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Research article

An empirical examination of antecedents and consequences of IT governance in US hospitals

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Abstract

Intense pressure to control costs and improve patient care quality is driving hospitals to increasingly look to information technology (IT) for solutions. As IT investment and IT capability have grown in hospitals, the need to manage IT resources aggressively has also increased. The rise in complexity and sophistication of the IT capability in hospitals has also increased the importance of IT governance in these organizations. Yet, there is limited empirical data about the antecedents and consequences of IT governance. We draw upon extant literature related to power and politics and capability management to propose, operationalize, and empirically examine a nomological model that explains and predicts IT governance and its ensuing impact on risk management and IT contribution to hospital performance. We empirically tests our hypotheses based on survey data gathered from 164 CIOs of US hospitals. The results have implications for hospitals' readiness and predisposition for IT governance, as their structural and relational mechanisms can affect IT governance and, indirectly, IT value creation. A contribution of this study is that it is one of the first to empirically examine antecedents to IT governance and its impact on IT performance in a high-velocity environment that is riddled with technological turbulence.
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Introduction

With the intense pressure placed on hospitals to provide higher quality of care, lower costs, and more and easier access to medical information for patients, these organizations are increasingly turning to information technology (IT) to meet these requirements (Chaudhry *et al*., 2006; Thrasher *et al*., 2007; Glaser *et al*., 2008; Raghupathi and Tan, 2008). The use of IT in hospitals lags its use in most other industries and only now is beginning to take hold (Raghupathi and Tan, 2008). In addition, the use of IT in hospitals has followed a predictable pattern that has occurred in other industries with more advanced IT resources. Early IT applications have been standalone applications with little or no integration among them (Chaudhry *et al*., 2006). Recently, there are some indications that more and more hospitals are implementing integrated IT applications that span several functions (Garets and Davis, 2006). These implementations include enterprise applications such as electronic medical records (EMR), enterprise resource planning (ERP) systems, and electronic medical administration

records (eMAR) (Stefanou and Revanoglou, 2006; DesRoches *et al*., 2008). Similar integrated and standardized systems have been central to raising the level of IT capability in organizations in other information intensive industries, where IT capabilities are high, such as banking, manufacturing, and insurance, just to name a few (Sabherwal and Kirs, 1994; Markus, 2000).

The rise in complexity and sophistication of the IT capability in hospitals has also increased the importance of IT governance in these organizations. As IT investment and IT capability have grown in hospitals, the need to manage IT resources aggressively has also grown. The fast growing investment in IT resources and their potential impact on the performance of hospitals necessitate an active governance stance as with other critical organizational resources, such as capital or labor (Kaarst-Brown, 2005). The importance of IT governance is further shown from studies that report that companies with an above-average IT governance program earn at least 20% more than companies with poorer governance pursuing the same strategy (Weill and Ross, 2004).

One of the major objectives of IT governance is in the area of capability management. Willson and Pollard (2009) note that capability management 'could be interpreted as the actions of managers within an organization intended to effectively develop and manage IT capabilities and, thus, increase its IT capability' (p. 99). The concept of IT capability has been linked to competitive advantage through the resource-based view (RBV) theory (Bharadwaj, 2000; Wade and Hulland, 2004). The RBV theory states that if capabilities are valuable, rare, inimitable, and non-substitutable, they are likely to yield a competitive advantage to the organization possessing such resources (Barney, 1991, 2001). This study is not a test of the RBV theory or competitive advantage. However, this theory does indicate the importance of capabilities in an organization and, ultimately, to capability management. It is logical that if capabilities are so important as to potentially yield a competitive advantage, the management of those capabilities is a critical function.

This paper examines some of the antecedents and consequent variables of IT capability management, a key component of IT governance. Given such a valuable resource to organizations, specifically hospitals, it is imperative to understand some of the factors that positively influence IT governance. Therefore the first research question of this study is (1) what are some of the antecedent factors to IT governance in hospitals? Of course, if IT resources are valuable to an organization and IT governance improves that organization, it would be important to know what resources or capabilities it affects. Therefore, the second research question is (2) what are some of the important consequent variables that are affected by IT governance in hospitals?

To answer these questions, of course, the literature on IT capability management is utilized. This literature explores the value of IT capability to organizations (Bharadwaj, 2000; Wade and Hulland, 2004; Bradley, 2006). We also leverage the power and politics perspective (Finkelstein *et al*., 2009) to link antecedents to IT governance in the study. The involvement of top managers and the relationships of top management teams (TMT) have been shown to be linked to positive results in the strategic IT management literature (Armstrong and Sambamurthy, 1999). However, the nature of that involvement and those relationships have only recently begun to be explored (Preston *et al*., 2008). Other researchers have chronicled the need to better understand the relationships between factors of IT leadership using theories from the strategic management literature (Karahanna and Watson, 2006). However, these researchers have also recognized that these theories must be placed in context and focused on the specifics of IT leadership in organizations (Karahanna and Watson, 2006; Preston *et al*., 2008).

The findings of this study offer several contributions to the IT literature. One, this study extends the power and politics perspective to include the IT domain and presents IT capability management in the form of IT governance. In addition, our findings underscore the importance of capability management and highlights the role of IT governance in IT value creation, by instantiating elements of both risk management and IT's contribution to hospital performance as consequences of IT governance. A third contribution of this study is that it identifies three internal contextual factors that influence IT governance. The internal contextual factors include power and politics relative to the CIO's structural power, IT-business mutual participation, and entrepreneurial culture. We further contribute to the IT literature by helping to expand the sparse risk management research stream in the IT literature by demonstrating the importance of risk management relative to IT governance and explaining why it should become a much more prominent issue in IT research.

In the following sections, we ground our study using the power and politics and capability management perspectives. We also use extant literature associated with these perspectives to develop our research hypotheses. Afterwards, we present our research methods, including an empirical examination of our research model. We test the relationships in our research model using survey data, consisting of responses from 164 CIOs of US hospitals, and archival data from the Healthcare Information and Management Systems Society (HIMSS) Analytics Database and GuideStar (www.guidestar.com). Following the presentation of the results of our hypothesis testing, we discuss theoretical and practical implications and limitations of our study. We conclude the paper with a short summary and a presentation of opportunities and directions for future research.

Theoretical development

IT governance

The study defines IT governance as the capacity of top management to control the formulation and implementation of the IT strategy via organizational structures and processes that produce desirable behaviors, which will ensure that IT initiatives sustain and extend the organization's strategy and objectives (De Haes and Van Grembergen, 2004; Weill, 2004; Weill and Ross, 2004). A desirable behavior is one that is consistent with the organization's mission, strategy, values, norms, and culture, and can manifest in a number of ways (Weill, 2004). IT governance

can be coordinated using a mixture of various structures, processes, and relational mechanisms (Ribbers *et al*., 2002).

The majority of research on IT governance focuses on the structural alternatives and mechanisms of IT governance. However, limited attention has been devoted to an equally important aspect of IT governance – process mechanisms. Such limited attention has led to only a partial understanding of IT governance and its mechanisms. In this study, we refer to IT governance as an overarching initiative encompassing two aspects of process mechanisms. The first aspect is enterprise management methodologies. Enterprise management methodologies pertain to the development of executive committees, the determination of core processes, and funding priorities (Weill and Ross, 2005). The second aspect is metric and compliance processes. Metric and compliance processes pertain to the joint estimation, measurement, and communication of the value of IT-enabled business processes (Weill and Ross, 2005). In this sense, IT governance is concerned with IT project selection and prioritization issues and how the authority for resources and the responsibility for IT is shared between business partners, IT management, and service providers (Weill, 2004; Weill and Ross, 2004, 2005).

IT governance is considered a critical factor in determining whether organizations are getting acceptable value from their IT investments (Weill and Ross, 2004). Organizations that succeed where others fail all have one thing in common – effective IT governance (Weill and Ross, 2004). Hence an organization's IT governance mechanisms are often indicative of the sophistication of its management (both IT and business) capability (Bradley, 2006). For example, some corporations and government agencies began with the implementation of IT governance mechanism to achieve a fusion between IT and business to obtain needed IT involvement of top management. As a result, getting value from IT is more so an organizational competency that business and IT executives alike are responsible for developing.

On the basis of synthesis of the IT governance literature, Xue *et al*. (2008) draw on the resource dependence theory to identify three factors – an organization's IT investment characteristics, external environment, and internal context – that influence IT governance. However, it should be noted that their view of IT governance was from a structural perspective rather than a relational perspective. In essence, they focused on antecedents of governance structures to the exclusion of governance mechanisms. De Haes and Van Grembergen (2004) explicate the need for organizations, and researchers alike, to focus on IT governance mechanisms. Akin to Weill and Ross (2004), De Haes and Van Grembergen (2004) leverage elements of corporate governance and IT and internal control frameworks from the IT Governance Institute to develop a well-accepted IT governance framework. A common thread across the corporate governance and IT and internal control frameworks is the reference to the internal environment/context of an organization as one of the more influential determinants of IT governance mechanisms. Hence, in this study, we limit our focus to the internal context.

Xue *et al*. (2008) argue that organizational centralization and IT function power are salient internal contextual factors that influence IT governance. Organizational centralization reflects the internal patterns of relationships, authorities, and communications of organizational actors (Xue *et al*., 2008). In light of the focus of this study on relational mechanisms of IT governance, rather than IT governance structures, we offer mutual participation of IT and business personnel as a proxy for organizational centralization. IT-business mutual participation refers to IT personnel participating in business initiatives (e.g., development of new products/services) and business personnel participating in the strategic IT decision-making process. Given that the elements of the mutual participation of IT and business personnel (i.e., strength of the CIO–CEO working relationship, business personnel participate in IT planning, and IT personnel participate in the development of new products/services) are representative of internal patterns of relationships, authorities, and communication. Power of the IT function is the other internal contextual factor proposed by Xue *et al*. (2008). Power of the IT function refers to the ability of the IT department to influence other organizational units through its position and stature within the organization (Jasperson *et al*., 2002; Xue *et al*., 2008). The power and politics perspective suggests that the power of an individual unit is often reflective of the structural power of the figurehead (i.e. executive) of that unit. On the basis of this view, we offer the CIO's structural power as a proxy for the power of the IT function (Figure 1).

