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# AN EXPLORATION OF ORGANIZATIONAL LEVEL INFORMATION SYSTEMS DISCONTINUANCE INTENTIONS[1]

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*Limited attention has been directed toward examining post-adoption stages of the information system life cycle. In particular, the final stages of this life cycle have been largely ignored despite the fact that most systems eventually reach the end of their useful life. This oversight is somewhat surprising given that end-of-life decisions can have significant implications for user effectiveness, the value extracted from IS investments, and organizational performance. Given this apparent gap, a multi-method empirical study was undertaken to improve our understanding of organizational level information system discontinuance. Research commenced with the development of a broad theoretical framework consistent with the technology–organization–environment (TOE) paradigm. The resulting framework was then used to guide a series of semi-structured interviews with organizational decision makers in an effort to inductively identify salient influences on the formation of IS discontinuance intentions. A set of research hypotheses were formulated based on the understanding obtained during these interviews and subsequently tested via a random survey of senior IS decision makers at U.S. and Canadian organizations. Data obtained from the survey responses was analyzed using partial least squares (PLS). Results of this analysis suggest that system capability shortcomings, limited availability of system support, and low levels of technical integration were key determinants of increased intentions to replace an existing system. Notably, investments in existing systems did not appear to significantly undermine organizational replacement intentions despite support for this possibility from both theory and our semi-structured interviews.*

**Keywords**: Information systems discontinuance, obsolescence, abandonment, replacement, life cycle management, technology–organization–environment (TOE) framework

## Introduction

A rich and extensive literature within the field of information systems has explored the adoption, implementation, and use of systems by organizations. In contrast, research within the field has offered relatively little insight into phenomena related to later life cycle stages. A review of more than 1,000 articles published in seven leading MIS journals over the past 20 years resulted in the identification of only 4 articles that gave notable attention to the final stages of the IS life cycle. Since decisions are eventually made to discontinue the use of most systems, this would appear to represent a relatively large gap in our understanding of the life of these systems (Sandborn 2007; Swanson and Dans 2000).

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The organizational salience of inadequate attention to discontinuance is underscored by the significant implications that end-of-life decisions can have for the information management capabilities of an organization and for the management of its resources. The premature discontinuance of a large enterprise system can, for instance, represent a substantial loss of organizational investment (Beatty and Williams 2006; Robey et al. 2002). Alternatively, the use of a system beyond its productive lifespan can have similarly negative implications for an organization (Kelly et al. 1999). For instance, Overby (2007) presents the case of an airline that incurred significant financial costs and damage to its reputation when one of its legacy systems failed. Similarly, the ability of a hospital group to provide urgent medical attention was severely impeded by the continued use of an unreliable system (Berinato 2003). As a result, there would appear to be considerable merit in undertaking efforts to improve our understanding of IS discontinuance.

Information system discontinuance is defined here as *the cessation of the use of an organizational information system* and, as such, it represents a significant milestone in the life of a system. This paper explores IS discontinuance in some depth with a view toward improving our understanding of what drives an operational system toward the end of its life. Given the limited prior attention to IS discontinuance in the literature, a grounded approach was adopted that sought to understand the phenomenon as viewed by practicing managers and then test this understanding within a larger population of these managers. The understanding thus gleaned provides a foundation for future discontinuance research as well as valuable guidance to organizations seeking to maximize the value obtained from their IS investments.

## Distinguishing Between Adoption, Continuance, and Discontinuance

Numerous investigators have contributed to our understanding of the factors underlying individual level adoption and use of information systems (e.g., Davis et al. 1989; Venkatesh et al. 2003). This vast body of work has identified perceived ease of use, perceived usefulness, and a range of other *personal* and *system* characteristics as impacting individual level IS adoption decisions. A related stream of research has sought to improve our understanding of what contributes to the adoption of information systems by *organizations* (e.g., Chau and Tam 2000; Teo et al. 2003). Since the adoption of a new system is frequently associated with the discontinuance of an existing system, there would appear to be some basis for expecting models of IS adoption to offer an adequate account of IS discontinuance. However, this view confounds the life cycle of an existing system with that of a newly adopted system. Since models of IS adoption only become meaningful once a specific alternative system has been identified, these models offer relatively little insight into the *initial formation of intentions to discontinue* the use of an existing system. Further to this, IS adoption models are entirely incapable of addressing circumstances where discontinuance does not lead to adoption such as when a system is simply abandoned. Reliance on these models would thus seem to impose needless constraints on our understanding of IS discontinuance.

Recent work has begun to examine some of the contributors to the continued use of information systems (e.g., Bhattacherjee and Premkumar 2004; Kim and Malhotra 2005). Since continuance can, to some extent, be considered the opposite of discontinuance, findings from this stream of research might be successfully applied to understanding discontinuance. A review of continuance research suggests that one of two approaches is typically adopted (Hsu et al. 2004). The first approach views continuance as an extension of acceptance behavior, with models of this form suggesting, for instance, that initial perceptions of system usefulness change as a consequence of system use (Kim and Malhotra 2005). These revised perceptions are then posited to drive the choice to use a system in the future. The second approach draws on expectation disconfirmation theory (Oliver 1980) to argue that discrepancies between what a user expects of an IS and what it delivers in practice determine future use (Bhattacherjee and Premkumar 2004).

Both of these approaches make important contributions to our understanding of the continued use of information systems. There are, however, two important reasons why this work does not suitably account for organizational IS discontinuance. First, continuance research has generally been conducted at the level of individual users while organizational discontinuance decisions are typically made by senior IS executives or others in the firm who may not be intense users of the system in question. Decisions made by these executives can be impacted by a wide range of factors likely to have limited relevance to individual users, such as the need to accommodate changes in strategic direction or the need to respond to pressures to reduce organizational costs. Organizational level decisions also need to consider the embedded nature of many systems as well as an extensive range of issues stemming from widespread reliance on a system to perform routine business functions.

The second key limitation in the suitability of continuance research to understanding organizational level IS discon-

tinuance is the fundamental difference between continuance and discontinuance decisions. Continuance represents, in essence, a status quo alternative that can occur in the absence of any conscious choice or planning (Kim et al. 2005). In contrast, discontinuance represents a rejection of the status quo that requires conscious commitment of the necessary organizational resources and effort to effect the associated change. This change can also have a number of spill-over effects, each of which must be factored into the discontinuance decision. Thus, while multiple research streams appear to inform our understanding of IS discontinuance, this prior work suffers from some notable limitations in its ability to offer comprehensive insight into what drives organizational discontinuance.

### The Significance of IS Discontinuance

Organizational investments in IT products and applications have been estimated to exceed $1 trillion dollars (US) per year with such investments accounting for over half of the annual capital expenditure of many large organizations (Chou et al. 2006). The costs of implementing a large system such as an enterprise resource planning (ERP) system have, for instance, been reported to routinely exceed $200 million (US) and the average budget for an ERP implementation project can represent the equivalent of between 2.3 and 2.8 percent of an organization's annual revenue (Beatty and Williams 2006; Robey et al. 2002). In addition to massive investments in hardware and software, organizations also commit substantial resources to link their information systems to business processes, organizational procedures, and the structure of their businesses (Kelly et al. 1999). Thus, discontinuance decisions can have significant implications for organizational effectiveness and the allocation of resources.

A large body of research has emerged that attempts to quantify the value obtained from IS investments (Kohli and Devaraj 2003). System life span has thus been identified as an important factor impacting this value (Richmond et al. 2006). Unlike investments in many other assets, investments in information systems tend to have limited scrap value (Fichman 2004). When an organization discontinues the use of a system, it largely ceases to derive further benefits from the system and is typically unable to extract residual value by selling it to other interested parties. As a consequence, the length of time that a system is used becomes a particularly important contributor to the ultimate value derived from investments in the system. Further to this, a number of researchers have suggested that the implementation of large-scale enterprise systems can precipitate a short-term fall in organizational performance (Abdinnour-Helm et al. 2003; Robey et al. 2002). Referred to as the "shake-out" period, this fall in performance can, for a variety of reasons, result in a system yielding negative net benefits for two or more years after it has been implemented (Abdinnour-Helm et al. 2003). Hence, an organization that discontinues the use of a system after three years might be engaging in discontinuance just as the system is beginning to yield notable benefits.

Despite the potential to extract additional benefits from a system, the value of an IS investment cannot be maximized by simply extending its life span indefinitely. Changing business needs have been identified as being among the more salient constraints on the continued use of existing systems (Schmidt et al. 2001). Underscoring the significance of such changes, some research has suggested that the pace of business change is increasing, thus contributing to an increase in the rate at which IS investments are becoming obsolete (Kelly et al. 1999). Failure to discontinue the use of such systems can severely constrain the ability of an organization to respond to external pressures (Gosain 2004). As a result, organizations are placed in a constant tension between the need to maximize the value extracted from existing system investments and the need to discontinue the use of systems that are no longer appropriate to their needs. At some point this tension shifts in favor of discontinuance and an organization will begin to form discontinuance intentions. The conceptual and empirical literature has, however, been largely silent on the factors that influence the formation of these intentions. Hence, there would appear to be a substantive need to address the following research question: *What factors lead to the emergence of organizational intentions to discontinue the use of an existing information system?*

Answering this question can be expected to provide significant insight to organizations seeking to maximize the value of their IS investments as well as to IS vendors seeking to understand and anticipate the needs of their customers. In our efforts to answer this question, we have adopted a top–down approach that emphasizes high-level organizational decision-making processes. As such, we regard our research as being complementary to earlier work that has taken a bottom-up approach to examine questions related to the maintenance and evolution of existing systems (Heales 2002; Kemerer and Slaughter 1999). Thus, while this prior work has given particular attention to code level changes and change requests, we are interested in developing an understanding of what drives organizational level IS discontinuance decisions. A multi-method initiative was undertaken to answer the research question. Consistent with prior research, we focused on eliciting the views of practicing managers to develop a theoretical understanding of IS discontinuance that would be both robust and well grounded in practical experience.

