Through the service operations strategy looking glass: Influence of industrial sector, ownership, and service offerings on B2B e-marketplace failures

Eve D. Rosenzweig,∗ Timothy M. Laseter, Aleda V. Roth

1. Introduction

Over the past decade, business-to-business (B2B) e-marketplaces have captured the imagination of practitioners and scholars alike. In this research, we characterize a B2B e-marketplace as an Internet-based service delivery system that links sellers’ offerings to buyers. Although a myriad of new B2B e-marketplaces were launched over the past decade, a substantial number failed shortly after the peak of the NASDAQ in 2000. The bursting of the Internet bubble provides a setting for assessing salient, theory-based determinants of failure—and success. Accordingly, we apply a service operations strategy lens and complementary organizational theories to explain how three strategic factors—industrial sector characteristics, ownership structure, and functionality of service offering—may have influenced B2B e-marketplaces’ odds of survival after the bubble. We empirically test these factors using logistic regression analysis on a sample of 854 B2B e-marketplaces.

Consistent with emerging e-services literature, our empirical results indicate that B2B e-marketplaces serving industrial sectors that are a better fit with the Internet service delivery systems—by high information dependence and low information tacitness—have the highest likelihood of success, as do e-marketplaces with service offerings that facilitate collaboration among multiple buyers and sellers. We also demonstrate the positive influence of consortium ownership structure on B2B e-marketplace survival, albeit not for first-mover consortia-backed e-marketplaces. Our findings contribute to the service operations strategy literature and provide direction for managers in the areas of e-service strategy and investment.

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A B S T R A C T

This paper contributes to the emerging area of e-service strategy in the context of business-to-business (B2B) e-marketplaces, which we view as Internet-based service delivery systems that link sellers’ offerings to buyers. Although a myriad of new B2B e-marketplaces were launched over the past decade, a substantial number failed shortly after the peak of the NASDAQ in 2000. The bursting of the Internet bubble provides a setting for assessing salient, theory-based determinants of failure—and success. Accordingly, we apply a service operations strategy lens and complementary organizational theories to explain how three strategic factors—industrial sector characteristics, ownership structure, and functionality of service offering—may have influenced B2B e-marketplaces’ odds of survival after the bubble. We empirically test these factors using logistic regression analysis on a sample of 854 B2B e-marketplaces.

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1 Tel.: +1 919 454 4707; fax: +1 864 656 2015.
2 Tel.: +1 434 924 4078; fax: +1 434 924 0717.

E-mail addresses: Eve.Rosenzweig@bus.emory.edu (E.D. Rosenzweig), LaseterT@darden.virginia.edu (T.M. Laseter), ARoth@clemson.edu (A.V. Roth).

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Our study poses a variant of these service operations strategy questions in the context of B2B e-marketplaces. Namely, how does the value-added of the service-offering functionality, nature of the industrial sector served, and ownership model influence the odds of B2B e-marketplace success or failure? We apply principles from the service operations strategy literature along with complementary organizational theories to examine how mismatches between attributes of these three antecedents and the B2B e-marketplace delivery system increased the propensity to fail immediately after the bubble burst. In contrast, when their respective attributes are aligned (e.g., facilitated Internet channel exchanges and customer value-added), the e-marketplace was more likely to survive.

The dramatic B2B e-marketplace failure rate over a relatively short period offers a unique opportunity to shed light on service strategy-related drivers of the collapse. Despite the increased literature on B2B e-commerce over the past decade, the preponderance of the existing academic work resides in the information systems and strategic management literatures. Thus, much of the focus of the extant B2B research pertains to new business models and strategies for leveraging the benefits of technology and the attributes of the information it provides. Rigorous empirical work on B2B e-commerce in the operations and supply chain management literature is emerging, but it still lags other management disciplines.

Moreover, while e-marketplaces are "services," we did not find any studies that predominantly make use of a service operations strategy perspective or lens to explain, in part, the risk of failure in B2B e-marketplaces. In addition, analysis of business success or failure is rare in operations management research in general. Toward that end, we subject to rigorous empirical scrutiny the failure rates of a sample of 854 B2B e-marketplaces using logistic regression analysis. To address our research question, our empirical model emphasizes three salient, strategic antecedents from theory and practice as potential differentiators of survivors and failures: (1) industrial sector characteristics, (2) ownership structure, and (3) functionality of service offering.

We first posit that the potential for B2B e-marketplaces to improve e-services within a particular industrial sector is, to some extent, a function of the information dependence and information tacitness of that sector’s characteristic value-added activities for creating products and services (Afuah, 2003; Evans and Wurster, 2000; Rosenzweig, 2002). In doing so, we develop a conceptual typology of industrial sectors based upon the relative information dependence and tacitness typically associated with the sector, drawing heavily upon the logic of the product–service continuum from the service operations strategy literature (Fitzsimmons and Fitzsimmons, 2008; Giffi et al., 1990; Roth and Menor, 2003; Sasser et al., 1978).

The emerging paradigm for success in e-services also brings to bear organizational ecology notions when considering the match between the industrial sectors and the service offerings on business performance. The organizational ecology literature infers that populations of organizations are heterogeneous and natural selection occurs, which, in turn, determines the odds of survival (Freeman et al., 1983). Following this logic, we argue that B2B e-marketplaces within industrial sectors characterized by value-added activities that are more transaction-based, codifiable, and scalable are more apt to be successful than those not having these information-based features (Boyer et al., 2002; Oliveira et al., 2002; Chava and Jarrow, 2004; Kauffman and Wang, 2003).

If all organizations within a particular industrial sector were equally likely to fail, then no organization would knowingly enter high-failure sectors. Instead, all would enter sectors with low failure rates. Thus, it is also important to consider service-offering functionality attributes—basic procurement, auction/matching of buyers and sellers, and collaboration—as enablers of B2B e-marketplace success. To do so, we draw upon strategic network theory (Katz and Shapiro, 1994; Rohlfs, 1974) and transaction cost economics (TCE) (Coase, 1937; Williamson, 1975).

Strategic network theory suggests that service offerings, such as auctions, that dynamically and effectively match buyers and sellers are a key source of Internet value creation, particularly relative to basic procurement offerings (Amit and Zott, 2001). Likewise, based on TCE, collaborative service offerings have the potential to offer buyers and sellers joint value-added not only in the form of transactional efficiency, but also with regards to more informed decision-making (enabled by investments in specific assets).

The above rationale suggests that e-services in which the processes and offerings are aligned with the Internet channel are more viable because of the matches with e-marketplace delivery systems (Boyer et al., 2002; Oliveira et al., 2002; Roth, 2001). With a few exceptions, this natural fit of service offerings and industrial sectors with Internet service delivery systems has not been investigated empirically.

Finally, also important from an organizational ecology perspective is the influence of ownership structures as antecedents of B2B e-marketplace failures. In a recent study highlighting the value of ownership structures in the context of B2B e-marketplaces, Mitra and Singhal (2008) find that, on average, the stock market reaction from joining consortia-based exchanges is positive (although marginally significant) on account of its role in facilitating supply chain integration. Our study further considers the viability of consortium ownership models, along with those B2B e-marketplaces with independent and publicly traded ownership models, by considering both the Darwinian and Lamarckian views of organizational ecology. Specifically, we contrast the viability of independent ownership models with the publicly traded and consortium ownership models, highlighting the publicly traded model as the business analog to Darwinian natural selection (Darwinian view) and the consortium model as one of adaptation to uncertainty (Lamarckian view).

In summary, from a service operations strategy perspective, it has yet to be determined which particular attributes of these three antecedents create a propensity for survival. Our paper contributes to service operations strategy theory and practice in several ways. First, our empirical results show that industrial sectors characterized by value-added and exchange activities that are highly information dependent and more codified (versus tacit) create what we call a “sweet spot” that greatly enhances the odds of B2B e-marketplace success. Interestingly, consortium ownership models tend to reduce the risk of failure, on average, whereas counter to the Darwinian view, publicly traded entities have no special edge over their independent counterparts. Notably, service-offering functionality that supports collaboration (i.e., the most customer value-added attribute) outweighs benefits attributed to network effects of auctions in mitigating B2B e-marketplace failures. Moreover, collaborative service offerings trump the potential opportunism suggested by TCE with investments in asset specificity.

In the next section, we present our theoretical model and corresponding hypotheses. Section 3 describes our research approach, including background on our failure classification methodology and various measurement and classification methods used to operationalize the constructs of interest. In Section 4, we discuss the results of our logistic regression modeling and the degree of support for each of our hypotheses. We conclude in Section 5 with a broader discussion of our study’s implications, its limitations, and opportunities for future research.

2. Theoretical model

Viewing B2B e-marketplaces as e-services, we consider three theoretically important factors posited to influence survival out-
comes: industrial sector characteristics, ownership structure, and service-offering functionality (see Fig. 1). We characterize each factor in terms of three generic types, based on their attributes. Our six hypotheses include paired comparisons against a base case for each factor.

2.1. Industrial sector characteristics

For the period leading up to the bursting of the Internet bubble, Mullaney et al. (2003) conclude that industrial sectors such as high tech and financial services exhibited the greatest potential for the Internet to add value for customers. In contrast, during that same period, sectors such as agriculture, construction, heavy manufacturing (e.g., automotive), education, healthcare, and retail/consumer packaged goods (CPG) showed relatively less promise. What might account for these industry-related observations?