Although Xue *et al*. (2008) offer only two internal contextual factors that influence IT governance. We argue there is a third element that is of equal, if not greater, importance – culture. As we previously mentioned, corporate governance and IT and internal control frameworks all speak to the importance of the internal environment for governance purposes. The internal environment entails or includes an organizations' system of shared beliefs, values, and norms, which are indicative of their organizational culture. Since the context of our study is hospitals, there is a unique characteristic of their competitive environment that makes the focus on the entrepreneurial aspect of their organizational culture more appropriate. For instance, health care is one of a few, if not the only, industries in which not-for-profit organizations compete with for-profit organizations for the same customer base (i.e., patients). Therefore, by extension of Xue *et al's*. (2008) work, we present the following internal contextual factors as potential antecedents to IT governance: CIO structural power, IT-business mutual participation, and entrepreneurial culture. In the following sections, we provide theoretical support for the inclusion of these factors and the related hypotheses.

CIO structural power and IT governance

Getting business value from IT is about leadership (Calder, 2005). Logically it would seem that effective IT governance is a direct result of whether the CIO is part of the TMT of the organization. Two important elements of IT governance are those of structure and process. IT governance is not simply an idea or concept in an organization; IT governance has substance. Its mechanisms must be defined, articulated, and set into an ordered structure or process.

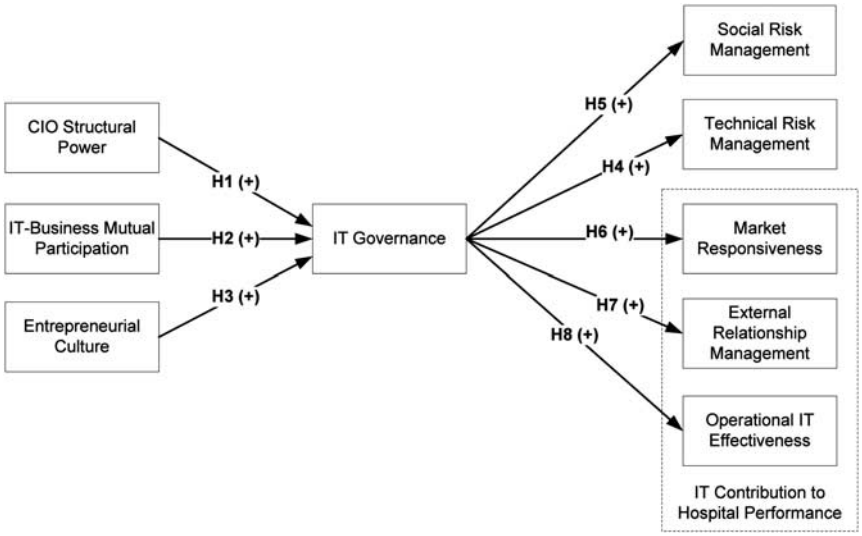

Figure 1 Research model.

The result may be an architecture, methodology, set of metrics, or similar structures that an organization uses as an overarching philosophy for governing IT and related resources (De Haes and Van Grembergen, 2004; Weill and Ross, 2004; Fletcher, 2006).

When the CIO is part of top management, he is part of the strategic decision-making for IT capability in that organization. This creates an atmosphere where a couple of positive developments associated with the development of effective IT governance are likely. First, the interactions of a diverse TMT around the development of IT governance mechanisms are likely to create a shared language among the participants. This is especially important in the IT domain because historically there has been a chasm in understanding between the CIOs and senior business managers because of differences in language (Preston and Karahanna, 2009a, b).

Nahapiet and Ghoshal (1998) noted that 'a shared language enhances combination capability' (p. 254). Combination capability, the ability to assemble organizational resources into a competitive intensity, does not reside solely within a single individual but in a diverse group of individuals that are able to speak the same language (Cohen and Levinthal, 1990). Boland and Tenkasi (1995) also reported that the combining of organizational knowledge is enhanced by a shared vocabulary. In fact, a number of scholars have reported that a shared vocabulary among organizational decision makers is a resource that can enable competitive advantage (Kogut and Zander, 1992; Monteverde, 1995).

Second, when the CIO is part of the decision-making process at the top of the organization, the CIO and technical staff are likely to gain business knowledge and the business managers are likely to acquire more technical knowledge. Working together on establishing strategic IT initiatives such as developing IT governance mechanisms for the organization should provide opportunities for IT and business executives to educate each other. A high level of communication between IT executives and business executives, which is likely from working together, should increase the likelihood of effective planning and application of IT resources in an organization (Reich and Benbasat, 2000). Furthermore, knowledge overlap among group participants is critical to the development and utilization of combination capability (Nahapiet and Ghoshal, 1998). In light of these two arguments linking shared IT decision-making and IT governance, the following hypotheses are given:

Hypothesis 1: The level of CIO structural power will positively influence the quality of IT governance.

IT-business mutual participation and IT governance

In the explanation leading up to Hypothesis 1, we expressed the importance of the business and IT executives working together to exchange their knowledge with each other to realize the best outcome for IT governance. To further increase the value of IT governance, participation by other IT and business personnel are also needed. Boynton *et al*. (1994) note that a mixture of IT and business knowledge and expertise is needed to generate effective strategic IT decisions. Prior research indicates that participation by business executives, IT personnel, and functional personnel in the strategic IT decision-making process results in better outcomes for organizational IT initiatives (e.g., Henderson, 1990; Sabherwal, 1999; Ranganathan and Sethi, 2002). We view the phenomenon of IT personnel participating in business initiatives (e.g., development of new products/services) and business personnel participating in the strategic IT decision-making process as IT-business mutual participation.

The participation of IT personnel in developing business strategies and new products and services will help educate them and help them to acquire new knowledge about the business. Understanding more about the business should help IT personnel become more aware of the types of applications and systems that are needed to support the business (King and Teo, 1997). Likewise, it is critical, for best outcomes, that business personnel learn about IT and participate in IT planning and other activities associated

with IT (Ranganathan and Sethi, 2002). With increased knowledge about IT, business managers and users would be able to understand better the importance of future IT applications and their relevance to business processes (Jarvenpaa and Ives, 1991; Sabherwal, 1999). Subsequently, business personnel, who are knowledgeable about IT and understand its role and potential, are more likely to support IT initiatives (Ranganathan and Sethi, 2002). Such support from business personnel at various levels, some of which who can ensure IT projects have proper funding and prioritization, increases the likelihood that IT initiatives will be successful and impactful (Weill and Ross, 2004; Preston *et al*., 2008; Preston and Karahanna, 2009b).

The participation of IT personnel in developing new products and services and learning more about the organization's line of business, coupled with business personnel increasing their IT knowledge base and understanding of IT's role in the organization, is likely to result in better working relationships and a higher level of communication between the two sides. The increase in mutual participation by business and IT personnel is important to the strategic IT decision-making process (Ranganathan and Sethi, 2002), even more so in light of Weill and Ross' (2004, 2005) conclusion that a major contribution of IT governance is to use IT resources to support business objectives and priorities. Further, proper and effective IT governance is believed to position an organization to be able to strategically exploit IT to better support business objectives and initiatives (De Haes and Van Grembergen, 2004; Weill, 2004; HIMSS Analytics, 2005; Burke, Randeree, Menachemi and Brooks, 2008; Huang, Zmud, and Price, 2010), thereby, implicitly indicating the potential for IT-business mutual participation to influence IT governance. In light of the abovementioned findings and arguments and our positioning of IT-business mutual participation as a reflection of the internal pattern of relationships, authorities, and communications, which are believed to impact the decision-making process in organizations (Xue *et al*., 2008), we proffer IT-business mutual participation as an antecedent to IT governance.

Hypothesis 2: The degree to which a hospital exhibits IT-business mutual participation will have a positive impact on its quality of IT governance.

Entrepreneurial culture and IT governance

Since the 1970s, organizational culture, also known as corporate culture, has been used as a powerful tool to interpret and understand organizational life, behavior, and processes of decay, adaptation, and radical change (Allaire and Firsirotu, 1984). Organizational culture is believed to be based on internally oriented beliefs concerned with how to manage, and externally oriented beliefs concerned with how to compete (Davis, 1984; Barringer and Bluedorn, 1999). Two main classifications of culture are commonly cited in the organizational culture literature (Bradley *et al*., 2006; Leidner and Kayworth, 2006). The first classification, sometimes referred to as entrepreneurial (Miles and Snow, 1978; Russell, 1989), represents organizations with a tendency of being on the leading edge and of being first to market. Organizations that fit this cultural type are often viewed as 'agents through which a creative new product, process, or service is brought into the marketplace' (Russell, 1989). The second classification, sometimes referred to as formal (Russell, 1989), represents organizations with an emphasis on control, stability, order, and bureaucracy (Russell, 1989; Cameron and Freeman, 1991; Jung, 2003). Formal organizations have a predisposition to demonstrate cost-effectiveness continually and to be consistently rigid. Relative to organizational culture, organizations with a more innovative orientation tend to be on one end of the spectrum, whereas organizations with little to no entrepreneurial intensity are considered to be on the other end of the spectrum of organizational culture.

An organization's entrepreneurial behavior has been shown to affect organizational variables in planning and other domains, including IT (Quinn and Spreitzer, 1991; Hoffman and Klepper, 2000; Kampas, 2003; Bradley *et al*., 2006). According to organizational culture theory, an entrepreneurial organization demonstrates innovation, spontaneity, and flexibility. Findings from prior research suggest that organizations do not employ or use IT in the same manner (Sabherwal and Chan, 2001; Sambamurthy *et al*., 2003; Bradley *et al*., 2006). Rather, they conclude that an organization's level of entrepreneurial focus contributes significantly to their use of IT. For example, Bradley *et al*. (2006) found that variations in the effectiveness of IT are a function of an organization's entrepreneurial focus. More specifically, Bradley *et al*. (2006) conclude that organizations that exhibit an entrepreneurial culture demonstrated greater IT effectiveness at the strategic and tactical levels.

One priority for IT governance is to ensure the effectiveness of IT investments and initiatives. For example, previous studies have found that top-performing organizations have effective IT governance that supports their strategies and institutionalizes desirable behaviors, which are often tied to the organizations' value systems (Weill, 2004; Weill and Ross, 2004). By extension of Bradley *et al*.'s (2006) findings, we would expect the level of IT governance to be influenced by an organization's level of entrepreneurship. On the basis of these findings and arguments, we present our next hypothesis as follows:

Hypothesis 3: The degree to which a hospital exhibits an entrepreneurial culture will have a positive impact on its quality of IT governance.

