MIS Quarterly

MISQ REVIEW

REVIEW: IT-DEPENDENT STRATEGIC INITIATIVES AND SUSTAINED COMPETITIVE ADVANTAGE: A REVIEW AND SYNTHESIS OF THE LITERATURE[1]

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Abstract

The role of information systems in the creation and appropriation of economic value has a long tradition of research, within which falls the literature on the sustainability of IT-dependent competitive advantage. In this article, we formally define the notion of IT-dependent strategic initiative and use it to frame a review of the literature on the sustainability of competitive advantage rooted in information systems use. We offer a framework that articulates both the dynamic approach to IT-dependent strategic advantage currently receiving attention in the literature and the underlying drivers of sustainability. This framework models how and why the characteristics of the IT-dependent strategic initiative enable sustained competitive advantage, and how the determinants of sustainability are developed and strengthened over time. Such explanation facilitates the pre-implementation analysis of planned initiatives by innovators, as well as the post-implementation evaluation of existing initiatives so as to identify the basis of their sustainability.

In carrying out this study, we examined the interdisciplinary literature on strategic information systems. Using a structured methodology, we reviewed the titles and abstracts of 648 articles drawn from information systems, strategic management, and marketing literature. We then examined and individually coded a relevant subset of 117 articles. The literature has identified four barriers to erosion of competitive advantage for IT-dependent strategic initiatives and has surfaced the structural determinants of their magnitude. Previous work has also begun to theorize about the process by which these barriers to erosion evolve over time. Our review reveals that signifi-

[1]Jane Webster was the accepting senior editor for this paper. Anitesh Barua was the associate editor. Jeanne Ross, Anandhi Bharadwaj, and Paul Pavlou served as reviewers.

cant exploratory research and theoretical development have occurred in this area, but there is a paucity of research providing rigorous tests of theoretical propositions.

Our work makes three principal contributions. First, it formalizes the definition of IT-dependent strategic initiative. Second, it organizes the extant interdisciplinary research around an integrative framework that should prove useful to both research and practice. This framework offers an explanation of how and why IT-dependent strategic initiatives contribute to sustained competitive advantage, and explains the process by which they evolve over time. Finally, our review and analysis of the literature offers the basis for future research directions.

Keywords: Strategic information systems, sustainable competitive advantage, competitive advantage, strategic agility, IT-dependent strategic initiatives

Introduction

Since the early 1980s, considerable research attention has focused on the strategic role of information technologies and their potential for creating competitive advantage (Benjamin et al. 1984; Cash and Konsynski 1985; Ives and Learmonth 1984; McFarlan 1984; Parsons 1983; Porter and Millar 1985). From this work has emerged the widely accepted conclusion that IT can be used to create competitive advantage through efficiency improvements, differentiation, and channel domination (Sethi and King 1994).

In this article, we review and synthesize the work that has examined the role of IT in sustaining competitive advantage so as to provide guidance for future research in this area. The strategic information systems tradition has shown that a narrow focus on technology as a source of competitive advantage—such as that recently assumed in the business press (Carr 2003)—is misguided and misleading. Thus, we center our review on the notion of IT-dependent strategic initiatives.

IT-dependent strategic initiatives consist of identifiable competitive moves (Smith et al. 1991) that depend on the use of IT to be enacted, and are designed to lead to sustained improvements in a firm's competitive position (Ross et al. 1996). Examples of such initiatives include business process reengineering, ERP-enabled business integration, customer relationship management, electronic commerce, electronic business, and electronic supply chain management initiatives. Our focus on IT-dependent strategic initiatives is rooted in a perspective that views strategy not as the making of a few discrete "one time" decisions, but as the configuration of interrelated and interlocking activities (Rivkin 2000; Siggelkow 2001). Thus, IT-dependent strategic initiatives do not simply consist of the building of a computer system or application that, allegedly, generates competitive advantage until it is successfully replicated (Carr 2003); rather, they consist of the configuration of an activity system, dependent on IT at its core, that fosters the creation and appropriation of economic value (Brandenburger and Stuart 1996). We term the initiatives as *IT-dependent* to highlight the fact that they could not be feasibly executed without the enabling technology foundation.

We organize previous work in this area through an integrative framework that surfaces both the determinants of sustainability of IT-dependent strategic initiatives—here called *barriers to erosion*—as well as the process through which, once implemented, IT-dependent strategies evolve to limit the decay of competitive advantage and reinvigorate these barriers to erosion. Our model identifies potential sources of sustainability and explains how they contribute to reduce threats to the leader's advantage over time.

Many examples point to the value of this analysis. Dell Inc. has been able to maintain its leadership position in the personal computer market for more than a decade. At the heart of Dell's strategy is its high velocity built-to-order production model for direct sales. The firm is continually improving the performance of its production system, as well as introducing further initiatives that leverage its core advantage (i.e., Dell Online). Wal-Mart Stores Inc.

has created a highly efficient supply chain that has proven very difficult for competitors to match. And Harrah's Entertainment, a recognized pioneer in the use of data warehousing and data mining technology (Goodhue et al. 2002), may have positioned itself for sustained superior performance with its customer relationship management initiative. The firm is continuously seeking new innovations around its core strategy—a discipline of continued marketing experimentation and customer knowledge dependent on its business intelligence infrastructure. According to our terminology, all three companies have built substantial barriers to erosion around their IT-dependent strategic initiatives and actively work to strengthen them over time so as to maintain their leadership position.

In the next section, we formalize the concepts of sustainable competitive advantage and barriers to erosion. We then outline the theoretical framework, grounded in more than two decades of research on strategic information systems, which we use to organize our findings. Following this, we outline the results of our literature review. The paper concludes with a discussion of our findings, and implications for future research and practice.

Sustainable Competitive Advantage

The concept of competitive advantage is rooted in the logic of value creation and distribution. A firm is said to enjoy competitive advantage when the value that is created in an economic exchange in which the firm partakes is greater than the value that could be created were the firm not to participate in the exchange (Brandenburger and Stuart 1996). Sustainability, a concept that has garnered less consensus (Wade and Hulland 2004), has traditionally been conceptualized as a condition where a "firm's competitive advantage resists erosion by competitor behavior….[This] requires that a firm possesses some barriers that make imitation of the strategy difficult" (Porter 1985, p. 20). The ability to protect a position of competitive advantage is, therefore, predicated on the successful creation of impediments to replication of the strategy by competitors—referred to as barriers to erosion (Reed and DeFillippi 1990; Wernerfelt 1984). The strength of these barriers to erosion determines the degree to which the process of competitive imitation is slow, difficult, and/or costly.

Proponents of the resource-based view of the firm originally introduced the notion of inability to replicate, saying that "a competitive advantage is sustained only if it continues to exist after efforts to duplicate that advantage have ceased" (Barney 1991 p. 102). This formulation, a difficult one to operationalize (Wiggins and Ruefli 2002), seems to treat any competitive advantage that is shorter than forever as temporary. But it provides no guidance to determine how long temporary may be, "other than implying [that] it is shorter than forever" (Hidding 2001, p. 206). Moreover, the duration of a "temporary" competitive advantage is important as it helps to determine whether innovation is warranted or not (Feeny and Ives 1990).

More recent definitions of the construct in the resource-based view recognize that sustained competitive advantage accrues when competitors "face significant challenges in acquiring, developing, and using" the resources underlying the value creating strategy (Mata et al. 1995, p. 495; see also Barney 1995; Ross et al. 1996). Our treatment of sustainability and the central role of barriers to erosion is consistent with this latter conceptualization.

The Response-Lag Drivers Perspective

Competitive imitation is thought to occur in sequential stages (MacMillan 1988, 1989). Once rivals recognize that a firm has achieved a position of advantage, they begin to scrutinize it in an effort to identify its sources. Considerable ambiguity may exist with respect to these sources, however, making it difficult for imitators to mount a response

(Reed and DeFillippi 1990). *Response lag* is defined as "the time it takes competitors to respond aggressively enough to erode the competitive advantage" (MacMillan 1989 p. 24).[2]

Different competitors will move with different speed and with different degrees of success (Chen and Miller 1994), and their entrance will dissipate some of the leaders' advantage. Yet barriers to erosion impede or prevent complete dissipation of the advantage, even for easily imitable products in industries with minimal barriers to entry (Makadok 1998). It follows that the strength of barriers to erosion is directly related to their ability to generate response lag and thus delay or deny imitation. We define the notion of *response-lag drivers* as the structural determinants of the magnitude of barriers to erosion. Response-lag drivers are characteristics of the firm, its competitors, the technology, and the value system in which the firm is embedded that contribute to raise and strengthen barriers to erosion.