In the subsections that follow, we shed light on the reasons why such seemingly disparate sectors, like high tech and financial services, or agriculture and education for that matter, show similar potential in terms of Internet value creation, specifically in the context of B2B e-marketplaces. To begin, we draw upon work by Afuah (2003) that examines the extent to which the use of the Internet can add value and/or facilitate the exchange process among business entities.

2.1.1. Information dependence

Afuah (2003, 42) defines information dependence “as the extent to which the value added or exchanged [among business entities] ... is through information rather than materials.” For instance, according to Afuah (2003), the financial services sector is more information dependent than automotive manufacturing, the latter of which is a member of our heavy manufacturing sector presented later in Section 3.2.2. The value-added or exchanged in financial services is highly information intensive, whereas in automotive manufacturing, it is largely materials intensive with an information complement.

In the context of this study, the greater the degree to which the value-added and exchange activities that transpire in an industrial sector depend on information, the greater the potential for B2B e-marketplaces to create value. In keeping with this logic, Kauffman and Wang (2003) find that the selling of digital products or services reduces an Internet firm’s likelihood of failure relative to those firms selling physical products.

It is useful to note that economists introduced the notion of information dependence as a way to classify industrial sectors long before the advent of Internet-based business models. In their seminal report series on the information economy, Porat and Rubin (1977, 15) conclude that

... information sectors produce and distribute all the information goods and services demanded by the economy ... noninformation sectors supply all the physical or material goods whose value or use do not primarily involve information.

As an illustrative example, Porat and Rubin highlight the computer industry—a member of our high tech sector in Section 3.2.2—as a part of the information economy because such organizations manufacture information machines. The authors go on to classify steel and aluminum manufacturers—members of our basic materials sector in Section 3.2.2—that supply vital materials to computer manufacturers as “noninformation” industries, because their products are not distinctively processors or distributors of information.

Notably, the degree of information dependence as an organizing principle also has its roots in the service operations strategy literature, which highlights the bundling of intangible services with tangible goods to produce core offerings along a product–service continuum (Fitzsimmons and Fitzsimmons, 2008; Karmarkar and Apte, 2007; Roth and Menor, 2003; Sasser et al., 1978). The service operations literature recognizes that even product-based businesses inevitably encompass some form of intangible service that might range from basic delivery to full after-sales support. Maintenance, repair, and operating (MRO) provider PartsLogistics.com, for example, not only matches buyers and sellers of industrial parts, but also offers the ability to research parts in order to identify critical information such as the OEM, part technical characteristics, and historical price and demand information. Nonetheless, while almost every industry delivers products that comprise both tangible and intangible elements, service-based sectors tend to include a substantial degree of intangible elements in what Giffi et al. (1990) coined as a strategic bill of material. Conversely, product-based sectors tend to feature predominantly tangible materials.

Recent service operations strategy investigations of Internet-based businesses have refined this notion of the product–service continuum by more explicitly examining the information content of the offerings. For example, Oliveira et al. (2002) and Boyer et al. (2002) emphasize the importance of considering the degree of information intensity of the product–service bundle in the design of e-services. Similarly, Karmarkar and Apte (2007), in drawing upon Porat and Rubin (1977), attempt to bring order to the hodgepodge of industries of the modern information economy by classification based upon the traditional product–service continuum and a degree of information content. Their framework highlights an industry’s role along the supply chain from product/manufacturing to process/services and the “product” ranging from material (atoms) to information (bits).

Taken together, product-based sectors generally exhibit relatively low information dependence since materials and goods constitute the majority of the product–service bundle. Service-based sectors, such as healthcare, have a higher degree of information dependence because their offerings are intangible and are typically created and consumed simultaneously. Further, unlike products, services are perishable in the sense that, prior to the purchase decision, one cannot inventory or inspect services. Clearly, there is a great need for coordination and interaction among staff, functions, and business partners in the delivery of services; and therefore, the potential for B2B e-marketplaces to create value in this arena is higher relative to product-based sectors.
Besides the classical view of service strategy, the degree of change or industry “clockspeed” (Fine, 1998) poses another factor in assessing information dependence. Information proves critical in rapidly changing industries, where information enables speed. Whether product-based or service-based, fast clockspeed companies must constantly communicate the benefits of each new generation of its offering to its customers. Beckman and Sinha (2005) and Mendelson and Pillai (1999) report that fast clockspeed sectors, like high tech, constantly update their supporting processes and communicate the changes to their employees and partners. This rationale would suggest that the stability of routines in more mature sectors (e.g., basic materials, construction) lowers the relative dependence on information, whether typically classified as a product-based or service-based business.

2.1.2. Information tacitness

Up to this point, we have argued the importance of considering the degree of information dependence as a critical characteristic that accounts for differences in B2B e-marketplace survival status across various industrial sectors. However, Afuah (2003, 43) also concludes that “Not all information can be exchanged over the internet… Tacit information is more difficult to exchange over the internet than explicit information.” Thus, by nature of its relative codifiability, information is heterogeneous (Nonaka, 1994; Polanyi, 1966)—and it is likewise essential to consider such heterogeneity in assessing the likelihood of B2B e-marketplace survival by sector. In keeping with this line of thought, we assert that industrial sectors characterized by value-added and exchange activities that rely on a great deal of tacit information are less likely to benefit from B2B e-marketplaces as those that rely more on codified or explicit information content.

The concept of tacit information traces back to Polanyi’s (1966) seminal research. In considering the “tacit dimension,” Polanyi (1966) concludes that one typically knows more than one can express. As a contrast, he describes explicit information as information that one is capable of clearly stating in the sense that one can readily record, verbalize, and transfer it across groups. Building on Polanyi and others (e.g., Nonaka, 1994), Afuah (2003, 43) maintains that:

Knowledge is tacit if it is uncoded, nonverbalized, and acquired largely through personal experience, such as learning-by-doing, experiencing, or observing… Tacit knowledge is often embedded in organizational routines and individual actions and, therefore, is difficult to duplicate.

We note that Nonaka (1994) and Grant (1996) similarly distinguish between tacit and explicit information. In fact, Grant (1996, 114) asserts that “…if most of the knowledge relevant to production is tacit, then transfer of knowledge between organizational members is exceptionally difficult.” (Such a transfer of tacit knowledge is possible, however, when members develop long-term relationships characterized by a shared, learned language by which to communicate (Kogut and Zander, 1992.) In summary, because tacit information is, by definition, uncoded and difficult to articulate across organizations, it is likely to be challenging to encode it in a form that is transferable over the Internet.

Returning to our roots in the service operations strategy literature, we assess the relative degree of information tacitness prevalent in industrial sector value-added and exchange activities by describing the sector’s typical offerings along the product–service continuum. In predominantly product-based businesses, business customers can often inspect the physical product and observe its characteristics directly. Likewise, one can often easily communicate product information to buyers through specifications, blueprints, and drawings, thereby reducing the need for tacit information.

For service sectors, the relative importance of information tacitness varies considerably and thus requires further parsing. Prior research has segmented service industries by process factors, including customization, the degree of customer contact or interface, and the degree of labor intensity (Chase, 1978; Chase and Tansik, 1983; Huete and Roth, 1988; Kellogg and Chase, 1995; Levitt, 1976; Schmenner, 1986). In this study, we focus on two general types of service processes: (1) those that are highly customer facing (e.g., have a high degree of interaction and customization); and (2) those that are transaction-oriented (e.g., routine services and/or services with a low degree of customer interaction).

Customer-facing service sectors, such as healthcare or professional services, offer on average a high potential for tacit—uncoded and nonverbalized—information exchange. Customers enter the service system, and tacit information is generally acquired and conveyed through the customer’s experience with the provider and delivery system. For customer-facing sectors, many aspects of the product–service bundle are also implicit, in that customers may only vaguely or partly sense the benefits, such as safety and service-provider attitude. As a result, many customer-facing service processes are inherently complex, knowledge-intensive, and highly variable. We expect this tacitness carries over to some degree to business customers due to the less-routine offerings, and the need to deliver a variety of implicit as well as explicit services.

Transactional service processes, such as energy and transportation, tend to be standardized and high volume, and in turn, offer greater scalability for e-services (Boyer et al., 2002; Oliveira et al., 2002). Transactional services represent a more production-like approach to services, with tight specifications and relatively low levels of uncertainty (Levitt, 1976). Because transactional services are typically associated with explicit information exchanges across organizations, they are prime candidates for transmittal over the Internet.

Based on the discussions presented above, we posit that the combination of high information dependency but less-tacit information requirements represents a “sweet spot” for B2B e-marketplace activities. We contend the sweet spot for adding value on the Internet via B2B e-marketplaces occurs not only in product-based industrial sectors that have a meaningful service component (e.g., MRO/office-supplies) or that are characterized by fast clockspeed (e.g., high tech), but also in transactional service-based sectors. In each of these cases, information matters…but just as critically to B2B e-marketplace success one can record and communicate the information via the Internet because the information is explicit rather than tacit. Thus, as depicted in Fig. 1, we hypothesize:

H1A. B2B e-marketplaces supporting industrial sectors with high information dependence and high information tacitness are more likely to fail than those supporting sectors with high information dependence and low information tacitness.

H1B. B2B e-marketplaces supporting industrial sectors with low information dependence and low information tacitness are more likely to fail than those supporting sectors with high information dependence and low information tacitness.

