IT-BASED CAPABILITIES, SERVICE INNOVATION, AND QUALITY IN HEALTH CARE

Completed Research Paper

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Abstract

Rapid advancements in information technology (IT) and changing consumer requirements are forcing organizations to move from a product-based economy to a service-based economy. Tremendous opportunities await organizations that set themselves apart from their competition through service innovation. One industry which traditionally lags behind in the using IT to effectively deliver services is health care. Successful application of IT in health care could facilitate service innovation by creating new business models that redefine the traditional relationships between providers and patients. Increased data availability and transparency can bring data and process driven methods to improve health care service delivery. In this study, we examine theoretically and empirically the role of "service" in health care. Specifically, our research questions are: "what is the role of IT-based capabilities in health care facility performance?", and "what roles do service innovation and quality play in mediating the relationship between IT-based capabilities and health care facility performance?"

Keywords: IT-based Capabilities, Service Innovation, Service Quality, Health Care, Process Perspective, Empirical Study

Introduction

In today's global economy, significant changes are taking place in the way that services and goods are produced and consumed (Bryson et al. 2004). The economy is transitioning from goods-based to services-based (Rai and Sambamurthy 2006). Services now account for 75% of the U.S. gross domestic product (GDP) (Pal and Zimmerie 2005). A new "service world" is emerging in which organizations, people, technology, and regulations mediate new forms of service production and consumption; and improvements in productivity, organizational forms, and management in the service industries are giving rise to a new global economy which is characterized by service activities (Bryson et al. 2004).

One key driver of this transformation is the advancement in information and communication technologies. Bryson et al. (2004) discuss the opportunities and impacts of using IT in the services sector. In the emerging electronic economy, "customers are demanding more value, customized to their exact needs, at less cost, and as quickly as possible" (El Sawy et al. 1999 p. 305). El Sawy et al. (1999) highlight the importance of IT-intensive value innovation in meeting this demand. There is tremendous opportunity "to innovate in services, to realize business and societal value from knowledge about service, to research, develop, and deliver new information services and business services" (Spohrer and Riecken 2006, p. 31). Adopting information technology has positive effects on service innovation practices, which increase the competitive advantage of firms (Chen and Tsou 2007). Barrett and Davidson (2008) argue that information and communications technology (ICT) has transformed the role of service organizations as evident from the dramatic innovation in business models, collaborations, and work practices in service provision. Service innovation, use, and management present tremendous opportunities for information systems scholars (Rai and Sambamurthy 2006).

One industry which lags behind in the use of IT to effectively deliver services is the health care industry. The use of IT in health care can yield cost savings and improve the quality of care for patients. Health care service delivery is an important challenge faced by health care organizations, which have to find ways to improve efficiency to drive down the cost of their services and to remain financially viable. These organizations are facing pressures to control costs, while at the same time increase service quality and access to health care information. IT has the potential to play an integral role in addressing these challenges. Successful application of IT in the health care industry could facilitate service innovation by creating new business models that redefine the traditional relationships between providers and patients. Increased data availability and transparency can bring data-driven methods to improve health care service delivery. There is a pervasive need for digitally enabled services for business processes in the health care industry (Rai and Sambamurthy 2006). End-to-end process deficiencies in the health care industry include fragmented processes across payers, providers, and hospitals, poor quality of patient records, accelerating costs and slow responsiveness (IBM Research 2004).

The focus of this study is on how the exploitation of IT-based capabilities influences how health care providers innovate with service and impact organizational performance. We explore theoretically and empirically what technology-driven service means in the health care industry. Specifically, this article addressed two research questions: "what is the role of IT-based capabilities in health care facility performance?", and "what roles do service innovation and quality play in mediating the relationship between IT-based capabilities and health care facility performance?"

Literature Review

In recent years, the information systems (IS) literature has placed much emphasis on firm resources and capabilities to affect its performance. The Resource Based View (RBV) of the firm (Barney 1991; Wernerfelt 1984) postulates that competitive advantage is derived from having resources that create value in the market-place and that are unique (Medcof 2001). This theoretical lens links the performance of organizations to resources and capabilities that are firm-specific, rare, and difficult to imitate or substitute. Capabilities are derived from a firm's ability to combine resources in unique ways to promote and sustain superior performance. Capabilities are firm-specific and developed over time.