## Theoretical Framing

Given the absence of strong *a priori* theory, we sought to first develop a conceptual framework that would help us to remain cognizant of extant theory during our initial qualitative exploration of IS discontinuance (Figure 1). Research, such as ours, that seeks to develop understanding by eliciting the salient beliefs of study participants typically assumes that the views of interest are explicitly known by, and salient to, these participants. Hence, our *a priori* theoretical framing served two key purposes. First, it helped us to ensure that we remained theoretically aware during our discussions. Second, it improved our ability to prompt informants concerning some potentially relevant issues for which they had low salience or limited awareness at the time of our discussion. As our research question suggests, the resulting framework is rooted at the organizational level of analysis (Rousseau 1985). However, given that discontinuance decisions are generally made in relation to specific systems, the "unit" of analysis is that of an individual information system.

The nature of IS discontinuance suggests that it is a form of intentionally driven, episodic change that arises as a result of disruption in an equilibrium between inertial tendencies and change forces (Weick and Quinn 1999). Guided by this understanding, we aimed to identify key change forces that might contribute to the emergence of discontinuance intentions as well as key sources of inertia that could potentially undermine the emergence of such intentions. Our effort to identify potentially relevant change forces and sources of inertia was guided by earlier studies that have examined a wide range of IS related research questions (Table 1). Salient among this work is the TOE framework, which identifies technology, organization, and environment as the three broad categories of factors that can impact IS-related decisions (Mishra et al. 2007). We therefore draw upon this work as a basis for categorizing the forces that we identify as potentially contributing to IS discontinuance and extend it by suggesting that sources of continuance inertia can similarly arise from one of these three categories.[2]

Since an IS discontinuance decision represents, in essence, a choice for change, change forces are characterized as key antecedents in the research framework (Miller and Friesen 1980; Van de Ven and Poole 1995). Over time, these change forces create pressure that is at odds with the considerable effort expended to institutionalize the continued use of existing systems (DiMaggio and Powell 1983; Kim et al. 2007). Based on prior work highlighting the impact of technological, organizational, and environmental factors on IS decision making, we identify declining system performance (Richmond et al. 2006; Swanson and Dans 2000), organizational initiatives aimed at altering where and how an organization operates (Kelly et al. 1999), and changes in the environmental context (Oliver 1992) as contributing to the formation of IS discontinuance intentions. It should be noted that since our interest was primarily related to understanding what contributes to the formation of IS discontinuance intentions, our model does not seek to account for interactions among the elements that we have included. While we acknowledge that such interactions are possible, our primary purpose at this stage was to identify the key direct effects.

The impact of change forces on the formation of discontinuance intentions can be counteracted by the presence of strong inertial tendencies that limit the extent to which discontinuance decisions will be made, irrespective of the presence of obvious pressures for change (Weick and Quinn 1999). Hence, analogous to the technological, organizational, and environmental change forces highlighted previously, we identified capital and other investments in an existing system (Ahtiala 2006), embeddedness of the existing system within a network of organizational routines and other organizational systems (Feldman and Pentland 2003; Gosain 2004), and institutional pressures (Kondra and Hinings 1998) as contributing to continuance inertia.

### *Change Forces*

Since change can arise from multiple sources, stronger theories of change generally incorporate multiple drivers (Van de Ven and Poole 1995). While it is possible to enumerate an extensive list of potential change forces, prior work has sought to consolidate these into general categories (Miller and Friesen 1980; Van de Ven and Poole 1995). This work suggests that life cycle based forces, teleological forces, and evolutionary forces are three key classes of change drivers. Hence, in addition to ensuring that our *a priori* framework gave consideration to technological, organizational, and environmental sources of change, we also sought to ensure that these three classes of change drivers were adequately represented.

#### System Performance Shortcomings

System performance can be defined as *the extent to which a system consistently and effectively accomplishes the tasks that it is expected to accomplish* and therefore incorporates elements such as the functionality, responsiveness, and reliability

[2]We would like to thank one of the reviewers who provided us with this insight.

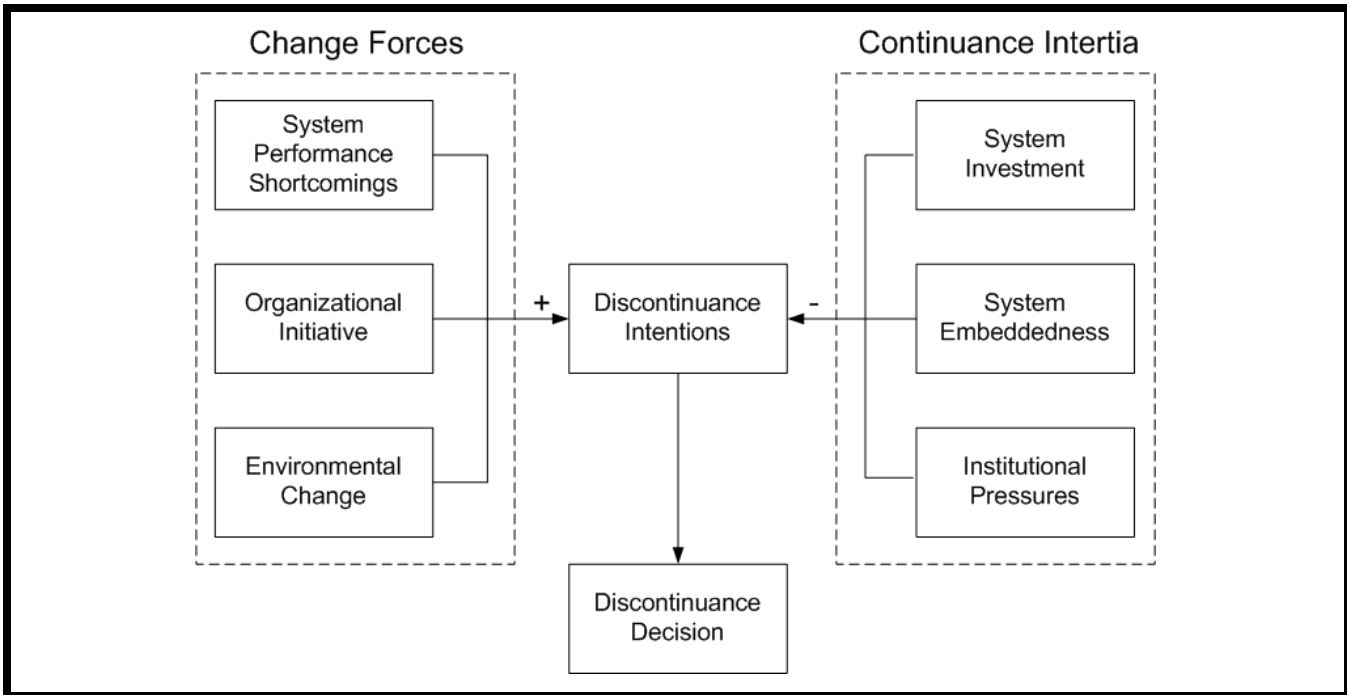



**Figure 1. Theoretical Framework**

**Table 1. Literature Foundations of Theoretical Framework**

| Foundational Ideas | Relevant References |
|---|---|
| Change as episodic and driven by disruption in an equilibrium between inertial tendencies and change forces | Weick and Quinn 1999 |
| Factors of relevance to IS decision making relate to either the technology (in our case an information system), the organization, or its environment | Mishra et al. 2007<br>Tornatzky and Fleischer 1990<br>Xue et al. 2008 |
| Life cycle, teleological, and evolutionary motors as three key classes of change forces | Miller and Friesen 1980<br>Van de Ven and Poole 1995 |
| Importance of system performance as a technological, life cycle based change force | DeLone and McLean 1992<br>DeLone and McLean 2003 |
| Importance of organizational initiative as an organizational, teleologically oriented change force | Child 1972<br>Kelly et al. 1999 |
| Importance of environmental change as an environmental, evolutionary change force | Lederer and Mendelow 1990<br>Mendelson and Pillai 1998 |
| Importance of system investment as a technology based source of continuance inertia | Ahtiala 2006<br>Arkes and Blumer 1985<br>Farrell and Shapiro 1988<br>Schilling 1998 |
| Importance of system embeddedness as an organizationally oriented source of continuance inertia | Granovetter 1985<br>Hannan and Freeman 1984<br>Leonard-Barton 1992<br>Swanson and Dans 2000 |
| Importance of institutional pressure as an environmentally based source of continuance inertia | DiMaggio and Powell 1983<br>Zucker 1987 |

of a system. Researchers have suggested that even highly institutionalized practices are subject to modification as a consequence of changing perceptions surrounding the technical effectiveness of these practices (Oliver 1992). In the context of IS research, performance-oriented forces have been identified as important drivers of end-of-life decision making (Swanson and Dans 2000; Venkatesh and Morris 2000) while software maintenance research and the literature related to information systems success have highlighted the importance of system performance to the successful development and adoption of information systems (DeLone and McLean 1992; Sommerville 2007).

Although the actual software associated with an information system is not subject to physical wear over the course of its life, performance can be negatively impacted by intrinsic characteristics of the software (Butler and Gray 2006), as well as by factors that include aging hardware, ongoing system maintenance, changes to related software, and changing usage patterns (Heales 2002; Kuhn et al. 2009; Swanson and Dans 2000). Since system performance is closely linked to life cycle processes, such performance was identified as the key life cycle force in our *a priori* framework. Given that system performance problems tend to be both salient and problematic for users and other stakeholders who depend on the output that a system produces, declining system performance was seen as being a likely contributor to discontinuance intentions.

### Organizational Initiative

Defined as *internal organizational effort directed toward altering where and how an organization operates*, organizational initiative asserts a teleological perspective that sees goal-directed behavior and strategic choice as fundamental drivers of organizational change (Miller and Friesen 1980; Van de Ven and Poole 1995). A wide range of organizational initiatives can be identified as potentially creating pressure for change in an organization's information systems. These include changing strategic plans, the replacement of key executives, pursuit of new product or market opportunities, the construction of new facilities, the introduction of new production technologies, changes in organizational structure, and involvement in merger and acquisition activity (Miller and Friesen 1980). Some researchers have argued that changes in the strategic vision of an organization, rather than strictly technical issues, are increasingly driving the need to discontinue the use of information systems (Kelly et al. 1999). For example, an organization planning to pursue strategic growth may regard a rudimentary financial accounting system as inappropriate in light of these plans. As a result, organizational initiative was identified as a potentially important contributor to the formation of discontinuance intentions.