2.2. Ownership structure

B2B e-marketplaces employ a variety of ownership structures (Daniel et al., 2004), ranging from independent, privately owned entities such as Ontario-based Farms.com Ltd., to publicly traded companies such as VerticalNet, to consortia such as GlobalNetXchange. By examining the evolution of business populations through studies of entries, adaptations, and failures (Hannan and Freeman, 1977; Meyer et al., 1990; Usher and Evans, 1996), the organizational ecology literature highlights the following two theo-
retorical perspectives as they pertain to e-business (Eid and Trueman, 2004; Phan, 2002): (1) the Darwinian view that emphasizes the role of natural selection and random variation in survival, and (2) the alternate Lamarckian view that emphasizes adaptation. In our research, ownership structure integrates these two perspectives.

First, the transition from private to public ownership functions as the business analog to Darwinian natural selection, representing a critical progression consistent with the lifecycle process theory of organization development and change (Van de Ven and Poole, 1995). An initial public offering (IPO) is a proxy for a successful transition out of entrepreneurial start-up mode (Choi et al., 2005). Although a transition to public ownership does not guarantee long-term success (Amit and Zott, 2001), it does typically represent a key milestone in the attainment of more structured operations and subsequently in the process of corporate natural selection. The scale, measurement systems, incentives, etc. necessary to justify public ownership along with the scrutiny required to achieve it suggest another reason why publicly traded B2B e-marketplaces should face a lower probability of failure relative to independent, privately owned e-marketplaces. Therefore:

**H2A.** Publicly traded B2B e-marketplaces are less likely to fail than independently owned ones.

Second, the consortium structure represents the Lamarckian view of organizations as highly adaptive entities (DiMaggio and Powell, 1983). The collective rationality and resulting tendency for companies to imitate the strategy of competitors might partially explain the rush of companies to invest in B2B e-marketplaces. In some cases, the larger companies were at first slow to respond to the opportunities provided by the Internet and then joined together to displace the generally smaller “first-movers” (Murtaza et al., 2004). Within the world of B2B e-marketplaces, uncertainty led to changing direction. Ford and GM, for example, started their own independent e-marketplace initiatives and then later joined to form Covisint as a consortium. Although negatively viewed as a “bandwagon effect,” (Tsikriktsis et al., 2004), Haverman (1993) has shown “mimetic isomorphism” to be an efficient response to uncertainty, which clearly characterized the era of the Internet bubble.

Based on a relatively small sample of 61 B2B e-marketplaces, Laseter and Bodily (2004) suggest that consortium ownership positively affects revenue among B2B e-marketplaces, but not time to profitability. A consortium partner can influence the consortium’s charges for services and may want to capture all of the value created in the relationship directly rather than leave it in the e-marketplace. Since all consortium owners share this same perspective, they drive up revenues through active use of the e-marketplace—and thereby build up the requisite level of transactions rapidly—but leave only enough profit for the e-marketplace to survive. Accordingly, we propose that:

**H2B.** Consortia-backed B2B e-marketplaces are less likely to fail than independently owned ones.

### 2.3. Functionality of service offering

Early efforts to classify e-marketplaces tended to group business-to-consumer (B2C) and B2B e-marketplaces together, with a bias towards the more visible B2C e-marketplaces (Armstrong and Hagel, 1996; Benjamin and Wigand, 1995; Mahadevan, 2000). From the service strategy perspective, it is particularly useful to examine the sources of value creation based on the functionality of the service offerings, ranging from simple transactions to relationship-enhancing transactions. For example, Anderson and Anderson (2002) identify three primary sources of value creation for e-commerce intermediaries: matching, requisitioning, and problem solving. Johnson and Whang (2002) present another framework comprising three e-business forms—e-commerce, e-procurement, and e-collaboration—that has many parallels to the value creation model. We integrate these two frameworks and adopt the following three descriptions of B2B e-marketplace service-offering functionality: procurement, auction/matching, and collaboration.

**Procurement functionality** in a B2B e-marketplace includes automated versions of traditional purchasing activities, such as catalog buying and quotation requests. For example, Branders.com, an independent e-marketplace, offers promotional products from leading suppliers in an online catalog covering thousands of items grouped into 29 categories (www.branders.com). Similarly, the online RFX processes of Request for Information (RFI), Request for Proposals (RFP), and Request for Quotations (RFQ) represent the e-marketplace versions of traditional procurement activities. IndustrialSupport.com offers an automated RFQ service in addition to an online inventory of industrial parts intended to help small businesses streamline parts procurement (www.industrialsupport.com).

**Auction/matching** encompasses the use of online auctions of one-to-many, as in the reverse auctions hosted by auction specialist FreeMarkets (now a part of Ariba, www.ariba.com). The auction/matching service offering also includes the dynamic matching found in many-to-many market transactions, similar to the trading function for clearing excess semiconductor inventory provided by Virtual Chip Exchange (www.virtualchip.com).

Online tools such as collaborative planning, forecasting, and replenishment (CPFR) generate a third type of service-offering functionality: collaboration. Many of the B2B e-marketplace consortia—such as Transora in consumer packaged goods and GlobalNetXchange in retailing—support CPFR between customers and suppliers. Although collaborative tools are common among the consortia (Mitra and Singhal, 2008), other B2B e-marketplaces, including Exostar in the aerospace industry and independent e-marketplaces such as the now-defunct Agribuy, offer tools to support collaborative design projects, for example, as well.

Consistent with the basic tenet of service operations strategy that service offerings and the delivery system (or channel) must be in alignment (Roth and Menor, 2003), this research aims to discern the service offerings that produce the greatest opportunity for successful B2B e-marketplace delivery. For guidance, we turn to strategic network theory (Katz and Shapiro, 1994) and TCE (Williamson, 1975).

The term “network effects” reflects the incremental value generated as more users join a network (Rohlfis, 1974). This term has migrated into the general business vernacular to describe the more formal concept of “network externalities.” Although in aggregate a B2B e-marketplace benefits from network externalities, certain B2B service offerings, such as those focused on auctions, for example, offer greater network externalities than others (Amit and Zott, 2001). That is, as more buyers participate in online auctions, more sellers are drawn to the market, which in turn draws more buyers in a virtuous cycle. This cycle is aptly demonstrated by the efficiency of the electronic energy marketplace, Intercontinental Exchange (Risk, 2006). Clearly, the interactive nature of online auctions and the network externalities from matching leverages the richness of the Internet more fully as a medium than digital catalogs and other procurement-related services (Jap and Mohr, 2002). Therefore, we propose:

**H3A.** B2B e-marketplaces emphasizing auction/matching functionality will be less apt to fail than those focusing on more basic procurement-related offerings.

The theory underlying TCE seeks to explain the appropriate boundaries of a firm based upon the costs of conducting transactions within the firm versus with outside providers (Coase,
The potential reduction in transaction costs engendered by the Internet (Benjamin and Wigand, 1995; Johnson et al., 2007) seems particularly relevant to our examination of potential service-offering-based drivers of failure among B2B e-marketplaces. When contrasting the functionality of basic procurement and collaborative service offerings, of particular interest is the role of asset specificity and marketplace uncertainty.

According to transaction cost theory, assets specifically tailored to a single customer increase the risk of “lock-in” due to high switching costs. Lock-in exposes a company to potential opportunism by the owner of the specialized resource (Williamson, 1985). Contrary to conventional wisdom, emerging theory in e-business argues for both transactional efficiency and the lock-in associated with asset specificity as sources of value for Internet-based businesses (Amit and Zott, 2001).

Although high switching costs can put a company at risk of exploitation, collaboration and asset specificity can be beneficial despite the lock-in risk (Amit and Zott, 2001; Dyer, 1997; Mukhopadhyay and Kekre, 2002). The sharing of information made possible by collaborative service offerings reduces information asymmetry; and this reduction in information asymmetry not only enables more informed decision-making, but also mitigates the potential transaction costs associated with asset specificity. Thus, if the collaborative service offerings prove equally valuable to both buyers and sellers, the parties can decrease the potential negative competitive tension engendered by traditional purchasing practices (Jap, 2002). Moreover, collaborative relationships drive superior financial results for suppliers due to increased revenue and better asset utilization, despite reduced gross margins (Dyer, 1996; Kalwani and Narayandas, 1995).

Likewise, Tunca and Zenios (2006) analytically demonstrate the importance of collaborative relationships in strengthening the viability of B2B e-marketplace offerings. Clearly, market size and cost uncertainty can increase the benefits that participants obtain from an electronic market that solely offers basic procurement functionality. However, Tunca and Zenios show that when the offering has significant incontractable attributes that need to be supported by informal relationships, alternative channels that emphasize deeper relationships can strategically overpower the efficiency gains offered by such e-marketplaces. Therefore, B2B e-marketplaces with collaborative service offerings that tender clear benefits for both buyers and suppliers are more likely to succeed. Accordingly:

**H3B.** B2B e-marketplaces emphasizing collaborative functionality will be less apt to fail than those focusing on more basic procurement-related offerings.

### 3. Research design and methodology

This study builds upon a comprehensive, secondary database of B2B e-marketplaces developed by the global management consulting firm Booz Allen Hamilton (BAH) during the first half of 2001. We augmented the BAH database with data from other secondary sources. In this research, we determined survival rates for a sample of the BAH database marketplaces 2 years after the NASDAQ peaked in 2000. To test our hypotheses, we also carried out analyses to create a consistent industry classification, define ownership structure, and develop a rigorous service-offering taxonomy.