Strategic IS research has been recently invigorated by the agility perspective (Sambamurthy et al. 2003; Weill et al. 2002) and the role that IT plays in enabling the firm to "launch many and varied competitive actions" (Sambamurthy et al. 2003, p. 237). This view, originally borne out of the idiosyncrasies of the hypercompetitive environment (D'Aveni 1994; Eisenhardt and Martin 2000; Sambamurty 2000), focuses on the firm as the unit of analysis. As such, it is concerned with explaining how the firm can use IT to identify and launch a variety of initiatives to solidify its business performance.

Our work complements this perspective by adopting a response-lag perspective that focuses on the individual strategic initiative as the unit of analysis. It is concerned with the role of specific initiatives and is best suited to answer questions such as the following: How difficult is a specific initiative to imitate and how long can it be expected to remain unique? What makes the initiative difficult to replicate? How long should the firm maintain commitment to the initiative before enhancing it or launching a new one? What degrees of freedom does the firm have in designing or improving the initiative so as to maximize its defensibility? What characteristics of the initiative (i.e., response-lag drivers) can be strengthened over time to extend its useful life? How can the specific IT-dependent strategic initiative contribute to the creation of valuable resources?

Failure to conduct this response-lag analysis risks leaving much of the potential benefits of the initiative on the table. Similar analysis is valuable *a posteriori* to seek ways to counter successful IT-dependent strategic initiatives or to explain the determinants of successful initiatives.

Theoretical Framework

The literature review is organized around an integrative framework that explicitly models the characteristics of an IT-dependent strategic initiative and the dynamic processes through which that initiative evolves over time. It also recognizes that sustainability of competitive advantage is affected by competitive response (Chen and Miller 1994) and the cycle speed of the ecology in which the firm competes (Hidding 2001; Lefebvre et al. 1997). The latter effects are represented in our model by the moderating role of the competitive environment (Figure 1).[3]

[2]The notion of response lag is familiar to strategists and information systems executives. One executive at a branded direct-sale apparel manufacturer indicated in an interview with the authors that his firm times innovations on the Web site to appear in the September/October time frame. The reason is that the firm and its competitors "lock down" their Web site functionality in November as they enter their busiest season—Christmas. Website innovations are generally easy to copy, but, as this example suggests, timing the innovation as they do ensures a minimum response lag spanning the year's largest selling season because it is impossible for competitors to examine, replicate, and test the new features before the lock-down period.

[3]Given the length and complexity of the literature review, and the limited attention that competitive response and ecology cycle speed have received in the specific context of IT-dependent strategic initiatives, they are introduced here for completeness, but their treatment is beyond the scope of this paper. Interested readers are referred to work on this topic (Eisenhardt 1989; Mendelson 2000; Moorman and Slotegraaf 1999; Wade and Hulland 2004).

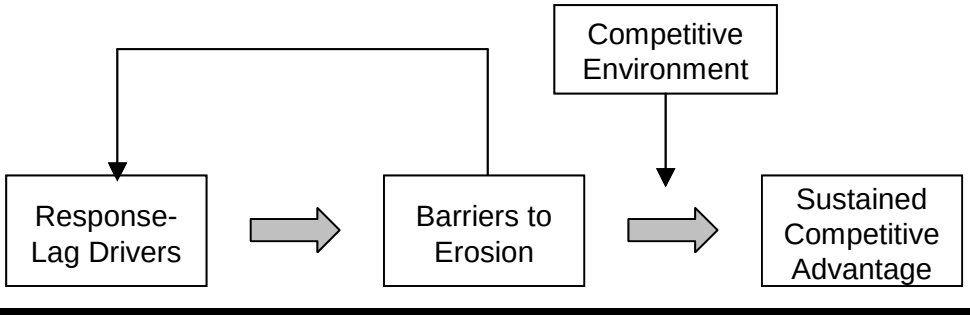

Figure 1. Theoretical Framework

Our literature review suggests that four barriers to erosion fully capture the determinants of sustainability in the context of IT-dependent strategic initiatives: *IT resources barrier*, *complementary resources barrier*, *IT project barrier*, and *preemption barrier*. These four barriers to erosion, underpinned by their respective response-lag drivers, contribute independently, or in combination with one another, to enable a firm to sustain competitive advantage.

The dynamic capabilities literature hypothesizes that firms leverage their current asset positions to develop and renew superior capabilities that enable them to maintain competitiveness (Teece et al. 1997). While the dynamic capabilities perspective is primarily concerned with how the firm can successfully "renew competencies to respond to shifts in the business environment" (Teece, et al. 1997, p. 515), it is also instrumental in explaining how barriers to erosion can be maintained and strengthened over time. Two fundamental dynamic processes contribute to reinforce barriers to erosion: *organizational learning* and *asset stock accumulation*.

From a theoretical standpoint, the analysis of these dynamic processes is concerned not with the immediate effect of response-lag drivers, but with their determinants and their evolution over time. It explains the process by which erosion of competitive advantage can be prevented, delayed, limited, or even reversed by the reinvestment in, and rejuvenation of, barriers to erosion (MacMillan 1989; Reed and DeFillippi 1990). It also illustrates which response-lag drivers can be strengthened over time, and how. Organizational learning and asset stock accumulation processes, described below, are often subject to time compression diseconomies and, therefore, cannot be accelerated by the firm (Bharadwaj 2000; Dierickx and Cool 1989).

Organizational Learning

Organizational learning is defined as "the capacity or processes within an organization to maintain or improve performance based on experience" (Nevis et al. 1995, p. 73). The dynamic capabilities research tradition suggests that a firm can develop superior capabilities through *learning mechanisms*, including repetition, experimentation, and even the analysis of small mistakes (Eisenhardt and Martin 2000). Organizational learning is subject to path dependency and cannot take place without appropriate preconditions (Eisenhardt and Martin 2000; Teece et al. 1997). In other words, because learning tends to be a localized process, the firm's history and its current set of available resources both enable and constrain the learning process. As Teece and his colleagues put it, "Where a firm can go is a function of its current position and the paths ahead" (1997, p. 522).

It follows that a process of organizational learning associated with IT-dependent strategic initiatives must evolve in co-presence with the initiative and the underlying IT—a phenomenon described as

learning-by-using (McKenney et al. 1995). Unless an IT-dependent strategic initiative is introduced, related organizational learning processes cannot be set in motion. For example, repeated practice with its high-velocity, built-to-order model enabled Dell to consistently increase inventory turns—thereby strengthening its direct sales initiative over time (Magretta 1998)—and subsequently to leverage its advantage to reach previously unserved consumers and small accounts using the Internet—a broadening of the initiative (Rangan and Bell 1999).

Asset Stock Accumulation

Asset stock accumulation is defined as the process by which a firm accrues or builds up a resource over time as a result of a "consistent pattern of resource flows" (Dierickx and Cool 1989, p. 1506). While many resources, such as personal computers or specialized labor, are readily available to firms that can purchase them on the open market, other resources are by definition non-tradable (e.g., a specialized IT infrastructure, a specialized information repository). These latter resources must be built by the organization over time, and the ability to do so is predicated on the availability of precursory assets. Under this condition, known as interconnectedness of asset stocks (Dierickx and Cool 1989), only the firm that has acquired or developed the precursory resources can begin the accumulation process. For example, Harrah's Entertainment has developed a comprehensive database of customer behaviors in and across the casinos of the Harrah's family (Loveman 2003). The population of this repository, started in 1998, would not have been possible unless Harrah's had launched its IT-dependent strategic initiative and built a core IT infrastructure enabling customer-level data collection using rewards cards and specially equipped, networked slot machines.[4]

Literature Review

Following the IS tradition, we define resources to encompass both assets and capabilities. Assets represent "anything tangible and intangible the firm can use in its processes for creating, producing, and/or offering its products (goods or services) to a market" (Wade and Hulland 2004, p. 109). Capabilities represent "repeatable patterns of actions in the use of assets to create, produce, and/or offer products to a market" (Wade and Hulland 2004, p. 109). Table 1 summarizes the barriers to erosion and response-lag drivers that emerge from our literature review. Each is described in depth below.