IT governance and risk management

According to classical decision theory, risk is associated with the amount of variance in the possible outcomes, their likelihoods, and their subjective values (March and Shapira, 1987). The greater the variance in these attributes of a given situation or task, the greater the risk (March and Shapira, 1987; Wallace *et al*., 2004). However, in practice, managers may not see large variation in positive outcomes as risky, only large variations for possible negative outcomes are seen as risky (March and Shapira, 1987). It is reasonable to assume that managers prefer less risk to more risk if the expected benefits are the same (March and Shapira, 1987). Thus, as March and Shapira state, 'expected value is assumed to be positively associated, and risk is assumed to

be negatively associated, with the attractiveness of an alternative' (p. 1405). To put the concept of risk into perspective, one should allow that 'only the threat of negative outcomes is considered a risk' (Wallace *et al*., 2004: 291). On the basis of this concept, risk factors are conditions that can pose a serious threat to the successful completion or accomplishment of a specific task (March and Shapira, 1987; Jiang *et al*., 2001; Wallace *et al*., 2004).

Risk management, in the IT literature, has mainly been associated with individual software projects and has not been extensively examined at the organizational level (Jiang *et al*., 2001; Mohtashami *et al*., 2006). However, the realities of the growth in the number of enterprise and extended enterprise systems and the extent of their impact have pushed IT risk management to the level of top management (Ifinedo, 2007). Risk management pertains to anticipating, preventing, and mitigating problems arising in the management of some organizational tasks such as making decisions about IT implementations (including decisions about personnel), communication, and coordination (Mohtashami *et al*., 2006). In addition, risk management in the IT literature tends to be viewed bilaterally. Risk attitudes are commonly divided into two categories, social subsystem risk and technical subsystem risk (Wallace *et al*., 2004). Social subsystem risk (also referred to as social risk) entails an organizational environment context that may be unstable or highly politicized, causing reductions in commitment and resources needed to successfully complete a task (Jiang *et al*., 2001; Wallace *et al*., 2004). Technical subsystem risk (also referred to as technical risk) involves the risk posed when new, unfamiliar, or simply complex technology, in the context of its intended use, adds to the complexity of a task or project (Wallace *et al*., 2004).

The need for more effective ways to manage risk is widely recognized (Purtell, 2007). Some have identified IT governance as a viable means to manage risk (Weill and Ross, 2004, 2005; Purtell, 2007). Moreover, some argue that effective and timely measures aimed at addressing risks fall under the domain of IT governance (Purtell, 2007). In addition, it has been shown that risks can be proactively managed by implementing processes and structures from a management standpoint (Wallace *et al*., 2004). In fact, studies have shown that companies with IT governance strategies stand a much better chance of managing risks, as compared to those without such strategies (Calder, 2005). In light of these findings and arguments, we present the following hypotheses:

Hypothesis 4: The quality of IT governance increases the extent to which technical risk management is addressed.

Hypothesis 5: The quality of IT governance increases the extent to which social risk management is addressed.

IT governance and IT contribution to hospital performance

Effective IT governance has been positively linked to firm performance in a number of studies (e.g., Byrd and Turner, 2001; Chatterjee *et al*., 2001; Preston *et al*., 2008). IT governance, when implemented effectively, places the CIO and other top management personnel in a position of authority to influence IT strategy and implementation. In addition, a collaboration of ideas is encouraged from diverse stakeholders, resulting in well-developed IT directives that are more aligned with organizational goals and objectives (Finkelstein and Hambrick, 1990). Decisions made through IT governance will certainly have an impact on how, where, and when technology is used throughout the organization; and this planned diffusion of technology will significantly improve performance (De Haes and Grembergen, 2004; Weill, 2004; Calder, 2005).

Prior studies of IT-enabled organizational performance have examined both strategic (Rai and Bajwa, 1997; Bradley *et al*., 2006) and operational initiatives (Banker *et al*., 1990; Bradley, 2006; Bradley *et al*., 2006). In the context of this study, we assess hospitals' performance, both internal and external, as enabled by the impact of IT use on their improved operational performance, ability to respond to market opportunities, and ability to manage external relationships. Organizations commonly use business cases to justify IT investments aimed at improving organizational performance (Bradley *et al*., 2006; Ross *et al*., 2006). Most business cases for IT investments are strategic in nature, such as the need to improve the return on investment of existing and new IT applications or the desire for improved speed to market of products and services (Ross *et al*., 2006). IT governance mechanisms are vital to proper prioritization, selection, and management of IT investments and projects (De Haes and Van Grembergen, 2004). Because IT governance has been shown to directly affect firm performance (Byrd and Turner, 2001; De Haes and Grembergen, 2004; Preston *et al*., 2008), it is likely that the realized benefits of IT use in hospitals is largely due to IT governance, as organizations that realize benefits from their IT investments are more apt to have effective IT governance (Ross *et al*., 2006).

Prior studies suggest a relationship between IT governance and IT performance. For instance, Peterson *et al*. (2000) and Ribbers *et al*. (2002) found a relationship between IT governance mechanisms and IT performance. This is partly because IT governance enables organizations to better define business cases and justify IT investments and projects to undertake. Thus, we suggest the following hypotheses:

Hypothesis 6: The quality of IT governance increases the extent to which IT has improved hospitals' market responsiveness.

Hypothesis 7: The quality of IT governance increases the extent to which IT has improved hospitals' management of external relationships.

Patient-centered measures are frequently used as performance outcomes in healthcare studies (Dowling, 1997; Devaraj and Kohli, 2000; Smith and Swinehart, 2001). An ever-increasing push for higher quality care drives the need for empirical evidence to support the relationship between IT and patient-centered outcomes. In this study, we define operational effectiveness as a hospital's ability to detect, catch, and reduce clinical errors, as enabled by IT. With an estimated 44,000–98,000 patient deaths being linked to clinical errors each year (Loughran, 2004), it is crucial that hospitals focus on processes, structures, and technologies that will significantly reduce the number of clinical errors.

Several studies have demonstrated the positive link between the use of IT and hospital performance (e.g., Devaraj and Kohli, 2000; Wang *et al*., 2005; Menachemi *et al*., 2006); and evidence of the relationship of IT use specifically to improved patient care is growing (Kaushal and Bates, 2002; Poon *et al*., 2006; Menachemi *et al*., 2007). On the basis of the findings and arguments provided above, we would expect the level of IT governance to influence IT-enabled operational performance of the organization. Hence the following hypotheses:

Hypothesis 8: The quality of IT governance increases the extent to which IT has improved hospitals' operational effectiveness.

Research methodology

Measurement development

Wherever possible, measurement items were adapted from existing scales. All survey items, with the exception of an indicator of CIO structural power (discussed in the next subsection), were measured on a Likert-type scale anchored by 'not at all' (1) and 'very great extent' (7) or 'strongly disagree' (1) and 'strongly agree' (7). The measurement items and source(s) of all measures used in this study are listed in Appendix A. Prior to administering the survey, 14 CIOs and three academicians knowledgeable about IT strategic planning in healthcare organizations reviewed the survey for understandability of the questions being asked, clarity of the questions, and consistency of the terminology used in the questions with that used in the healthcare industry.

CIO structural power

CIO structural power is a formative construct and was measured using two categorical items adapted from Preston *et al*. (2008). One of the two items asked respondents to indicate to whom they formally report. The data for the other item, which was aimed at determining whether the CIO is a member of the hospital's TMT, were obtained from GuideStar (www.guidestar.com). GuideStar is a 501(c)(3) non-profit organization that gathers and publicizes information about non-profit organizations, including their IRS and financial documentation and details about their key personnel. Together, the two items capture the essence of CIO structural power.

IT-business mutual participation

The items used are developed from concepts of other researchers such as Ranganathan and Sethi (2002), Sabherwal (1999), and Henderson (1990) concerning the topic of IT and business collaboration, sharing, and participation in business and IT activities. We asked respondents to rate their level of agreement with items pertaining to the strength of the CIO–CEO working relationship, IT participation in business activities, and business personnel's participation in IT planning.

Entrepreneurial culture

Entrepreneurial culture was measured using four items adapted from Quinn and Spreitzer (1991). We asked respondents to rate their level of agreement with items aimed at capturing the degree to which their hospital exhibits an entrepreneurial behavior.

IT governance

IT governance is a formative second-order construct that consists of two first-order constructs, enterprise management methodologies, and metric and compliance processes. Enterprise management methodologies was measured using four items adapted from Brown and Grant (2005), Ross (2003), and Sambamurthy and Zmud (1999). We asked respondents to rate the extent to which they employed specific mechanisms or processes to ensure that IT and IT resources are transformed and leveraged to meet the enterprise-wide needs of the organization. Metric and compliance processes was measured using four items adapted from Brown and Grant (2005), Ross (2003), and Sambamurthy and Zmud (1999). We asked respondents to rate the extent to which they employed specific mechanisms to assess the compliance, effectiveness, and success of IT projects and initiatives.

Social risk management

Social risk management was measured using four items adapted from Jiang *et al*. (2001) and Wallace *et al*. (2004). We asked respondents to rate the extent to which their hospitals addressed risks posed by individual and organizational attitudes and views towards IT projects and initiatives.

Technical risk management

Technical risk management was measured using four items adapted from Jiang *et al*. (2001) and Wallace *et al*. (2004). We asked respondents to rate the extent to which their hospitals addressed issues that pertain to the complexity of IT projects and the use of new, emerging, and unfamiliar technologies.

Operational IT effectiveness

Operational IT effectiveness was measured using three items, adapted from Hamilton and Chervancy (1981a, b). The measures capture the extent to which IT has improved a hospital's ability to detect and reduce clinical errors. We asked respondents to rate the extent to which IT has enabled their organization to accomplish the aforementioned tasks over a 5-year period.

Market responsiveness

Market responsiveness was measured using five items, adapted from Bharadwaj (2000) and Weill (1992), to capture the effect IT had on a hospital's ability to respond to market opportunities and conditions and to stakeholders' (any combination of patients, physicians, insurance carriers, regulatory agencies, suppliers) needs. We asked respondents to rate the extent to which IT has enabled their organization to carry out the aforementioned initiatives over a 5-year period.

External relationship management

External relationship management was measured using three items, adapted from Bharadwaj (2000) and Feeny and Willcocks (1998), to capture the effect IT had on a hospital's ability to manage relationships with outsourcing partners, vendors, and contracted caregivers (e.g., physicians, nurses, and other clinicians not directly employed by the hospital). We asked respondents to rate the extent to which IT has enabled their organization to carry out the aforementioned initiatives over a 5-year period.

Control variables

The control variables used in this study were number of full time equivalents (FTE), number of beds, and strategic intent (i.e. for-profit or not-for profit). The data for these variables were obtained from the HIMSS Analytics Database. The FTE and beds variables were chosen as proxies for hospital size. In addition, the strategic intent variable was chosen to account for differences in profit motives among hospitals. These variables have been consistently used in prior studies related to IT strategic planning and implementation and healthcare informatics (Byrd and Davidson, 2003; Liang *et al*., 2004; Bradley *et al*., 2006).