#### 3.1. Research database

In early 2001, BAH teams in the U.S., Europe, Latin America, and Asia/the Pacific/Japan examined publicly available, archival information sources to create a database of 1802 B2B e-marketplaces (Laseter et al., 2001). The database includes key information such as headquarters location, ownership information, and a profile of the services offered.

In order to conduct a meaningful analysis, we need a precisely defined subsample of the BAH e-marketplaces, so we began by developing a consistent subset of universal record locators (URLs) with the URL designsations .com, .org, or .net. In addition, we retained only BAH entities that had one or more specific service offerings (defined as in Table 1), eliminating those whose only service offering was coded as “other.” We also excluded from our subsample all private e-marketplaces operated for the benefit of a single large company (e.g., www.gemedicalsystems.com launched by GE Medical Systems, now operated by GE Healthcare) since they did not represent new, separate business entities, as well as those presented exclusively in a language other than English due to the language limitations of our research team. This prescreening yielded a subset comprising 1227 B2B e-marketplaces.

#### 3.2. Measures

For the purposes of our research, several of the measures originally provided by BAH had to be further developed or refined. We

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<th>Descriptive statistics.</th>
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<tr>
<td>Energy</td>
<td>35</td>
</tr>
<tr>
<td>Financial services</td>
<td>73</td>
</tr>
<tr>
<td>Healthcare</td>
<td>64</td>
</tr>
<tr>
<td>Heavy manufacturing</td>
<td>53</td>
</tr>
<tr>
<td>High tech</td>
<td>65</td>
</tr>
<tr>
<td>Hospitality</td>
<td>33</td>
</tr>
<tr>
<td>MRO/office-supplies</td>
<td>80</td>
</tr>
<tr>
<td>Professional services</td>
<td>47</td>
</tr>
<tr>
<td>Retail/CPG</td>
<td>115</td>
</tr>
<tr>
<td>Transportation</td>
<td>75</td>
</tr>
<tr>
<td>Other</td>
<td>66</td>
</tr>
<tr>
<td>Total</td>
<td>942</td>
</tr>
<tr>
<td>Survival status</td>
<td></td>
</tr>
<tr>
<td>Active</td>
<td>515</td>
</tr>
<tr>
<td>Failed</td>
<td>427</td>
</tr>
<tr>
<td>Total</td>
<td>942</td>
</tr>
<tr>
<td>Headquarters location</td>
<td></td>
</tr>
<tr>
<td>Asia/Pacific/Japan</td>
<td>62</td>
</tr>
<tr>
<td>Europe</td>
<td>177</td>
</tr>
<tr>
<td>North America</td>
<td>692</td>
</tr>
<tr>
<td>Other</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>942</td>
</tr>
<tr>
<td>Ownership model</td>
<td></td>
</tr>
<tr>
<td>Consortium</td>
<td>53</td>
</tr>
<tr>
<td>Publicly traded</td>
<td>79</td>
</tr>
<tr>
<td>Independent</td>
<td>810</td>
</tr>
<tr>
<td>Total</td>
<td>942</td>
</tr>
<tr>
<td>Service offering</td>
<td></td>
</tr>
<tr>
<td>Design collaboration</td>
<td>46</td>
</tr>
<tr>
<td>Digital catalogs</td>
<td>693</td>
</tr>
<tr>
<td>Logistics services</td>
<td>215</td>
</tr>
<tr>
<td>Online auctions</td>
<td>621</td>
</tr>
<tr>
<td>Supply chain planning</td>
<td>84</td>
</tr>
<tr>
<td>Total</td>
<td>942</td>
</tr>
</tbody>
</table>

*Since B2B e-marketplaces can offer multiple services, these numbers reflect double counting and accordingly do not add to 100%.*

---

3 This database has been used in practitioner-focused articles published in strategy business. In addition, Laseter and Bodily (2004) utilize the database for contact information in targeting consortia-owned B2B e-marketplaces.
now detail our process for defining the measures for survival status, industry group, ownership structure, and service-offering clusters, along with several control variables in the subsections below.

### 3.2.1. Survival status

A practical, logical approach in ascertaining an e-marketplace’s survival status is simply to visit each associated website. However, given the ephemeral nature of many B2B e-marketplaces, such an approach is not straightforward: many entities retain accessible URLs even though their site may not actively facilitate e-commerce. For example, in their study of dot-com startups, Goldfarb et al. (2005b, 22) ultimately classified 40 websites as “living dead, that is, businesses that are not functioning, but still have live websites.” Consequently, as described below and depicted in Fig. 2, we developed a well-structured protocol and heuristics to create a definitive classification of survival status. Through this process, we classified each B2B e-marketplace entity as “active,” “dead,” “acquired,” or, if we were unable to make a determination of survival status, “uncertain.”

To begin, we visited the websites of the 1227 B2B e-marketplaces during the summer of 2002 to determine their operating status. We started by typing in the designated URL associated with each B2B e-marketplace in a web browser. If we failed to access the URL, we revisited it at least a week later in case the root cause was simply a short-term technical outage. If routed to an alternative site—for example, www.WineBuyer.com rerouted us automatically to www.Wine.com—we performed secondary research to determine whether the original e-marketplace had been acquired or simply had a name change. We specifically sought to clarify whether a company, or rather simply its URL, was acquired because active companies often took ownership of the URLs of failed companies to redirect traffic automatically to their own websites.

If able to access the e-marketplace successfully, we next examined the site to find the most recent date reference in a news release, item catalog listing, or copyright. We also identified a contact name on the site and sent a short e-mail with a general request for further information on the e-marketplace. We logged whether the e-marketplace replied to our query and followed up with a second e-mail 1 week later if we did not receive a reply.

We classified any e-marketplace that replied directly to our query as “active.” Those that did not respond to either of the two e-mails and did not feature any date references in the current year were classified as not active, i.e., “dead.” As indicated in Fig. 2, some websites provided contradictory signals—for example, current-year dates but a failure to reply to our two e-mail requests—and we gave these an “uncertain” classification. To be conservative, we omitted these from further analysis. Following such a rigorous classification approach greatly diminishes the possibility that we are systematically underestimating or overestimating survival rates (Goldfarb et al., 2005b).

After removing any entities classified as acquisitions or uncertain from the research population of 1227 entities, 942 B2B e-marketplaces remained that could be clearly distinguished as either survivors or failures. These 942 e-marketplaces represent the data from which we subsequently operationalize the independent variables. Consistent with the Internet bubble burst, only 55% of the 942 e-marketplace entities remained active in 2002—the low point of the NASDAQ stock market decline. This high-failure rate is consistent with results developed independently by Deloitte Consulting and CAPS Research (Le et al., 2004). We provide the descriptive statistics for the 942 B2B e-marketplaces in Table 1.

### 3.2.2. Industry meta groups

Upon in-depth investigation of the original BAH database, we found an industry classification providing 26 different options with differing levels of specificity. Accordingly, we developed a more logical and parsimonious classification system comprising 14 major industrial sectors (see Table 1), and established a systematic process to ensure a degree of consistency in these classifications.

To begin, for the purposes of this research, we combined several BAH industry classification categories into single, higher-level
sctors to achieve a relatively similar level of specificity across the classification categories. For example, the BAH database includes chemicals, metals, and plastics industry classifications. We merged these three industries into a single sector we refer to as “basic materials.” Alternatively, some BAH classifications were already at an appropriate level of specificity for our study, such as construction, energy, financial services, and healthcare, so we retained these categories in our industrial sector classification.

To ensure correct classification, two of the authors reviewed the 942 B2B e-marketplaces and independently classified each of these e-marketplaces into one of the 14 industrial sectors specified in Table 1. In doing so, we avoid single-rater bias issues. We note that 66 e-marketplaces lacked a specific sector focus, and as a result, we removed these e-marketplaces from our subsequent logistic regression analysis. In a check for robustness, the exclusion of these 66 B2B e-marketplaces from the logistic regression analysis did not substantively influence our results.

The Perreault and Leigh (1989) measure of interjudge agreement ($I_r$) of this initial, independent coding was 87.11%, which indicates excellent agreement.4 We re-examined the few e-marketplaces for which we observed inconsistencies between the two sets of coding, using the third author to resolve any discrepancies, and ultimately to reach complete agreement. As shown in Table 1, the resulting number of B2B e-marketplaces by industrial sector ranges from 33 sites serving the hospitality sector to 115 for retail/CPG.

Our literature review (see Section 2.1) guided the development of the conceptual typology of B2B e-marketplaces serving these 14 industrial sectors into three meta groupings as depicted in Fig. 3, using the degree of information dependency and tacitness as the two axes. We refer to the resulting three meta groups as mature-product-based sectors (low dependence/low tacitness), customer-facing service sectors (high dependence/high tacitness), and sweet spot sectors (high dependence/low tacitness). While theoretically possible, as expected, we did not observe B2B e-marketplaces serving industrial sectors characterized by value-added and exchange activities that are low in information dependence and high in information tacitness in our sample. Given the theoretical arguments in Section 2.1, this quadrant in Fig. 3 represents a poor combination for the creation of value through B2B e-marketplaces. Furthermore, since tacit information is uncoded, it tends to go unnoticed unless it is important. Thus, emphasis on simultaneous low information dependence and high information tacitness does not appear to be logically sustainable.