IT Resources Barrier

At any point in time, competing firms have a different endowment of IT resources at their disposal to identify, assemble, deploy, and use information technologies (Bharadwaj 2000; Santhanam and Hartono 2003). An organization can exploit this idiosyncratic set of IT resources to create response lag (Wade and Hulland 2004). When a firm's IT-dependent strategic initiative leverages some preexisting IT resources, competitors who do not have ready access to the same or substitute resources find it costly and difficult to replicate. For example, at the heart of Wal-Mart's dominance is its superior supply chain. To foster its efficiency, Wal-Mart developed a continuous replenishment strategy requiring real-time, point-of-sale data. For this initiative, Wal-Mart leveraged its proprietary satellite network connecting all of its geographically dispersed stores. Competitors with no access to a network of comparable functionality faced substantial obstacles to replication.[5]

[4]Note that to the extent that the information is specialized to the casino, it is non-tradable and, therefore, must be accumulated by Harrah's directly. Any other casino wishing to pursue a similar initiative must engage in its own data collection effort.

[5]Unlike the IT project barrier described below, the IT resources barrier is not concerned with the nature of the IT at the core of the initiative, but with the prerequisite organizational IT resources underpinning the strategic initiative.

Table 1. Barriers to Erosion and Relative Response-Lag Drivers

Barrier to Erosion	Response Lag Drivers
1. *IT Resources Barrier*	IT Assets • IT infrastructure* • Information repositories* IT Capabilities • Technical skills† • IT management skills† • Relationship asset *
2. *Complementary Resources Barrier*	Complementary Resources*†
3. *IT project barrier*	Technology Characteristics • Visibility • Uniqueness • Complexity Implementation Process • Complexity • Process change
4. *Preemption Barrier*	Switching Costs • Tangible co-specialized investments* • Intangible co-specialized investments* • Collective switching costs* Value System Structural Characteristics • Relationship exclusivity • Concentrated links

*Response-lag drivers subject to asset stock accumulation processes

†Response-lag drivers subject to organizational learning processes

Recent research on the strategic impact of information systems explicitly addresses the role of IT assets and IT capabilities in building response lag (see Table 2).

IT Assets

IT assets available to the firm include hardware components and platforms (e.g., a private satellite network), software applications and environments (e.g., a proprietary revenue management system using custom developed models), and data repositories (e.g., a database of historical customer behavior). Two principal IT assets have been identified in the literature: IT infrastructure and information repositories.

IT Infrastructure. An IT infrastructure is defined as "the base foundation of the IT portfolio (including both technical and human assets), shared through the firm in the form of reliable services" (Broadbent et al. 1999b, p. 163). As such, the IT infrastructure provides the foundation for the delivery of business applications and services (Broadbent and Weill 1997). The IT infrastructure varies in reach (the extent of the connectivity both within and outside of the firm), and range (the scope of services that it can support) (Keen 1991). As reach and range increase, the resources made available by the IT infrastructure, and its ability to support a wide range of strategic initiatives, increase as well (Broadbent et al. 1999a). With IT infrastructure development times estimated to be in the five- to

Table 2. Concept Matrix: IT Resources Barrier

		IT Assets		IT Capabilities		
Citation	**Methodology**	**Infrastructure**	**Information Repositories**	**Technical Skills**	**Management Skills**	**Relationship Asset**
(Attwell 1992)	Theoretical			X		
(Barton and Peters 1992)	Case study (s)[a]	X			X	
(Bharadwaj 2000)	Archival	X		X	X	
(Broadbent and Weill 1997)	Theoretical	X		X	X	
(Broadbent et al. 1999a)	Case study (m)	X		X	X	
(Broadbent et al. 1999b)	Case study (m)	X		X	X	
(Clemons 1986)	Theoretical	X		X	X	
(Clemons and Row 1991a)	Case study (s)	X	X			
(Copeland and McKenney 1988)	Case study (m)	X		X	X	
(Dehning and Stratopoulos 2003)	Archival	X		X	X	
(Duliba et al. 2001)	Archival				X	
(Duncan 1995)	Survey	X	X	X		
(Feeny 2001)	Theoretical	X				
(Feeny and Ives 1990)	Theoretical	X	X			
(Feeny and Willcocks 1998)	Theoretical	X		X		X
(Garud and Nayyar 1994)	Theoretical		X			
(Glazer 1991)	Theoretical		X			
(Henderson and Venkatraman 1993)	Theoretical	X		X	X	
(Jarvenpaa and Leidner 1998)	Case study (s)	X		X	X	
(Johnston and Carrico 1988)	Case study (m)					X
(Kettinger and Grover 1995)	Archival	X		X	X	
(Kettinger et al. 1994)	Archival	X	X			
(King et al. 1989)	Survey	X	X			
(Kotha 1995)	Case study (m)	X		X	X	
(Lindsey et al. 1990)	Case study (s)			X	X	
(Mata et al. 1995)	Theoretical	X		X	X	
(McFarlan 1981)	Theoretical			X	X	

Table 2. Concept Matrix: IT Resources Barrier (Continued)

		IT Assets		IT Capabilities		
Citation	**Methodology**	**Infrastructure**	**Information Repositories**	**Technical Skills**	**Management Skills**	**Relationship Asset**
(Monteiro and Macdonald 1996)	Theoretical	X	X		X	
(Pemberton et al. 2001)	Survey		X			
(Porter and Millar 1985)	Theoretical	X				
(Robertson and Gatignon 1986)	Theoretical			X		
(Ross and Beath 2002)	Survey	X	X	X	X	
(Ross et al. 1996)	Theoretical	X		X	X	X
(Santhanam and Hartono 2003)	Archival			X	X	
(Sambamurthy et al. 2003)	Theoretical	X	X	X	X	X
(Wade 2001)	Survey	X	X	X	X	X
(Weill et al. 2002)	Theoretical	X	X	X	X	
(Wiseman and MacMillan 1984)	Theoretical		X	X		
(Wixom and Watson 2001)	Survey	X		X		

[a] We use the label "Case study (s)" to identify a single site case study and the label "Case study (m)" to identify a multi-site case.

seven-year range (Bharadwaj 2000), the response lag and ensuing barrier to erosion is likely to be very substantial (Duncan 1995).

IT infrastructures are subject to asset stock accumulation dynamics. When a firm introduces a strategic initiative that employs reusable technology, it contributes to the development of an infrastructure that can be leveraged in the future by the initiative, through improvements, or by other initiatives (Barton and Peters 1992; Ross et al. 1996). This process is theorized to create "options value" that provides the leader with the ability to expand the original initiative or to create new ones at a lower cost, more quickly, and with less inherent risk than competitors (Applegate 2003; Sambamurthy et al. 2003).

Information Repository. An information repository is a collection of logically related data, organized in a structured form, that is accessible and usable for decision-making purposes.[6] Information is now widely recognized as a fundamental firm resource, and organizations are investing significantly to improve their ability to collect, store, manage, and distribute it (Wixom and Watson 2001). Moreover, the emergence of powerful analytical technologies and the declining costs of storage have created significant opportunities for strategies predicated on data analysis (Brohman et al. 2003; Glazer 1991). Information repositories can contribute to the creation of substantial response lag to imitation since information that can be kept secret, proprietary, or that is co-

[6]The term *information repository* is not synonymous with *database management system*. The asset is the available data that can be leveraged to create value, rather than the software programs that hold it.

specialized[7] with the resources or offerings of other firms contributes to delaying imitation (Rumelt 1987). In other words, if an IT-dependent strategic initiative relies on substantial information repositories, it is not enough for competitors to replicate the initiative: they must accumulate the needed information as well.

Information repositories are subject to asset stock accumulation (Glazer 1991). For example, a critical resource underpinning Harrah's IT-dependent strategic initiative is its exhaustive data about customer preferences and behavior (e.g., gambling, shopping, dining). This information repository represents a valuable resource that is impossible to rapidly replicate. Imagine a destination customer visits the Las Vegas properties once a quarter to play blackjack, information about six visits takes 1.5 years to accumulate.