Data collection

Sampling

The population of interest is US hospitals, as identified in the HIMSS Analytics Database. The HIMSS Analytics Database, formerly known as the Dorenfest Integrated Healthcare Delivery Systems (IHDS+) Database, contains information on more than 5000 hospitals and 28,000 medical facilities in the US. The database contains various types of data about these healthcare organizations such as their IT applications, the existence of IT plans and policies, and IT department costs and composition. These hospitals represent a broad spectrum of diversity, size, geographic reach, and comprehensiveness of patient care. The population was determined by identifying hospitals, both independent hospitals and hospitals that are part of a conglomerate (e.g., integrated delivery system or network, multi-hospital system) that have a CIO at the hospital level. We further reduced the target population by eliminating hospitals that had the same CIO. For example, if four hospitals in the target population had the same CIO listed, even if the CIO was at the hospital level, we eliminated all four hospitals from the population. We took this approach of reducing the population for a couple of reasons. One reason we took this approach was to minimize the risk of the CIO reporting the same data for multiple hospitals, thus affecting the variance of the data reported. Another reason we took this approach was to reduce the chance that the CIO would inadvertently report the wrong information for a hospital.

After identifying the study's population, we used the hospitals' profit status to divide the data into two strata, for-profit and not-for-profit. We then generated random numbers for the hospitals in each stratum and sorted the data in ascending order. While maintaining consistency between the sample and population, relative to the ratio of not-for-profit to for-profit hospitals, we chose 1000 hospitals from the population. The 1000 hospitals chosen served as the targeted sample for the current study.

Survey administration

We obtained contact information for individuals identified as CIOs from the HIMSS Analytics Database. Request for participation in the study and instructions for completing the survey were sent via e-mail to CIOs of the hospitals in the targeted sample pool. The e-mail included an explanation of the study, its purpose, its anticipated contribution, and a link to the sponsor letter from the CEO of HIMSS Analytics, the research arm of HIMSS. The link to the electronic survey was included in the e-mail so that interested participants could complete the survey at the time and location of their choosing. We offered a complimentary report of the summarized results of the study to all participants as an incentive to participate in the study (nearly 95% of the respondents requested this report).

Of the 1000 CIOs in the sample, 45 could not be contacted, 81 indicated that hospital or healthcare system (although these executives were from different hospitals, their hospitals were part of the same healthcare system) policy forbade their participation in the study. After two reminders, 167 responses were received (19%). We eliminated three responses from the dataset after we deemed them as not useable due to them being vastly incomplete. The responding hospitals, on average, have 822 non-IT FTE, 35 IT FTE, 151 staffed beds, and net operating revenues of $122 million.

We checked for non-response bias by verifying that early and late respondents did not significantly differ in their demographic characteristics and responses on principal constructs. We tested for non-response bias by verifying that early and late respondents did not significantly differ in their demographic characteristics and responses on principal constructs. We identified early respondents by selecting those that responded in the first 2 weeks. All *t*-tests between the means of the two groups showed no significant differences ($P<0.05$ level). The breakdown of not-for-profit (NFP) and for-profit (FP) hospitals that responded was 85% and 15%, respectively. The ratio of NFP to FP for responding hospitals in this study is comparable to the general population, which is 82% NFP and 18% FP. The relative comparability of this ratio between the sample and the population makes it more likely that the results derived from the current study are generalizeable to the population.

Data analysis and results

Analysis

We employed partial least squares (PLS) structural equation modeling to test the hypothesized relationships in this study. Petter *et al*. (2007) recommend that the relationship between the measures and construct be closely examined, even when using measures previously validated and used in other research studies. Although our measures

were derived from prior studies, we examined our measures to determine the appropriate way to model the constructs. We applied four established decision rules (see Jarvis *et al*., 2003; Petter *et al*., 2007; Roberts and Thatcher, 2009) in deciding whether to conceptualize each of our multi-item constructs as reflective or formative. The four decision rules pertained to (1) the theoretical causal direction between the construct and indicators, (2) indicator interchangeability, (3) whether indicators covary, and (4) whether indicators have the same antecedents and consequences. Following these decision rules we modeled both CIO structural power and IT-business mutual participation as formative, and we modeled enterprise management methodologies, metric and compliance processes, social risk management, technical risk management, operational IT effectiveness, market responsiveness, and external relationship management as reflective. We approximated the second-order construct, IT governance, with the measurement items of the first-order factors enterprise management methodologies and metric and compliance processes. This approach is also known as the repeated indicators method (Chin *et al*., 2003). Using the abovementioned four decision rules as a guide for our second-order construct, it seemed appropriate to model IT governance as formative.

Measurement validation

In accordance with prior studies (Henseler *et al*., 2009), we assessed the validity and reliability of the items and constructs in our model. We assessed the validity and reliability of the reflective items and constructs by examining the loadings of items on their respective latent variable (Hulland, 1999). The higher loadings imply that there is more shared variance between the construct and its associated items than error variance (Hulland, 1999). As represented in Appendix B, all items loaded heavily and significantly (at $P<0.05$) on their respective constructs; the results are indicative of individual item reliability.

Consistent with prior studies (Bradley *et al*., 2006; Karim, 2009; Hult *et al*., 2010), we assessed the reliability of our scales using composite reliability (ρ) (Werts *et al*., 1974). Composite reliability is preferred over Cronbach's α because it offers a better estimate of variance shared by the respected indicators and because it uses the item loadings obtained within the nomological network (Hair *et al*., 2006; Karim, 2009). Furthermore, composite reliability is perceived as a stronger reliability assessment when compared to Cronbach's α, and is considered a more conservative test of reliability (Garver and Mentzer, 1999). As indicated in Table 1, the composite reliability scores for all scales exceed the minimum threshold level of 0.70 (Nunnally and Bernstein, 1994; Kline, 1998), thus indicating the reliability of the scales used in this study.

Although the previously mentioned item loadings and their significance appear to demonstrate convergent validity, we also assessed the convergent validity of our first-order constructs using Fornell and Larcker's (1981) average variance extracted (AVE) criterion. As listed in Table 1, the AVE for each construct exceeds the minimum threshold value of 0.50 (Fornell and Larcker, 1981; Chin, 1998; Chin *et al*., 2003; Henseler *et al*., 2009). The combined results (i.e. the factor loadings and construct AVE values) provide the basis for our confidence that the reflective constructs in our research model demonstrate convergent validity.

We assessed discriminant validity of our reflective constructs via the cross loadings criterion (Chin, 1998; Chin *et al*., 2003) and AVE (Fornell and Larcker, 1981). According to the cross loading criterion (Chin, 1998; Chin *et al*., 2003), the loading of each indicator is expected to be greater than all of its cross-loadings. On the basis of the cross-loadings listed in Appendix B, the criterion is satisfied. On the basis of the AVE, evidence of discriminant validity occurs when the square root of the AVE is greater than the correlations between constructs in the research model (Fornell and Larcker, 1981; Chin, 1998; Gefen *et al*., 2000; Gefen and Straub, 2005). The square root of the AVE

Table 1 Correlation matrix and average variance extracted of principal constructs

Construct	*Reliability (no. of items)*	*AVE*	*Mean*	*S.D.*	*EMM*	*MCP*	*EC*	*SRSK*	*TRSK*	*MKR*	*EXRM*	*OITE*	*ITBMP*	*CSP*
EMM	0.90 (4)	0.70	4.55	1.30	**0.84**									
MCP	0.87 (4)	0.62	4.22	1.23	0.76	**0.79**								
EC	0.86 (4)	0.60	4.33	1.15	0.50	0.57	**0.77**							
SRSK	0.93 (4)	0.76	3.78	1.61	0.33	0.15	0.13	**0.87**						
TRSK	0.89 (4)	0.67	4.79	1.20	0.68	0.56	0.51	0.31	**0.82**					
MKR	0.91 (4)	0.68	4.84	1.10	0.66	0.40	0.44	0.20	0.58	**0.82**				
EXRM	0.80 (3)	0.57	4.38	1.14	0.43	0.26	0.49	−0.01	0.22	0.51	**0.75**			
OITE	0.91 (2)	0.83	5.22	1.18	0.51	0.61	0.41	0.14	0.45	0.39	0.28	**0.91**		
ITBMP	N/A (3)	N/A	5.08	1.40	0.78	0.66	0.57	0.23	0.65	0.60	0.33	0.55	N/A	
CSP	N/A (2)	N/A	N/A	N/A	0.32	0.28	0.14	0.15	0.31	0.24	0.06	0.21	0.26	N/A

EMM = Enterprise Management Methodologies; MCP = Metrics and Compliance Processes; EC = Entrepreneurial Culture; SRSK = Social Risk Management; TRSK = Technical Risk Management; MKR = Market Responsiveness; EXRM = External Relationship Management; OITE = Operational IT Effectiveness; ITBMP = IT-Business Mutual Participation; CSP = CIO Structural Power.

Notes: N/A is listed formative construct because reliability estimate is not valid for formative construct. N/A is also listed for formative construct in lieu of descriptive statistics because some of the items that make up the formative construct are categorical. The bold numbers on the leading diagonal are the square root of the AVE.

for each first-order construct (bold diagonal elements in Table 1) is greater than its respective inter-construct correlations (off-diagonal elements in Table 1). These results suggest that the principal reflective constructs in our model demonstrate discriminant validity.

We assessed the validity of our formative constructs, CIO structural power, IT-business mutual participation, and IT governance, by examining the significance of the parameter estimates for each formative indicator (see Figure 2). It has been argued that the parameter estimates of formative indicators can be interpreted as validity coefficients (Roberts and Thatcher, 2009). Table 2 details the parameter estimates and respective *t*-statistics for indicators of our formative constructs. Indicators for all formative constructs were significant, except for one indicator of the CIO structural power construct (see Figure 2 – Panel A). Whereas some argue that non-significant indicators may not be valid measures of the construct (Diamantopoulos and Winklhofer, 2001), others suggest that it is acceptable to retain non-significant indicators if they contribute to the construct's content validity (Bollen and Lennox, 1991; Petter *et al*., 2007; Roberts and Thatcher, 2009). For the latter reason, we chose to retain the one non-significant indicator to ensure sufficient breadth of coverage for capturing the content of the CIO structural power construct. This is important on a conceptual level because eliminating an indicator could potentially result in a measure that captures only a portion of the respective construct (Bollen and Lennox, 1991; Petter *et al*., 2007; Roberts and Thatcher, 2009). Hence, the nature of the construct would have been altered (Bollen and Lennox, 1991; Little *et al*., 1999; Petter *et al*., 2007; Roberts and Thatcher, 2009). In further support of our decision to retain the non-significant formative indicator, Petter *et al*. (2007) and Roberts and Thatcher (2009) intimate that conceptual considerations should always be taken into account when eliminating indicators.