Paswan et al. (2009) present a typology for service innovation that is embedded in the service-dominant logic (SDL). SDL questions the traditional distinction between goods and services and argues that goods

are delivery mechanisms for the exchange of services (Bolton 2004; Lovelock and Gummesson 2004; Lusch et al. 2007; Vargo and Lusch 2004). Paswan et al. (2009) present their service innovation typology using an eight-cell service innovation matrix which is based the on the contextually relevant dimensions of perceived environmental uncertainty, service firm's strategic orientation, and managers' market orientation. They then discuss the research and managerial implications of the typology. While the Paswan et al. (2009) typology advances theory building in the field of service innovation and SDL, it has not been empirically validated. While their study didn't empirically test service innovation, our study does. While addressing the limitations of their study, Paswan et al. (2009) state that they did not "actively explore the notion of organizational absorptive capacity" (p. 533). Our study addresses this research gap as well by incorporating organizational learning capability as a capability in our research model.

Song et al. (2009) develop and empirically test a new staged service innovation model (SIM) in which they explicitly incorporate a service quality prelaunch training stage. They developed the new SIM based on "a combination of empirically grounded research with 53 key decision makers from four well-known companies and integration of two theoretical foundations ((NPD) and SERVQUAL)" (p. 572). The New Product Development (NPD) / New Service Development (NSD) literature suggests that new product/service performance depends on effective execution of all the process stages. According to the Service Quality (SERVQUAL) literature, service performance is related to providing continuous good service on all five components of service quality. Song et al. (2009) empirically test the new SIM model using data from 329 firms in five service industries. Their study results show that integrating prelaunch service quality training into the staged NSD process leads to more successful service innovation. Our research adds to the NSD and SERVQUAL literature in two ways. First, it sheds light on the IT-based capabilities that lead to service innovation. Second, it demonstrates that organizational performance in the health care context depends not just on the effectiveness of the process quality, but also on service innovation.

Agarwal and Selen (2009) examine the impact of collaboration through service value networks on service innovation through dynamic capability-building processes. They discuss the concept of elevated service offerings (ESO) which they define as "a new or enhanced service offering that can only eventuate as a result of a collaborative arrangement, one that could not otherwise be delivered on individual organizational merits" (p. 432). Agarwal and Selen (2009) demonstrate that higher-order dynamic capabilities in services are generated as a result of collaboration between stakeholders using empirical data from a large Australian telecommunications company. They argue that higher-order capabilities such as customer engagement, collaborative agility, entrepreneurial alertness, and collaborative innovative capacity all of which culminate in the creation and delivery of ESO emerge only through collaboration and education of the stakeholders. Agarwal and Selen (2009) state that one avenue for future research is to use strategic and operational measures for service innovation (ESO). In our study we measure the potential impact of service innovation on strategic and operational performances of the health care facilities.

Ordanini and Maglio (2009) draw upon the service dominant logic (SDL) and the new service development (NSD) literature to examine the decisions that maximize the likelihood of developing successful new services using a qualitative comparative analysis technique. They use market orientation, internal process organization, and external network as the three main decisional nodes in their NSD framework to come up with combinations that maximize service innovation success. Ordanini and Maglio (2009) tested their framework in the context of hospitality services. Their results indicate that successful NSD can be achieved through two sets of decisions. The first set of decisions is a combination of a proactive market orientation (PMO), non-responsive market orientation (non-RMO), and a formal top-down innovative process. The second set is represented by a combination of both responsive and PMO, with a significant involvement of players in the network (an open innovation model). While Ordanini and Maglio (2009) use market orientation, internal process organization, and external network as the three main decisional nodes in their framework, we use environmental uncertainty, internal process organization, and patient network in our model. Also, Ordanini and Maglio (2009) test their framework in the hospitality service industry with a qualitative analysis technique, whereas we empirically test our model in the health care industry using quantitative methods.

Bardhan et al. (2010) present a robust stakeholder analysis framework for evaluating research in services science. Their framework emphasizes the multiple roles of different stakeholders including producer

stakeholders, consumer stakeholders, intermediary stakeholders, and monitor stakeholders. Bardhan et al. (2010) use a multidisciplinary approach to their study including disciplines such as IS, computer science, economics, finance, marketing, and operations and supply chain management. They argue that the study of service science is a fundamental content area for IS research. While the Bardhan et al. (2010) study involves conceptual framework development, our study is an empirical analysis. Bardhan et al. (2010) indicate that one limitation of their study is that organizational issues such as the effects of service orientation and technology on knowledge management have not been addressed. By incorporating organizational learning capability in our research model, we address this gap in research. They add that their study has not given the producer stakeholder issues much scrutiny while much of the focus of our study is on producers of service innovation, namely the health care facilities.