IT Capabilities

While different technologies are inherently dissimilar and thus create unique challenges, over time firms have developed unique sets of IT capabilities (McKenney et al. 1995). As a consequence of this idiosyncratic development, some firms find themselves in a better position than their rivals when using and managing certain classes of technologies (Bharadwaj 2000; Dehning and Stratopoulos 2003; Ross et al. 1996; Wade and Hulland 2004). IT capabilities that have received research attention include technical skills, IT management skills, and relationship assets.

Technical Skills. Technical skills refer to the ability to design and develop effective information systems. As such, they include proficiency in system analysis and design, infrastructure design, programming, and so on (McKenney et al. 1995; Ross et al. 1996). While some have argued that technical IT skills are easily obtainable in the labor market (Mata et al. 1995), the IT adoption literature suggests that they are in-fact subject to organizational learning dynamics (Fichman 2000) and knowledge barriers (Attewell 1992). Thus, preexisting specific knowledge or a diverse technical knowledge set allow firms to more easily adopt and use IT (Cohen and Levinthal, 1990).

IT Management Skills. IT management skills refer to the ability to provide leadership for the IS function, manage IT projects, evaluate technology options (Mata et al. 1995), manage change (McKenney et al. 1995), and envision creative and feasible technical solutions to business problems (Feeny and Willcocks 1998; Ross et al. 1996). Managerial IT skills are thought to significantly reduce the costs and lead times associated with IT development (Bharadwaj 2000). They also form the basis for envisioning and producing enhancements to existing IT-dependent strategic initiatives.

IT management skills are developed through the process of organizational learning. For instance, American Airlines developed superior capability in managing and using reservation technology and the information it produced (Hopper 1990; Pemberton et al. 2001) through its pioneering efforts with the SABRE reservation system. Leveraging this superior capability and the development of SMARTS, a proprietary application for channel analysis and management, American maintained its competitive advantage in distribution long after standard reservation systems functionalities had become available to all major airlines (Christiaanse and Venkatraman 2002).

Relationship Asset. Relationship asset refers to a mutual respect and trusting rapport established over time between the IS function and the business (Ross et al. 1996) that enables IS specialists and users to work together more effectively. By coordinating and communicating extensively, they share a vision for the role of IT within the business, executives share the risk and accept the responsibility for IT projects, and IS specialists are able to anticipate business IT needs and devise appropriate solutions (Feeny and Willcocks 1998; Ross et al. 1996).

Relationship assets are subject to asset stock accumulation. Mata et al. (1995) provided the first complete articulation of the process by which relationship assets are developed. They theorized

[7]A resource is defined as co-specialized when its value is dissipated or greatly diminished unless the resource is used in conjunction with other co-specialized resources (Teece 1989).

that the pillars of a friendly and trusting relationship between IT and the business can take years to develop. This development is built on past experiences and positive interactions. Individuals or groups that display competence in a task over time accumulate idiosyncrasy credits (Hollander 1960), which they can leverage at a later date to exert influence (Hollander 1960; Hollander 1971). It follows that IT-dependent strategic initiatives are instrumental in the development of strong relationship assets.[8] As the business and the technology partners develop mutual understanding and tighter relationships, the firm's ability to enhance existing IT-dependent strategic initiatives, as well as deploy new ones, increases.

Recent alignment literature lends support to this notion. An investigation of high-performing IS functions in eight companies revealed that the enduring trait was a strong relationship between the business and information systems professionals, often stemming from mutual respect and ongoing relationships developed over time (Chan 2002).

Complementary Resources Barrier

While technology is a core component of IT-dependent strategic initiatives, enabling the system of value-adding activities, its successful implementation requires a number of other complementary organizational resources to be mobilized. Previous research has investigated the role of information systems in leveraging these organizational resources via co-presence or co-specialization (Clemons and Row 1991b; Powell and Dent-Micallef 1997).

When a firm deploys an IT-dependent strategic initiative, it employs a number of non-IT resources arranged into a highly interrelated activity system. For example, Pacific Pride's "cardlock" initiative leveraged the firm's distribution network of gas stations (Nault and Dexter 1995). Harrah's Entertainment's initiative leverages its national network of casinos to capture drive-in traffic and foster cross-selling—a strategy that competitors with portfolios of properties concentrated in a single market cannot match. Interestingly, these complementary resources need not be considered valuable to begin with. Rather, they could be valueless or even considered liabilities until they are connected to a new "engine of value creation" (Miller 2003). As in the example of Wyndham International's substantial real estate investment (Piccoli and Applegate 2003), an IT-dependent strategic initiative can be instrumental in leveraging a liability into a resource necessary to attain a unique competitive position.

When a firm has access to co-specialized complementary assets that underpin the IT-dependent strategic initiative, significant response lag can be created because imitation of the initiative is predicated on the ability to obtain the same (or equivalent) complementary resources (Clemons and Row 1991b). To the extent that the technology is co-specialized to, and amplifies the value of, unique complementary resources, its mere imitation by competitors is not sufficient. Narrowly replicating one element of a strategic initiative (e.g., the IT core) equates to playing an incomplete game that leads to a decline of the imitator's current position rather than to successful erosion of the leader's competitive advantage (Siggelkow 2001). As a consequence, successful imitation of an IT-dependent strategic initiative requires the introduction of a comparable IT core, the development or acquisition of the necessary complementary resources, and a reconfiguration of the linked activities—a risky strategy that becomes unmanageable when the number of activities to be replicated increases (Atkins 1998; Rivkin 2000).

The extant literature has identified a number of response-lag drivers contributing to strengthening the complementary resources barrier (see Table 3).[9]

[8]As a CIO we interviewed put it, "They [other executives] had no faith in the guy who preceded me. When I came in, I focused on getting a number of quick wins. Now they know we can deliver. "

[9]In an effort to limit the scope of this review, and due to the non-IT nature of this barrier, we have not identified single response-lag drivers, but rather provide a holistic discussion of the barrier.

Table 3. Concept Matrix: Complementary Resources Barrier

Citation	Methodology
(Atkins 1998)	Case study (s)
(Bharadwaj 2000)	Archival
(Chen and Hitt 2002)	Archival
(Christiaanse and Venkatraman 2002)	Archival
(Clemons and Row 1991a)	Case study (s)
(Clemons and Row 1991b)	Theoretical
(Clemons and Weber 1990)	Case study (s)
(Dyer and Singh 1998)	Theoretical
(Feeny 2001)	Theoretical
(Feeny and Ives 1990)	Theoretical
(Han et al. 2001)	Survey
(Hart and Saunders 1997)	Theoretical
(Henderson and Venkatraman 1993)	Theoretical
(Jarvenpaa and Leidner 1998)	Case study (s)
(Kettinger and Grover 1995)	Archival
(Kettinger et al. 1994)	Archival
(Kotha 1995)	Case study (m)
(Makadok 1998)	Archival
(Mata et al. 1995)	Theoretical
(Mykytyn et al. 2002)	Theoretical
(Pavlou 2002)	Archival
(Powell and Dent-Micallef 1997)	Survey
(Sambamurthy et al. 2003)	Theoretical
(Sethi and King 1994)	Theoretical
(Slater and Narver 1995)	Theoretical
(Stalk et al. 1992)	Theoretical
(Venkatraman and Zaheer 1990)	Archival

Examples of complementary resources include scale of operations and market share (Clemons and Row 1991a; Kettinger et al. 1994), organizational structure or governance (Feeny and Ives 1990), slack resources (Kettinger et al. 1994), access to distribution channels (Feeny 2001), physical assets (Feeny and Ives 1990), ownership structure (Piccoli and Applegate 2003), corporate culture (Barney 1986; Feeny and Ives 1990; Powell and Dent-Micallef 1997), top management commitment (Henderson and Venkatraman 1993; Keen 1991), competitive scope (Clemons and Row 1991a; Feeny and Ives 1990), and software and process patents (Atkins 1998; Mykytyn et al. 2002). Firms with a unique activity system (Siggelkow 2001) or unique business processes (Davenport 1993) may also be able to leverage these resources to create value for customers. External resources, such as interorganizational relationships (Dyer and Singh 1998), brand recognition, image, and trust, are intangible and developed over time (Porter 1991). They can be valuable components of IT-dependent strategic initiatives as well (Hart and Saunders 1997; Kotha 1995).