As shown in Fig. 3, we classified the four mature, commoditized industrial sectors—agriculture, basic materials, construction, and heavy manufacturing—into the mature-products-based sector quadrant. Overall, this industry group tends to have highly routinized tasks and/or explicit production schedules to facilitate coordination, which indicates relatively lower levels of information dependence and tacitness. One might argue that construction is different given the extent of the service component associated with this sector. However, similar to the other sectors classified in this quadrant, many facets of construction are typically associated with routinized project management activities (e.g., residential and basic facilities). Therefore, the value-added and exchange activities characteristic of this sector depend on relatively less information than other service sectors in our sample. In addition, blueprints typically transmit key information, which are quite detailed and hence highly codified.

Next, we classified those service-intensive sectors with relatively high degrees of customer interaction, customization, and/or complexity—education/knowledge, healthcare, hospitality, professional services, and retail/CPG—in the customer-facing service sectors group. The value-added and exchange activities in such sectors typically rely on a great deal on information, and much of this information is tacit in nature.

Finally, we classified five industrial sectors—energy, financial services, high tech, MRO/office-supplies, and transportation—as falling into the sweet spot sectors group, which is characterized by high information dependence but low information tacitness. This group comprises more routine and mass services and includes producers of tangible goods with a significant service component in their strategic bill of materials. For example, MRO/office-supplies industries provide goods that facilitate or are part of a service package. Hence, they have greater information dependence, particularly relative to the mature-product-based sectors in the bottom right quadrant. As discussed in Section 2.1, high tech fits here because it is a dynamic (fast clockspeed) sector with many ongoing design changes that have to be conveyed frequently to business partners. In addition, most high tech products include significant software components.

Fig. 3 shows the number of B2B e-marketplaces falling within each of the three quadrants in our conceptual typology, with 254 in mature-product-based sectors, 328 in the sweet spot sectors, and 294 in customer-facing service sectors. Consistent with our theoretical development in Section 2.1, we find that the B2B e-marketplace failure rate differs across these industry groups ($p = .00$) but not within each group (mature-product-based sectors: $p = .48$; sweet spot sectors: $p = .51$; customer-facing service sectors: $p = .38$). Such statistics provide an additional check of the validity and robustness of our industry meta groups, as it suggests shared characteristics among the sectors comprising each group.

3.2.3. Ownership classification

Our operationalization of B2B e-marketplace ownership structure is consistent with the coding in the original BAH database. That is, if the e-marketplace emerged from a collaboration of several companies, compatible with the BAH database, we classified it as a consortium, whether formed as a for-profit or nonprofit entity. For those entities not classified as a consortium, we then determined whether the e-marketplace was publicly traded on one of the major stock exchanges, such as the New York Stock Exchange or NASDAQ. We classified all others as independent, i.e., privately owned. Independent ownership dominated the sample (86%) of 942 B2B e-marketplaces. Only 8% are publicly traded, while 6% are consortium-backed (see Table 1).

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4 I.e., values that exceed 65% generally indicate an acceptable level of agreement (Moore and Benbasat, 1991).
Table 2
Service-offering types by cluster.

<table>
<thead>
<tr>
<th>Service-offering taxons</th>
<th>Overall sample</th>
<th>Procurement aides Cluster 1</th>
<th>Auction/matching specialists Cluster 2</th>
<th>Collaboration facilitators Cluster 3</th>
<th>F-statistic p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital catalogs</td>
<td>74%</td>
<td>100% (2, 3)</td>
<td>0% (1, 3)</td>
<td>62% (1, 2)</td>
<td>F = 5594.2 p ≤ .0001</td>
</tr>
<tr>
<td></td>
<td>N = 693</td>
<td>N = 656</td>
<td>N = 0</td>
<td>N = 37</td>
<td></td>
</tr>
<tr>
<td>Online auctions</td>
<td>66%</td>
<td>59% (2)</td>
<td>88% (1, 3)</td>
<td>58% (2)</td>
<td>F = 33.2 p ≤ .0001</td>
</tr>
<tr>
<td></td>
<td>N = 621</td>
<td>N = 388</td>
<td>N = 198</td>
<td>N = 35</td>
<td></td>
</tr>
<tr>
<td>Logistics services</td>
<td>23%</td>
<td>21% (3)</td>
<td>12% (3)</td>
<td>88% (1, 2)</td>
<td>F = 98.4 p ≤ .00001</td>
</tr>
<tr>
<td></td>
<td>N = 215</td>
<td>N = 135</td>
<td>N = 27</td>
<td>N = 53</td>
<td></td>
</tr>
<tr>
<td>Supply chain planning</td>
<td>9%</td>
<td>2% (2, 3)</td>
<td>7% (1, 3)</td>
<td>88% (1, 2)</td>
<td>F = 536.5 p ≤ .0001</td>
</tr>
<tr>
<td></td>
<td>N = 84</td>
<td>N = 15</td>
<td>N = 16</td>
<td>N = 53</td>
<td></td>
</tr>
<tr>
<td>Design collaboration</td>
<td>5%</td>
<td>2% (3)</td>
<td>4% (3)</td>
<td>38% (1, 2)</td>
<td>F = 92.4 p ≤ .0001</td>
</tr>
<tr>
<td></td>
<td>N = 46</td>
<td>N = 15</td>
<td>N = 8</td>
<td>N = 23</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>N = 942</td>
<td>N = 656</td>
<td>N = 226</td>
<td>N = 60</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. The percentages in each cell indicate the penetration rate of each service offering.
2. Numbers in parentheses represent statistically significant differences among clusters (p ≤ .05) based upon Duncan’s pairwise comparison procedure.
3. The p-values associated with the F-statistics are derived from one-way ANOVAs.

3.2.4. Service-offering clusters
The BAH database documented the current and planned service offerings for each B2B e-marketplace in five core service areas: digital catalogs, online auctions, logistics services, supply chain planning, and design collaboration. Across the 942 B2B e-marketplaces, the penetration rates of the services offered varied dramatically from a high of 74% for digital catalogs to a low of 5% for design collaboration (see Table 1), with an average of 1.76 services per e-marketplace. Accordingly, we sought to identify the dominant combinations (or clusters) of current service offerings based on their B2B e-marketplace functionality, as hypothesized by our theoretical model.

To develop a numerical taxonomy of service offerings, we conducted a two-step cluster analysis recommended by Hair et al. (1996) and Ketchen and Shook (1996). That is, we employed the ACECLUS procedure followed by the FASTCLUS procedure in SAS 9.1, using service-offering type as the taxons. Our two-step analysis identified three distinct service-offering clusters, which we label procurement aides, auction/matching specialists, and collaboration facilitators (see Table 2).

Cluster 1—procurement aides—contains 656 B2B e-marketplaces. Each member offers digital catalogs and has relatively low rates of penetration across the other four service-offering types. Clearly, procurement aides emphasize the streamlining of traditional purchasing transactions by utilizing digital catalogs to share information in a fast and economical manner.

Cluster 2, the auction/matching specialists, comprises 226 B2B e-marketplaces, of which 88% offer online auctions. None offered digital catalogs, and all have below-average use of the three collaborative service offerings. Thus, auction/matching specialists focus on offering firms increased visibility to market prices, and more generally, to supply opportunities (Elmaghraby, 2007).

The 60 e-marketplaces in Cluster 3—collaboration facilitators—show the highest penetration rates for the three services requiring the greatest degree of interaction between customers and suppliers: logistics services, supply chain planning, and design collaboration. 88% of the collaboration facilitators offer logistics services and supply chain planning, while 38% offer design collaboration (a service with an overall penetration rate of only 5%). While collaboration facilitators likewise make use of digital catalogs and online catalogs, they do so to a lesser degree than the procurement aides and auction/matching specialists, respectively. This combination of service offerings is consistent with Johnson et al. (2007, 1271), who find that firms often automate basic supply chain processes, such as online purchasing ordering systems, prior to “using e-business technologies for supply chain integration and collaboration.”

We demonstrate the validity and robustness of our three-cluster solution in four key ways. First, the service-offering variables are significantly different from one another across the clusters, thereby establishing the distinctiveness of the procurement aide, auction/matching specialist, and collaboration facilitator clusters. Second, following the clustering procedures described above, we also investigated two- and four-cluster solutions. The three-cluster solution is both theoretically and statistically superior to these alternative solutions. Third, similar to Miller and Roth (1994), we utilized discriminant analysis to assess whether our three clusters were correctly classified based on a jackknife procedure and the linear discriminant function, with good results. That is, the discriminant analysis, conducted in SAS 9.1, yielded a 96% success rate, which exceeds the 95% rule-of-thumb cut-off value. Finally, the correlations between industry meta groups (Fig. 3) and service-offering clusters (Table 2) indicate that no tautological relationships exist.

3.2.5. Control variables
Consistent with the “liability of newness” perspective expressed in the business failures literature (Chava and Jarrow, 2004; Freeman et al., 1983; Ranger-Moore, 1997; Stinchcombe, 1965), we expect newer B2B e-marketplaces to have higher failure rates than more established B2B e-marketplaces. Relative to their more established counterparts, young B2B e-marketplaces typically invest greater effort and (scarce) resources towards training, the creation and execution of new organizational routines, and the development of a credible web of supply chain relationships. For example, Hannan and Freeman (1984, 158) assert, “External actors may also wait for an initial period of testing to be passed before making investments in exchange relationships with new organizations.”

