the case of Netflix.com, a firm selling online subscription-based DVD rental services. In order to offer its customers the best service in the industry, Netflix.com has achieved a 24-h cycle time in the fulfillment of most of its DVD orders, while ensuring that virtually all of its customers are able to rent their top choice among an array of 40,000 DVD titles available at its Internet site. Its service-customization strategy has enabled Netflix.com to successfully compete against price leaders such as WalMart.com (Hof, 2005). However, to implement this strategy, executives at Netflix.com have had to assemble a specialized infrastructure and develop skilled human resources across more than 20 distribution centers strategically located to store and quickly deliver the DVDs at the lowest cost possible (Internet Retailer, 2004; Niederhoff et al., 2004).

Alternatively, an ICF may carry out some transactions where logistics service is supported by resources and knowledge with specific value to customers that happen to be involved in the transaction (transaction-level asset specificity). This case is illustrated by the emphasis that managers at online grocers, such as FreshDirect.com, place on specialized distribution resources and labor to customize their delivery routes in order to meet overlapping delivery time windows requested by customers who happen to reside relatively close to each other (Boyer et al., 2005).

An ICF may also offer products that have intrinsic value to customers or this value may be dependent on consumption time or location (product-level asset specificity). Floral products provide an interesting illustration of this case. Their perishable nature, combined with marked demand seasonality, create time constraints on their physical distribution. These constraints require that ICFs, such as 1-800-Flowers.com, develop specialized resources to hold and distribute these products for prompt delivery to their shoppers. Moreover, the development of these resources would allow 1-800-Flowers.com to redeploy their assets and perform other inbound logistics activities more effectively.

Uncertainty, in turn, results from unexpected variations in circumstances surrounding the exchange between an ICF and a logistics service provider (Williamson, 1975; Grover and Malhotra, 2003). This may include a lack of knowledge about the demand for

products marketed by the ICF and for the logistics service that supports the marketing of those products.

It may also include a lack of knowledge regarding the conduct and capabilities underlying the performance displayed by the focal logistics service provider external to the ICF. At PETsMART, for example, these performance uncertainties have defined how the pet-product retailer approaches its work with logistics service providers. PETsMART has chosen not to seek a provider's help with drop-shipping for its online orders because conditions in PETsMART's business operations have made it costly for the ICF to gauge with certainty the performance that the provider would bring to the table.

Drop-shipping at PETsMART centers on voluminous, high-value products, such as dog crates and horse saddles, and involves a few vendors—each with different drop-shipping policies and processes. These conditions have limited the scalability of drop-shipping across products and vendors and have required a lot of intervention and monitoring by PETsMART's management. As a result, it has been difficult for the merchant to confidently predict the level of performance it would obtain from a provider engaged in performing the tasks necessary to source inventory owned and held by PETsMART's vendors and coordinate its direct shipment to online consumers.

Thus, at the most general level, the sources of uncertainty can be effectively grouped into two categories (Williamson, 1975). The first category pertains to a lack of knowledge about the environment. The second category concerns a lack of knowledge about the performance of other transacting actors (Sutcliffe and Zaheer, 1998), such as logistics service providers.

2.1.2. Asset specificity, uncertainty, and ICFs' reliance on networked governance structures for logistics services

Together, asset specificity and uncertainty create transaction costs. When asset specificity in a logistics service increases, concomitant *safeguarding* costs will arise. This is because the ICF will need to protect itself from being held captive by the logistics service provider's inherent tendency to behave opportunistically. Furthermore, when high levels of uncertainty combine with bounded rationality (which is already inherent in ICF management's limitations in receiving, storing, retrieving, and communicating information from logistics service providers), an ICF will face *adaptation* costs: the expenditures incurred in fully specifying in advance and continually adjusting to changes in the conditions surrounding the logistics-service exchange and in the performance of the logistics service provider (Williamson and Ouchi, 1981; Rindfleisch and Heide, 1997; Grover and Malhotra, 2003).

In turn, the existence (or absence) of *safeguarding* and *adaptation* costs will determine whether ICF management will establish a relationship with a focal provider to manage a particular logistics service. ICF management may choose to form such a relationship within a networked structure when the levels of asset specificity and uncertainty are low and there are minimal costs associated with (1) *safeguarding* each transaction's asset and (2) *adapting* to unforeseen circumstances (Williamson and Ouchi, 1981; Rindfleisch and Heide, 1997). Conversely, when asset specificity and uncertainty levels are high, ICF management would avoid relying on a focal provider and instead be more inclined to manage the service internally. These arguments lead to our first set of hypotheses.

Hypothesis 1a, (b), [c]. A decrease in a logistics service's asset specificity at the *ICF level* (*transaction level*) [*product level*] will cause ICF management to increasingly rely on a focal logistics service provider for this service.

Hypothesis 2a, (b). A decrease in uncertainty about a logistics service's *environment* (*provider performance*) will cause ICF management to increasingly rely on a focal logistics service provider for this service.

2.1.3. Asset specificity and uncertainty as predictors of strength in networked governance structures

Decisions to establish relationships between an ICF and a focal logistics service provider are embedded in broader networked structures that also comprise the ICF's customers, vendors, and "last-mile" delivery companies, such as UPS. This argument resonates with Kogut's (2000) and Gulati et al.'s (2000) principles on the entrenchment of inter-firm relationships in wider networks of specialized constituents. Because the establishment of relationships between ICFs and providers has a bearing on whether ICFs can reach their customers, vendors, and "last-mile" delivery companies, the levels of asset specificity and uncertainty that determine the formation of these relationships will also influence the strength of the networked structures in which these relationships are governed.

We draw from Katz and Shapiro (1985) and Besen and Farrell (1994) to define strength of networked structures. Accordingly, we operationalize this construct in terms of the current size of the network that the logistics service provider makes available to the ICF in order to access an

array of service users, as well as the expectation of future network size accessible to the ICF through the breadth and quality of options available to complement compatible services for the ICF. To illustrate the concept of network strength in the context of our study, consider the case of Ensenda, a logistics service provider that caters to ICFs' ''last-mile'' fulfillment needs. Through its services, Ensenda brings together local delivery companies across the U.S. and Canada into one network and makes this network available to ICFs seeking an economical and broad geographical scope in the fulfillment and merchandise-return services they can offer to their customers. In doing so, Ensenda offers ICFs the opportunity to broaden their reach into new market areas. It may also expand ICFs' connections to new suppliers interested in establishing drop-shipping agreements. Furthermore, it gives individual ICFs direct access to complementary delivery and reverse-logistics services performed by each of 300 motor-carrier-based delivery companies within Ensenda's network (Mottley, 2004).

Binding an ICF with its vendors, delivery companies, and customers will become more compelling when asset specificity decreases in the logistics-service exchange between the ICF and the provider (e.g., Ensenda) that facilitates the development of these networked relationships (Jones et al., 1997). The implication is that the development of a stronger networked structure to reach other constituents in the distribution channel would become more viable as asset specificity decreases (Erramilli and Rao, 1993). This is because a reduction in asset specificity would mitigate the threat of opportunism by the focal logistics service provider and, consequently, lower the safeguarding costs incurred by the ICF in reaching these constituents (Amit and Zott, 2001).