### Environmental Change

Environmental change can be defined as *change in the physical or social factors that lie outside of the boundaries of an organization* (Duncan 1972). Evolutionary change models typically regard external forces as driving change and, as such, environmental change is seen as accounting for evolutionary based change in our *a priori* framework. A wide range of environmental changes have been identified in the literature as contributing to the need for organizational change. These include revised government regulations and the emergence of new and distinctive competitive threats (Oliver 1992). The information systems literature has also acknowledged the need to respond to environmental change in relation to the management of information systems (Lederer and Mendelow 1990). Rapid environmental change can, for example, be expected to increase the pace at which information systems become obsolete (Mendelson and Pillai 1998). Similarly, the introduction of regulations such as those surrounding the need to retain email for the purpose of legal discovery can undermine the continued viability of some systems (Miller 2010). Hence, it was expected that environmental changes would have potentially significant implications for IS discontinuance.

## *Continuance Inertia*

Analogous to our efforts to adequately account for technological, organizational, and environmental drivers of change, we also sought to identify technological, organizational, and environmental sources of continuance inertia. This process led to the identification of the level of financial and other investments in an existing system, the degree of embeddedness of this system within organizational activities, and institutional pressures from the organization's environment as three potentially important contributors to continuance inertia.

### System Investment

System investment is defined as *the financial and other resources committed to the acquisition, implementation, and use of an information system.* Building on the idea that commitment can escalate, the sunk cost effect is the tendency of decision makers to continue making resource commitments to an endeavor once an initial commitment of resources has been made (Arkes and Blumer 1985). Given that investments in an information system can be considerable, the sunk-cost effect suggests that organizations will be reluctant to discontinue their use of existing systems since this would represent a "loss" of considerable sunk costs. The discontinuance of a

system that has consumed considerable organizational resources can also threaten the reputation of those who have supported these investments, thus leading them to support continued system use.

Even in the absence of sunk cost and reputation effects, investments in the implementation and operation of an existing system represent switching costs that can constrain the actions that an organization will be likely to take in the future (Farrell and Shapiro 1988; Schilling 1998). For instance, the time and other resources needed to train users, acquire technical expertise related to system operation, and foster commitment to system use can represent potentially significant switching costs that can reasonably be expected to negatively impact discontinuance intentions (Ahtiala 2006). While not all such investments will be rendered obsolete by a discontinuance decision, a sound basis remains for believing that significant levels of investment in a system will encourage its continued use.

### System Embeddedness

System embeddedness is defined as *the extent to which the use of an information system is an integral part of organizational activity*. An organization that has successfully implemented an information system gains competence with the system (March 1981). This competence can lead to expansions in the breadth and depth of system use such that the scope of a discontinuance effort begins to impose significant constraints on the formation of discontinuance intentions (Leonard-Barton 1992). A second dimension of system embeddedness is the nature of the organizational routines that often surround information systems. Although routines can greatly assist in the process of fostering system use, such routines are widely thought to constrain the ability of organizations to change (Feldman and Pentland 2003; Van de Ven and Poole 1995). Thus, it can be expected that an organization will be relatively unwilling to discontinue its use of a system that is supported by a set of interdependent relationships and tightly embedded in organizational routines. Finally, it should be noted that the extent to which a system is linked to other information systems both within an organization and across organizational boundaries can vary such that some systems are more tightly integrated than others. A decision to discontinue the use of a tightly integrated system is likely to be made with reluctance since it would entail changes to a wide range of related elements (Swanson and Dans 2000). Consequently, system embeddedness was considered to be a potentially important source of continuance inertia.

### Institutional Pressures

Institutional theory has traditionally been concerned with organizational legitimacy and how the need for legitimacy fosters the emergence of norms and practices that prove resistant to change (Scott 2001). This emphasis on behavioral persistence serves to highlight the potential role that institutional pressures may have in fostering continuance inertia. Coercive, normative, and mimetic pressures have been identified by institutional theorists as the three key pressures that can lead organizations to conform to the practices of other organizations (DiMaggio and Powell 1983). Although pressures to comply with regulatory demands and conform to social and professional norms may also contribute to continuance inertia, it is mimetic pressures that rely on a degree of orthodoxy and taken-for-grantedness that are most suggestive of inertial tendencies (Scott 2001). Mimetic isomorphism, seen as *the tendency of firms to mimic or copy the actions of those organizations that are perceived to have high levels of legitimacy*, was therefore identified as the institutional pressure most likely to contribute to continuance inertia (DiMaggio and Powell 1983).

Mimetic behavior can be the optimal choice when an organization is seeking to avoid risk, particularly given that following the lead of another organization represents a decision to adopt a course of action that has already proven successful (Kondra and Hinings 1998). Although organizations might be driven to adopt a system because others are doing so, our interest relates to discontinuance rather than adoption. Hence, we focus on whether organizations experience pressure to continue using existing systems because these systems are being used by other organizations. Given prior research, it was expected that continued use of a system by competitors and other organizations with high legitimacy would contribute to increased continuance inertia. Thus, an organization might, for example, continue to use a particular ERP system because it is regarded as a standard in their industry.

## Qualitative Exploration

Guided by our initial theoretical framework, a qualitative study was undertaken to develop a grounded understanding of organizational IS discontinuance. The purpose of the theoretical framework described in the preceding section was to sensitize us to the wide range of factors *potentially* impacting IS discontinuance intentions. Given the lack of strong theory, it was fully expected that our understanding would evolve based on empirical findings.

Data for this stage of the research was collected via semi-structured interviews conducted with senior decision makers who were sufficiently familiar with organizational IS discontinuance to adequately discuss the subject in an interview session. In principle, it would have been possible to collect data using a range of alternative qualitative techniques including focus groups and variants of the Delphi method. Semi-structured interviews were, however, used to permit in-depth exploration of the research question with every study participant and to develop an understanding of the relevant issues as seen from the independent perspective of a range of decision makers. An interview guide was purposefully constructed to permit comprehensive exploration of the factors impacting IS discontinuance (Appendix A). Use of semi-structured interviews permitted informants to freely express their views while also affording us the opportunity to raise issues suggested by our *a priori* framework. The use of a semi-structured approach also permitted us to dynamically test our understanding of informant remarks throughout the course of each interview.

Purposeful, criterion-based sampling was used to identify decision makers representing both IT and line-of-business functions at organizations of various sizes and operating in a range of industries (Paré 2004). New informants continued to be identified until theoretical saturation was achieved (Strauss and Corbin 1998). Thus, a total of 21 informants representing 17 different organizations operating in 10 industries were interviewed (Table 2). Of the 21 informants, 15 held responsibilities within the information technology function while the remaining six were representatives of other functional areas having either salient IT needs or notable accountability for IT decision making. Interviews lasted for an average of slightly more than 35 minutes and all interviews were recorded and transcribed by the researchers to yield a total of approximately 330 single-spaced pages of text.

## Data Analysis

Analysis of interview transcripts was guided by grounded theory techniques to permit salient constructs and relationships to emerge from the data set informed, but not imposed, by researcher preconceptions (Paré 2004; Strauss and Corbin 1998). The data analysis process commenced with an impressionistic reading of transcript text to develop some familiarity with recurring themes. This reading was followed by the assignment of codes or labels to all informant remarks considered relevant to some aspect of IS discontinuance. Subsequent to open coding, axial coding was performed to establish key dimensions and relationships. Initial code assignments were also revised, abstracted, and consolidated during the process. Once a relatively concise set of codes had been established, the relationships between codes were reviewed to ensure that they did not exhibit inconsistencies, such as one construct being posited as leading to both an increase and a decrease in another. Inconsistencies such as this were resolved by reviewing source remarks and then revising the characterization of relationships accordingly.

Subsequent to completion of this initial process, a comprehensive review of the informant remarks underlying every code and relationship was conducted. The objective of this review was to assess codes and relationships in light of the understanding gained during data analysis and to ensure that these codes and relationships continued to reflect the spirit of informant remarks. Finally, an assessment was conducted of the adequacy of the data coding effort using a procedure similar to that described by Paré (2004). This procedure involved a determination of the level of agreement between code assignments made by the researchers and those made by a naïve coder (Everitt and Hothorn 2006; von Eye and Mun 2005). Raw agreement was 80 percent while Cohen's Kappa was, at 0.726 ($p < 0.000$), above the widely recommended minimum value of 0.7 (Boudreau et al. 2001). Hence, agreement scores suggested that the results of our data analysis fairly represented the discussions held with our informants.