Start-up activities take time to develop, which provides more established B2B e-marketplaces with an advantage over newer ones. At the same time, B2B e-marketplace first-movers may establish dominance in the marketplace that is difficult for followers to overcome. As a result, we anticipate older B2B e-marketplaces—that tend to have more established operations and durable ties with supply chain partners—to be more apt to survive than younger ones.

We examine three proxies for e-marketplace age with secondary data obtained from Alexa, a web information company...
Table 3
Profiles of selected B2B e-marketplaces.

<table>
<thead>
<tr>
<th>B2B e-marketplace</th>
<th>Founding date/headquarters location</th>
<th>Industrial sector</th>
<th>Industry meta group</th>
<th>Ownership model</th>
<th>Service-offering cluster</th>
<th>Survival status</th>
</tr>
</thead>
<tbody>
<tr>
<td>E2open</td>
<td>March 2000 US/California</td>
<td>High tech</td>
<td>Sweet spot sector</td>
<td>Consortium</td>
<td>Collaboration facilitator</td>
<td>Active</td>
</tr>
<tr>
<td>TheSupply.com</td>
<td>May 1999 US/California</td>
<td>High tech</td>
<td>Sweet spot sector</td>
<td>Independent</td>
<td>Procurement aide</td>
<td>Dead</td>
</tr>
</tbody>
</table>

* Date shown is the earliest of the Alexa Online Sinc and Wayback Machine dates as described in Section 3.2.5.

(http://www.alex.com). Each age proxy is measured in quarters from the time at which we assessed the survival fate of each B2B e-marketplace (summer 2002). The first employs an Alexa “Online Sinc” date. The second age variable builds upon the earliest date documenting a website in the “Wayback Machine,” a source used by prior researchers (Goldfarb et al., 2005b). Our third age-related variable simply uses the earliest of the Online Sinc and Wayback Machine dates.

Since the three age variables lead to similar results in our subsequent logistic regression analyses, we include the third age variable as the control because it provides a founding date for the greatest number of entities (n = 918) in our subsample of 942 B2B e-marketplaces. The average e-marketplace age for this continuous control variable—relative to the summer of 2002—is approximately 14 quarters (3.5 years), and the median age is 12 quarters (3 years). These statistics are consistent with Laseter and Bodily (2004), who observed an average age of slightly under 14 quarters as of third quarter 2002 in their sample of 61 B2B e-marketplaces.

In addition, we control for country location of the entity’s headquarters using the BAH database. Because countries located outside of North America may have different characteristics, on average, with respect to development of B2B e-marketplaces, headquarters location might control for other important factors, such as national customer readiness for technology. Essentially, our headquarters location control variable tests whether North American and foreign B2B e-marketplaces exhibited similar failure patterns.

The headquarters of the entities represented by the 942 B2B e-marketplaces spans 30 countries. Not surprisingly, since our sampling frame included only e-marketplaces in English, the majority are located in North America (73%), with Europe accounting for the next largest percentage (19%) and Latin America and Asia/Pacific/Japan together comprising 8% (see Table 1).

3.2.6. B2B e-marketplace case examples

To illustrate the application of the above measures in practice, we highlight several B2B e-marketplaces from our sample (see Table 3). Consider the success story of E2open, founded in 2000 with “... a vision of providing a complete solution for today’s complex, outsourced trading networks—a solution that includes software, deployment, operations, and partner management” (http://www.e2open.com/about/corporate-overview). Positioned early on in the high tech sector and thus a member of our sweet spot sectors group, E2open had the backing of a consortium including IBM, LG Electronics, Panasonic, Toshiba, and Hitachi. This B2B e-marketplace also positioned itself as a value-added solution for collaborative coordination among customers and their suppliers (rather than solely offering basic procurement or auction/matching functionality). Today, E2open supports over 75,000 trading partners and has revenues of approximately $40 million (Hoge, 2009).

Like E2open, TheSupply, Inc. targeted the high tech sector but with the stated mission “to design, develop, and deploy the world’s first and leading e-commerce solution for the electronics materials industry” (http://web.archive.org/web/20010302142251/thesupply.com/top_company_info/frametop_company_info.html).

In contrast to E2open, however, TheSupply, Inc. lacked the backing of a consortium of companies to guide its efforts as initial investors and customers (see Table 3). Furthermore, this B2B e-marketplace focused on linking online catalogs rather than the value-added services of a collaboration facilitator. Today, if one were to access the URL www.thesupply.com, one would discover that the domain name is for sale. As this example illustrates, B2B e-marketplaces operating in industrial sectors characterized by value-added and exchange activities that are highly information dependent and more codifiable may improve the odds of success, but certainly does not guarantee it.

Elemica further underscores the idea that industrial sector membership—and specifically being a member of the sweet spot sectors group—is unlikely to be the sole driver of B2B e-marketplace survival. Although not a member of the sweet spot sectors group (Table 3), Elemica—founded in 1999 with consortia backing from 22 companies in the oil and gas industrial sectors—has successfully focused on collaboration tools with a mission to “… unlock the true value of global collaboration through robust business applications” (http://www.elemica.com/About/History/page.aspx).

Our final case example, Industrialbid.com, made strategic operations decisions in multiple areas that likely lowered its odds of B2B e-marketplace success (Table 3). Industrialbid.com operated in a mature-product-based industrial sector with a catalog offering, designed to be populated by interested sellers. Without the backing of a critical mass of suppliers or customers and with a business model offering very limited value-added service, it is unclear whether or not this B2B e-marketplace ever moved far beyond a couple of web pages that continued to reside on a server for a few years before becoming another bulletin board for a domain name (now for sale).

4. Results and discussion

As described above, of the 942 B2B e-marketplaces for which we have survival status information, 66 lack a specific industry focus and 24 are missing Alexa age-related data. Thus, our analysis of the original BAH database and development of the measures yielded a final sample of 8545 B2B e-marketplaces with complete information for testing the hypothesized model. We note that there are no discernable differences between the sample of 942 and that of 854 in terms of failure rates, ownership classification, and service-offering cluster membership. Likewise, cross tabs of failure rates with the ownership classification and service-offering cluster membership variables reveal no statistical differences between these two samples.

5 Because two B2B e-marketplaces are not focused on any particular industrial sector (classified as “other”) and are likewise missing Alexa age-related data, we use a sample of 854 (942 − 66 − 24 = 854) B2B e-marketplaces to test our hypothesized model.
Using the dataset of 854 B2B e-marketplaces and controlling for age and headquarters location, we regress the failures and survivors against the following characteristics: industry meta grouping, ownership structure, and service-offering functionality. Because of the dichotomous nature of the B2B e-marketplace failure variable, we fit the hypothesized logistic regression model below using maximum likelihood estimation:

\[ Y = \beta_0 + \beta_1 \text{age} + \beta_2 \text{North America} + \beta_3 \times \text{mature-product-based} + \beta_4 \text{customer-facing services} + \beta_5 \text{publicly traded} + \beta_6 \text{consortium} + \beta_7 \text{auction/matching specialists} + \beta_8 \text{collaboration facilitators} + \varepsilon \]

Note that categorical variables for a headquarters location outside of North America (rest-of-world), sweet spot sectors, independently owned B2B e-marketplaces, and procurement aides are not explicitly included in the model above because these categorizations are designated as the comparison or reference groups. We estimate all logistic regression models using the LOGISTIC procedure in SAS 9.1 software.

We utilize two methods to determine how well the hypothesized model specified above fits the data. First, we assess several traditional logistic regression goodness-of-fit statistics: the Pearson chi-square and the likelihood ratio chi-square fit statistics. If a logistic regression model fits the data well, these two fit statistics will be statistically nonsignificant assuming the sample size requirement that each predicted cell count is at least five is met (Stokes et al., 1995).

Due to the age control variable, our hypothesized model, like most logistic regression models containing continuous explanatory variables, does not meet the sample size requirement of at least five observations per predicted cell count. Accordingly, one should interpret statistically significant Pearson chi-square and the likelihood ratio chi-square fit statistics with caution. The resulting Pearson chi-square ($Q_P = 352.4, 306 \text{ d.f.}; p = .04$) and likelihood ratio chi-square ($Q_L = 342.3, 306 \text{ d.f.}; p = .08$) test statistics for our hypothesized model are indeed statistically significant, which basically provides inconclusive evidence regarding overall model fit.

Despite the word of caution raised above, we note that interpretation of $Q_L$ involves comparing the main effects of the hypothesized model with a SAS-estimated saturated model, the latter of which is a fully specified interaction model. Essentially, the $Q_L$ test statistic is a chi-square difference test of the hypothesized model and the SAS-estimated saturated model. A statistically nonsignificant $Q_L$—assuming the models meet the sample size requirement for use of this test—indicates that the set of interaction terms from the SAS-estimated saturated model do not explain any significant variation beyond that explained by the main effects of the hypothesized model, thereby suggesting good model fit (for the hypothesized model). Because our $Q_L$ test statistic is weakly significant ($p \leq .10$), we examine in Section 4.4 whether any interaction terms should be added to the hypothesized model.