Moreover, a reduction in uncertainty in a service exchange with a provider will allow ICF management to increase its confidence that other firms (e.g., vendors or delivery companies) involved directly or indirectly in that service will not exploit its bounded rationality (Barney and Hansen, 1994). Thus, with a lower uncertainty, ICF management will be better positioned to broaden its use of vendors' and delivery companies' services and capabilities. For one, there will be no need to spend the resources necessary to add relational elements to respond to unforeseen circumstances. These circumstances could surface in the ICF's relationship with the provider and could also permeate the ICF's relationships with its vendors and delivery companies (Wathne and Heide, 2004). Second, a reduction in uncertainty will enable ICF management to strengthen its end-market orientation due to a greater ability to monitor and assess the costs necessary to serve its customers (Gulati et al., 2000). The arguments presented above lead to our second set of hypotheses:

Hypothesis 3a, (b), [c]. A decrease in a logistics service's asset specificity at the *ICF level* (*transaction level*) [*product level*] will strengthen the networked governance structure available to an ICF through a focal logistics service provider.

Hypothesis 4a, (b). A decrease in uncertainty about a logistics service's *environment* (*provider performance*) will strengthen the networked governance structure available to an ICF through a focal logistics service provider.

2.2. Network strength and ICFs' reliance on networked governance structures for logistics services

An examination of networked governance structures reveals that their strength, as defined in Section 2.1.3, is a function of the degree to which they offer *externalities* (i.e., access to users) to ICFs, once ICFs tap into the logistics services available through the networked structures. It also depends on the amount and quality of options that ICFs have available to complement the logistics services obtained from focal providers through the network. As access to a greater variety of quality, compatible services increases, the level of network *complementariness* goes up (Katz and Shapiro, 1985, 1994).

Externalities in the networked structure can increase a logistics service's value and, thus, its likelihood of it being sourced externally by a firm (Amit and Zott, 2001). An ICF will be more likely to engage a logistics service provider that (1) can offer connections to customers, vendors, and delivery companies who generate opinion leadership and word-of-mouth (Hagel and Armstrong, 1997) and (2) can generate gains in scale economies (Shapiro and Varian, 1999).

Because complementariness in the networked structure makes the focal offering by the provider more productive (through scope economies) or complete (as part of a whole solution), it creates a compelling reason for a firm to engage the provider (Frels et al., 2003). For an ICF, the benefits it derives from a logistics service offered by a provider depend on a focal solution, such as shipment consolidation. But, the benefits also depend on the ICF's ability to access complementary elements that may reside peripherally in the provider's network (e.g., direct order delivery).

In particular, complementariness might motivate an ICF to establish relationships with a focal provider because this would allow the ICF to develop low-cost connections to existing and new network constituents offering additional services that are critical for the ICF and its customers (Economides, 1996). To illustrate this concept, consider the case of Eddie Bauer, an apparel retailer that engaged Newgistics (a logistics service provider) to run the order return service for its online customers. The decision to rely on Newgistics was influenced by the provider's ability to embed this service into the distribution networks of UPS and other delivery companies, which could consolidate the returns into economical transportation loads and offer substantial cost savings (Demery, 2003).

The quality of complementary services available within the networked structure also plays a key role in the decision to form relationships with a focal service provider (Frels et al., 2003). For instance, ICF managers are more likely to seek logistics services from providers when those offerings allow access to complementary services that can streamline the ICF's access to inventory and can lower its order cycle times (Amit and Zott, 2001). This concept can be illustrated by ICFs' decisions to rely on PFSWeb, a logistics service provider that kits inventory consigned by ICFs' suppliers in its distribution facilities. Through this service, PFSWeb frees ICFs from coordinating with suppliers to consign many combinations of inventory caches at multiple locations to fulfill customer orders. By serving as a nexus between the ICFs and their suppliers, PFSWeb can not only consolidate operations from a channel standpoint, but also from a geographical perspective, thereby eliminating redundant inventory across stocking locations and echelons and lowering the time spent sourcing this stock.

Thus, externalities and complementariness strengthen the networked governance structure available to an ICF through a focal logistics service provider. As summarized in our fifth hypothesis, this strengthening bolsters decisions by ICF management to rely on the provider.

Hypothesis 5. A stronger networked governance structure available to an ICF for a particular logistics service through a focal provider will drive ICF management to rely more on the provider for this service.

3. Methodology

Fig. 1 presents our empirical model. The unit of analysis in this model is in line with that in our theoretical framework: hypothesis testing focused on an ICF and its reliance on a focal provider for the management of a logistics service necessary to fulfill its customer orders. We used a survey approach to obtain the data to test the hypotheses because this methodology has been found to be well suited for obtaining factual and generalizable information about these kinds of business decisions (e.g., Anderson, 1985; Klein, 1989; John and Weitz, 1989; Frels et al., 2003).

3.1. Sampling and data collection

The population platform necessary to administer our survey spanned 4733 ICFs. We obtained the ICFs' names and demographic information from the *Directory of Mail Order Catalogs*. The ICFs were positioned across different distribution-channel echelons and each of them sold over $1 million in merchandise per year. These conditions allowed us to minimize potential bias from survey responses submitted by informants at small Internet retailing startups, who have overwhelmingly sought relationships with logistics service providers (Saloner and Spence, 2002).

To administer our survey to the 4733 ICFs in the *Directory of Mail Order Catalogs*, we relied on the readership of *Operations and Fulfillment Magazine* to obtain position and contact information of individual informants. We were able to obtain contact information for individuals within 1368 of the 4733 firms listed in the *Directory of Mail Order Catalogs*. This register constitutes our sample frame and included no multiple representatives per firm. The register accounts for 38.9% of firms listed in the *Directory of Mail Order Catalogs*.

After performing a pilot test with 204 participants drawn from our sample frame, we contacted via telephone the remaining individuals (1164). The phone contacts followed the same standardized script used for our pilot test and, in line with research by Dillman et al. (1974) and Heberlein and Baumgartner (1978), allowed us to both pre-notify the respondents of the forthcoming survey and filter our sample frame. The filtering process resulted in a total of 827 qualified survey participants, who were still employed at their organizations and had decision-making authority over ICFs' actions to incorporate logistics service providers in their distribution channels.

We mailed a survey instrument to each of these individuals, along with a personalized cover letter explaining our research objectives and promising the complete confidentiality of their responses. The letter also offered access to an online report summarizing our