Many response-lag drivers associated with the complementary resources barrier are subject to organizational learning and asset stock accumulation processes. Zhang and Lado (2001), for example, theorize that the potential for information systems to produce sustainable competitive advantage should be sought for their indirect effect in developing and leveraging organizational capabilities. For instance, Wal-Mart's "cross-docking" logistic capability hinges on daily communication between its in-store point-of-sales systems, its distribution centers, and its suppliers (Stalk et al. 1992). Wal-Mart began experimenting with cross-docking upon the introduction of its IT-dependent, continuous replenishment strategic initiative. Thus, without its pioneering effort in continuous replenishment it would not have had the facilities to begin the organizational learning process and develop its cross-docking capability.

IT Project Barrier

Since IT-dependent strategic initiatives rely on an essential enabling IT core, they cannot be implemented until the necessary technology and associated information systems have been successfully deployed—the more time consuming and costly the process, the more resilient the IT project barrier. In other words, the longer and more expensive it is to design, develop, and introduce the information processing functionality needed to deliver the initiative's value proposition, the stronger is the IT project barrier.

Information technologies are not homogeneous and undifferentiated entities, rather they are malleable and differ in their intrinsic characteristics, their ability to complement other organizational resources, and the degree of organizational change that needs to occur when they are implemented (Orlikowski and Iacono 2001). For example, Web pages are normally rapidly built and visible to competitors, but data warehouses are generally lengthy undertakings concealed from competitors' view (Feeny 2001; Wixom and Watson 2001). In extreme cases, the amount of time and money needed to replicate the leader's initiative may render imitation unjustifiable. When United and American Airlines introduced travel agent automation, providing travel agents with access to their reservation systems, the other airlines decided not to follow due to the estimated high cost and risk of this initiative (McKenney et al. 1995).[10]

More subtly, the response lag generated by the IT project barrier may be instrumental in enabling sufficient organizational learning and asset stock accumulation to prevent erosion of the leader's advantage. Glazer (1991) first conceptualized this relationship when studying successful innovators, stating that "the organization first put in place an information technology infrastructure and then went *beyond the technology* to view the management of *'information'* itself as an asset" (p.2, emphasis in original). In other words, the IT project barrier may provide the leading firm with a head start that enables it to engage in the learning and accumulation process that strengthens its response-lag drivers and further reinforces its barriers to erosion. The stronger the IT project barrier, the longer this head start. For example, Harrah's Entertainment could not begin to accumulate customer behavior data until its IT-dependent strategic initiative—including data capture, storage, and analytical IT at the core—was in place and operational (Loveman 2003). It follows that the IT project barrier may play a fundamental role in creating sustainable competitive advantage by providing sufficient response lag to enable organizational learning and asset stock accumulation to take place. This dynamic is similar to the time-in-market effect partially responsible for market share differential among early and late product market entrants (Brown and Lattin 1994; Makadok 1998).

The extant literature has coalesced around two categories of response-lag drivers underpinning the IT project barrier: IT characteristics and implementation process (see Table 4). While related,

[10]The IT resources and IT project barriers are related to one another. The IT project barrier creates, *ceteris paribus*, objective difficulties. But the IT resources barrier recognizes that all else is often not equal and enables analysis of how well different competitors are positioned to react to the initiative.

Table 4. Concept Matrix: IT Project Barrier

		IT Characteristics			Implementation Process	
Citation	Methodology	Visibility	Uniqueness	Complexity	Complexity	Process Change
(Attwell 1992)	Theoretical			X	X	
(Barton and Peters 1992)	Case study (s)				X	
(Bharadwaj et al. 1993)	Theoretical	X	X	X		
(Broadbent et al. 1999b)	Case study (m)			X	X	X
(Clemons and Row 1991a)	Case study (s)	X				
(Davenport 1998)	Theoretical				X	X
(Feeny 2001)	Theoretical			X		
(Feeny and Ives 1990)	Theoretical	X			X	
(Mata et al. 1995)	Theoretical	X				
(McFarlan 1981)	Theoretical				X	
(Nault and Dexter 1995)	Case study (s)					X
(Reed and DeFillippi 1990)	Theoretical	X	X	X		
(Reich and Huff 1991)	Case study (m)				X	
(Robertson and Gatignon 1986)	Theoretical			X		
(Rumelt 1987)	Theoretical	X		X		
(Sethi and King 1994)	Theoretical		X			

these two classes of response-lag drivers contribute to the creation of response lag at different times. IT characteristics primarily have an effect during the development of the IT core or when competitors evaluate the information processing functionalities of the leader's initiative. The contribution of the implementation process to response lag primarily occurs after design and development, when the IT core is rolled out to deliver the information processing functionalities of the initiative.

IT Characteristics

Information technologies differ with respect to their intrinsic characteristics and, *ceteris paribus*, their potential to produce response lag. The literature has identified three response-lag drivers in this category: visibility, uniqueness, and complexity. We define them in turn below.

Visibility. Visibility represents the extent to which the IT at the core of the initiative is readily observable by competitors. The visibility dimension can be conceptualized as a continuum spanning from internal systems (e.g., Harrah's Entertainment's engine for data analysis) to public systems (e.g., Lands' End Live: Web-based chat with customer service agents). The degree to which the characteristics and results of an innovation are discernible to others is generally linked to the rate of diffusion of the innovation (Moore and Benbasat

1991). Thus, as visibility decreases it becomes harder and harder for competitors to garner reliable information about the system, its functionality, and its role in supporting the firm's strategic initiatives. As a consequence, a low-visibility IT core affords its IT-dependent strategic initiative longer lag time.

Uniqueness. Uniqueness is defined here as a continuum. On one side of the spectrum are self-contained, off-the-shelf IT that are standardized and need minimal integration or customization to a given environment (e.g., a new e-mail system). At the opposite end of the spectrum are custom developed applications that are not available for acquisition in the open market and/or require extensive integration and customization (e.g., Amazon.com's collaborative filtering engine for suggestive selling). When uniqueness is low, propagating institutions such as consultants and service firms can be engaged by any firm seeking to deploy the standard functionality (Fichman and Kemerer 1997; Robertson and Gatignon 1986). Conversely, when uniqueness is high, no standardized solution is available on the open market and a customized solution needs to be developed—a typically more costly and time consuming proposition.

Complexity. Complexity is a soft-primary characteristic of IT (Fichman 2000), indicating that information technologies differ with respect to their inherent degree of complexity. Complexity contributes to making it difficult for organizations to assimilate and effectively use technology. As a consequence, while organizations have different endowments of resources and skills that allow them to be more or less effective with any one technology, some technologies objectively offer more obstacles than others and, therefore, have the potential to produce substantially different response lag to imitation. Simple technologies, such as a static Web site, can quickly be designed and developed by all competitors, while more complex ones, such as supply chain management, often require substantial investments and time in their design and development, thus creating much higher response lag.

Implementation Process

Information technologies not only differ with respect to their intrinsic characteristics, but also in how they are implemented and become available for utilization by the organization (Orlikowski and Iacono 2001). While IT characteristics and implementation process are related, they serve as independent sources of response lag. The literature has identified two response-lag drivers in this category: implementation process complexity and the degree of process change required.

Implementation Process Complexity. Implementation process complexity represents the degree of difficulty associated with the process by which technology solutions at the core of the IT-dependent strategic initiative come to permeate an organization. Once the IT core has been designed and developed, the conversion process starts, including installation, configuration, end-user training, and reorganization. Thus the effect of this response-lag driver is felt after the technology has been designed and developed, and the firm is rolling it out in an effort to create a working information system (Sawyer 2001). A customer relationship management initiative, for example, requires the implementation of a collection of operational and analytical IT products (Goodhue et al. 2002). Purchasing or developing the IT components is only a step in the process of "achieving CRM functionalities."