## Qualitative Exploration: Results and Hypothesis Development

Our interviews indicated that the term *discontinuance* was used relatively infrequently by practicing managers. Rather, they confirmed that abandonment, replacement, and upgrade were the three key end-of-life outcomes that fell under our definition of discontinuance. Abandonment represented the clearest form of discontinuance in that the use of an abandoned system is halted without introducing a replacement. Instances of abandonment were, however, quite rare and we were therefore unable to obtain significant insights concerning this form of discontinuance. Upgrades were far more common, although these varied from small-scale maintenance projects to large-scale initiatives. Our understanding of the notion of an upgrade was complicated by the fact that the scope of upgrade efforts was often ambiguous, thereby making it difficult to determine whether many of these initiatives constituted discontinuance as we defined it. In contrast with upgrades and abandonment, the nature of replacement was relatively unambiguous. Indeed, factors contributing to the formation of replacement intentions were discussed extensively during our interviews. Replacement was, in fact, discussed over four times more frequently than either abandonment or upgrade. These observations led us to focus primarily

**Table 2. Interview Informants**

| Organizational Role | Industry | Organization Size |
|---|---|---|
| Finance Director | IT | Small |
| IT Manager | Hospitality & Leisure | Small |
| Finance Director | Real Estate | Medium |
| IT Manager | Legal Services | Medium |
| IT Manager | Health Care | Medium |
| Director of Business Services | Electronics | Medium |
| Communications Manager[a] | Retail | Large |
| IT Manager[a] | Retail | Large |
| IT Manager | Retail | Large |
| Sales Manager | IT | Large |
| Senior VP Technology[b] | Hospitality & Leisure | Large |
| IT Director[b] | Hospitality & Leisure | Large |
| IT Director | Health Care | Large |
| Consultant[c] | Health Care | Large |
| IS Executive[c] | Health Care | Large |
| IS Executive[d] | Government | Large |
| IS Executive[d] | Government | Large |
| Chief Technology Architect | Financial Services | Large |
| Strategy Consultant | Financial Services | Large |
| Enterprise Architect | Financial Services | Large |
| CIO | Education | Large |

[a,b,c,d]Letters indicate informants from the same organization.

on IS replacement intentions and to refine our initial research question as follows: *What factors lead to the emergence of organizational intentions to replace an existing information system?*

As this question suggests, our particular interest was in understanding what drives and constrains the emergence of plans or intentions to replace an existing system. Although these intentions can initiate a series of events that ultimately lead to a replacement outcome, it is important to note that the stage at which replacement intentions are formed is conceptually quite distinct from the stage at which a decision is made to replace a system with a specific alternative. Take, for example, a customer service system being used at one of our study organizations. Over time, the company outgrew the capabilities of this system and, at some point, it became clear that it could no longer meet the organization's goal of enhancing customer service. Management thus began to form the replacement intentions that are the focal interest of our research. While these intentions can trigger a series of subsequent actions, including the analysis of requirements, alternative evaluation, and new system selection, we are less interested in these downstream events as they are at least partially addressed by theories of adoption and acceptance.

Interview discussions led to the identification of a wide range of factors that might impact the formation of IS replacement intentions. Most of these were, however, cited quite infrequently and were typically considered to be of minor importance by informants. Hence, given our interest in offering generalizable findings, research hypotheses were only developed in relation to those factors discussed in some depth by multiple informants (see Table 3). The following discussion outlines these elements within the context of our sensitizing framework, beginning with a discussion of change forces.

## System Performance Shortcomings

As suggested by our sensitizing framework, discussions with interview informants led to the identification of some notable

elements of system performance that can contribute to the formation of IS replacement intentions. In particular, numerous remarks indicated that the likelihood that a system will be replaced was heightened by limitations in the capabilities of the system and by declining system reliability.

**System Capability Shortcomings**: A system capability shortcoming is *a limitation in the functionality of an information system that undermines its ability to meet organizational needs*. As this definition suggests, perceived shortcomings in the capabilities of existing information systems are closely linked to the requirements that an organization has for these systems. Hence, system capability shortcomings were frequently framed in reference to organizational needs or requirements. Although informants occasionally identified organizational needs as contributing to replacement intentions, further analysis indicated that these needs were only considered relevant to the extent that they exposed shortcomings in the capabilities of an existing system. This situation is illustrated by an informant who suggested that his organization needed to review historical data that an existing system was unable to provide. Such shortcomings were seen as constraining organizational ability to pursue strategic objectives and to otherwise respond to the demands of customers and other key stakeholders. It was, therefore, hypothesized that

H1: System capability shortcomings are associated with increased replacement intentions.

**System Reliability**: System reliability is defined as *the extent to which a system can be counted on to perform its intended tasks*. Although the IS success literature suggests that systems that have been successfully implemented will be reliable, at least initially, declining reliability over the life of a system was widely viewed by informants as increasing the likelihood that the system would be targeted for replacement. The importance of system reliability was underscored by informant observations that the use of a system can be extended for a considerable period of time provided that it continues to be reliable. In contrast, the continued use of systems that were becoming unreliable was widely regarded as presenting excessive risk to the business. Hence, it was hypothesized that

H2: Reduced system reliability is associated with increased replacement intentions.

## Organizational Initiative

Some discussion during interview sessions centered on the implications that organizational initiatives can have for IS replacement. However, these discussions generally suggested that, while salient, the impact of such initiatives is typically mediated by their impact on the ability of a system to meet organizational needs. One informant observed, for example, that replacement would be driven by whether "applications satisfy current business requirements." Hence, systems deemed to be incapable of meeting new needs introduced by an organizational initiative were targeted for replacement. In contrast, organizations were rarely observed to pursue IS replacement in the absence of such capability shortcomings. As observed by a second informant, while it might be ideal for organizations to ask themselves "what kind of technology or initiatives would this organization benefit from, that never happens." Hence, the impact of organizational initiative on replacement intentions was typically seen as being both indirect and highly system dependent. Therefore, no specific research hypotheses were therefore formulated.

## Environmental Change

Technological innovation was identified as the main environmental change having an impact on the formation of replacement intentions. In particular, some informants suggested that changes in the external technology landscape could have significant consequences for the costs and availability of system support. As a result, we formulated two hypotheses that reflect the impact of changes in the technology landscape on the formation of replacement intentions.

**System Support Availability**: System support availability, defined as *availability of the vendor and other support capabilities considered important to the continued use of an information system,* was viewed by informants as having a significant impact on the intention to replace a system. Among the more salient reasons identified for declining availability of system support were the reduced availability of individuals with the requisite expertise, vendor decisions to discontinue product support, and concerns surrounding the ability to obtain replacement parts for the hardware upon which a system runs. Continuing to operate a system under conditions of limited support availability was widely believed to significantly increase organizational risk, particularly when the system in question was viewed as important to ongoing operations. This finding suggests that, irrespective of its causes, reduced availability of system support is an important driver of the need to replace a system and it was thus hypothesized that

H3: Reduced system support availability is associated with increased replacement intentions.

**System Support Cost:** System support costs are *the costs that an organization incurs to support ongoing operation of an information system*. Despite the importance of support availability to end-of-life decisions, our informants noted that excessive support costs can lead to an increased interest in replacing an existing system even when support remains readily available. Such cost increases were seen as problematic regardless of whether they stemmed from increases in the price that vendors charge for support plans, increases in labor rates that must be paid in light of skill shortages, or as a result of other pressures. It was, therefore, hypothesized that

H4: Higher system support costs are associated with increased replacement intentions.

### System Investment

Turning to sources of continuance inertia, system investment can be defined as *the financial and other resources committed to the acquisition, implementation, and use of an information system*. Such investments were highlighted by many informants as playing a potentially significant role in inhibiting the formation of replacement intentions. Numerous informants expressed a strong desire to want to avoid "wasting" investments in existing systems. Informant remarks further suggested that such investments were viewed quite broadly and were, therefore, seen to include such things as the initial capital investments in a system, past commitments of time and other resources to support and maintain the system, and investments made in training IT staff and system users. Thus, it was hypothesized that

H5: Higher levels of investment in a system are associated with reduced replacement intentions.

### System Embeddedness

The most common dimension of system embeddedness that appeared to undermine the formation of IS replacement intentions was technical integration or *the extent to which an information system relies on sophisticated linkages among component elements to deliver needed capabilities*. Informants maintained that replacement intentions were formed more easily for systems with only limited technical integration when compared to those characterized by extensive, complex integration. Substantial integration was regarded as increasing the likelihood that severe difficulties would be encountered, and it was therefore hypothesized that

H6: Systems exhibiting higher levels of technical integration are associated with reduced replacement intentions.

### Institutional Pressures

The tendency to mimic or copy the actions of other organizations was noted by some informants as possibly reducing organizational interest in replacing an existing information system. None of these remarks were, however, made spontaneously by our informants. Rather, they were made in response to prompting that we undertook to explore various aspects of our *a priori* framework and they tended to be quite ambivalent in nature. Thus, informants were observed to either express tentative agreement with our suggestions and then move on to discuss other issues or simply assert that the practices of other organizations "aren't that important" to their decisions. Hence, our interviews provided relatively little evidence that either mimetic behavior or institutional pressures in general were particularly important to the formation of IS replacement intentions and, as a result, no research hypotheses were developed.

### Summary

The hypotheses outlined in the preceding discussion are summarized in Table 3 along with some of the supporting remarks made by our informants. A graphical depiction of the associated research model is provided in Figure 2. This figure includes our hypothesized relationships, relationships suggested by our *a priori* framework that were not found to be salient during the preceding initiative, and relationships assumed to exist but not explored by the quantitative study presented in the following section. This model can be viewed as an initial step in the development of theory related to IS discontinuance.