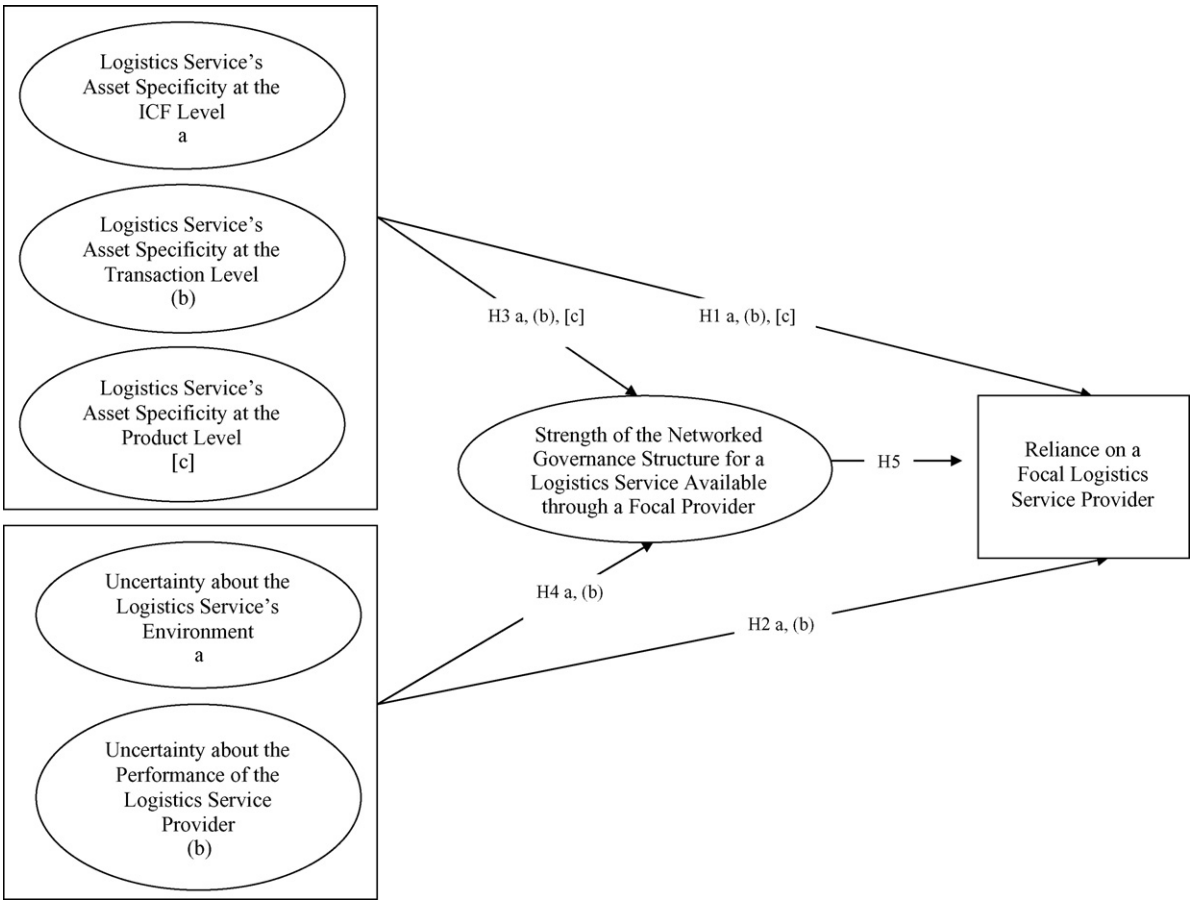

Fig. 1. Research model.

results to all participants. We repeated these procedures a month later. In this second wave of mailings, we targeted only those individuals who did not respond to our first mailing wave.

Respectively, respondents returned a total of 164 and 32 usable questionnaires during the first and the second mailing waves. This translated into a total of 196 responses, a response rate of 23.7% with respect to our filtered sample frame of 827 participants, and a representation rate of 16.8% with respect to the overall sample frame of 1164 individuals. The response rate is consistent with those achieved in our pilot test and in other survey studies in operations and supply chain management research within Internet settings (e.g., Froehle and Roth, 2004; Frohlich and Westbrook, 2002).

We also assessed biases among our survey respondents relative to the rest of the population by comparing the average order size our respondents reported for their firms (over $400 per order) with that reported for the remaining firms in our population frame (almost $240 per order) (Malhotra and Grover, 1998; Biemer, 1991). A t-test value of 0.6 ($p = 0.5$) failed to identify any statistical differences between our respondents and the rest of the population. Comparisons were also made between respondent answers to the first and second mailing waves (Armstrong and Overton, 1977). An independent-sample t-test across all non-demographic questions yielded no significant mean differences at an omnibus 0.05 level.

Most of the 196 responses were from managers (34.2%), directors (30.1%), and vice presidents (23.0%) in such fields as logistics, operations, and supply chain management. Furthermore, responses were received from firms with a wide range of annual gross sales and with a broad dispersion in their numbers of employees (Table 1). A great deal of diversity was also observed among the types of logistics services involved in the relationships between the ICFs in our sample and their focal providers. Fig. 2 catalogs the services found in the relationships that the ICFs in our study had established with their focal providers. Moreover, this figure presents

Table 1
Demographic statistics

Annual gross sales		Number of employees	
$117,359,000 (average) $150,573,000 (S.D.)		6191 (average) 36,311 (S.D.)	
Bracket ($ million)	Participating firms (%)	Bracket (number of employees)	Participating firms (%)
Frequency distribution			
[1, 10]	27.0	[0, 50]	26.2
(10, 50]	25.0	(50, 100]	17.2
(50, 100]	15.3	(100, 500]	28.8
(100, 250]	16.8	(500, 1000]	13.1
(250, 500]	7.7	(1000, 10000]	10.5
(500, ∞)	8.2	(10000, ∞)	4.2
Total number of firms			
196		196	

examples of providers offering these services. Two categories of services in this figure are relevant in characterizing the providers' offerings. The first category corresponds to physical-infrastructure-based services, which are heavily based on transportation and inventory/warehousing assets. The second category corresponds to information-resource services, which offer data management and coordination solutions.

3.2. Measures

To test the hypotheses, we rely on three sets of constructs and measures. In the first set, we use latent measures reflected in multi-item scales capturing the constructs of asset specificity, uncertainty, and the strength of networked governance structures available to the ICFs through their providers. In the other two sets, we use individual measurements to capture the level of ICF reliance on the providers, as well as control variables that are theoretically linked to this reliance. Below and in Appendix A, we discuss these measures and present the survey questions necessary to operationalize them.

3.2.1. Asset specificity, uncertainty, and strength of networked governance structure

The measurement regarding a logistics service's asset specificity captures the ICF, the transaction, and the product levels we defined in Section 2. This measurement uses items that were adapted from Anderson (1985), Heide and John (1988), Klein (1989), and John and Weitz (1989) and were subjected to exploratory factor analysis (EFA) using our pilot test responses. Asset specificity at the ICF level captures how feasible it is for an ICF to rely on an external party to access and share knowledge and resources regarding a particular logistics service. In turn, the measures of

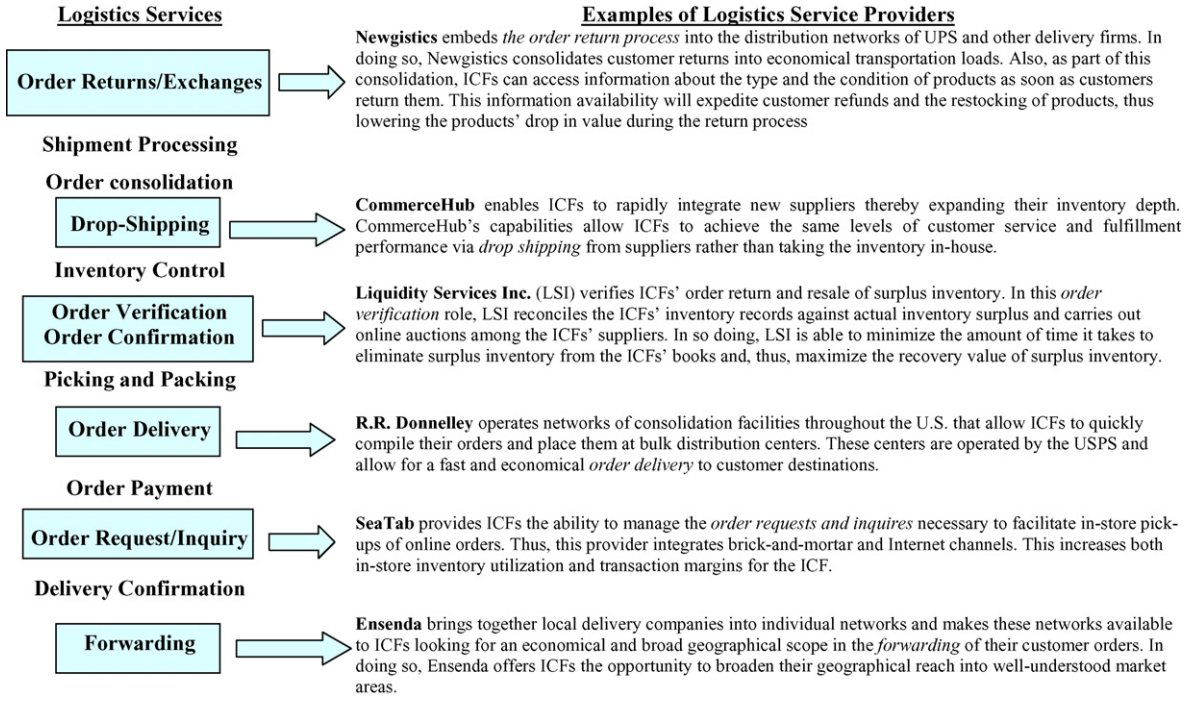

Fig. 2. An overview of logistics services and their providers in relationships with ICFs.