We took steps to assess method bias commonly associated with self-reported measures captured via a common instrument. First, we performed Harman's one-factor test by including all indicators in a principal components factor analysis (Podsakoff *et al*., 2003) and

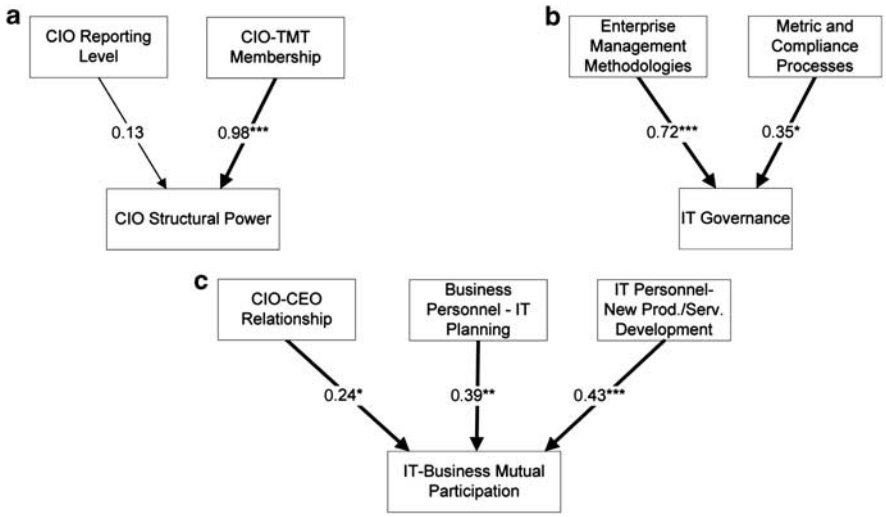

Figure 2 CIO structural power and IT governance formative construct results.
Notes: ***Significant at $P<0.001$; **Significant at $P<0.01$; *Significant at $P<0.05$.

Table 2 Parameter estimates for formative constructs

Construct	*Item/Construct*	*Weight*	*Standard Error*	*T-statistic*
CIO structural power	CIO reporting level	0.13	0.24	0.53
	CIO–TMT membership	0.98	0.07	13.99***
IT-business mutual participation	CIO–CEO relationship	0.24	0.06	2.27*
	Business Personnel – IT planning	0.39	0.12	3.03**
	IT personnel – New product/Service development	0.43	0.04	4.53***
IT governance	Enterprise management methodologies	0.72	0.14	4.75***
	Metric and compliance processes	0.35	0.17	2.04*

Note: ***$P<0.001$; **$P<0.01$; *$P<0.05$.

examining the unrotated factor solution to determine the number of factors that are necessary to account for the variance in the items. Using Harman's test, evidence for common method bias exists if either a single factor emerges or if one general factor accounts for the majority of the covariance among the items (Podsakoff *et al*., 2003; Pavlou *et al*., 2007). The factor analysis revealed seven factors and the most covariance explained by one factor is 35%. We also examined correlations between our variables. Our correlation matrix (see Table 2) does not indicate any highly correlated factors (highest correlation is $r = 0.76$), whereas evidence of common method bias would have resulted in extremely high correlations ($r > 0.90$) (Pavlou *et al*., 2007). In summary, our results show that neither case exists; therefore, our data do not indicate evidence of substantial common method bias (Chin *et al*., 2003).

Results of testing the structural model

The research model was analyzed with SmartPLS (2.0 M3) (Ringle *et al*., 2005), a path modeling tool that is well-cited for highly complex predictive path models (Hennig-Thurau *et al*., 2007). We used the bootstrap resampling technique with 500 samples to estimate the significance of the path coefficients. The PLS path coefficients for our proposed research model are shown in Figure 3.

First, CIO structural power has a significant and positive effect on IT governance ($\beta = 0.15$, $P < 0.05$), thereby supporting Hypothesis 1. Second, both IT-business mutual participation ($\beta = 0.64$, $P < 0.001$) and entrepreneurial culture ($\beta = 0.24$, $P < 0.001$) have significant and positive effects on IT governance, thus supporting Hypothesis 2 and Hypothesis 3, respectively. Moreover, IT governance has significant and positive effects on technical risk management ($\beta = 0.66$, $P < 0.001$), social risk management ($\beta = 0.33$, $P < 0.001$), market responsiveness ($\beta = 0.66$, $P < 0.001$), external relationship management ($\beta = 0.47$, $P < 0.001$), and operational IT effectiveness ($\beta = 0.56$, $P < 0.001$), thereby supporting Hypothesis 4, Hypothesis 5, Hypothesis 6, Hypothesis 7, and Hypothesis 8, respectively. The results show that hospital's strategic intent (i.e. profit status) influences both social risk management and their perceptions of IT-enabled external relationship management. We observe that not-for-profit hospitals managed social risks more than for-profit hospitals. Conversely, CIOs in for-profit hospitals had a greater perception of external relationship management than CIOs in not-for-profit hospitals. Therefore, strategic intent was retained in the structural model (see Figure 3) for social risk management and external relationship management. None of the other controls had a significant influence on any of the constructs in our research model, and were subsequently dropped from the model as controls.

Discussion of results

Two research questions drove this study: (i) what are some of the antecedent factors to IT governance in hospitals and (ii) what are some of the important consequent variables that are affected by IT governance in hospitals? The current study addressed these questions through the development and empirical testing of a theoretical model that places IT governance as the central point within the nomological network. The results of the data analysis and directions for future research are discussed below.

The survey data collected from the 164 CIOs support our research model and thereby validate our theoretical development for the study. The study has three important findings. First, the power and politics perspective explains why some hospitals have effective IT governance and others do not. Specifically, three conditions play a role in hospitals' IT governance mechanisms: (i) CIOs' need to increase their personal power base, including structural power; (ii) mutual participation by IT and business personnel in development of new products/services and IT planning, respectively; and (iii) hospitals need to embrace and exhibit a more entrepreneurial organizational culture. Second, we use the literature on IT project

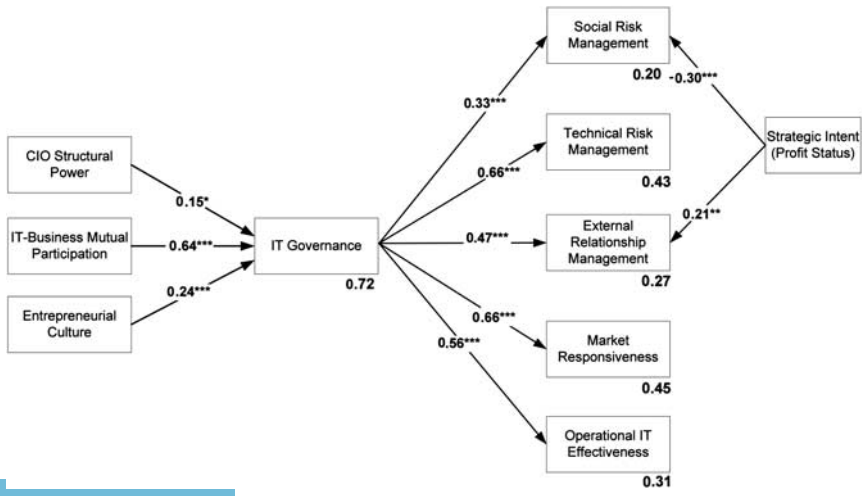

Figure 3 Smart PLS results of hypothesis testing.
Notes: Variance explained shown below each construct. ***Significant at $P < 0.001$; **Significant at $P < 0.01$; *Significant at $P < 0.05$.

management to provide insight into the impact of IT governance on hospitals' risk management initiatives. Third, we contribute to the IT governance literature by demonstrating the influence of IT governance on IT's contribution to hospital performance.

Whereas there is a scarcity of literature that considers the antecedents of IT governance and the ensuing impact on IT contribution to the organization, this area of research is even sparser in health care. In an effort to address this void in the literature, our study examines the potential antecedents to IT governance and IT governance's impact on IT contribution in hospitals. The data confirm three such antecedents. First, we find that CIOs' structural power has a significant influence on the level of IT governance in hospitals. However, contrary to existing literature, we find no significant evidence of the CIO reporting level being a major contributor to CIOs' structural power. Whereas prior research examining the influence of the CIO–CEO relationship on IT initiatives and organization performance suggests that CIOs who report directly to the CEO should be better able to deliver strategic IT applications (Kearns and Sabherwal, 2007; Preston *et al*., 2008; Preston and Karahanna, 2009a). From a directional perspective, our finding is consistent with the aforementioned authors in that we see a positive relationship between the CIO reporting structure and the level of CIO structural power. However, from a significance standpoint our findings are not congruent with prior research. For instance, some argue that a CIO, who is at a peer level with the organization's senior executives, is more likely to be accepted into the organization's inner circle and will therefore be successful in educating, advising, and actively influencing other senior executives (Earl and Feeny, 1994; Preston *et al*., 2008). Although it appears that our findings contradict the findings of others, relative to the CIO reporting structure, we assert that our findings provide clarity as to the role of organizational dynamics in hospitals that provide a context in which something that would ordinarily have a negative impact has a positive influence on the outcome variable, IT governance in this case.

Prior research has suggested that CIOs who report directly to the CEO should be better able to align IT with the organization and deliver strategic IT applications (Kearns and Lederer, 2003). This implies that the CIO's reporting structure is indicative of his or her power to enact change. Perhaps this may be true in more stable environments and/or organizations with less uncertainty. However, we find that the CIO's reporting structure is not a significant predictor of the CIO's structural power in hospitals. Whereas this could appear to be a negative result, we argue it is the context of our study in a high-velocity environment that sheds a positive light on this result.