## Quantitative Assessment of Research Model

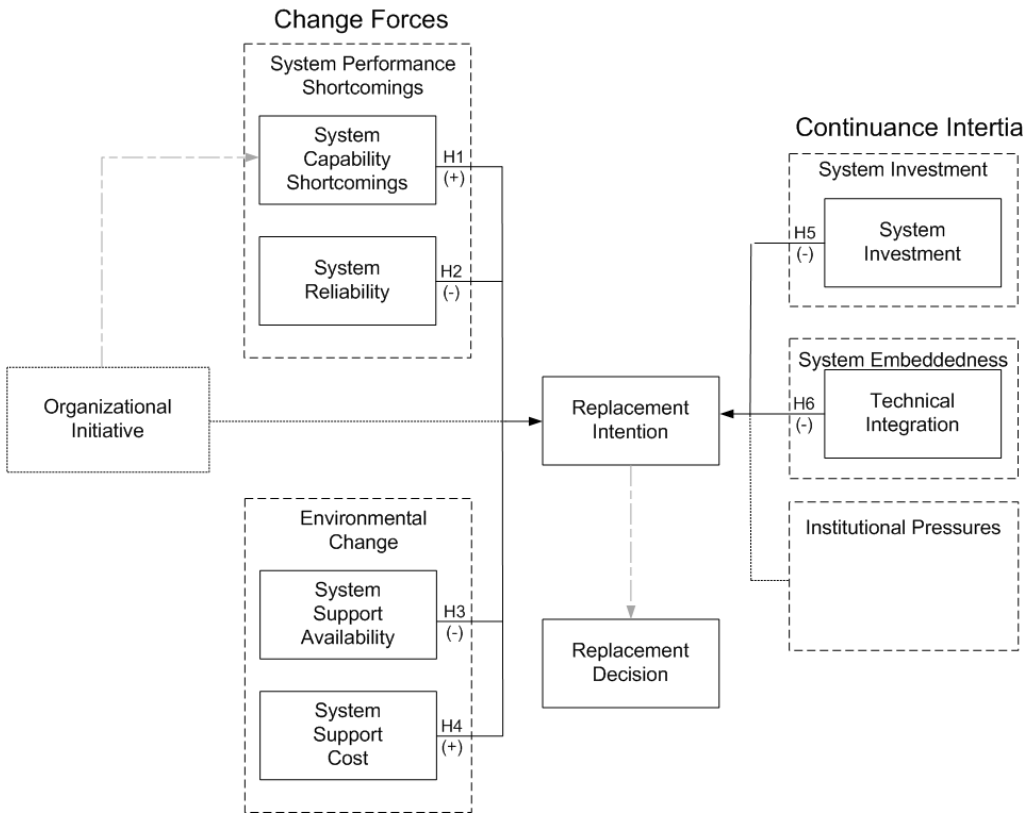
The final phase of our research involved the development and distribution of a survey instrument to a broad cross-section of information system decision makers working at medium and large-sized organizations operating within the United States and Canada. The use of a cross-sectional survey made it possible to test the research model within a broad community of IS decision makers and to thereby assess the generalizability of our qualitative findings.

**Table 3. Summary of Qualitative Study Findings and Resulting Research Hypotheses**

| Hypothesis | Informant Support |
|---|---|
| H1: System capability shortcomings are associated with increased replacement intentions. | After a while if it's not really doing what you need it to do, for sure you're going to look at something else. (Informant 14)<br>So from a business perspective when we look at the life cycle of an application, it's totally tied to business requirements…does that application satisfy the current needs. (Informant 10)<br>We're not happy with the functionality so…we're moving to a net new system. (Informant 12)<br>I can just never get what I want out of it. (Informant 1) |
| H2: Reduced system reliability is associated with increased replacement intentions. | So it's fairly stable and, you know, it works. (Informant 7)<br>If it was running smoothly I'd leave it alone…most of the people would say leave it alone. (Informant 16)<br>Reliance on these systems has increased dramatically to the point where if a system goes down today, it's a major issue. (Informant 12) |
| H3: Reduced system support availability is associated with increased replacement intentions. | Our issue was that the old system was not supportable. (Informant 2)<br>The question becomes is the system supported because once the vendor no longer supports this product, that's time to move on. (Informant 12)<br>The main thing was that [Product] updates stopped. It was no longer supported by [Vendor] and to us that's the one thing, that's the kicker. If we lose our support by the people that make it, then it's just too old. We've got to move on. (Informant 7) |
| H4: Higher system support costs are associated with increased replacement intentions. | The maintenance that we were paying the vendor, because it was a vendor system, was astronomical. (Informant 3)<br>The system is just simply costing way too much to maintain, there's too many bodies helping to maintain it, there's too many resources being spent whether they are financial or actual people resources. (Informant 6) |
| H5: Higher levels of investment in a system are associated with reduced replacement intentions. | When you've spent that much on a system…even though you don't like it, you don't want to throw it away. (Informant 1)<br>There's a lot of time and investment on those things and usually…these applications will live longer than they should. (Informant 6)<br>It was a challenge explaining to them and getting them to buy in on why we wanted to change after investing all this time with this one system. (Informant 11)<br>The customization costs money and the investment, once it's done, if you've only used it for a year have you recovered that investment? (Informant 16) |
| H6: Systems exhibiting higher levels of technical integration are associated with reduced replacement intentions. | They were relatively isolated. (Informant 5)<br>…because they're so tightly integrated that you can't just say okay, let's just replace this piece. (Informant 18) |

## *Methodology*

Our survey study was guided by well-established survey preparation and distribution practices as well as by the extensive literature related to the general conduct of survey research (e.g., Dillman 2007; Ju et al. 2006). The process commenced with development of clear construct definitions (Table 4). These definitions were formulated by drawing on the remarks of interview informants and by examining prior research that discussed notions similar to those expressed by our informants. Preliminary measurement items were created in accordance with our construct definitions and refined through a card sorting procedure. Once refined, these measures were incorporated into a draft survey that was subjected to pretesting with a small group of academics and practitioners. Pretest participants were identified through a partnership with a local chapter of the Society for Information Management. The draft survey was refined based on feedback received during pretesting and then tested in a pilot study.




Dotted Lines – not supported by qualitative study
Dash-Dot Lines – future research

**Figure 2. Research Model**

**Table 4. Survey Research Constructs and Definitions**

| Construct | Definition | Literature Sources |
|---|---|---|
| Replacement Intention | A belief by those who are responsible for the decision to replace an information system that the system should, in fact, be replaced. | Castner and Ferguson 2000<br>Teo et al. 2003<br>Venkatesh et al. 2003 |
| System Capability Shortcomings | Limitations in the functionality of an information system that undermine its ability to meet organizational needs. | Gill 1995<br>Weill and Vitale 1999 |
| System Investment | The financial and other resources committed to the acquisition, implementation, and use of an information system. | Gill 1995<br>Keil et al. 2000 |
| System Reliability | The extent to which a system can be counted on to perform its intended tasks. | McKinney et al. 2002<br>Weill and Vitale 1999 |
| System Support Availability | Availability of the vendor and other support capabilities considered important to the continued use of an information system. | Beatty and Williams 2006<br>Gill 1995<br>Kremers and Van Dissel 2000 |
| System Support Cost | The costs that an organization incurs to support ongoing operation of an information system. | Gill 1995 |
| Technical Integration | The extent to which an information system relies on sophisticated linkages among component elements to deliver required capabilities. | Swanson and Dans 2000 |

| Table 5. Survey Distribution Process | |
|---|---|
| **Step** | **Details** |
| Initial Contact | One page introductory letter mailed to entire sample |
| First Survey Package | Survey package including a $5 gift card mailed to entire sample |
| Thank-You/ Reminder Card | Hand-stamped post card mailed to entire sample |
| Second Survey Package | Survey package that did not include a gift card mailed to all individuals from whom a response to previous correspondence could not be confirmed |
| Follow-Up Calls | Personal telephone calls made to all individuals from whom a response to previous correspondence could not be confirmed |

## Pilot Study

A pilot test of the draft survey instrument was conducted to obtain feedback on its clarity and appropriateness, to estimate the response rate that could be expected from the main study, and to identify other unforeseen difficulties with either the survey or the planned distribution procedures (Boudreau et al. 2001). The pilot study survey was distributed to 150 respondents drawn from the main study sampling frame using distribution procedures that were identical to those planned for the main study. The sampling frame used was the Directory of Top Computer Executives, the combined eastern U.S., western U.S., and Canadian edition (Applied Computer Research 2007). Since this directory identifies top ranking IS executives at over 25,000 U.S. and Canadian organizations, it provided a sampling frame that was reasonably representative of profit-oriented medium- and large-sized businesses operating in both the United States and Canada. It also offered the advantage of including additional information that facilitated data collection and permitted more rigorous *post hoc* assessment of nonresponse bias (Groves 2006).

**Survey Distribution**: Surveys were distributed in accordance with the broad principles of the tailored design method (TDM) (Dillman 2007). This approach to survey distribution seeks to maximize response rates by increasing respondent trust, reducing the perceived costs of survey completion, and increasing completion rewards. Survey respondents were thus provided with token incentives and were contacted as many as five times over a period of approximately five weeks (Table 5). Each contact effort was observed to increase the number of responses received.

**Respondent Screening**: The survey instrument included a prescreen question that asked respondents to indicate whether they were suitably familiar with IS replacement decisions made by their organization. Respondents answering "yes" to this question were then asked to select one system currently being used by their organization and complete the survey with this system in mind. The only guidance offered in regard to system selection was that it could be "any system ranging from a common commercial package to an advanced software solution." Specific examples of systems were not provided to ensure that any such examples did not become disproportionately represented in the responses received. We verified that the systems being reported upon were operational and not systems that had either been replaced or were in the process of being replaced by asking respondents to indicate how many more years they were expecting their organization to continue using the system. The average response to this question was 4.8 years.

**Response Rate**: Completed responses were received from 33 of the 150 individuals included in the pilot study and some form of contact was made with over half of these individuals. Once we had excluded ineligible respondents, respondents at organizations no longer in operation, respondents no longer working at the organization to which correspondence was directed, and respondents for whom mail was returned as undeliverable, our response rate was 30.6 percent.

**Final Construct Measures**: Minor revisions were made to two measurement items following the pilot study to yield a final set of reflective construct measures (Table 6). All responses were measured using an analog Likert agreement scale (Couper et al. 2006). Response values were obtained by measuring the point at which respondents placed an "X" on an 8.2 centimeter scale bar having seven equally spaced anchor points that were labeled using the conventional labels of strongly disagree, mostly disagree, somewhat disagree, neither agree nor disagree, somewhat agree, mostly agree, and strongly agree. Our response values thus ranged from 0 (strongly disagree) to 8.2 (strongly agree). This approach was adopted based on pretesting where respondents indicated a desire to convey views that fell between the standard seven-point Likert scale anchor points. As such, it helped us to obtain a more granular understanding of the views of our respondents and minimize respondent frustration while completing the survey.