asset specificity at the transaction and at the product levels, respectively, capture perceptions about (1) the relevance of logistics-service resources and knowledge across a wide spectrum of transactions with customers and (2) the extent to which logistics services are specialized on product characteristics with specific value to customers or are specified by product-consumption time by consumers.

The uncertainty measurement follows from Heide and John (1988) and John and Weitz (1988), who considered both the logistics service environment and the provider's performance. To capture the strength of the networked governance structure available to the ICF through the provider, we adapted items from Frels et al. (2003) to measure the extent to which this governance structure would offer externalities and complementariness to the ICF. Like the asset specificity items, the items in uncertainty and strength of networked governance structure resulted from an EFA of our pilot test responses.

3.2.2. ICF reliance on a focal logistics service provider

This construct was operationalized as the percentage of Internet orders for which a logistics service was managed with the support or involvement of a focal provider. We used a continuous measure to capture this construct. This approach is consistent with that adopted by John and Weitz (1988), Maltz (1994), and Masten et al. (1989) to, respectively, examine vertical integration decisions for distribution, warehousing, and manufacturing functions. Moreover, we followed John and Weitz's (1988) and Levy's (1985) lead and used an open-ended question to capture this information.

3.2.3. Control variables

Prior research has found other variables to be linked to firms' reliance on external providers. Because they are not the focus of our study, they are included in our analysis as control variables.

The first control variable captures the total number of service functions that logistics service providers perform on behalf of each ICF participating in our study (Appendix A, question 29). An increase in the number of functions is indicative of a reduction in logistics competency by each ICF. Therefore, we expect that this variable will have a positive influence on our dependent variable (Lai, 2004).

The second control variable measures gross revenues obtained by each of the ICFs as a result of their most recent annual sales (Appendix A, question 30). This variable is an indicator of internal scale economies by each of the ICFs with respect to other parties in their distribution channels, including logistics service providers. Thus, this variable may negatively affect ICF reliance on external organizations, in general (Scherer and Ross, 1990), and focal providers (Maltz, 1994), in particular.

The third control variable uses a quadratic scale to measure gross revenues obtained by each of the ICFs as a result of their most recent annual sales. Through this variable, we aim to account for abnormally elevated reliance on logistics service providers by very large ICFs, which are likely to exhibit great relational power with respect to logistics service providers. Therefore, we would expect to observe a positive effect of this variable on our dependent variable.

The fourth control variable incorporates the longevity of each ICF's relationship with its focal provider into the analysis (Appendix A, question 31). Since the duration of the relationship between the ICF and the provider is indicative of consistent performance and limited instances of opportunistic behavior over time, leading to greater trust between the parties (Ganesan, 1994; Knemeyer and Murphy, 2004), we expect to observe a positive link between this variable and the dependent variable.

4. Analysis and results

Following the approach proposed by Anderson and Gerbing (1988), the correlation coefficients in Table 2 were used to perform a confirmatory factor analysis (CFA) and assess the adequacy of the factor structure pertaining to the measurement model. This model includes the latent factors capturing the constructs pertaining to asset specificity, uncertainty, and strength of networked governance structure. Subsequently, maximum-likelihood estimation was used to test the structural model, in accordance with the correlation coefficients in Table 2 and the path-related hypotheses shown in Fig. 1.

4.1. Measurement model

The results of the measurement model suggest a high level of accuracy associated with the latent variables (Table 3). The fit indices for the overall measurement model and for each latent variable suggest that the CFA accurately reflected the underlying variance–covariance structure tying the indicator variables according to the criteria by Hu and Bentler (1999). Moreover, since all loadings are statistically different from zero (0.05 level) and none of the standardized residuals is above or below 2.0 and −2.0, the CFA results provide evidence of

Table 2
Correlation coefficients[a]