High-velocity environments, such as hospitals, are characterized by 'rapid and discontinuous change in demand, competitors, technology, and/or regulation, such that information is often inaccurate, unavailable, or obsolete' (Bourgeois and Eisenhardt, 1988: 816). The healthcare landscape is riddled with aggressive price competition, rapid technological advancements, and frequent changes in standards (Alexopoulos *et al*., 2001). For instance, hospitals are undergoing a revolution due to healthcare reform, which is partly market-driven and partly policy-driven, and new government regulations aimed at increasing the adoption of IT. In addition, the nature and demand in hospitals is changing as mergers and acquisitions redefine the nature of competition (Stepanovich and Uhrig, 1999). In light of how many of these tumultuous events can further propagate discontinuous change in demand and information asymmetry, we reason, as others have (e.g., Leggat *et al*., 2005; Guo and Company, 2007), that a hospital is a high-velocity environment.

Given that scholars have consistently acknowledged environmental velocity's influence on organizations' formal, strategic decision-making processes (Eisenhardt, 1989; Judge and Miller, 1991) and the way key organizational members interact, we attribute the contrast between our finding, relative to the influence of the CIO reporting structure on CIO structural power, and that of Preston *et al*. (2008) to this environmental velocity context. When there is a shift or major change in the healthcare industry, the shift can dramatically reshape the industry structure and define the context of the competitive strategies used by hospitals to build new sources of competitive advantage (Lei and Slocum, 2005). As a result of operating in a high-velocity environment, hospitals must adopt short planning horizons (Barringer and Bluedorn, 1999; Bradley *et al*., 2011). Another explanation as to the CIO reporting structure appearing not to be significant in high-velocity environments could be the tendency of the organizations in such an environment to exhibit an entrepreneurial culture (Eisenhardt, 1989; Barringer and Bluedorn, 1999; Baum and Wally, 2003). Given that an entrepreneurial environment represents organizations with an emphasis on spontaneity, flexibility, and individuality (Russell, 1989; Cameron and Freeman, 1991; Jung, 2003; Leidner and Kayworth, 2006), and requires rapid response in identifying critical system processes, recognition of all relevant resources, access to real-time information, and the capacity to analyze 'what-if' scenarios (Stepanovich and Uhrig, 1999), the CIO reporting structure may not matter as much nor have as much impact on these issues as the CIO's membership in the TMT.

Our research offers insights into the mechanism through which the structural position acts to enable IT contribution, by increasing the CIO's latitude to undertake strategic IT initiatives. Missed strategic opportunities can arise when a CIO is without such legitimate power. Our finding provides some clarity as it suggests that TMT membership is a stronger determinant of the CIOs' structural power than is the relational structure relative to the levels removed from the CEO. Although the finding may seem odd at first glance, there could be a rational explanation. The key is that another condition is present and significant – the condition of the CIO as a member of the TMT. It seems that it is not the formal reporting structure that determines effectiveness here but the potential for shared decision-making to manifest. This is further echoed by the belief that there is more value in the CIO working very closely with other members of the TMT (Armstrong and Sambamurthy, 1999; Preston and Karahanna, 2009a), in this case to determine the best IT governance for the hospital. Involvement in such strategic planning initiatives provides a formal mechanism for the interaction between the CEO, CIO, and other members of the TMT. The establishment of such

formal mechanisms may be critical in establishing effective IT governance. Preston and Karahanna (2009a) find that, although the CIO reporting directly to the CEO was not important in knowledge sharing, formal organizational structures such as a steering committee were an important predictor of knowledge sharing in organizations.

Viewed this way, the finding in this study is congruent with the conclusion from Armstrong and Sambamurthy (1999) – the CIO's membership in and interactions with the TMT is more important than the CIO's formal reporting structure. The CIO actively working with other members of the TMT to establish IT governance and to complete other tasks makes the difference in effectiveness. Our finding might also inform us about other organizational governance initiatives in other management areas. Open and strong working relationships through some formal organizational mechanisms among the TMT members are likely to yield good outcomes. As predicted, the results of our study show that CIO structural power directly influences IT governance. This finding supports prior literature that contends human capital is a key determinant of authority related to strategic choices (Hambrick and Mason, 1984; Karake, 1995; Preston *et al*., 2008), such as IT governance, which Xue *et al.* (2008) argue can be viewed as a strategic choice because it helps organizations manage IT investment decisions and the IT investments themselves.

We also find that IT-business mutual participation has a positive impact on IT governance. This suggests that hospitals are more likely to have a higher quality of IT governance when their environmental dynamics include a strong working relationship between the CIO and CEO, IT personnel participation in the development of new products and/or services, and business personnel participation in IT planning. This finding is consistent with the assertions of Xue *et al.* (2008), who cite the importance of the combinative capability of IT and business personnel in IT initiatives. Our finding could also suggest that hospitals with the aforementioned mutual participation of IT and business personnel increase the possibility of success of their IT initiatives by way of a higher quality of IT governance. An unintended implication of this relationship could be reciprocity, in which hospitals that have a history of not effectively governing their IT resources may in turn not receive the needed support to maximize IT investments.

Many recent IT initiatives have been undertaken by hospitals due to healthcare reform and government regulations; and most of these revolve around the clinical areas of the hospital as opposed to the business areas. In addition, because many of these initiatives have been government mandated, and such government oversight is likely to continue, the strength of the CIO–CEO working relationship will continue to be important. One reason for the continued importance of this working relationship is that government mandated initiatives are not based on user buy-in (although this is important). However, their effectiveness is subject to user buy-in; this is where the CIO–CEO working relationship is paramount. According to the upper echelon theory, the effectiveness of top management support and participation in many ways depends on the characteristics and subsequent behaviors of top management (Hambrick and Mason, 1984; Carpenter *et al*., 2004; Finkelstein *et al*., 2009). This is especially true when you consider that government mandated initiatives are typically the responsibility of top management. With that said, it is also important for business personnel to participate in IT planning, regardless of the targeted audience. Because clinical initiatives (especially those that are IT-intensive or reliant) have implications for business processes and hospitals' financial performance in terms of financial constraints and budgeting, project prioritization, and forecasting of value, it is vital that business personnel be involved in IT planning. This is supported by Weill and Ross' (2004) position that getting value from IT (i.e. effective IT governance) is more so an organizational competency that business and IT executives alike are responsible for developing.

Our finding that IT-business mutual participation has a positive impact on IT governance supports and extends the prior work of other scholars. For instance, Galbraith's information processing theory suggests that a large variety and amount of information needs to be exchanged across functions to make strategic decisions such as those involved with IT governance (Galbraith, 1974). The complexity, uncertainty, and importance of creating IT governance strategies and policies, like other strategic decisions, require a large amount of participation among the organizational personnel (Ranganathan and Sethi, 2002; Weill and Ross, 2004). Ranganathan and Sethi (2002) state that 'given the high information asymmetries and high-capacity information-processing needs, a heterogeneous, cross-functional participation that would bring in a variety of information inputs, knowledge, and expertise has been suggested for strategic decision processes' (p. 65). Our finding is also supports the claim that the attainment of organizational goals require the commitment and participation of both IT and business personnel (Sabherwal, 1999; Ranganathan and Sethi, 2002). Recognizing that IT governance relates to the control that management and others in an organization have over the formulation and implementation of the IT initiatives through which the IT strategy and, ideally, the business strategy of the organization are executed, a primary function of IT governance is to help organizations prioritize IT objectives by establishing an accountability framework for IT investments. As such, our finding suggests that IT-business mutual participation influences these IT investments, which some believe will generate business value and facilitate the attainment of organizational goals (Weill, 2004; Weill and Ross, 2004).

In addition to CIO structural power and IT-business mutual participation, the positive impact of an entrepreneurial organizational culture on IT governance is an important concern. Our finding suggests that the level of organizational entrepreneurial values and norms explains why the degree of commitment to IT governance varies across hospitals. Specifically, we find that the more entrepreneurial a hospital's organizational culture the more the hospital tends to focus on governance of IT resources. The result could be explained by the typical structure of entrepreneurial organizations.

Bradley *et al.* (2006) contend that organizations with a more entrepreneurial culture face more relative uncertainty and are, therefore, more likely to need guiding mechanisms concerning IT. Our findings serve as an extension of

Bradley *et al*.'s (2006) work in that we establish IT governance as a consequence of the entrepreneurial nature of hospitals' organizational culture, thus providing insight into the nature of the relationship between organizational culture and IT governance. In contrast, our finding is in conflict with that of Weill and Ross (2005). In their study, Weill and Ross (2005) report that organizations with an entrepreneurial focus require few governance mechanisms. The conflicting findings could be due to the level of uncertainty and the high-velocity environment in which hospitals operate. Although Weill and Ross' (2005) study spanned multiple industries, very few of the organizations in their study were from the healthcare industry. As such, our finding highlights the importance of IT governance in organizations that operate in high-velocity environments, specifically hospitals, and that have an entrepreneurial focus.

The context of our study potentially offers additional insights relative to our finding. For instance, Parente and Van Horn (2006) find that the marginal effect of IT on for-profit hospital productivity is to reduce the number of days supplied, whereas in not-for-profit hospitals the marginal effect of IT is to increase the quantity of services supplied. Their finding is consistent with the differing objectives of not-for-profit and for-profit hospitals in that for-profit are more focused on efficiency and not-for-profit hospitals are driven more by their desire to provide comprehensive patient care via new services. Although this distinction could be translated to other industries, the novelty for health care lies in the fact that it is virtually the only industry in which not-for-profit and for-profits organizations compete for the same customer base (i.e. patients) and service providers (i.e. clinicians). In light of these two types of hospitals' differing objectives of IT and their level of entrepreneurial activity and competition in the same market space, the importance of and need for IT governance is clear.

The second key finding of this study is that IT governance directly influences two perspectives of risk management, social and technical risk management. IT governance has a positive effect on both social and technical risk management. We explain the impact on technical risk management by discussing IT governance in relation to corporate governance. IT governance is a subset of corporate governance, and as such it is believed to be subject to the same covenants and constraints (Weill and Ross, 2004; Webb *et al*., 2006). An area that is typical of a corporate governance framework is risk management (Webb *et al*., 2006). As such, an objective of IT governance is effective management of IT risks (Spremic and Popovic, 2008). Our finding suggests IT governance is important to hospital's IT risk management agenda. Furthermore, our finding supports the premise of other studies that present risk management as an outcome of IT governance (IT Governance Institute, 2003; Sallé, 2004; Fletcher, 2006). Although the aforementioned studies isolate risk management to IT risk management, our findings are of particular interest because we take a broader view of risk management by including social risk management. This is an important contribution because effective IT governance 'will help organizations understand the issues and risks surrounding the strategic importance of IT' (Damianides, 2005: 78). Such an understanding would likely require management of social risks, such as negative attitudes towards IT or IT's contribution to strategic initiatives. This is plausible given that 'effective IT governance encourages and leverages the ingenuity of the enterprise's people in IT usage and ensures compliance with the enterprises overall vision and values' (Weill and Ross, 2004: 2). Our finding can be explained relative to a specific IT governance goal. A goal of IT governance is to create a control environment for desirable actions/behaviors to drive the effective use of IT (Weill and Ross, 2004; Robinson, 2005). A control environment is shaped by the attitudes and actions of the board of directors and managers (Robinson, 2005); as such, social risks abound and the level of IT governance is likely a determinant of the degree to which social risks are managed. Prior research suggests that social risks influence technical risk (Wallace *et al*., 2004); this could serve as the basis for an alternative explanation of our finding. For instance, given the arguments in the extant literature on IT governance and our finding of the significant relationship between IT governance and technical risk management, it possible that in devising mechanisms to mitigate technical risks hospitals are by default mitigating social risks that have been shown to influence technical risks. Future studies should explore this potential indirect relationship.