**Table 6. Main Study Construct Measures and Control Variables**

| Construct | Items |
|---|---|
| Capability Shortcoming | The performance and functionality of this system is highly inadequate. |
| | There are notable limitations in the ability of this system to meet our needs. |
| | We would like to have many capabilities that are not supported by this system. |
| Organization Size | Number of employees working at organization |
| Replacement Intention | We plan to replace this system with a competing system. |
| | Our intention is to replace this system with an entirely different system. |
| | We will be implementing a replacement to this system. |
| Support Availability | Support for this system is readily available. |
| | We do not encounter difficulties in obtaining needed system support services. |
| | We can easily obtain the support resources necessary to continue operating this system. |
| Support Cost | Supporting the ongoing use of this system is costly. |
| | Support costs for this system are excessive. |
| | The ongoing operational costs of this system are high. |
| System Age | Approximately how many years has your organization been using this system? |
| System Investment | Significant organizational resources have been invested in this system. |
| | We have committed considerable time and money to the implementation and operation of this system. |
| | The financial investments that have been made in this system are substantial. |
| System Reliability | People here consider this system to be reliable. |
| | This system has proven itself to be dependable. |
| | This system can be counted on to perform as needed. |
| Technical Integration | The technical characteristics of this system make it complex. |
| | This system depends on a sophisticated integration of technology components. |
| | There is considerable technical complexity underlying this system. |

**Control Variables**: Based on prior literature and remarks made by our interview informants, organizational size and system age were identified as two key control variables (e.g., Armstrong and Sambamurthy 1999; Swanson and Dans 2000). Using sampling frame data, organizational size was operationalized as the natural log of employee count. System age was measured by asking respondents to indicate the length of time that their focal system had been in use.

## Main Study

A paper survey was mailed to 1,500 randomly selected senior information system decision makers in a cross-sectional study of medium- and large-sized for-profit organizations operating in both the United States and Canada. Surveys were distributed using procedures that were essentially identical to those used to distribute the pilot study surveys. This effort resulted in a total of 222 completed responses for an effective response rate of 21.4 percent, after those surveys found to be undeliverable for a variety of reasons were eliminated from the sample.

Data screening revealed no problems with range restriction on any of our measures. However, prior to proceeding with our analysis, it was necessary to eliminate some cases from the data set as a consequence of missing values for the organizational size control variable. This resulted in a final data set of 172 cases. Nonetheless, *post hoc* analysis indicated that excluding cases with missing values did not substantively impact the reported results.

**Nonresponse Bias:** A number of *post hoc* techniques were used to assess the extent to which nonresponse bias might have impacted the generalizability of reported results. The three key techniques used were comparisons between respondents and nonrespondents using ancillary data from the sampling frame (number of IS employees at organization, number of personal computers deployed), comparisons between early and late respondents using research construct measures, and an evaluation of nonrespondent feedback (Groves 2006). Results of these procedures suggested that nonresponse did not significantly impact the reported results (Table 7).

**Table 7. Assessment of Nonresponse Bias**

| Assessment Technique | Findings and Conclusions | Key Assumptions of Technique | Sources |
|---|---|---|---|
| Compare Respondents to Nonrespondents on Preestablished Characteristics | No statistically significant differences identified between respondents and nonrespondents on any of the variables examined thereby suggesting that nonresponse bias is not a salient factor. | Nonresponse is related to preestablished characteristics in the same way that it is related to constructs of interest. | Dooley and Lindner 2003<br>Groves 2006<br>Ravichandran and Rai 2000 |
| Compare Early and Late Respondents on Substantive Variables of Interest (Wave Analysis) | Only 1 of 28 differences was significant at p = 0.05 and none of the differences were significant at p = 0.01 thus indicating a general absence of nonresponse bias. | Later respondents more closely resemble nonrespondents than early respondents. Individual response likelihood does not vary across waves. | Armstrong and Overton 1977<br>Dooley and Lindner 2003<br>Ravichandran and Rai 2000 |
| Conduct Follow Ups with Nonrespondents | Follow-up calls with nonrespondents suggested no theoretically relevant patterns of nonresponse. Reasons for nonresponse were generic and similar to those reported by other IS researchers. | Follow up is not subject to nonresponse. | Dooley and Lindner 2003<br>Flynn et al. 1990<br>Groves 2006<br>Ravichandran and Rai 2000 |

## *Data Analysis and Results*

Main study data was analyzed using partial least squares (PLS). PLS permits the modeling of latent variables and the simultaneous assessment of both measurement and structural models (Barclay et al. 1995; Chin 1998). In addition, PLS is considered particularly suited to contexts requiring the development of new theory and recent research suggests that it can be used to assess the impact of common method bias on research results (Liang et al. 2007; Podsakoff et al. 2003). PLS was thus deemed well-suited to the analysis of main study data.

### Construct Reliability and Validity

Cronbach alphas (A) all exceeded the widely recommended minimum value of 0.7 and none of the observed construct reliabilities (C.R.) was less than 0.8 (Fornell and Larcker 1981; Hair et al. 2006). All construct loadings were found to be significant at greater than the recommended p-value of 0.05 (Gefen and Straub 2005) and typically exceeded the recommended threshold value of 0.707 (Barclay et al. 1995). Average variance extracted (AVE) was found to account for a minimum of 50 percent of the variance in each construct and the square root of AVE for each construct was much larger than the construct's correlation with every other construct (Barclay et al. 1995; Gefen and Straub 2005). Measurement items loaded on their respective constructs at a value of at least 0.1 greater than their loading on other constructs (Barclay et al. 1995; Gefen and Straub 2005) and all items loaded higher on their intended construct than on any other construct. Hence, it was concluded that the construct measurement items were consistent and exhibited a substantial degree of convergent and discriminant validity. See Table 8 for item cross loadings and Table 9 for construct correlations.

### Path Analysis

SmartPLS (Version 2.0.M3) (Ringle et al. 2005) was used to evaluate the statistical significance and relative salience of the research hypotheses. Results of model testing indicated that the constructs included in the research model accounted for approximately 48.4 percent of the variance in replacement intentions (Figure 3). In particular, the results provided support for the significance of three of the six research hypotheses (H1, H3, and H6). System capability shortcomings and limitations in the availability of support for a system were found to contribute to the formation of replacement intentions, while the formation of such intentions was significantly undermined by the technical integration of a system. In contrast, the analysis failed to support H2, H4, or H5 although paths were at least in the directions posited by H2 and H5. The lack of support for these three hypotheses suggests that system reliability and system support costs do not contribute directly to the formation of replacement intentions. Also, somewhat surprisingly, the level of investment in an existing system did not seem to significantly impede the formation of IS replacement intentions. Finally, neither organizational size nor system age was found to be significantly related to replacement intentions.

Variance inflation factors indicated that multicollinearity did not significantly impact reported results (Hair et al. 2006). In addition, although statistical approaches to the assessment of

**Table 8. Item Cross Loadings**

| Construct Items | Cap Short | Sup Avail | Sup Cost | Sys Invest | Sys Rel | Tech Int |
|---|---|---|---|---|---|---|
| Capability Shortcomings 1 | **0.8365** | -0.6061 | 0.3265 | 0.0010 | -0.4743 | -0.0127 |
| Capability Shortcomings 2 | **0.8563** | -0.5219 | 0.3829 | 0.1335 | -0.4194 | -0.0078 |
| Capability Shortcomings 3 | **0.8940** | -0.5468 | 0.3300 | 0.0894 | -0.4392 | -0.0582 |
| Support Availability 1 | -0.5306 | **0.8393** | -0.2964 | 0.0324 | 0.4076 | 0.1320 |
| Support Availability 2 | -0.4914 | **0.8664** | -0.2315 | 0.0571 | 0.4724 | 0.0374 |
| Support Availability 3 | -0.6444 | **0.8957** | -0.3548 | -0.0099 | 0.5590 | 0.0835 |
| Support Cost 1 | 0.4403 | -0.2909 | **0.8557** | 0.4181 | -0.1481 | 0.3018 |
| Support Cost 2 | 0.3341 | -0.3469 | **0.9195** | 0.2212 | -0.3266 | 0.2384 |
| Support Cost 3 | 0.2406 | -0.2179 | **0.8500** | 0.4148 | -0.1835 | 0.3408 |
| System Investment 1 | 0.0244 | 0.0140 | 0.2597 | **0.9415** | 0.1481 | 0.4608 |
| System Investment 2 | 0.1609 | 0.0654 | 0.3906 | **0.8594** | 0.1300 | 0.4826 |
| System Investment 3 | 0.1049 | -0.0154 | 0.4768 | **0.7798** | 0.0575 | 0.4166 |
| System Reliability 1 | -0.3871 | 0.4508 | -0.2346 | 0.0714 | **0.8416** | 0.1269 |
| System Reliability 2 | -0.3597 | 0.4611 | -0.2122 | 0.1820 | **0.8716** | 0.1021 |
| System Reliability 3 | -0.5582 | 0.5362 | -0.2532 | 0.1232 | **0.9055** | 0.1462 |
| Technical Integration 1 | -0.0527 | 0.0827 | 0.3067 | 0.3341 | 0.0468 | **0.7451** |
| Technical Integration 2 | -0.0394 | 0.1040 | 0.2193 | 0.4856 | 0.1792 | **0.9112** |
| Technical Integration 3 | 0.2114 | -0.1654 | 0.4579 | 0.4750 | 0.0017 | **0.6360** |

**Table 9. Construct Correlations**

| Constructs | Mean | SD | A | C.R. | Cap Short | Rep Intent | Sup Avail | Sup Cost | Sys Invest | Sys Rel | Tech Int | Emp Count | Sys Age |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capability Shortcoming | 4.07 | 1.98 | 0.830 | 0.897 | 0.863 | | | | | | | | |
| Replace Intention | 3.84 | 2.73 | 0.875 | 0.923 | 0.583** | 0.894 | | | | | | | |
| Support Availability | 5.32 | 2.06 | 0.836 | 0.901 | -0.645** | -0.574** | 0.867 | | | | | | |
| Support Cost | 4.14 | 1.98 | 0.855 | 0.908 | 0.398** | 0.159 | -0.342** | 0.876 | | | | | |
| System Investment | 5.90 | 1.68 | 0.852 | 0.897 | 0.087 | -0.132 | 0.028 | 0.370** | 0.863 | | | | |
| System Reliability | 5.93 | 1.60 | 0.848 | 0.906 | -0.513** | -0.463** | 0.558** | -0.268** | 0.145 | 0.873 | | | |
| Technical Integration | 5.19 | 1.71 | 0.722 | 0.813 | -0.034 | -0.292** | 0.096 | 0.317** | 0.516** | 0.145 | 0.722 | | |
| Control Variables | | | | | | | | | | | | | |
| Employee Count | 1965 | 5293 | NA | NA | 0.000 | -0.033 | 0.088 | -0.110 | 0.004 | 0.001 | -0.025 | NA | |
| System Age | 9.35 | 5.81 | NA | NA | 0.157 | 0.171 | -0.188 | 0.074 | 0.116 | -0.020 | 0.070 | 0.127 | NA |