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	$(V30)^2$	V31
V1	1.00																															
V2	0.36	1.00																														
V3	0.32	0.77	1.00																													
V4	0.12	0.60	0.72	1.00																												
V5	0.37	0.17	0.30	0.19	1.00																											
V6	0.36	0.36	0.38	0.31	0.52	1.00																										
V7	0.27	0.30	0.36	0.35	0.64	0.56	1.00																									
V8	0.31	0.24	0.34	0.25	0.61	0.46	0.44	1.00																								
V9	0.30	0.36	0.35	0.24	0.42	0.65	0.58	0.53	1.00																							
V10	0.23	0.33	0.35	0.30	0.49	0.53	0.56	0.55	0.51	1.00																						
V11	0.34	0.32	0.41	0.27	0.54	0.48	0.50	0.51	0.51	0.68	1.00																					
V12	0.16	0.18	0.12	0.05	0.08	0.29	0.14	0.08	0.23	0.20	0.24	1.00																				
V13	0.21	0.10	0.13	0.13	0.37	0.24	0.29	0.32	0.26	0.28	0.40	0.17	1.00																			
V14	0.24	0.32	0.30	0.26	0.32	0.40	0.47	0.35	0.47	0.41	0.42	0.12	0.25	1.00																		
V15	0.01	0.01	−0.11	0.02	−0.03	0.08	−0.02	−0.06	0.01	−0.05	0.01	0.05	−0.01	−0.13	1.00																	
V16	−0.01	0.08	0.03	0.15	−0.09	−0.08	−0.10	0.01	−0.11	−0.01	0.05	−0.01	0.01	−0.10	0.61	1.00																
V17	0.04	0.09	−0.04	0.07	−0.10	0.09	0.01	−0.04	0.06	−0.03	0.08	0.01	−0.01	0.01	0.65	0.58	1.00															
V18	0.05	0.14	0.11	−0.09	0.04	0.11	0.15	−0.01	0.14	−0.05	0.04	0.09	−0.13	−0.05	−0.13	−0.12	−0.05	1.00														
V19	0.08	0.11	0.07	−0.08	0.10	0.09	0.13	0.06	0.16	−0.07	0.09	0.13	−0.06	−0.03	−0.03	−0.06	0.02	0.87	1.00													
V20	0.15	0.19	0.13	−0.01	0.19	0.32	0.26	0.18	0.28	0.06	0.18	0.18	0.07	0.12	−0.09	−0.15	−0.01	0.66	0.76	1.00												
V21	−0.06	0.26	0.18	0.02	0.06	0.31	0.35	0.03	0.42	0.10	0.19	0.20	0.11	0.19	−0.06	−0.09	−0.01	0.47	0.48	0.56	1.00											
V22	0.11	0.11	0.06	0.01	0.02	0.05	0.06	0.07	0.09	−0.05	−0.07	0.10	0.03	−0.03	−0.03	−0.12	0.02	0.43	0.52	0.46	0.46	1.00										
V23	0.18	0.16	0.01	−0.05	0.07	0.13	0.14	0.09	0.16	−0.06	−0.08	0.10	0.01	0.01	0.01	−0.10	0.10	0.46	0.56	0.51	0.48	0.83	1.00									
V24	0.22	−0.03	−0.21	−0.31	0.17	0.23	0.27	0.15	0.17	0.12	0.08	0.08	0.21	−0.02	−0.01	−0.06	0.12	0.34	0.34	0.43	0.42	0.49	0.53	1.00								
V25	0.06	0.16	0.07	−0.07	0.07	0.13	0.19	0.07	0.24	0.01	0.11	0.17	0.01	−0.01	0.01	0.02	0.02	0.13	0.58	0.59	0.58	0.60	0.55	0.54	0.59	1.00						
V26	0.05	0.25	0.14	0.01	0.10	0.16	0.23	0.13	0.33	0.07	0.17	0.25	−0.03	0.06	0.01	0.05	0.04	0.55	0.60	0.57	0.59	0.54	0.60	0.57	0.82	1.00						
V27	0.25	0.06	0.05	−0.12	0.02	0.25	0.26	0.19	0.26	−0.01	0.15	0.23	0.15	0.13	−0.10	−0.13	0.01	0.48	0.57	0.64	0.52	0.57	0.56	0.63	0.68	0.65	1.00					
V28	−0.10	−0.15	−0.12	−0.15	−0.33	−0.11	−0.42	−0.11	−0.17	−0.18	−0.13	−0.08	−0.06	−0.11	−0.13	−0.14	−0.21	−0.01	−0.04	−0.07	0.11	0.25	0.12	0.10	0.19	0.19	0.18	1.00				
V29	−0.22	−0.17	−0.22	−0.19	−0.12	−0.18	−0.08	−0.09	−0.15	−0.15	−0.15	−0.07	−0.01	−0.07	−0.01	−0.09	−0.10	−0.07	0.01	−0.03	0.12	0.19	0.16	0.16	0.13	0.14	0.01	0.52	1.00			
V30	−0.04	0.17	0.05	0.13	−0.14	−0.13	−0.07	0.10	0.03	−0.05	−0.03	−0.09	−0.08	−0.02	−0.04	0.03	0.06	0.01	−0.02	−0.10	0.06	0.01	−0.02	−0.16	0.02	−0.06	−0.11	−0.07	0.02	1.00		
$(V30)^2$	−0.04	0.17	0.05	0.14	−0.14	−0.12	−0.05	−0.12	0.03	−0.03	0.01	−0.09	−0.07	−0.01	−0.03	0.01	0.05	0.02	−0.03	−0.07	0.08	−0.01	−0.04	−0.12	0.04	−0.04	−0.09	−0.02	0.06	0.96	1.00	
V31	−0.02	0.02	0.01	−0.04	0.06	0.07	0.01	−0.01	0.07	−0.03	0.03	0.18	0.19	−0.07	0.02	−0.10	−0.06	0.14	0.23	0.25	0.26	0.29	0.33	0.23	0.30	0.24	0.31	0.44	0.36	0.01	0.02	1.00

[a] The variables in the correlation matrix are labeled in accordance with the numbering we used in Appendix A.

Table 3
Measurement model

Fit indices for the overall CFA model (encompassing all factors)	Comparative fit index (CFI) = 91, root mean square error of approximation (RMSEA) = 0.07, 90% RMSEA interval = (0.06, 0.08), standardized root mean squared residual (SRMSR) = 0.07, goodness of fit index (GFI) = 0.84, adj. GFI = 0.78, non-normed fit index (NFI) = 0.88, and $\chi^2 = 602.16$ (277 D.F.)		These indices meet the fit benchmark criteria furthered by Hu and Bentler (1999)	
Factor	Indicators[a]	Non-standardized loadings[b]	Standardized loadings[b]	Standardized errors
Asset specificity ICF level	V1	0.627	0.366	0.931
	V2	1.383	0.818	0.576
	V3	1.546	0.937	0.349
	V4	1.230	0.766	0.643
Asset specificity transaction level	V5	1.332	0.830	0.557
	V6	1.186	0.711	0.703
	V7	1.164	0.753	0.658
	V8	1.147	0.707	0.707
	V9	1.248	0.790	0.614
	V10	1.269	0.718	0.696
	V11	1.097	0.652	0.758
Strength of networked governance structure	V21	0.847	0.671	0.742
	V22	0.898	0.678	0.736
	V23	0.967	0.697	0.717
	V24	1.050	0.721	0.693
	V25	1.162	0.833	0.554
	V26	1.147	0.814	0.581
	V27	1.226	0.818	0.575
Asset specificity product level	V12	0.500	0.300	0.950
	V13	1.212	0.606	0.796
	V14	0.626	0.420	0.908
Uncertainty provider performance	V18	1.202	0.867	0.499
	V19	1.418	0.990	0.022
	V20	1.164	0.761	0.649
Uncertainty logistics service's environment	V15	1.245	0.826	0.564
	V16	1.038	0.736	0.677
	V17	1.148	0.787	0.616

Average variance extracted (AVE), composite reliability (CR), and Cronbach's α values were estimated separately for each factor. The values obtained were

	AVE[c]	CR	Cronbach's α
Asset specificity ICF level	0.57	0.83	0.79
Asset specificity transaction level	0.55	0.89	0.89
Asset specificity product level	0.42	0.42	0.65
Uncertainty provider performance	0.77	0.91	0.90
Uncertainty logistics service's environment	0.61	0.83	0.83
Strength networked governance structure	0.56	0.90	0.91

[a] Indicators are labeled in accordance with Appendix A.
[b] All loadings were significantly different from zero at the 0.05 level.
[c] The AVE values exceeded the shared variance values obtained from this model. The shared variance values between each pair of factors ranged from 0.06 to 0.29. The statistically significant cross-loadings among the factors were: 0.51, 0.54, 0.09, 0.24, 0.32, 0.2, and 0.08.

convergent validity (Anderson and Gerbing, 1988) and unidimensionality (Steenkamp and Van Trijp, 1991). Also, the composite reliability measures obtained independently for each latent variable provide evidence of convergent validity for the constructs (Reines-Eudy, 2000). In turn, the values for the average variance extracted we obtained for the latent variables and their relationship to the shared variance values in the measurement model, compare favorably with the criteria for discriminant validity prescribed by Fornell and Larcker (1981).

Discriminant validity in the measurement model was further assessed by examining the chi-squared difference tests on the values obtained for 16 models (Anderson and Gerbing, 1988). In the first 15 models, the correlation parameter between each latent-variable pair was constrained to equal 1. In the sixteenth model, the correlation parameters were allowed to take on any value. Chi-squared difference tests between each of the first 15 (constrained) models and the sixteenth (unconstrained) model ranged from a minimum of $\Delta\chi^2_{\text{constrained}-\text{unconstrained}} = 10.26$ to a maximum of $\Delta\chi^2_{\text{constrained}-\text{unconstrained}} = 338.15$ (each with 1 degree of freedom). These $\Delta\chi^2$ values suggest that the fit measure of each of the constrained models was significantly worse (at a 0.05 level) than the fit measure of the unconstrained model. Thus, a strong indication of discriminant validity was present in the measurement model since the probability that all combinations between the latent variables adequately represent the same construct is less than 5%.