The third key finding of this study is that IT governance directly influences IT contribution to hospital performance, as measured by market responsiveness, external relationship management, and operational IT effectiveness. This finding gives some credence to Csaszar and Clemons' (2006) assertion that IT governance is an important determinant of IT goals and performance. The finding suggests IT governance is an important antecedent to IT contribution in general, and market responsiveness, external relationship management, and operational IT effectiveness specifically.

We observe that an increase in IT governance results in a perceived improvement in the effectiveness of hospitals' IT in terms of improving the speed at which they can respond to internal and external demands and forces. This finding demonstrates the need for effective IT governance in order to achieve the speed and capabilities to meet the demands of external stakeholders. Our finding that IT governance has a positive impact on perceptions of IT-enabled market responsiveness is in line with the arguments of Ross *et al*. (2006), who assert that external performance improvements are likely the result of effective IT governance. Further, this finding elevates the importance of IT governance in a healthcare context. Recalling our previous mentioning of the value of IT governance in light of for-profit and not-for-profit hospitals' differing objectives of IT and their level of entrepreneurial activity and competition in the same market space, this particular finding sheds additional light on that statement. We observe that when the level of IT governance is accounted for in our research model, that the strategic intent (i.e. profit status) has no significant bearing on IT's contribution to and/or its marginal effect on either hospitals' focus on efficiency or their initiatives to provide/introduce additional services. This illustrates, empirically, the overarching significance of the role of IT governance in hospitals.

Relative to our finding that IT governance influences perceptions of IT-enabled external relationship management, Beckett-Camarata *et al.* (1998) view relationship management as a tool that organizations use to bring about external effectiveness in the form of customers' perception of service quality and organizational performance. In support of our finding, Grant *et al.* (2007) argue that IT governance is an effective means of ensuring proper management of external relationships. We also observe that IT governance has a positive influence on perceptions of operational IT effectiveness as measured by the IT-enabled clinical error detection and reduction. This finding appears to support Robinson's (2005) claims about the relationship between IT governance and IT effectiveness. For example, Robinson (2005: 45) intimates that 'indications of low IT effectiveness are shining a spotlight on the need for IT governance as a vehicle for bolstering performance.' His statement, which is congruent with our finding of IT governance's impact on operational IT effectiveness, implies that IT governance is a key enabler of IT effectiveness. Because IT governance has been shown to directly affect firm performance (Byrd and Turner, 2001; De Haes and Grembergen, 2004; Preston *et al.*, 2008), it is likely that the realized benefits of IT use in hospitals, specifically to detect and reduce clinical errors, is due to IT governance (Ross *et al.*, 2006). In summary, our finding suggests IT governance, via its effect on IT contribution to hospital performance as measured by market responsiveness, external relationship management, and operation IT effectiveness, generates business value for hospitals. Our findings provide some credence to Robinson's (2005: 45) assertion of IT governance's emergence as an 'antidote to anemic IT performance, paving the way to more effective use of technology in supporting business needs'. This notion is consistent with the arguments of Weill and Ross (2004) and Xue *et al.* (2008), who believe effective IT governance is the single most important predictor of IT-generated value.

Limitations of the study and suggestions for future research

Before discussing the implications of our findings, we acknowledge some limitations of this study that present opportunities for future research. First, the reliance on a single key informant to evaluate the organization's IT governance and IT capabilities could suggest that the results may be subject to method bias. Similar to other studies we tried to eliminate the extent of such bias both *ex ante* and *ex post* (Pavlou, 2006; Liang *et al.*, 2007). *Ex ante*, we took care to develop the measures of this study so that they were independent of each other and their expected outcomes. Further, we altered the design of our questionnaire using the scale reordering procedure (i.e., we presented nearly all of our dependent/consequent variables after, rather than before, the independent/antecedent variables) to reduce the effects of consistency artifacts. Ex post, we conducted multiple tests to determine the extent to which our results are biased. Our tests (i.e., Harman's one-factor test, marker variable analysis, and correlation analysis) suggest that method bias does not account for the study's results.

Our attempt to operationalize and measure IT governance in this study is exploratory at best. Future studies, should attempt to further refine and validate the items used. It could also be beneficial for future studies to determine whether it is more accurate to represent IT governance as two, separate first-order constructs or as a second-order factor.

Our approach and findings relative to having respondents consider the most recent 5-year period when responding to questions related to IT contribution to hospital performance may be difficult to replicate. This is primarily because of the uniqueness of the moment given that the 5-year period covered the latter 5 years of the 10-year existence of HIPAA. This scope was important because the enactment of HIPAA served as a major impetus for much of health care's investment in IT applications. Although future studies cannot revisit this point, a longitudinal study might be of value, especially considering the amendments to HIPAA via the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009. This Act applies even more pressure to healthcare providers in light of the paradigm shift towards patient-centered health care. Comparison of the results in this study to those of a study that covers the latter 5 years of the 10-year anniversary of the HITECH Act could prove to be quite interesting and informative.

We believe the study's findings extend the power and politics perspective to the IT domain. However, the findings are based on a single industry, which happens to be quite different from most others. The power and politics perspective should be applied to IT studies in other industries to add further evidence of the value of this literature to the IT strategy literature. We call for future studies to examine this possibility.

Implications for theory and future research

The results of this study certainly have implications for the literature on IT capability management and power and politics. The findings in this study expand the power and politics perspective to include the IT domain and present IT capability management in the form of IT governance. IT has truly become a strategic resource in many organizations including in hospitals. Structural and relational mechanisms within hospitals associated with IT governance do, in fact, matter. The implications cascade through the entire organization and have effects on IT contribution to hospital performance in a variety of ways. Other studies should consider additional antecedents to IT governance similar to the way prior studies have done the same relative to strategic alignment (Preston and Karahanna, 2009a) and CIO strategic decision-making (Preston *et al.*, 2008).

In addition, the study results underscore the importance of capability management and highlights the role of IT governance in IT value creation. As with many other management issues in organizations, superior performance, which can lead to competitive advantage, starts at the top when considering IT issues. IT governance is a powerful force in both positively enabling risk management and IT capabilities, both of which have been linked to establishing competitive advantage (Chan *et al.*, 1997; Jiang *et al.*, 2001; Wallace *et al.*, 2004).

Risk management research in IT has been sparse. Yet, given the legislative impetus for healthcare organizations and providers to implement large-scale enterprise systems such as EMRs, there is a great need to investigate risk management in the healthcare domain. Risk management should become a much more prominent issue in IT research because of the massive effect, positive or negative, enterprise systems have on the entire organization. This is especially true when you consider such systems are very expensive and have a propensity for low value generation even after successful implementation.

This study clearly articulates that internal contextual factors influence IT governance. The internal contextual factors include power and politics relative to the CIO's structural power, IT-business mutual participation, and entrepreneurial culture. This study is one of the first to confirm empirically IT governance as a key determinant of IT contribution to hospital performance and risk management. Moreover, researchers need to compare the points of view of different stakeholders in the organizations. The CIO might have a different viewpoint from the CEO as it pertains to the importance of different types of IT governance. In fact, the opinions of other C-level executives, such as the chief financial officer, might need to be examined as well.

Implications for practice

The healthcare industry is under extreme pressure to reduce costs and improve the quality of patient care; hospitals remain at the forefront of these efforts. With that said, the evidence is clear that IT governance mechanisms exist to significantly enhance a hospital's ability to manage risks and leverage IT to improve organizational performance. The real issue is how to govern IT to ensure that IT resources are utilized in the most effective manner, an issue that is a top priority for hospital executives.

As this study has shown, hospitals would be well served to start at the top. Before assessing the effectiveness of their IT governance mechanisms, it is advisable that hospital executives consider the CIO's structural power, mutual participation of IT and business personnel, and organization's entrepreneurial culture. Such an assessment is vital when you consider these factors' impact on IT governance and the degree to which our results suggest IT governance influences both technical and social risk management and IT contribution to hospital performance. By paying close attention to mutual participation of IT and business personnel, the hospital's level of entrepreneurship, and the CIO's structural power, specifically the CIO's membership on the TMT, hospitals can create an atmosphere of effective IT governance that potentially can, in the end, lead to sustainable competitive advantage.

Another implication for practice is the importance of business personnel, which includes clinical personnel in hospitals, involvement in IT planning activities and IT personnel involvement in business development initiatives. For example, hospital CEOs and non-IT TMT members are often healthcare practitioners that likely possess a strong knowledge of issues affecting physicians and other medical personnel. Thus, it will be important to engage the CIO to potentially balance and complement the viewpoints and goals of the CEO and TMT members. The right TMT will recognize the importance of IT governance for improved performance, will promote a healthy exchange of business and IT knowledge, will jointly educate one another on the unique needs of the stakeholders, and will effectively share in making decisions regarding IT. In doing so, the hospital will have implemented a more strategically oriented set of IT governance mechanisms that will, in turn, ensure the hospital is more responsive to the market, is more prepared to manage risks, and is better able to develop, manage, and leverage relationships with other healthcare providers and constituents.

Conclusion

In this study, we aimed to identify and examine some of the antecedents and consequent variables of IT governance in hospitals. We drew upon extant literature related to power and politics and capability management to propose, operationalize, and empirically examine a nomological model that explains and predicts IT governance and its ensuing impact on technical and social risk management and IT contribution to hospital performance (i.e., market responsiveness, external relationship management, and operational IT effectiveness). Empirical tests of our hypotheses based on survey data gathered from 164 CIOs of US hospitals show strong support for the influence of CIO structural power, IT-business mutual participation, and entrepreneurial culture on IT governance, and its ensuing impact on the abovementioned outcomes. The results have implications for hospitals' readiness and predisposition for IT governance, as their structural and relational mechanisms can affect IT governance and, indirectly, IT value creation. Further, the results of this study offer several contributions to the IT literature. One, this study extends the power and politics perspective to include the IT domain and presents IT capability management in the form of IT governance. In addition, our findings underscore the importance of capability management and highlights the role of IT governance in IT value creation, by instantiating elements of both risk management and IT's contribution to hospital performance as consequences of IT governance. A third contribution of this study is that it identifies three internal contextual factors that influence IT governance. We further contribute to the IT literature by helping to expand the sparse risk management research stream in the IT literature by demonstrating the importance of risk management relative to IT governance and explaining why it should become a much more prominent issue in IT research.