Second, as suggested by Stokes et al. (1995) for logistic regression models that include continuous variables, we assess the fit of the hypothesized model compared to a reduced model that only includes the age and North America control variables. Specifically, we compute a likelihood ratio test to determine whether the added contribution of the six additional categorical variables (mature-product-based, customer-facing services, publicly traded, consortium, auction/matching specialists, and collaboration facilitators) is statistically significant and therefore provides an improvement in overall model fit. The reduced model log likelihood value is 1128.3 while the hypothesized is 1087.4, the difference of which yields a highly significant likelihood ratio test statistic (40.9, 6 d.f.; $p < .001$). This likelihood ratio test result offers some empirical evidence that the hypothesized model fits the data well as suggested from our theoretical arguments.

In terms of interpreting the individual parameter estimates of the hypothesized model (Table 4), a negative beta coefficient indicates that the explanatory variable decreases the likelihood of the B2B e-marketplace failure; a positive coefficient indicates the opposite. Of the control variables, as expected, we find that the older the B2B e-marketplace, the less likely it is to fail ($\beta_1 = -1.33; p < .001$; Table 4). A North American headquarters location, however, does not appear to be a significant predictor of B2B e-marketplace success or failure (see Table 4). Below we discuss the hypothesized

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5 Given it lacks univariate normality, we transform the age control variable by taking the logarithm.

7 In computing the $Q_L$ statistic for the hypothesized model, SAS automatically estimates a saturated model for comparison purposes. According to Stokes et al. (1995, 306), “...in a saturated model, there are as many parameters in the model as there are response functions.” Thus, a saturated model is fully specified in the sense that it includes the main effects and all possible interaction effects. We do not report the results of this SAS-estimated saturated model.
model logistic regression results in Table 4 that are associated with the hypotheses given in Section 2.

4.1. Influence of industry group characteristics on B2B e-marketplace failure

Based on H1A and H1B, we expect B2B e-marketplaces associated with what we call sweet spot sectors to be less likely to fail than those positioned at the extremes of the product–service continuum. As predicted, the positive coefficients of the variables for the mature-product-based sectors ($\beta_4 = .56; p \leq .001$) and customer-facing services sectors ($\beta_4 = .56; p \leq .001$) demonstrate that those industry meta groupings were more apt to fail during the collapse of the Internet bubble (Table 4), indicating a potential mismatch, on average, with e-marketplace delivery systems. In fact, odds ratio estimates indicate that B2B e-marketplaces operating within the mature-product-based sectors and customer-facing service sectors had a greater probability of failure of 1.62 and 1.75 times, respectively, relative to those in the sweet spot sectors group.

Overall, these empirical results are in line with the theoretical scope and impact of the Internet on firm boundaries as proposed by Afuah (2003) and the emerging e-services strategy literature. Clearly, changes in technology have the potential to drive substantial corresponding changes to industrial sectors and, at a higher level, even entire economies (Karmarkar and Apte, 2007). In our sample, the relative degree of information dependence and tacitness associated with a sector's characteristic value-added activities for creating products and services determines, in part, the ability of B2B e-marketplaces to add value.

Our findings are also consistent with the e-services literature that views advanced information and communication technology (ICT) as a good medium for more routine and scaleable service processes, and as a hedge when product or market responsiveness is needed. On average, the value-added of the Internet for more mature, commodity-like product-based sectors is not sufficient to produce high relative odds of success. Interestingly, the complexities typically associated with customer-facing service processes appear to spill over, or have a "trickle-up" effect, to business partner interactions in the B2B e-marketplace environment, making the Internet a potentially less useful channel and thereby increasing the odds of failure.

4.2. Influence of ownership structure on B2B e-marketplace failure

Counter to expectations, the empirical results show no support for H2A. That is, publicly traded entities have similar odds of failure as their independently owned counterparts ($\beta_5 = -.03, p \geq .10$; see Table 4). The lack of statistical evidence underscores an important lesson: access to the stock market does not increase the odds of B2B e-marketplace success.

In support of H2B, consortium ownership is highly significant with a negative parameter estimate ($\beta_6 = -1.64, p \leq .001$), thereby indicating decreased likelihood of failure versus independent ownership. Indeed, the corresponding odds ratio of .194 suggests that consortium-backed B2B e-marketplaces are about one-fifth as likely to fail as the more common independently owned ones. Although not hypothesized, further analyses involving all paired contrasts indicates that consortium-owned B2B marketplaces are also less likely to fail compared to publicly traded ones ($\beta = -1.61, p \leq .001$). These findings highlight the benefit of companies joining forces and provide strong evidence for the value of mimetic isomorphism in improving e-marketplaces' odds of survival after the NASDAQ peaked in 2000.

4.3. Influence of service-offering clusters on B2B e-marketplace failure

In contrast to conventional wisdom, we found no empirical support for H3A: B2B e-marketplaces classified as auction/matching specialists appear to be just as likely to fail as those offering more common procurement aides ($\beta_7 = -.07, p \geq .10$; see Table 4). Thus, the expected network effects may not be realized for auction/matching B2B service offerings over and above those for basic procurement.

On the other hand, our empirical results offer weak support for H3B. Consistent with Tunca and Zenios' (2006) analytic work, we find that the collaboration facilitators cluster has lower odds of failure relative to the more functionally based procurement aides ($\beta_8 = -.56, p \leq .10$). These results corroborate findings in the strategic management and marketing literatures (Dyer, 1997; Jap, 2002): the value of investments in asset specificity that are beneficial to both buyers and sellers extends to the world of the Internet. In B2B, collaborative tools (e.g., forecasts and dynamic

Table 5
Interaction model logistic regression analysis results.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter estimate</th>
<th>Std. error</th>
<th>p-value</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age × rest-of-world</td>
<td>-.14834</td>
<td>.2302</td>
<td>.0000</td>
<td>.227</td>
</tr>
<tr>
<td>North America</td>
<td>.1340</td>
<td>.1736</td>
<td>.4404</td>
<td>1.143</td>
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<tr>
<td><strong>Industry grouping</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Mature-product-based services</td>
<td>.4784</td>
<td>.1883</td>
<td>.0111</td>
<td>1.613</td>
</tr>
<tr>
<td>Customer-facing services</td>
<td>.5294</td>
<td>.1777</td>
<td>.0029</td>
<td>1.698</td>
</tr>
<tr>
<td><strong>Ownership model</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent ownership</td>
<td>.3497</td>
<td>.3523</td>
<td>.3209</td>
<td>1.419</td>
</tr>
<tr>
<td>Consortium</td>
<td>-.12455</td>
<td>.3936</td>
<td>.0016</td>
<td>.288</td>
</tr>
<tr>
<td><strong>Service-offering cluster</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procurement aides</td>
<td>.3497</td>
<td>.1768</td>
<td>.5870</td>
<td>.908</td>
</tr>
<tr>
<td>Collaboration facilitators</td>
<td>-.5495</td>
<td>.3181</td>
<td>.0840</td>
<td>.577</td>
</tr>
<tr>
<td><strong>Age × ownership model</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age × independent ownership</td>
<td>-.15473</td>
<td>.9842</td>
<td>.1159</td>
<td>.213</td>
</tr>
<tr>
<td>Age × publicly traded ownership</td>
<td>2.6614</td>
<td>.7864</td>
<td>.0007</td>
<td>14.316</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Pearson chi-square (Q) result: 278.88 (304 d.f., p = .046). Likelihood ratio chi-square ($\chi^2$) result: 324.54 (304 d.f., p = .000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Since age is a continuous explanatory variable, use of a reference group is not applicable for the main effect term.</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
product design information) provide much greater information richness than do procurement aides. Further, procurement aides create dyadic pairs of transactions—a single customer ordering from a specific supplier—whereas collaborative service offerings extend to multiple parties, and in turn, provide for greater reach and richness of information (Evans and Wurster, 2000; Rosenzweig, 2002). Thus, the value-added of collaborative tools in fostering customer-supplier relationships appears to be a service strategy-based deterrent to B2B e-marketplace failures.

4.4. Post hoc analysis

Recall that the Q statistic associated with the hypothesized model is significant, albeit weakly, suggesting interaction terms may be important. Although we considered all interaction terms related to the saturated model, we simply report a model containing the age x ownership interaction effects as this set of variables was the only one to show statistical significance. Note that because interaction terms increase the potential for multicollinearity, we mean centered the age variable (Aiken and West, 1991). We refer to the results generated from this post hoc analysis as “interaction model” results (see Table 5).

The Pearson chi-square ($Q_p = 278.9, 304 d.f.; p = .85$) and likelihood ratio chi-square ($Q_L = 324.5, 304 d.f.; p = .20$) test statistics for our interaction model are statistically nonsignificant and therefore indicate good overall model fit. At the same time, we note that the main effect logistic regression results associated with the hypothesized (Table 4) and interaction (Table 5) models are statistically the same, thereby attesting to the robustness of our hypothesis test results.

While the main effects of B2B e-marketplace age and consortium ownership both positively affect the odds of survival, we find that older consortium e-marketplaces are more likely to fail relative to older independent ($\beta = 2.66, p < .001$; Table 5) and publicly traded ($\beta = 4.21, p < .001$; additional paired contrast not reported in Table 5) e-marketplaces. To ease interpretation, we present these interaction effects as predicted probabilities for selected age groups in Table 6. The predicted probabilities, calculated using the “predict” command in STATA 11, provide additional detail with respect to the effect of B2B e-marketplace age on survival status for the three ownership models.

For example, consistent with H2B, Table 6 indicates that consortium-backed B2B e-marketplaces have a lower probability of failing, on average, relative to independently owned (and publicly traded) ones. However, the results in Tables 5 and 6 combined suggest that the likelihood of failure increases with B2B e-marketplace age for the consortium ownership model, and decreases with age for the independent and publicly traded ownership models.