Consider the case of Harrah's. When the firm embarked on its CRM initiative, it had to shift the allegiance of its casinos' general managers from the property to the brand—a dramatic reorganization necessary to complement its transactional and analytical IT core (Loveman 2003). This was a lengthy process that highly decentralized competitors would have to engage in to match Harrah's brand-wide value proposition to its customers.

Degree of Process Change. Degree of process change refers to the extent to which the firm's processes need to evolve to adapt to the new technology in an effort to optimize the performance

of the information system as a whole (O'Hara et al. 1999). Because of the tight link between IT and the processes the technology enables and supports, this is a crucial response-lag driver. As work in business process reengineering and ERP traditions has shown, when technologies require substantial process change before they can be utilized, considerable time and money needs to be devoted to the project even after the IT core has been made available (Kumar and Van Hillegersberg 2000; Scott and Wagner 2003). This lag driver is particularly powerful when firms have company-specific business practices and processes, developed over long periods of time, that need to be adapted to the requirements of the new IT-dependent strategic initiative (Soh et al. 2000).

Preemption Barrier

The three barriers to erosion discussed thus far are each concerned with competitors' ability to replicate the leader's IT-dependent strategic initiative. The preemption barrier instead focuses on the question of whether, even after successful imitation has occurred, the leader's position of competitive advantage can be threatened. It stems from the research tradition of competitive response and preemption (Chen and MacMillan 1992; MacMillan 1983; Rivkin 2000). This tradition sees the firm as able to take action to "shape its luck" by minimizing competitors' ability to successfully respond (MacMillan 1983).

Early research in this area focused primarily on the role of switching costs associated with proprietary IT investments. Later described as the "create, capture, keep" paradigm, this work was criticized based on the premise that partners or customers[11] can anticipate the risks of being locked-in to a proprietary technology (Mata et al. 1995). Recent work has broadened the debate, recognizing that preemption potential is rooted in value propositions that require co-specialized investments by the customer, and that customers willingly agree to make the needed investments as a means of partaking in the initiative (Chen and Hitt 2002; Shapiro and Varian 1999).[12] These investments are not only associated with obtaining and operating the IT core of the IT-dependent strategic initiative, but they also include all the tangible and intangible co-specialized investments the customer has made in the initiative (Shapiro and Varian 1999). Note that for successful preemption to occur, customers need not be severely locked-in through significant switching costs. Instead, they must have made enough co-specialized investments to have an incentive to remain in a relationship with the firm (Chen and Hitt 2002).[13]

When the preemption barrier is high, competitors cannot simply imitate the leader's initiative; they need to either compensate the customer for the cost of switching or provide enough additional

[11]The preemption barrier to imitation emerges in the context of relationships between the firm and other organizations. While these business relationships may occur with any entity in the firm's value system, for simplicity we refer to them henceforth as "the customer."

[12]A bank executive we interviewed indicated that some banks are attempting to become "trusted consolidators" of top clients' complex financial positions. This strategy entails the collection of extensive information about customers' current services, banking profile, insurance holdings, investment portfolio, mortgage, credit and loan positions, scheduled bills payment, and so on. The bank does not provide all products, but it strives to offer a consolidated view of all financial positions by automatically retrieving and organizing the pertinent information over the Web. Customers that find the service useful and use it over time develop a strong relationship with the bank and face substantial costs to move to a competitor. Switching costs extend well beyond customers' proficiency with the bank's Web site. In order to change its provider, the customer must research and evaluate competitors, compare offerings, configure the competitor's application, migrate historical data (if possible), open new accounts, close old accounts, and so on.

[13]While a cursory examination may suggest that these costs are negligible, early research shows that even in markets with apparently negligible co-specialized investments and low barriers to entry, like the money market mutual funds market, significant entry order effects, due to early mover lock in, do exist (Makadok 1998). This empirical result confirms that, "Even when switching costs appear low, they can be critical for strategy" (Shapiro and Varian 1999, p. 108). What appears to be critical is not the absolute magnitude of the cost of switching, but its size relative to the value that customers receive from the product or service.

value to justify the customer's decision to incur the switching costs (Shapiro and Varian 1999). That is, imitators must be "that much better," where "that much" is an amount at least equal to the current value of all co-specialized investments that the customer has made. As a bank executive we interviewed eloquently observed when speaking about customers' reluctance to switch to an alternative provider of online banking: "Do not underestimate the power of entanglement."

The extant literature has identified a number of response-lag drivers that can be grouped into two categories: switching costs and value system structural characteristics (see Table 5).

Switching Costs

IT-dependent strategic initiatives, heavily relying on the collection, storage, manipulation, and distribution of information, are particularly suited to the creation and exploitation of switching costs (Chen and Hitt 2002; Shapiro and Varian 1999). Switching costs stem from investments that are specific[14] or co-specialized to the IT-dependent strategic initiative. The literature has identified three sources of switching costs: co-specialized tangible investments, co-specialized intangible investments, and collective switching costs.

Co-specialized Tangible Investments. When an IT-dependent strategic initiative is deployed, it sometimes requires that customers procure the physical assets necessary to participate in the initiative. Co-specialized tangible investments represent the current value of these assets. These investments range from computer hardware and telecommunication equipment to software applications and interfaces between the customer's existing systems and the firm's IT. For example, hotel franchisees regularly buy costly software interfaces to the franchising brand's reservation system; these interfaces often become valueless, however, if the property is rebranded. Information that the customer accumulates while participating in a firm's IT-dependent strategic initiative represents another example of a co-specialized asset when the customer's information repository is only usable with the firm's initiative. Moreover, the information collected may only be valuable as long as the customer maintains a relationship with the franchisor—a condition known as information specificity (Choudhury and Sampler 1997). For example, in hotels, revenue management models and historical records are often brand specific and become valueless if, for instance, a hotel is re-branded.[15] The investments customers have made in Apple's iTunes proprietary music format represent another example.

Co-specialized tangible investments are subject to the process of asset stock accumulation. The impact of co-specialized tangible investments fluctuates over time, owing to the fact that switching costs associated with many tangible investments tend to decrease over time as the useful life of the investment grows shorter (Shapiro and Varian 1999). Thus, the value of this response-lag driver may follow a reverse sawtooth pattern whereby switching costs are greatest upon acquisition or upgrade of the assets, and degrade over time until the next investment is made. It follows that the firm's leadership position is most at risk as the customer faces the cyclical capital outlay. Information repositories, whose value tends to increase over time with their increasing size and scope, are one exception to this rule.

Co-specialized Intangible Investments. When an IT-dependent strategic initiative is deployed, it often necessitates that the firm's customers make a set of co-specialized intangible investments.

[14]The term *specific* indicates that the value of these complementary investments is significantly lower in any alternative use.

[15]Note that the revenue management software used is generally not proprietary or brand specific. Yet the historic data and the forecasting models the hotel has developed assume that the hotel operates under a specific brand (e.g., Hilton). If the hotel is rebranded, while the software, the data, and the models can be retained by the franchisee, their value is much lower because the data and models are specific and assume that the hotel sports the Hilton flag (i.e., has access to Hilton's reservation systems, operational standards, brand equity, customer base, customer loyalty, etc.).

Table 5. Concept Matrix: Preemption Barrier

		Switching Costs (Co-specialized Investments)			Value System's Structure	
Citation	Methodology	Tangible	Intangible	Collective	Concentration	Exclusivity
(Amit and Zott 2001)	Case study (m)			X		
(Armstrong and Hagel 1996)	Theoretical			X		X
(Chen and Hitt 2002)	Archival	X	X			
(Clemons 1986)	Theoretical	X	X			
(Clemons and Row 1988)	Case study (s)			X		X
(Clemons and Weber 1990)	Case study (s)			X		
(Dos Santos and Peffers 1995)	Archival	X	X			
(Duliba et al. 2001)	Archival	X	X		X	
(Feeny 1988)	Survey	X	X			X
(Feeny 2001)	Theoretical			X		X
(Feeny and Ives 1990)	Theoretical	X	X		X	X
(Johnston and Carrico 1988)	Theoretical	X	X	X		
(Kettinger et al. 1994)	Archival	X	X		X	
(Kotha 1995)	Case study (m)					X
(McFarlan 1984)	Theoretical			X		X
(Nault and Dexter 1995)	Case study (s)	X	X			
(Porter and Millar 1985)	Theoretical				X	
(Rumelt 1987)	Theoretical	X	X			
(Vitale et al. 1986)	Theoretical			X		

These investments often occur in the form of time expenditures. For instance, to benefit from personalization initiatives, customers often need to take the time to complete a profile. Common examples of co-specialized intangible investments include training (Feeny 1988), practice over time leading to proficiency with the technology (Shapiro and Varian 1999), costs associated with searching for and contracting with other partners and setting up new relationships (Makadok 1998), and uncertainty surrounding switching decisions and the available alternatives (Schmalensee 1982).