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Appendix A

Construct operational definitions and scales

CIO structural power
The CIO's reporting level and TMT membership.
Sources: Preston *et al*. (2008) and GuideStar (www.guidestar.com) CIORptLev:
Who do you report to? If the person is not the CEO, how many reporting levels are between you and the CEO?
(a) 0 (I report directly to the CEO); (b) 1; (c) 2 or more (reverse coded (a) 3, (b) 2, (c)1).
CIO–TMT: Is the CIO a formal member of the organization's top management team (TMT)? Yes/No

IT-business mutual participation
The degree to which IT personnel participate in business initiatives and business personnel participate in IT planning.
Sources: Adapted from Chan (2002) and King and Teo (1997).
Scale: 7-point scale ranging from *strongly disagree* (1) to *strongly agree* (7)
Please rate your level of agreement with each of the following:

ITBMP1: CEO and CIO have a strong working relationship.
ITBMP2: Business personnel participate in IT planning.
ITBMP3: IT personnel participate in new product/service development

Entrepreneurial culture
The degree to which the hospital exhibits an entrepreneurial culture.
Source: Quinn and Spreitzer (1991).
Scale: 7-point scale ranging from *strongly disagree (1) to strongly agree* (7)
Please rate your level of agreement with each of the following:

EC1: My organization is very dynamic and entrepreneurial.
EC2: My organization's CEO is an innovator or risk taker.
EC3: The glue that holds my organization together is commitment to innovation and development.
EC4: My organization emphasizes growth and the acquisition of new resources.

IT governance-enterprise management methodologies
Sources: Adapted from Sambamurthy and Zmud (1999); Ross (2003); Brown and Grant (2005).
Scale: 7-point scale ranging from *strongly disagree* (1) to *strongly agree* (7).
Please rate your level of agreement with each of the following:

ITGov1: My organization employs a methodology to increase the effectiveness of IT investments.
ITGov2: My organization employs a methodology to manage enterprise-wide technical standards.
ITGov3: My organization employs a methodology to align IT project priorities with business priorities.
ITGov4: My organization employs a methodology to encourage business process module reuse.

IT governance-metric and compliance processes
Sources: Adapted from Sambamurthy and Zmud (1999); Ross (2003); Brown and Grant (2005).
Scale: 7-point scale ranging from *strongly disagree (1) to strongly agree (7).*
Please rate your level of agreement with each of the following:

ITGov5: My organization employs a formal compliance process for IT projects.
ITGov6: My organization employs metrics (e.g., six sigma) to assess IT projects.
ITGov7: My organization employs a formal technology adoption process.
ITGov8: My organization conducts post-implementation assessment of business impacts of IT (including IT projects).

Social risk management
Sources: Adapted from Jiang *et al.* (2001); Wallace *et al.* (2004).
Scale: 7-point scale ranging from *strongly disagree (1) to strongly agree (7).*
Please rate the extent to which your organization has addressed the risk posed by each of the following:

SRSK1: The negative effects of corporate politics on IT projects.
SRSK2: An unstable organizational environment (e.g., excessive turnover, organization undergoing restructuring during project, change in organizational management during project).
SRSK3: The negative attitudes of senior business stake holders towards IT projects.
SRSK4: Lack of cooperation from business stakeholders in adopting new technologies (e.g., not committed to project, resistant to change).

Technical risk management
Sources: Adapted from Jiang *et al.* (2001); Wallace *et al.* (2004).
Scale: 7-point scale ranging from *strongly disagree (1) to strongly agree (7).*
Please rate the extent to which your organization has addressed the risk posed by each of the following:

TRSK1: The use of new/emerging information technology (e.g., open source, web services).
TRSK2: The high level of technical complexity of IT projects.
TRSK3: The use of leading edge information technologies.
TRSK4: The use of information technology that has not been used in prior projects.

Market responsiveness
Sources: Adapted from Weill (1992); Bharadwaj (2000).
Scale: 7-point scale ranging from *not at all (1) to very great extent (7).*
On the basis of the past 5 years, please rate the extent to which IT has improved each of the following:

MKTR1: My organization's speed of response to stake holders' needs.
MKTR2: My organization's ability to tailor products/services to individual stakeholder needs.
MKTR3: The speed at which my organization can enter new markets.
MKTR4: The rate at which my organization can introduce new products/services.

External relationship management
Sources: Adapted from Feeny and Willcocks (1998); Bharadwaj (2000).
Scale: 7-point scale ranging from *not at all (1) to very great extent (7).*
On the basis of the past 5 years, please rate the extent to which IT has improved each of the following:

EXRM1: My organization's ability to work with external suppliers to leverage shared IT capabilities to create high-value IT resources.
EXRM2: My organization's ability to manage relationships with outsourcing partners.
EXRM3: My organization's ability to manage relationships with contracted caregivers who are not employed by this organization.

Operational IT effectiveness
The extent to which IT has improved the hospital's performance in terms of aiding in detection and reduction of clinical errors.
Sources: Adapted from Hamilton and Chervancy (1981a, b).
Scale: 7-point scale ranging *from not at all (1) to very great extent (7).*
On the basis of the past 5 years, please rate the extent to which IT has improved each of the following:

OITE1: My organization's ability to reduce clinical errors.
OITE2: My organization's ability to detect/catch clinical errors.

Appendix B

Table B1 Factor loadings

Indicator	*OITE*	*EC*	*EXRM*	*EMM*	*MCP*	*MKR*	*SRSK*	*TRSK*	*ITBMP*	*CSP*
OITE1	**0.94**	0.40	0.21	0.50	0.62	0.40	0.14	0.48	0.58	0.23
OITE2	**0.88**	0.35	0.33	0.42	0.46	0.30	0.10	0.32	0.39	0.15
EC1	0.27	**0.87**	0.49	0.45	0.46	0.48	0.19	0.51	0.50	0.15
EC2	0.22	**0.67**	0.12	0.13	0.28	0.07	0.10	0.13	0.35	0.14
EC3	0.41	**0.77**	0.51	0.51	0.48	0.43	0.09	0.38	0.53	0.02
EC4	0.34	**0.78**	0.31	0.35	0.49	0.29	0.03	0.47	0.37	0.13
EXRM1	0.36	0.27	**0.70**	0.38	0.21	0.53	0.41	0.26	0.25	−0.05
EXRM2	0.21	0.45	**0.86**	0.34	0.19	0.47	0.00	0.20	0.21	−0.07
EXRM3	0.17	0.37	**0.68**	0.31	0.21	0.28	−0.17	0.12	0.29	0.16
EMM1	0.41	0.39	0.49	**0.82**	0.61	0.64	0.17	0.54	0.60	0.27
EMM2	0.52	0.42	0.34	**0.94**	0.72	0.60	0.37	0.65	0.76	0.35
EMM3	0.48	0.43	0.26	**0.91**	0.67	0.53	0.29	0.69	0.78	0.28
EMM4	0.25	0.49	0.50	**0.63**	0.52	0.45	0.21	0.34	0.37	0.11
MCP1	0.53	0.45	0.28	0.62	**0.85**	0.23	0.06	0.45	0.45	0.20
MCP2	0.32	0.34	0.08	0.60	**0.76**	0.27	0.12	0.51	0.43	0.19
MCP3	0.56	0.66	0.20	0.55	**0.81**	0.34	0.16	0.42	0.60	0.27
MCP4	0.47	0.30	0.26	0.63	**0.72**	0.42	0.14	0.40	0.55	0.23
MKR1	0.40	0.44	0.52	0.65	0.39	**0.89**	0.27	0.56	0.65	0.16
MKR2	0.31	0.37	0.41	0.62	0.33	**0.87**	0.19	0.59	0.50	0.28
MKR3	0.32	0.43	0.43	0.56	0.39	**0.83**	0.18	0.46	0.45	0.22
MKR4	0.19	0.07	0.33	0.31	0.19	**0.62**	0.06	0.29	0.38	0.32
MKR5	0.34	0.34	0.38	0.44	0.27	**0.86**	0.01	0.44	0.45	0.06
SRSK1	0.20	0.06	0.05	0.19	0.10	−0.01	**0.71**	0.27	0.09	0.13
SRSK2	0.13	0.13	0.04	0.36	0.25	0.23	**0.89**	0.35	0.25	0.13
SRSK3	0.13	0.04	−0.08	0.28	0.09	0.21	**0.95**	0.20	0.22	0.11
SRSK4	0.07	0.22	0.00	0.28	0.09	0.15	**0.92**	0.30	0.20	0.17
TRSK1	0.26	0.53	0.26	0.54	0.41	0.57	0.23	**0.80**	0.55	0.30
TRSK2	0.36	0.40	0.08	0.55	0.48	0.43	0.31	**0.88**	0.52	0.31
TRSK3	0.49	0.48	0.22	0.66	0.57	0.53	0.21	**0.92**	0.63	0.25
TRSK4	0.32	0.26	0.20	0.48	0.33	0.39	0.31	**0.66**	0.41	0.15
ITBMP1	0.49	0.71	0.31	0.61	0.53	0.47	0.16	0.59	**0.81**	0.23
ITBMP2	0.42	0.27	0.09	0.59	0.49	0.30	0.35	0.48	**0.75**	0.18
ITBMP3	0.48	0.51	0.38	0.72	0.60	0.65	0.12	0.57	**0.92**	0.24
CSP1	−0.08	−0.03	−0.11	0.11	0.01	0.08	0.12	0.02	0.12	**0.33**
CSP2	0.25	0.15	0.09	0.31	0.29	0.23	0.13	0.32	0.24	**0.97**

Notes: OITE = Operational IT Effectiveness; EC = Entrepreneurial Culture; EXRM = External Relationship Management; EMM = Enterprise Management Methodologies; MCP = Metrics and Compliance Processes; MKR = Market Responsiveness; SRSK = Social Risk Management; TRSK = Technical Risk Management; ITBMP = IT-business Mutual Participation; CSP = CIO Structural Power.