*Diagonal values are square root of average variance extracted

**Significant at p=0.01 (two-tailed)

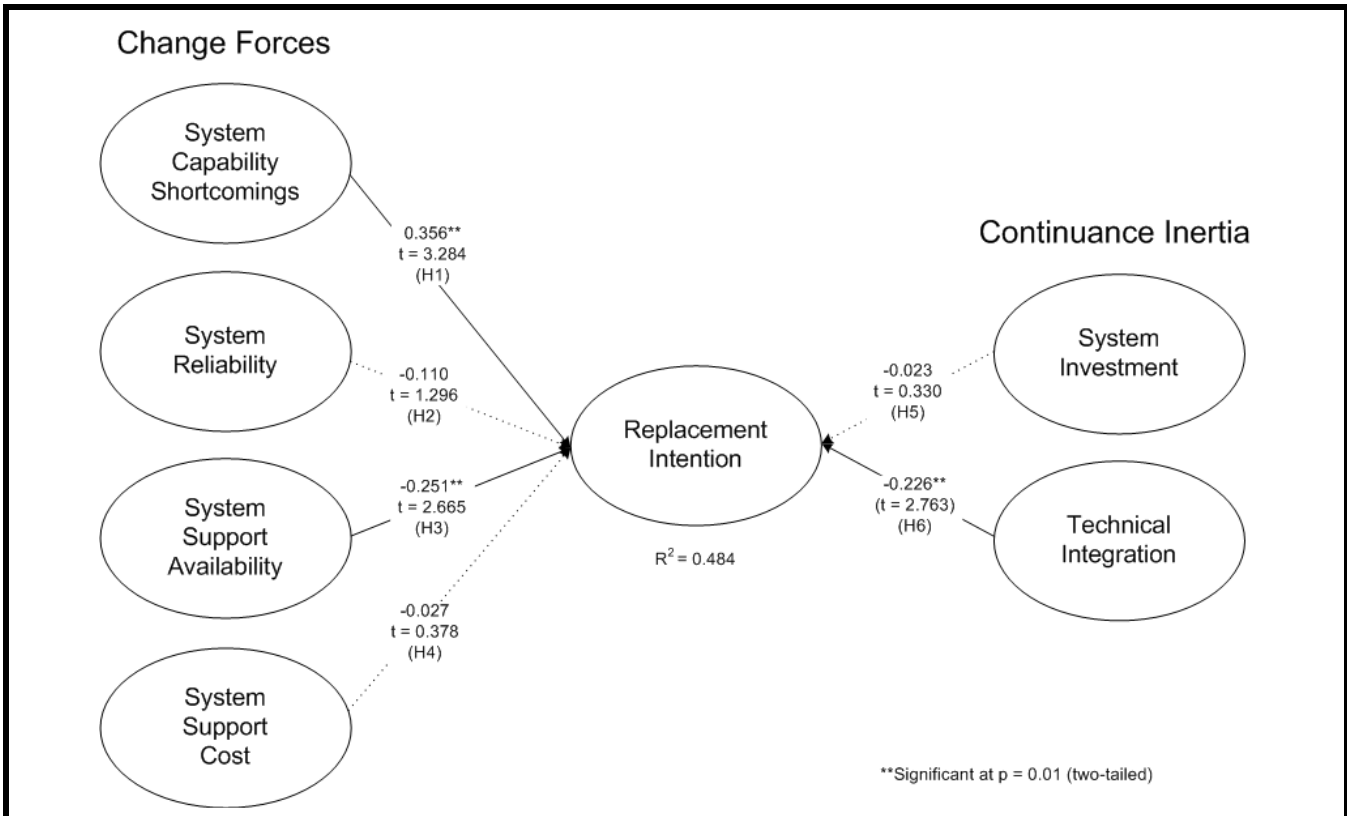



**Figure 3. Main Study Path Model Results**

common method bias continue to evolve, an assessment of common method bias conducted in accordance with prior work found that it was not a significant factor (Liang et al. 2007). On average, items loaded on the method factor at a value of 0.100 and accounted for variance of only slightly more than 1 percent. Evidence for the absence of significant common method bias was also provided by the lack of any notable changes in either the model path coefficients or the model $R^2$ following introduction of a method factor. An assessment of the power of our analysis was performed with G*Power Version 3.0.10 (Faul et al. 2007). *Post hoc* assessment of achieved power indicated a power of 0.88 for moderate effect sizes ($f^2 = 0.15$). This level of achieved power is well above the recommended minimum threshold of 0.8 (Cohen 1992).

## Discussion

A multi-method initiative was undertaken to identify the key factors leading to the formation of organizational-level IS discontinuance intentions. In the absence of existing theory, a sensitizing device was developed based on a review of the literature to guide a series of exploratory interviews with senior IS managers. This inquiry provided the basis for the development of a tentative model of IS discontinuance and a set of related research hypotheses. Model hypotheses were then tested via a large-scale cross-sectional survey of senior IS decision makers. Results of this survey suggest that system capability shortcomings, support availability, and technical integration are the three most salient factors impacting IS replacement intentions. Survey results also served to highlight the lack of significance of a number of factors that prior research suggested as potentially relevant, including the level of investment in existing systems. These results can be regarded as an important first step in the development of theory related to IS discontinuance.

### *System Capability Shortcomings*

System capability shortcomings were identified throughout the research as being among the most salient aspects of sys-

tem performance driving IS replacement intentions. Such shortcomings were highlighted as being relevant by approximately 75 percent of our interview informants and were subsequently found to be the most significant factor impacting replacement intentions in our large-scale survey study. This finding suggests, for example, that the inability of a customer relationship management (CRM) system to provide customer order details or payment status information can drive the formation of replacement intentions irrespective of the system's ability to greatly facilitate the identification of prospective new customers. Survey results further demonstrated that the importance of system capability shortcomings was not substantially impacted by system age or organizational size.

The salience and broad relevance of system capability shortcomings to IS discontinuance is in considerable accord with the emphasis placed on system capabilities by both the software engineering and information systems success literatures (DeLone and McLean 1992; Sommerville 2007). These literatures argue quite strongly that suitable capabilities are key to the successful implementation and use of an information system. Under static circumstances, development and implementation efforts aimed at ensuring successful system adoption might reasonably be expected to result in a system that could be used indefinitely. However, as was underscored by interview informants, organizational needs are subject to relatively frequent changes that can undermine the continued suitability of the capabilities of existing systems (Kelly et al. 1999). Discrepancies between what a system is capable of delivering and what is required of it can lead to user frustration, reduced effectiveness, and missed opportunities.

The significant positive impact of system capability shortcomings on IS replacement intentions indicates that decision makers tend to focus primarily on what systems lack rather than what they provide when contemplating this form of discontinuance. The tendency to place greater emphasis on system shortcomings is in general accord with expectation disconfirmation theory (Oliver 1980). Disconfirmation theory suggests that the likelihood that an organization will discontinue the use of a system depends on the magnitude of the discrepancy between what the system delivers in practice and what it is expected to deliver. Replacement intentions would thus be predicted to fall when the capabilities of a system exceed organizational expectations and rise when its capabilities fall below these expectations. The emergence of new requirements at any point in the life of a system can create significant discrepancies between the capabilities that the system offers and those capabilities that are expected, thereby contributing to increased discontinuance intentions. Thus, an important message of this study is that, while system benefits can lead to IS adoption, it is system shortcomings that serve as the key driver of discontinuance.

### Environmental Change

Technological innovation was the only environmental change identified by interviewees as having a direct impact on discontinuance. In particular, innovations in the technological landscape were widely reported to impact the extent to which support was available for existing systems as well as the costs of obtaining this support. Since support availability and cost were seen by our informants as having a notable impact on discontinuance, our survey study sought to more explicitly quantify this impact. While this study failed to find a significant relationship between system support costs and IS replacement intentions, inadequate availability of system support was observed to significantly increase organizational intentions to replace existing systems. In an effort to better understand the insignificant impact of support costs on replacement intentions, we undertook a *post hoc* assessment of our research model (not shown to conserve space). This analysis examined the supposition that increasing support costs would serve to diminish the perceived availability of system support. Our analysis supported this somewhat intuitive claim and thus provides some guidance for future research.

### System Investment

Despite numerous remarks made by interview informants suggesting that greater investments in existing systems would reduce discontinuance intentions, our survey study found that organizational replacement intentions were not significantly impacted by the magnitude of investments in these systems. This result was quite unexpected and was in marked contrast to the extensive body of IS research highlighting the salience of escalation of commitment and switching costs to behavioral persistence (Ahtiala 2006; Wang and Keil 2007). Although this result might indicate the dominance of rational decision-making processes, the impact of escalation of commitment may have also been diminished in our context if personal responsibility for past resource commitments was lacking (Arkes and Blumer 1985). Since the systems being reported upon were, on average, more than eight years old, it is reasonable to expect that many of our respondents were not the same individuals who committed resources to the initial acquisition and implementation of these systems. This fact is likely to reduce feelings of personal responsibility and thereby diminish the relevance of escalation of commitment.

Despite the potentially reduced relevance of system investment, significant switching costs still exist. One does not, for example, replace an enterprise resource planning system without incurring substantial user training costs. Since these costs are likely to be at least somewhat related to the magnitude of investments in an existing system, it seems reasonable to expect that higher levels of investment in a system will negatively impact organizational intentions to replace the system. Nonetheless, even removing all other paths from our PLS model (Figure 3) failed to identify the presence of a significant relationship. Hence, it would appear that the formation of organizational replacement intentions may not be notably constrained by the level of investment in an existing system. This observation serves as an important caution to IS vendors that they should not assume that substantial investments in their systems will prevent customers from contemplating replacement with alternatives.