Intangible co-specialized investments are subject to asset stock accumulation and tend to rise over time (Shapiro and Varian 1999). A good example is individual proficiency with software programs that tends to increase as a function of time and use (Chen and Hitt 2002). Thus, a Microsoft Office user faces significantly higher switching costs as time goes on because adopting a competing software application would depress her productivity. Moreover, she may lose the value of other investments made in the software (e.g., Visual Basics-based custom modules). As a con-

sequence, IT-dependent strategic initiatives that leverage co-specialized intangible investments have the potential to build self-reinforcing barriers to erosion.

Collective Switching Costs. A unique form of switching costs is represented by collective switching costs, occurring when the market presents network externalities, and representing the combined switching cost of all entities in the network (Shapiro and Varian 1999). In the presence of network externalities, participation in the dominant network affords the most value while, at the same time, it increases the value of the network. As a group, participants face collective switching costs that exceed the simple sum of individual switching costs because, unless a coordinated defection occurs, any individual defector finds himself cut out of the network and its benefits (Shapiro and Varian 1999). When collective switching costs are prevalent, only "wholesale defection makes sense" (Feeny and Ives 1990, p. 40); however, the coordination costs of wholesale defection are often daunting (Shapiro and Varian 1999).

Collective switching costs are subject to asset stock accumulation dynamics that, over time, enable the leading firm to strengthen an already advantageous position by increasing the size of the network it sponsors.[16] A clear example of the power of this response-lag driver is provided by eBay, Inc. and its dominance of the online auction market in the face of retaliation by powerful competitors such as Amazon.com and Yahoo!, Inc.

Value System's Structure

A firm does not engage in economic activity in isolation, but as a link in a larger value system including upstream and downstream members (Porter 1985). The structure of this value system can provide significant opportunity for preemptive strategies and for the exploitation of the response-lag drivers discussed above (MacMillan 1983). Unlike typical response-lag drivers, however, the structure of the value system does not directly impact the strength of the preemption barrier to erosion. Instead it plays a facilitating or inhibiting role by moderating the impact of other response-lag drivers on the strength of the preemption barrier. We discuss two characteristics of the value system—relationship exclusivity and concentrated links—below.

Relationship Exclusivity. An exclusive relationship is said to exist when economic actors in the value system, upstream or downstream from the focal firm, elect to do business with one and only one organization. That is, these actors (e.g., customer, supplier) place a premium on dealing exclusively with the innovator or one of its competitors, but not both. For example, most consumers will prefer to consolidate their mutual funds investments with one provider. In time they may switch providers, but they will not likely simultaneously require the same service from more than one. Conversely, major consulting firms have a relationship and negotiated rates with many of the large hotel chains; hence, they have a concurrent relationship with multiple direct competitors. Relationship exclusivity is generally associated with IT-dependent initiatives that provide integrated services and that benefit from the accumulation of historical information.

In the presence of relationship exclusivity, preemption is easier because laggards cannot simply enter the market when they have replicated the initiative, but must instead displace the leader for any customer that has already established a relationship with the innovator. As a consequence, the base of available customers who face no switching costs is inherently smaller then it would be if no relationship exclusivity existed, and it grows smaller the longer the leader's lead time.

Concentrated Link. The various entities within a value system can be characterized as links in the chain of value creation (e.g., raw material pro-

[16]Examples of IT-based strategic initiatives that create increasing collective switching costs over time include communities of interests (e.g., purchasing circles and telecommunication groups such as Verizon Wireless "in"), user communities (e.g., Microsoft Office user base), trading networks (e.g., Bloomberg users, eBay customers), etc.

ducers, suppliers, distributors, firm's customers, end consumers). The degree of concentration in a link is inversely proportional to the number of suitable entities populating that link.[17] Thus, a highly concentrated value system link is one where there are relatively few counterparts (upstream or downstream in the value system) available with whom the firm can work (MacMillan 1983). For cruise lines, the total number of travel agents serving the target market may be the concentrated link. In the case of a fighter jet manufacturer, it may be the pool of customers approved by the firm's national government. Given the firm's resource constraints, when a link has a high degree of concentration, the proportion of entities in the link that can be effectively reached, educated, and influenced in a given amount of time is higher. Consequently, the firm stands a better chance of capturing a significant proportion of relationships and thus of being able to leverage switching costs to "lock out" competitors. Conversely, when a link in the value system has a low degree of concentration, the firm may be unable to establish a relationship with enough entities to preempt a successful competitor's response (Huff and Robinson 1994).

Conclusions

We reviewed the abstracts of 648 articles from the information systems, strategic management, and marketing literatures, and categorized 117 relevant studies. Based on this review, we developed an integrative model summarizing the determinants of sustainability of competitive advantage rooted in information systems use.

Pundits contend that as "information technology's power and ubiquity have grown, its strategic importance has diminished" (Carr 2003, p. 5). The accuracy of this statement is debatable (McFarlan and Nolan 2003) and, more importantly, our review of the literature shows that a narrow focus on "IT" is misguided and misleading. The focus should be on IT-dependent strategic initiatives—of which IT represents a fundamental component—because technology does not contribute to firm performance in isolation, but instead contributes as part of an activity system that fosters the creation and appropriation of economic value.

The literature has coalesced around four barriers to erosion that seem to fully capture the potential for IT-dependent strategic initiatives to afford sustained competitive advantage: *IT resources barrier*, *complementary resources barrier*, *IT project barrier*, and *preemption barrier*. The integrative framework we propose identifies the response-lag drivers underpinning these four barriers, as well as the process of organizational learning and asset stock accumulation by which they may be strengthened over time. Our review suggests that considerable opportunity exists for using IT to enable sustained competitive advantage through IT-dependent strategic initiatives. As IS scholars, it is incumbent upon us to uncover and explain how IT-dependent strategic initiatives lead to the creation and appropriation of economic value. We believe that our work can offer a useful structure to this quest and we offer some suggestions for future research.

Implications for Research and Practice

After two decades of research on strategic information systems, the question of sustainability remains largely unanswered due to a paucity of empirical studies. One reason for this dearth of research is the difficulty inherent in the longitudinal nature of the phenomenon of interest and the use of highly aggregated outcome variables (e.g., firm performance). But because firms excel in specific initiatives and/or business processes, while they are sometimes at a disadvantage in others, aggregate outcome variables are not well suited to this analysis (Ray et al. 2004). The example of Wyndham International is illustrative. The firm has been very innovative with its customer relationship management initiative—Wyndham ByRequest—

[17] An economic actor is deemed suitable if the firm that is implementing the IT-dependent strategic initiative would find a business relationship with it desirable.

and has seen positive results (e.g., brand recognition, customer loyalty). Yet, because of its legacy debt position, the firm remains in deep financial trouble and has recently been forced to restructure. A research focus on IT-dependent strategic initiatives as the unit of analysis, such as the one proposed here, may help mitigate these difficulties (Ray et al. 2004). The effect of specific IT-dependent strategic initiatives can be measured on immediate outcomes viz. the competition's performance on the same dimensions. We encourage future research at this level of analysis.

With the popularization and intuitive appeal of the resource based view of the firm, much recent literature has focused on the role of IT resources. While this work remains largely theoretical, or only tangentially related to this barrier to erosion, some authors have begun to test the role of specific response-lag drivers. Bharadwaj (2000) and Santhanam and Hartono (2003) found that firms with high IT capability outperformed a control sample over a sustained period of time. Barton and Peters (1992) linked sustained competitive advantage to IT management skills and the availability of a modular IT infrastructure, and Pemberton et al. (2001) demonstrated the value of information repositories. Others found that IT management skills contribute to sustainable competitive advantage while technical IT skills and IT infrastructure do not (Dehning and Stratopoulos 2003).