4.2. Structural model

The second stage of the analysis involved the assessment of the structural model described in Fig. 1. For clarity, Fig. 1 omits latent-variable indicators, error terms, and covariance paths among the five independent latent variables. A number of error terms in these variables were allowed to covary in order to account for associations among constructs within and across the two transaction cost attributes of asset specificity and uncertainty (Rindfleisch and Heide, 1997). Fig. 1 also omits links that were included in the structural model in order to account for previously discussed endogeneity between an ICF's reliance on its focal logistics service provider and the control variables presented in Section 3.2.3.

Table 2's correlation coefficients yielded the structural model's causal path coefficients in Table 4. These results provide support for Hypotheses 1b and 1c: negative and statistically significant (0.05 level) path coefficients show that as asset specificity in the logistics service decreases at the transaction and at the product level, ICFs exhibit an increased reliance on focal providers to help them manage the logistics activities. The results also offer support for Hypotheses 2a and 2b. As suggested by the negative and significant path coefficients in Table 4, a decrease in the level of uncertainty about the environment surrounding a logistics service and a reduction in the uncertainty about the performance of the focal provider of that service are coupled with a greater reliance by an ICF on this provider.

Support for Hypothesis 3a was also found among the path coefficients in Table 4. A decrease in asset specificity in the logistics service at the ICF level is coupled with a strengthening of the networked governance structure available to an ICF through its focal provider.

In addition, the results in Table 4 offer support for Hypothesis 5. They show that stronger networked governance structures available to ICFs through focal providers are linked to increased reliance by ICFs on these providers to manage their logistics services.

In contrast, our results failed to provide support for Hypothesis 1a because they showed no direct link between ICFs' reliance on logistics service providers and asset specificity at the ICF level. Since ICFs' success depends on their developing scalable growth across numerous customers and products, our results lead us to infer that, relative to asset specificity at the ICF level, asset specificity at the transaction and product levels will play a significantly more prominent role in ICFs' decisions to rely on logistics service providers.

Furthermore, our results offered no support for Hypotheses 3b and 3c. ICFs appear not to distinguish the role of asset specificity as it relates to providers' network strength at the transaction and product levels. Instead, independently of the providers' network strength, our validation of Hypotheses 1b and 1c suggests that ICFs will reach out directly to providers as they carry out more standardized transactions with their customers, market items with increasingly broader appeal, or market items with values that are independent of consumption time or location.

Finally, we were unable to validate Hypotheses 4a and 4b, which link the strength of the networked governance structure available to an ICF through a focal service provider with (1) the level of uncertainty surrounding the logistics service and (2) the uncertainty about the performance of the service's provider. Given the empirical support we found for Hypotheses 2a and 2b, we speculate that a reduction in uncertainty surrounding logistics services and the performance of the services' providers will prompt ICFs to raise their reliance on

Table 4
Structural model: Causal path results[a]

Structural path	Path coefficients		Hypothesis (sign)[b]
	Non-standardized	Standardized	
Logistics service's asset specificity (ICF level) → reliance on a focal logistics service provider	0.019	0.025	1a (−)
Logistics service's asset specificity (transaction level) → reliance on a focal logistics service provider	**−0.188**	**−0.191**	1b (−)
Logistics service's asset specificity (product level) → reliance on a focal logistics service provider	**−0.191**	**−0.266**	1c (−)
Uncertainty logistics service environment → reliance on a focal logistics service provider	**−0.260**	**−0.264**	2a (−)
Uncertainty performance of the logistics service provider → reliance on a focal logistics service provider	**−0.351**	**−0.356**	2b (−)
Logistics service's asset specificity (ICF level) → strength of the networked governance structure	**−0.091**	**−0.103**	3a (−)
Logistics service's asset specificity (transaction level) → strength of the networked governance structure	0.106	0.096	3b (−)
Logistics service's asset specificity (product level) → strength of the networked governance structure	0.159	0.196	3c (−)
Uncertainty logistics service environment → strength of the networked governance structure	0.057	0.051	4a (−)
Uncertainty performance of the logistics service provider → strength of the networked governance structure	**0.710**	**0.638**	4b (−)
Strength of the networked governance structured reliance on a focal logistics service provider	**0.417**	**0.471**	5 (+)
Number of service functions with logistics service providers → reliance on a focal logistics service provider	**0.273**	**0.320**	
ICF gross annual revenues → reliance on a focal logistics service provider	**−0.290**	**−0.368**	
(ICF gross annual revenues)^2 → reliance on a focal logistics service provider	**0.190**	**0.241**	
Longevity of ICF–provider relationship → reliance on a focal logistics service provider	**0.250**	**0.312**	
ICF gross annual revenues → strength of the networked governance structure	−0.004	−0.005	

[a] A satisfactory variance fit was obtained in the structural model, since the model yielded R^2 values of 0.46 and 0.47 for the variables measuring reliance on a focal logistics service provider and strength of the networked governance structure (Shah and Meyer-Goldstein, 2005). Overall covariance fit indices included: RMSEA = 0.06, SRMSR = 0.10, and χ^2 = 1,274.82 (422 degrees of freedom). The combination of these indices suggest an adequate fit between the model-implied covariance matrix and the data, according to benchmarks traditionally put forth by prior Operations Management research for structural equation models (Shah and Meyer-Goldstein, 2005).
[b] Statistically significant ($p < 0.05$) path coefficients appear in bold font.

providers. However, this increase in reliance is not contingent upon the contribution that uncertainty reductions may have on the strength of networked governance structures available to ICFs through logistics service providers. Instead, ICFs may actually choose to protect themselves from adaptation challenges by pursuing relationships with providers that offer more focused networked governance structures, especially when services in these relationships are subject to uncertainty in their surrounding environment and in their performance across a widely diverse industry landscape.

5. Discussion

Our study draws from transaction-cost and strategic-network theories to offer a more thorough understanding of ICFs' decisions to rely on outside providers for logistics services. While these theories have been individually utilized in the past (i.e., Levin, 1998; Dahlstrom et al., 1996), our study integrates key tenets from both theories to systematically explain ICFs' decisions to seek logistics service providers' help with order fulfillment operations (Fig. 3).

Our results show that as asset specificity at the transaction level decreases, ICFs will become more reliant on services provided by logistics service providers. For example, an ICF that requires a standardized distribution channel with flexible delivery windows would exhibit a greater reliance on a logistics service provider than would a firm with more specific customer requirements in these areas. As a result, those decision makers choosing whether to engage a provider should carefully examine the nature of logistics service requirements in their transactions with customers. Management at ICFs faced