As a final observation on the lack of a significant link between system investment and replacement intentions, it is worth noting that our finding might simply indicate that the magnitude of switching costs is being underestimated during the initial formation of replacement intentions. It is, for example, quite easy to overlook the costs of integrating a new system with other organizational systems when one first contemplates replacement. Since the present initiative focused primarily on the emergence of replacement intentions, the reported results may reflect the fact that switching costs cannot be fully established until a specific new system has been identified and evaluated. Hence, we believe it is reasonable to expect that the impact of investments in an existing system will become more relevant as an organization moves from replacement intentions toward the identification and selection of a new system.

## Practitioner Relevance

The significant impact that system capability shortcomings, support availability, and technical integration have on IS discontinuance suggests a number of important implications for IT and business managers at organizations that use information systems, as well as for organizations that develop and sell these systems (Table 10). First, in accordance with research adopting a bottom–up approach to understanding discontinuance (e.g., Heales 2002), the results of this research highlight the importance of considering the long-term flexibility of a system during the processes of system selection and implementation. Organizations that do so can expect to achieve longer system life spans and thereby maximize the value of their investments in these systems. Since not all organizations need the same level of flexibility, this effort requires that an organization adequately assess the degree of flexibility that is required. Thus, while flexible information systems can help organizations to avoid the need to replace existing systems, organizations that develop a particular competence in anticipating future needs will be better equipped to use this understanding to best advantage.

Information system vendors can draw on the importance of system capability shortcomings to IS discontinuance as a guide for their product development efforts. The increase in replacement intentions associated with such shortcomings suggests that the identification and remediation of capability shortcomings should receive considerable attention during the development of new product versions. Given the context-specific nature of how organizations understand system capability shortcomings, open communication with customers will be critical to ensure that new version releases adequately address these shortcomings. In contrast, when a vendor fails to fully understand and adequately address system capability shortcomings, customers will begin to contemplate replacement. This threat to its existing customer base can significantly undermine the long-term success of a vendor.

## Limitations

As with any research initiative, the present work is not without limitations. First, it is important to recognize that our survey study relied on a single individual to obtain measures of both dependent and independent variables. As a result, it reflects individual perspectives rather than a shared mind set and reported findings may have been influenced by the implicit or explicit biases of our respondents. Although our analysis suggests that the impact of common method bias is likely to be minimal, such analysis is not without limitations and certainly does not preclude all possible forms of bias. Nonetheless, we believe that our approach represents a reasonable compromise given the significant likelihood that matched pair designs would yield insufficient responses to draw meaningful conclusions. Opportunities do, however, exist for future research that aims to separate the measure of replacement intentions from the measure of other constructs. Such efforts are likely to be facilitated by working with specific organizations rather than depending on responses from randomly selected organizations.

The cross-sectional nature of our survey study makes it difficult to discern the presence of biases that might, for example, arise from past efforts to eliminate information systems that are expensive to support. Use of a cross-sectional survey also imposes limits on our ability to draw causal inferences. A number of characteristics of the study

**Table 10. Implications of the Research for Practice**

| Stakeholder | Insights/Implications of the Research |
|---|---|
| IS Managers | • Highlights the value of monitoring the costs and benefits of upgrades over the life of a system since a failure to routinely upgrade will increase the likelihood that replacement will become necessary<br>• Highlights commitment to continued use that ensues from efforts to integrate systems |
| Business Managers | • Identifies importance of considering long term flexibility required of systems to overcome capability shortcomings that emerge over their life spans<br>• Underscores risks associated with continued use of unsupported systems |
| IS Vendors | • Improves ability to identify customers at risk of replacing a system<br>• Improves ability to identify prospects that may be contemplating replacement of a competitor's system<br>• Highlights importance of addressing capability shortcomings in product revisions<br>• Highlights importance of ensuring that product upgrades are convenient, low cost, and do not introduce shortcomings for existing customers<br>• Suggests that switching costs may not prevent replacement<br>• Establishes that withdrawing product support can foster replacement intentions<br>• Illustrates that integrating a system with other customer systems can reduce the likelihood of replacement |

served, however, to provide some degree of confidence in the key causal links. Salient among these was our reliance on the results of a qualitative exploration as the basis for all research hypotheses. This approach permitted hypotheses to be based on causally oriented statements made by individuals who were responsible for the key outcomes of interest. Nonetheless, opportunities do exist to conduct longitudinally oriented research that can overcome some of the limitations associated with cross-sectional studies. This line of inquiry would help to address questions related to our initial research question such as how organizational discontinuance intentions emerge and to provide insights into key antecedents of our model constructs.

Finally, it is important to acknowledge the impact that the inductive nature of this research might have had on reported findings. Although our approach permitted us to identify some of the most important factors impacting the formation of discontinuance intentions, it is possible that it has resulted in the exclusion of other important factors. This risk would, however, seem to exist regardless of the specific research approach adopted given the relatively under-explored nature of the domain. Related to this concern, it is also possible that relevant factors have been excluded owing to biases that might arise as a consequence of the lack of anonymity during our interview sessions and limits in the extent to which informants can articulate their underlying thought processes (Wilson and Dunn 2004). Unfortunately, similar types of risk also seem to exist with a number of alternative approaches. Nonetheless, in addition to the specific opportunities for future research discussed in the following section, we issue a general call for more research related to IS discontinuance including work that employs alternative methodological approaches.

## *Future Research*

Given limited prior attention to IS discontinuance, numerous opportunities exist for future work. There is, for example, the potential to explore in more depth how organizations choose among the various discontinuance options that are available to them, to more fully integrate our findings with those reported in the software maintenance literature, and to explore discontinuance in other contexts, such as not-for-profit organizations where heightened financial constraints may make investments in existing systems a much stronger impediment to the formation of discontinuance intentions. Similarly, since our research sought to elicit findings of relevance to a broad range of information systems, there are considerable opportunities to test both significant and non-significant findings in the context of a range of specific system classes. These lines of inquiry might, for example, be used to assess whether some of the factors that were not found to be especially significant in our studies are relevant within specific contexts.

Further examination of our nonsignificant findings and efforts to theorize in regard to some of the relationships that may exist among our model constructs might improve our understanding of why, for example, system investments and some aspects of system embeddedness were not found to significantly impact discontinuance intentions. By way of guidance for such initiatives, we conducted *post hoc* analysis (not

shown to conserve space) which suggests that technical integration can have a significant impact on system support costs and lack of system support contributes to increased system capability shortcomings. Future research might also seek to explore in more depth the role and significance of non-technology based system embeddedness on the emergence of discontinuance intentions. This research could, for example, give further consideration to the role of organizational routines and a general reluctance to change.

Considerable merit would appear to exist in more extensive research examining the emergence of discontinuance intentions among other relevant stakeholders as well as the processes by which intentions translate, over time, into actual upgrade, replacement, and abandonment decisions. Such efforts might, for example, find that institutional pressures have greater salience as an organization attempts to act on its replacement intentions. In addition, it should be noted that our measures of technical integration are somewhat suggestive of the broader notion of technical complexity. Hence, opportunities exist to refine and improve upon some of the measures that we have used as well as to conduct research that uses established theory and/or non-perceptual construct measures.

Our reliance on global item measures suggests an opportunity to extend our understanding of IS replacement intentions by measuring lower-level intentions such as those of individuals or departments. This would make it possible to determine how organizational replacement intentions might be derived from these lower-level intentions (Rousseau 1985). Research in this vein could be used to develop a dashboard or scorecard that permits organizations to evaluate the life cycle stage of their systems. Such an assessment tool would likely help managers to optimize their return on system investment. Development of these kinds of tools would, of course, be facilitated by efforts to elicit a more in-depth understanding of the key antecedents to our model constructs. For example, our research suggests that organizational initiatives can have a significant impact on system capability shortcomings. This observation highlights the need for research that examines exactly how organizational initiatives impact system capability shortcomings, which initiatives have the largest impact, and what other factors also impact system capability shortcomings.

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# Appendix A

## Interview Guide

1. Can you give some insight into your professional experience, your current organization, the industry in which it operates, and the types of information systems it uses?
   - Firm size? Location in industry value chain?
   - General perception of firm performance? Future prospects?
   - How long at current firm? In current industry?
   - How many systems do you have?
   - How long do you typically keep a system?
   - Do you occasionally evaluate your IS portfolio? How? How often?

2. The use of a system can be discontinued because it is no longer required or as a consequence of an upgrade or replacement decision. Can you explain the differences between these three decisions as you understand them?
   - What are the factors contributing to each type of decision?
   - What factors are relevant to one type of decision but not relevant to the others?
   - Are any of these linked to the decision to adopt a new system? If so, how?
   - Have you discontinued the use of a system without adopting an alternative? How was this different from an upgrade/replacement? How was it the same?

3. Can you talk about an effective discontinuance decision?
   - What was the purpose of the system?
   - What was the history of the system (how used, frequency of use, time used)?
   - Why was the decision effective?
   - What was the decision process like?
   - What contributed to the decision?
   - What do you feel was ignored or considered unimportant to the decision?

4. Contrasting with this decision, can you talk about an ineffective discontinuance decision?
   - What was the purpose of the system?
   - What was the history of the system (how used, frequency of use, time used)?
   - Why was the decision inappropriate?
   - What was the decision process like?
   - What contributed to the decision?
   - What do you feel was ignored or considered unimportant to the decision?

5. Looking to the future, can you talk about a prospective discontinuance decision?
   - What is the purpose of the system?
   - What is the history of the system (how used, frequency of use, time used)?
   - How will this decision be made?
   - What do you feel will contribute to the decision?
   - Do you anticipate any problems related to this decision?

6. Can you provide me with any additional insights on discontinuance decisions?
   - Explore system performance, organizational initiative, environmental change, system investment, system embeddedness, mimetic behavior.