On the one hand, these results simply suggest that early, or first-mover, versions of consortia-backed B2B e-marketplaces were not as viable as one might expect. An alternate explanation, however, may be due to the general degree of goodwill ($) among investors and consortium members toward this ownership structure early on relative to the independent and publicly traded B2B e-marketplaces (Mello, 2001). Given the initial hype and willingness to invest in consortia-backed B2B e-marketplaces, perhaps some first-mover consortium partnerships delayed their ultimate demise over the time horizon of our study. Such a conjecture is consistent with Laseter and Bodily (2004), who find that consortium ownership was positively related to the leading indicator of revenues, but not the profitability metrics included in that study.

5. Conclusions

This study offers empirical support for a number of emergent ideas in B2B e-commerce research and fills an identified gap in the growing e-services operations strategy literature. We provide empirical evidence that three service strategy-related characteristics—industrial sector, ownership form, and functionality of service offering—influenced B2B e-marketplace survival 2 years after the Internet peak. Our study addresses the recent call for studies that advance e-services research. However, many more questions in this emerging area of study remain unanswered. Below, we summarize the limitations of the study, areas for future research, and the contributions of our research to theory and practice.

5.1. Limitations and areas for future research

Like all research efforts, ours faced limitations that suggest opportunities for future research. To date, much of the research into B2B e-marketplaces has drawn from anecdotal evidence or relatively small samples. Although this examination of failure rates of B2B e-marketplaces addresses a large sample of e-marketplaces, it may not be fully representative. The BAH database is one of the most comprehensive available, but our subsample may have gaps due to a rigorous screening process. While we tested for regional differences, our analysis uses an English-based subset of the original database due to the authors’ lack of foreign language skills and the need for evaluating each site.

Our method for identifying failures, although rigorous and practical given the nature of the entities under study, does not provide definitive evidence of failure or survival. Our subsample captures B2B e-marketplace entities launched during the run-up to the NASDAQ peak in 2000; assessment of their status occurred during the summer of 2002 as the nadir approached. Arguably, such a study has limitations in that we are unable to control precisely for several additional factors or conditions. For example, the relatively short period of study obscures the importance of longer-term infrastructural factors, such as competencies that are required for long-run sustainability, which should be the subject of future research. Likewise, technology is constantly evolving, and future research should examine if and how our results change over time. Nonetheless, our initial examination indicates that the vast majority of the failures occurred within the shakeout period, and the final model is relatively robust, with key strategic service operations components that are consistent with theory.

Finally, because we use secondary data, we were not able to control directly for the size of the B2B e-marketplaces. Often, one measures size in terms of revenues (or assets, in financial services). In the context of this research, getting an appropriate measure of size is nontrivial, and there are no standard metrics. E-marketplaces operate with many different revenue models, and some of these entities may have failed before achieving any revenues. Add their start-up nature, the wide mix of options, and evolving business

Table 6

<table>
<thead>
<tr>
<th>Age (quarters)</th>
<th>Status</th>
<th>Survival status of “dead”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young (≤12 quarters)</td>
<td>Consortium (n = 34)</td>
<td>.1158</td>
</tr>
<tr>
<td></td>
<td>Independent (n = 396)</td>
<td>.5541</td>
</tr>
<tr>
<td></td>
<td>Publicly traded (n = 14)</td>
<td>.6735</td>
</tr>
<tr>
<td>Mid (13–19 quarters)</td>
<td>Consortium (n = 8)</td>
<td>.2201</td>
</tr>
<tr>
<td></td>
<td>Independent (n = 243)</td>
<td>.4010</td>
</tr>
<tr>
<td></td>
<td>Publicly traded (n = 30)</td>
<td>.4201</td>
</tr>
<tr>
<td>Old (≥20 quarters)</td>
<td>Consortium (n = 9)</td>
<td>.3670</td>
</tr>
<tr>
<td></td>
<td>Independent (n = 96)</td>
<td>.2410</td>
</tr>
<tr>
<td></td>
<td>Publicly traded (n = 24)</td>
<td>.1237</td>
</tr>
</tbody>
</table>

a B2B e-marketplace ages are actual ages, not log transformed.
models, and it is not clear that controlling for a typical size measure would offer truly meaningful insights.

5.2. Theoretical summary

Observations from practice suggest that some industrial sectors have a significant edge over other sectors in successfully leveraging B2B e-marketplaces. We build upon and extend the service operations literature in order to provide theoretical underpinnings for such empirical observations, and we do so using two important information-based factors: the relative degrees of information dependence and of information tacitness. Many acknowledge that current industrial classification schemes are insufficient to describe the emergence of services in goods-producing firms and the pace of technological innovation. These two attributes of information—in combination—proved theoretically and practically useful in distinguishing among classes of industrial sectors (e.g., between product sectors that have mature processes and those with high levels of service components and between service sectors whose processes are fairly routine and transactional and those that are highly customer facing).

A highly significant finding is that industry meta groups on both extremes of the product-service continuum increased odds of B2B e-marketplace failure. That is, the odds of failure for B2B e-marketplaces serving mature-product-based sectors and customer-facing service sectors are nearly double those of the ones serving a sweet spot due to their mismatch with the e-marketplace service delivery system. The time horizon of our study essentially allows us to obtain a snapshot of the long-standing bipolar distinctions between tangible product and intangible service businesses, as certain of their attributes impose barriers to survival in turbulent times.

The partial support of our hypotheses regarding ownership structure provides a further contribution to the organizational ecology body of knowledge. Although most of the e-marketplaces in our study never went public, their survival resulted from the same underlying dynamics that caused the stock market collapse. The differences between failure rates of independent and publicly traded e-marketplaces showed no significance, perhaps due to the short time horizon of the study and/or the bubble effect for Internet stocks during the time of the study.

The success of consortium-backed e-marketplaces, on average, illustrates the value of the bandwagon effect (i.e., mimetic isomorphism) for the mitigation of uncertainty in the context of e-business, and supports the assertions of early e-commerce researchers that business entities adapt in challenging environments. Moreover, these findings are consistent with Mitra and Singhal’s (2008, 99) recent observation that “... in spite of the downturn in the Internet economy, [ consortia-based] industry exchanges have had remarkable survival rates.” Nonetheless, it is important to note that our results also suggest that older consortium marketplaces are more apt to fail relative to older independent and publicly traded marketplaces. Although we provide several plausible reasons underlying these results, this area of study offers an interesting opportunity for future research.

Our operationally defined clusters of B2B e-marketplace service offerings lend empirical credence to the conceptual models of service archetypes presented by Johnson and Whang (2002) and Anderson and Anderson (2002), and the analytical results of Tunca and Zenios (2006). The conventional wisdom that had created a heavy focus on network effects and encouraged the electronic reverse auctions in the early B2B e-marketplaces (Elmaghraby, 2007; Jap and Mohr, 2002) was not well supported in our results. Our findings suggest that strategic network theory, and specifically network externalities, may not fully capture the value creation possibilities afforded by auction/matching B2B service offerings (Amit and Zott, 2001). Such service offerings certainly enable efficiencies, but no more so than digital catalogs and other basic procurement-related services according to our results. Future research should assess the ways in which auction/matching B2B service offerings go beyond simply digitizing existing transactions, thereby uncovering how these offerings allow for novel structuring (and restructuring) of transactions.

Our results indicating decreased failure rates among B2B e-marketplaces that facilitate collaboration among buyers and sellers relative to those focused on basic transactional efficiency suggests that B2B e-marketplaces add more value through the collaborative investment in specific assets than they do from simply reducing administrative transaction costs of procurement. Nonetheless, our results were not as strong as anticipated in this regard, which prompts one to consider the idea that perhaps classical TCE applies less to the Internet domain of B2B e-marketplaces (Amit and Zott, 2001). Rather than view transactions as discrete events (consistent with classical TCE), it may be necessary to consider sets of transactions via the e-marketplace over time. Clearly, B2B e-marketplaces readily enable complementary and/or facilitating transactions between buyers and sellers. Thus, expanding the TCE unit of analysis to sets of transactions between buyers and sellers seems to be a fruitful area for future study.

5.3. Managerial implications

This study offers equally valuable insight for practitioners by providing hard statistics on the failure rates of B2B e-marketplaces and the service strategy-based drivers of these failures. The results for the key factors provide some strategic directions for managers in their decisions about where to continue investment and where to abandon further spending.

The findings regarding ownership model may encourage managers to stick with well-established governance models for consortium operations going forward in order to share knowledge and risks, and to be more cautious in pursuit of IPOs. Indeed, the significant differences by industry meta group may help managers to focus ongoing investments into B2B e-marketplaces in the sweet spot sectors with value-added and exchange activities characterized by high information dependence, but not an unreasonably high level of information tacitness. The differential failure rates by the service-offering cluster suggests that one can improve the odds of e-marketplace success by investments in tools such as design collaboration that enhance relationships and knowledge sharing.

Although many B2B e-marketplaces failed during the boom-and-bust cycle of Internet speculation, this innovative business model will remain for many years to come. At a macro level, industrial sector characteristics, ownership models, and service-offering functionality undoubtedly will continue to evolve. We hope that our ongoing research can at a minimum inform, and at times, influence that evolution.

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References