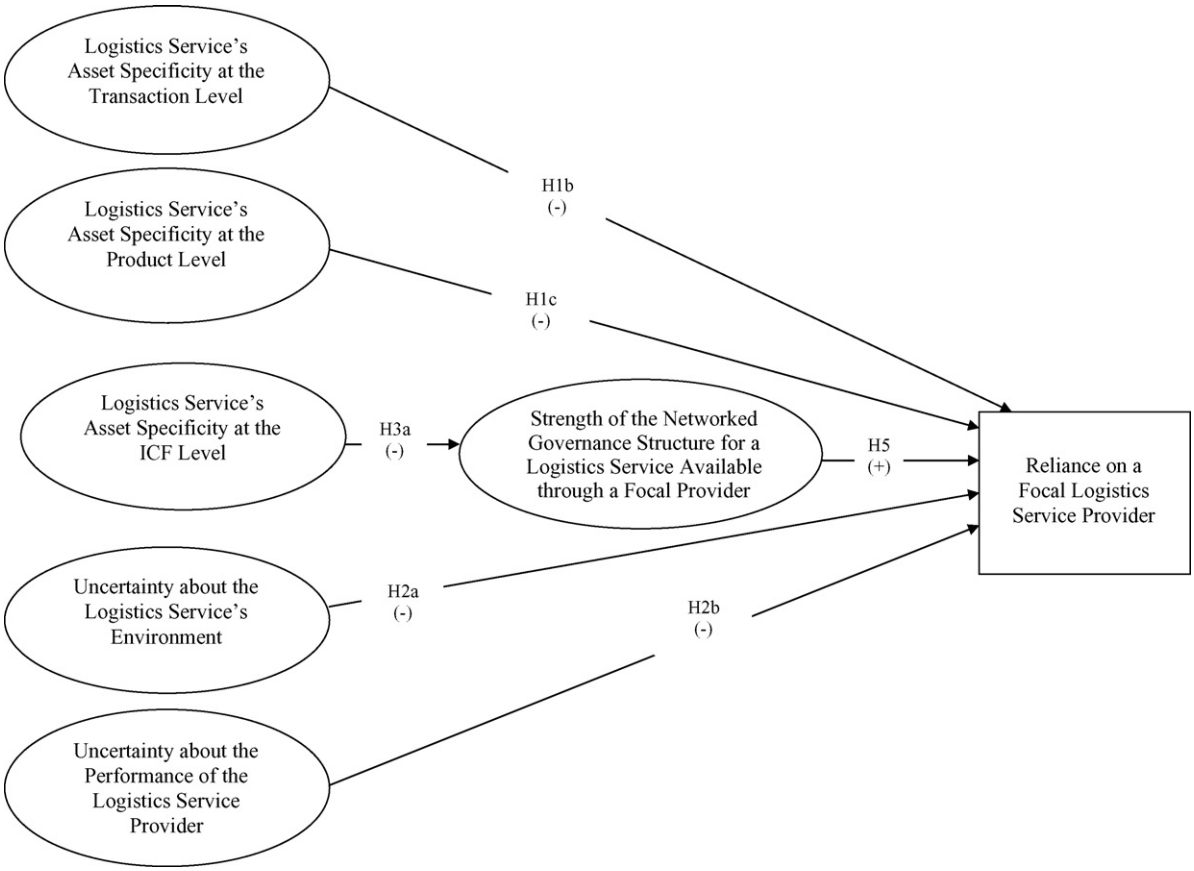

Fig. 3. Summary of main results based on statistically significant paths found in the model.

with specialized needs may be better served by maintaining an internal control over logistics activities.

Similarly, our results suggest that asset specificity at the product level shapes decisions by ICF management to rely on logistics service providers. In particular, we found that management at ICFs offering products with specialized, time-constrained, or location-specific value are less likely to seek these providers. That is to say, if an ICF deals with highly perishable products, it may be better served by internally controlling much of its logistics services.

On the other hand, our study did not detect a direct link between ICFs' reliance on logistics service providers and their endeavors to compete for profits through proprietary resources and knowledge in their logistics services. ICFs' need to develop specialized logistics know-how appears not to prevent these firms from establishing relationships with providers.

Instead, ICFs' decisions to establish relationships with providers depend on the level of environmental uncertainty surrounding a logistics service and the level of uncertainty about the performance of the focal service provider. This is exemplified by one of the ICFs participating in our survey, which sought a provider's assistance with inventory-control service. According to the president of this ICF, the low level of uncertainty with respect to the environment surrounding the logistics service and the high level of confidence about the performance of the provider facilitated the development of the relationship between the ICF and the provider. This is because the adaptation and safeguarding costs involved in the relationship were very low and did not require the ICF to continually monitor, adapt, and protect against uncertainties in the logistics service's environment or against uncertainties in the logistics service provider's performance. As a result, the ICF's value proposition for using the provider was very compelling.

Our study also evaluated the effect that the strength of networked structures has on decisions to implement alternate managerial options for ICFs' logistics services. Our findings suggest that strength is a direct determinant of the reliance on logistics service providers by ICFs. The implication is that executives at ICFs tend to look beyond the focal-provider offering

when choosing an appropriate relationship mechanism. Instead, they make their choices in the context of relationship networks and complementary services they can access through their use of particular providers' services and assets.

For example, a supply chain manager for a health-product ICF participating in our study indicated that the decision to establish a relationship with a focal logistics service provider depended on the available strength of the provider's network, as defined by the level of externalities and complementariness. Thus, because the provider could expand the diversity, economy, and quality of service options that are available to complement a primary service (drop-shipping), decision makers at this ICF chose to rely more on this provider.

Our results also contribute to the literature by isolating effects on ICFs' reliance on logistics service providers caused by the interplay between the construct capturing the providers' network strength and the construct capturing asset specificity at the ICF level. In particular, they show that the strength of networked governance structures is a conduit for the indirect effects that asset specificity has on the reliance of ICFs on logistics service providers. A decrease in asset specificity at the ICF level is coupled with a stronger networked governance structure available through a logistics service provider. In turn, as discussed above, these stronger networked governance structures motivate ICFs' reliance on logistics service providers. Thus, when ICFs are not concerned with proprietary knowledge and require less specialized resources for their logistics services, they will rely more on focal providers because this lower level of asset specificity will allow the ICFs to tap into stronger networks of extended relationships and complementary services.

However, we found no evidence to suggest that ICFs carrying out standardized transactions with their customers or marketing items with a broad appeal or with values that are independent of consumption time or location will have access to strong networks through logistics service providers. Also, we saw no evidence to suggest that reductions in uncertainty surrounding logistics services are coupled with stronger networked governance structures available to ICFs through focal providers.

We did, however, found that reductions in uncertainty about providers' performance are linked to smaller, more focused networked governance structures. Theory and evidence from isolated cases suggest that there are ICFs for which a decrease in uncertainty in providers' performance will strengthen the networked governance structure available to them through the logistics service providers. Surprisingly, our results show that there are many other ICFs for which these very same reductions in uncertainty will be coupled with networked governance structures comprising more limited markets and suppliers and more focused services.

Finally, consistent with our expectation, we found that ICFs are more prone to establish relationships with logistics service providers when the ICFs have already farmed out an increasing number of service functions or have longstanding relationships with those providers. We also found that annual gross revenues are negatively related to ICFs' reliance on focal logistics' service providers. However, this relationship is not linear: the positive and significant coefficient on the path between the variables measuring quadratic gross revenues and ICFs' reliance on focal providers suggests a u-shaped relationship. That is, as ICF revenues and internal scale economies increase, reliance on focal providers decreases. However, this trend is reversed for very large ICFs, which may increasingly rely on providers due to their greater relational power with respect to the providers.

5.1. Managerial implications

ICF management evaluating whether or not to use a focal logistics service provider may draw from our results to look beyond the services offered directly by this focal organization to the set of services that the organization makes available through its network of relationships. For instance, it would make sense to establish a relationship with a provider if doing so would expand access to untapped and lucrative markets by leveraging the provider's relationship networks. Fertile markets for developing these relationships may encompass customers overseas (Yorgey-Lester, 2003) and corporate customers (Miller et al., 2004). Also, ICFs may seek providers (1) to assist them in implementing logistics services that are compatible with and improve upon other services they currently offer to their customers or (2) to obtain services that are well suited to those offered by the ICFs' upstream suppliers.