A major challenge facing researchers in this important area is the operationalization of some of the key concepts. Early work has relied on proxies, such as lists of most admired companies from the practitioner literature, but calls have been issued to develop reliable measures that can be used to build a cumulative research tradition (Santhanam and Hartono 2003). Survey instruments could be developed so that executives closely involved in the development or management of IT-dependent strategic initiatives may assess the drivers as well as the business outcomes associated with the initiative. Another approach consists of identifying observable characteristics of each construct that can be used to consistently and reliably measure response-lag drivers across initiatives and time. For example, an information repository can be evaluated with respect to scope (e.g., the number of entities currently captured in the repository) and size (e.g., the number of records available for analysis). Relationship assets may be measured through network analysis by evaluating the degree to which the IS function is isolated or comingled with business with respect to communication, trust, and other relevant constructs.

No study to date has directly attempted to evaluate the ability of the IT project barrier to produce response lag. Research on the response-lag drivers associated with this barrier has remained exclusively theoretical. Yet, without rigorous studies confirming or challenging the notion that because IT is easily replicable it cannot contribute to sustainability, no such conclusion is warranted. At a minimum, the documented high failure rate of IT projects casts some doubts on the accuracy of the "easily replicable" hypothesis. Similarly, the argument that computers are more powerful and the functionalities of once large systems are now available and affordable to all firms (Carr 2003) is flawed. Consider an oft-cited example: SABRE. When first introduced, SABRE represented a significant technical achievement and a substantial financial investment relative to the average degree of computerization and spending among competing firms. SABRE was, for its time, both highly complex and highly unique (Copeland and McKenney 1988). Thus, it was not its *absolute* computational power, or the *absolute* investment required, that determined SABRE's ability to generate response lag. Rather, it was its complexity and cost *relative* to the state of the art *at the time* that ensured its uniqueness and, at least partly, difficulty of imitation (McKenney et al. 1995). As computing power has improved exponentially, and as its cost has fallen, what were once unique systems have now become competitive necessities (Clemons and Row 1991b). In other words, the bar has risen significantly. But there is no evidence that the underlying mechanisms have changed as well. On the contrary, our review of the literature suggests that under certain circumstances (e.g., low visibility, high uniqueness) the IT project barrier can create

significant response lag in its own right. One approach to testing this idea may be to identify a set of IT-dependent strategic initiatives that relied on different technologies and explain the variance in response lag to imitation that each generated based on their characteristics.

IT-dependent strategic initiatives require a set of resources and capabilities to be successfully implemented. But, with the recent exception of strategic agility research (Sambamurthy et al. 2003; Weill et al. 2002), the literature is silent about how resources are generated and what role IT plays in fostering them. Our framework suggests that once an IT-dependent strategic initiative is introduced, through organizational learning and asset stock accumulation processes, the firm can leverage its leadership position to further strengthen other barriers to erosion. It is also unclear what resources are specific to a given IT-dependent strategic initiative and which ones are instead more general and available to the firm to launch new, unrelated initiatives. These unexplored questions provide fertile ground for future research and the potential to make outstanding contributions to research and practice.

The preemption barrier to erosion received some research attention early on (Clemons 1986; Dos Santos and Peffers 1995), but, with few notable exceptions demonstrating that firms have considerable control over their ability to create IT-based switching costs and harness them to the retention of customers (Amit and Zott 2001; Chen and Hitt 2002), it seems to have fallen out of favor. This is surprising given the potential that IT-dependent strategic initiatives have to create preemption through switching costs. Our review also suggests that relationship exclusivity and a concentrated value systems link may maximize the effect of switching costs on sustainability. Yet, no research to date has explicitly modeled this moderating effect.

Beyond testing the framework we have proposed, and the current gaps in the literature, there are many opportunities to extend our theorizing. Recently, the strategic agility perspective has challenged us to think about information systems as digital options generators (Sambamurthy et al. 2003). Within this view, a firm can use its current IT capabilities to afford itself future opportunities to leverage digital processes and knowledge to launch future competitive moves and initiatives. Marrying the impetus of the strategic agility perspective with the unit-level focus espoused in this paper creates a wealth of valuable cross-level research opportunities. For example, some of the response-lag drivers developed through organizational learning or asset stock accumulation will be specific to the IT-dependent strategic initiative that generated them, while others will likely be broader and contribute generally to digital options generation. In order to map the characteristics of initiative to their potential for options generation, a taxonomy of IT-dependent strategic initiatives may be developed and tested. Cross-organizational initiatives (e.g., supply chain management) represent a class of initiatives that creates fertile ground for extending our work beyond the current focus on an individual firm. With the widespread adoption of enabling technologies (e.g., radio frequency identification), this area of research has the potential to be extremely timely and relevant.

Finally, while this article provides an intellectual basis in support of planning for sustained competitive advantage, our work presently provides little guidance about the process that might be employed to carry out such planning. Who, for instance, should be involved in this process and how would they be facilitated? What are the principal challenges to gathering and processing the information necessary to carry out many of the value judgments necessary to estimate the strength of the barriers to erosion? From the follower, rather than the innovator, perspective, how should the firm use the framework to diagnose the sources of the leader's advantage?

Acknowledgments

We would like to thank Sergei Boukhonine and Deborah Bauder for their indispensable support with the background research that made this article possible. We would also like to thank the

editors and the review panel for their guidance and support throughout this project.

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Appendix A

Methodology

The literature on sustainable competitive advantage is interdisciplinary. Thus, following the methodology proposed by Webster and Watson (2002), we performed a search spanning the information systems, strategic management, and marketing literatures. As a first step, we examined selected journals in these fields and completed full-text electronic searches[18] on keywords including "competitive advantage and information systems" or "competitive advantage and information technology."[19] These searches identified a total of 602 articles (see Table A1). The titles and abstracts of each article were examined to evaluate whether inclusion was warranted (i.e., the article appeared to be concerned with, or relevant to, the question of sustainability of competitive advantage based on information systems).[20] This process, patterned after similar previous work (Van de Ven and Poole 1995), provided 80 articles for in-depth review and coding.

In an effort to broaden the search beyond the original set of journals, we noted cited works of potential interest in the articles reviewed (Webster and Watson 2002). A further set of 46 articles, from journals other than those formally searched, was collected and a subset of 37 articles was read in full and coded.

Our categorization of the literature was concept-driven (Webster and Watson 2002) and organized around the theoretical framework presented above. For each article, we noted what response-lag driver the authors had identified and/or tested and the process, if any was provided, by which the driver was thought to contribute to sustaining competitive advantage. The results, including specific barriers to erosion and response-lag drivers that emerged from the analysis, are presented in the article organized by the guiding frameworks and concept matrices (Webster and Watson 2002). Out of 117 coded articles, 69 included variables of interest and are compiled in the analysis.

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[18]The following databases where used: Proquest, Science direct, JSTOR archive.

[19]All issues of the following journals were searched in an effort to include top journals in the selected disciplines and broaden the search beyond North American journals: *MIS Quarterly*, *Information Systems Research*, *Management Science*, *Journal of Strategic Information Systems*, *European Journal of Information Systems*, *Academy of Management Review*, *Strategic Management Journal*, *Academy of Management Journal*, *Organization Science*, *Journal of Marketing, Journal of Marketing Research*.

[20]Note that, in an effort to develop a comprehensive model of the role of information systems in sustainable competitive advantage, we included not only articles that explicitly tested a construct's own contribution to sustainability, but also those that, while concerned with other research questions, discussed, directly or indirectly, such contributions.

Table A1. Journal Articles Analyzed

Journal	Abstract	Coded	Of Interest
MIS Quarterly	137	17	13
Information Systems Research	14	6	3
Management Science	41	11	2
Journal of Strategic Information Systems	128	13	8
European Journal of Information Systems	39	3	0
Organization Science	31	6	2
Academy of Management Review	34	4	2
Academy of Management Journal	47	7	0
Strategic Management Journal	74	7	5
Journal of Marketing	49	5	5
Journal of Marketing Research	8	1	0
Other	46	37	29
Total	648	117	69