ICF managers may also use our results to account for the transaction costs they would incur if they depended on providers to allocate operational factors necessary to carry out the logistics services externally. For logistics service providers to be a viable solution there must be as little uncertainty as possible in the logistics services' environment and in the performance of the providers. High uncertainty will increase perceived adaptation risks among ICF management, requiring providers to offer proportionally higher discount rates for their logistics services to ICFs.

The role of uncertainty takes on special significance when managers at ICFs coordinate logistics services internally so that they can reach ill-defined markets. Some of our study participants selling apparel and accessories to Internet consumers faced this type of uncertainty in their logistics service environment when they tapped into obscure markets or launched products for which no prior demand information was available. As a result, executives at these ICFs chose not to initially establish relationships with providers whose services involved significant demand unpredictability, instability, and complexity or where it was difficult to monitor demand for those services.

Finally, our research suggests that an ICF's reliance on a focal provider is economically favorable when asset specificity is not present. Typically, a provider will attempt to capture a large trading volume to reach the scale economies needed to compete with other providers. This provider will be reluctant to invest in logistics assets that are specific to a particular type of transaction between an ICF and its customers, or an individual product marketed by an ICF unless the provider can charge for that level of specialization. Since those charges will increase ICF costs, logistics solutions that are organized by the provider for high asset specificity conditions are unlikely to be favorable for ICFs.

5.2. Opportunities for future research

Our research might be extended to consider whether UPS and other ''last-mile'' delivery companies could bundle their services with those offered by logistics service providers and give ICFs access to more valuable and economical portfolios of solutions. Recently, ''last-mile'' delivery companies have focused on expanding their services through the acquisition of brick-and-mortar storefronts necessary to offer one-stop shipping, and other services to non-Internet consumers (Harris, 2004). In the future, these offers may be complemented through the addition of specialized logistics services currently offered by providers exclusively to ICFs and their customers. To pursue this research opportunity, authors may need to sidestep methodologies, such as surveys, and, instead, use case studies to develop close insights into the processes involved in establishing relationships between ICFs and ''last-mile'' delivery companies offering bundles of additional logistics services.

Researchers could also extend our paper to evaluate the relationship between ICFs' reliance on logistics service providers and the channel structures ICFs have at their disposal to take their products to markets. Our study focused on a combination of multi-channel and pure-play ICFs. Research could address the possible existence of differences between those firms utilizing a mixed channel structure and those using an exclusive Internet-based structure (Maltz et al., 2005). Of particular interest would be the influence of existing physical assets on the governance structure decision.

Further research could also apply the resource-based view (RBV) of the firm to expand our insights. An RBV focus could explain how ICFs leverage their relationships with logistics service providers to develop sustained advantages and, thus, improve their performance through the bundling of resources within their cores (Conner and Prahalad, 1996; Barney, 1990). This work must be carried out longitudinally, as it will be necessary to first consider ICFs' conduct in the development of relationships with providers and, subsequently, the performance outcomes caused directly by that conduct.

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Appendix A. Overview of measures

Questions 1–28 pertain to *a primary logistics service function* in the Internet orders' *fulfillment* operations for the survey respondent's firm. For simplicity, these questions refer to this service function generically as ''fulfillment function.'' As well, these questions concern an individual (focal) provider offering the logistics service function. This focal provider may be charged with the management of the service or may have been designated to manage the service by the respondent's firm. Questions 29–31 correspond to control variables. Question 29 concerns *a full array of logistics functions and providers*.

Factor	Item
Asset specificity ICF level	1. In our company, it helps tremendously to have been around a while in order to understand the operational procedures involved in performing the fulfillment function (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	2. Internal information regarding our fulfillment function would be very helpful to our competitors (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	3. A release of inside information on our fulfillment function could do our firm a lot of damage (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	4. We are extremely cautious at preserving the confidentiality of information concerning our fulfillment function (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
Asset specificity transaction level	5. It has taken our firm a lot of time and effort to learn the specific consumer requirements of the fulfillment function (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	6. Our firm has spent a lot of time and effort in customizing its fulfillment function (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	7. The fulfillment function in each order requires close coordination with our firm's consumers (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	8. Our consumers care a lot if we are directly involved in performing the fulfillment function or not (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	9. Our firm leverages the fulfillment function to build relationships with its consumers (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	10. The consumer personalization in performing the fulfillment function has a big effect on our firm's sales (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	11. Our fulfillment function design depends on unusual consumer needs that can only be understood with a great deal of experience (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
Asset specificity product level	12. Best description of the product characteristics involved in the fulfillment function, in your firm's Internet channel (response options were based on a 7-item scale ranging from "commodity" to "customized")
	13. Our product's intrinsic characteristics (e.g., perishability, obsolescence) require fast fulfillment (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	14. Fast order fulfillment is the key to our product's competitive positioning (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
Uncertainty logistics service's environment	15. Best description of the nature of demand for Internet orders fulfilled by your firm (response options were based on a 7-item scale ranging from "easy to monitor trends" to "difficult to monitor trends")
	16. Best description of the nature of demand for Internet orders fulfilled by your firm (response options were based on a 7-item scale ranging from "stable industry volume" to "unstable industry volume")
	17. Best description of the nature of demand for Internet orders fulfilled by your firm (response options were based on a 7-item scale ranging from "easy to forecast" to "difficult to forecast")
Uncertainty about performance of logistics service provider	18. Professionals who I respect have adopted fulfillment functions that are similar to the function performed by this provider (response was based on a 7-point Likert scale ranging from "strongly agree" to "strongly disagree")
	19. Professionals in firms that lead our industry have adopted fulfillment functions that are similar to the function performed by this provider (response was based on a 7-point Likert scale ranging from "strongly agree" to "strongly disagree")
	20. Firms whose quality is highly regarded in the industry utilize the services of this provider (response was based on a 7-point Likert scale ranging from "strongly agree" to "strongly disagree")

Appendix A (*Continued*)

Strength of networked governance structure	21. The support of this provider allows the activities in our firm's fulfillment function to be highly compatible with other activities within our firm (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	22. This provider supplies the resources that make our firm's fulfillment function available to consumers everywhere (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	23. This provider supplies the resources that make our firm's fulfillment function widely available to consumers (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	24. This provider supplies a lot of information on the resources needed to effectively perform the fulfillment function for our firm's consumers (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	25. The resources this provider dedicates to our firm's fulfillment function are of very high quality (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	26. The resources this provider dedicates to our firm's fulfillment function are highly reliable (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
	27. The resources this provider dedicates to our firm's fulfillment function are very advanced (response was based on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree")
Main dependent variable	The following is a question about the relationship between your firm and the provider you selected for this survey. 28. Please state the percentage of the Internet orders that is fulfilled with the involvement of the provider in the service function you selected for this survey _____%
Control variables	29. Of the list below, tally the different functions performed by logistics service providers in general __Order request/inquiry __Order confirmation/verification __Order payment __Drop-shipping __Picking and packing __Inventory control __Order consolidation __Shipping __Order delivery __Delivery confirmation __Order returns/exchanges __Order forwarding __Other (please specify) _____
	30. What are your firm's approximate annual gross sales (please mark one)? __Less than or equal to $10 million __More than $10 million, but less than or equal to $50 million __More than $50 million, but less than or equal to $100 million __More than $100 million, but less than or equal to $250 million __More than $250 million, but less than or equal to $500 million __More than $500 million [We used a continuous variable, based on the midpoint of the discrete variable's range, to preserve the measurements' validity in the statistical analysis]
	31. How long have you been involved in the relationship with your selected provider? ____ years

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