In the next section, we integrate various concepts from the literature and develop a theoretical model to examine the role of IT-based capabilities in enabling service innovation and quality, and thereby enhancing the performance of health care facilities.

Theoretical Development and Research Model

The process perspective provides a powerful framework for conducting a systematic investigation of firm performance and outcomes. In a process model, output or outcome variables are not directly related to input or independent variables, but there are mediating process variables which signify a developmental progression (McGrath 1964) and they open the underlying "black box". Using the process perspective, Palvia et al. (2010) present a theoretical framework and empirically test a three-level capability–quality–performance (CQP) model to understand outsourcing vendor outcomes and their antecedents. The original CQP model developed by Palvia et al. (2010) is presented in Figure 1. In the CQP framework, the first level is capabilities, which includes relationship management, contract management, and IT management capabilities as the independent variables. Quality, the second level of the CQP framework has three mediating variables that represent process quality: partnership, service, and deliverable quality. The third level represents performance as the dependent variables and includes operational performance, and strategic performance.

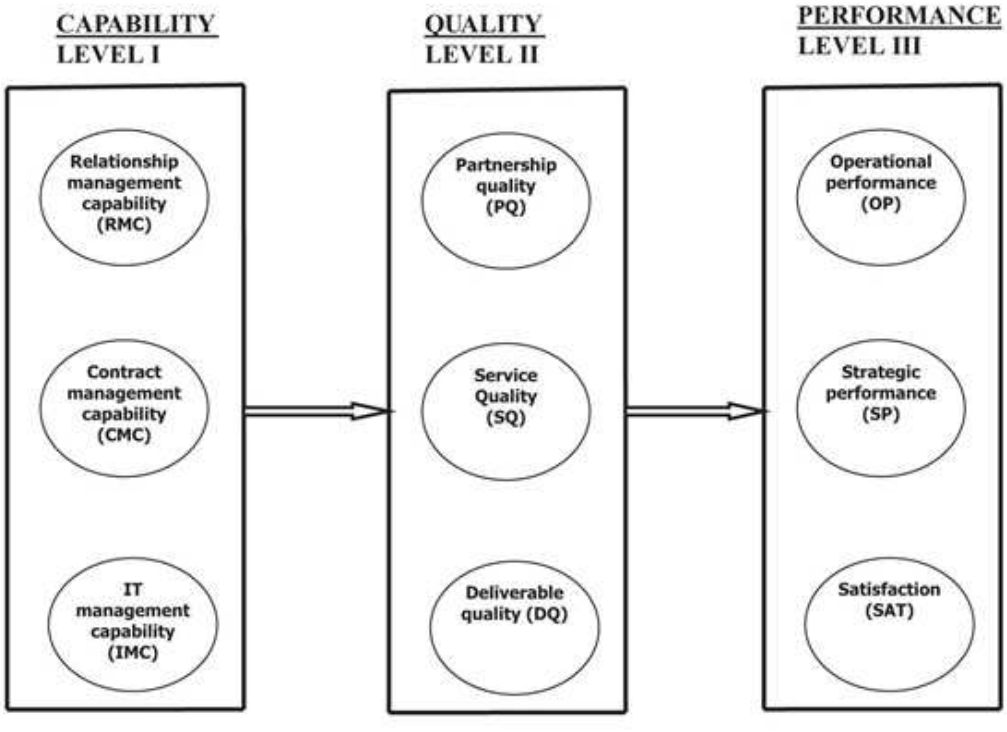

Figure 1. The Capability-Quality-Performance (CQP) Model (Source: Palvia et al. 2010)

This article extends their work by adapting the framework to the health care context and developing new constructs. In this study, the CQP model is adapted to the context of organizations that specialize in providing health care services to patients. Based on the literature, service innovation capability and organizational learning capability were added to the capabilities construct in the original CQP model. The ability of health care facilities to offer innovative services to their patients depends on the ability of the organization to develop certain capabilities that both explore for new innovations and exploit existing innovations (Wheeler 2002). We term this the service innovation capability. To be able to increase the quality of services offered to their patients, health care facilities must constantly learn from how well they are doing in providing those services. We refer to this as the organizational learning capability (Wheeler 2002). Contract management capability was dropped from our research model as no explicit service contracts are maintained between the health care facilities and their patients. With the increased role of service innovation (Barrett and Davidson 2008; Spohrer and Riecken 2006) enabled by technology, service innovation was added as a new construct to level II of the CQP model. Service innovation captured the health care facility's use of IT for exploratory and exploitative innovation (Jansen et al. 2006).

In terms of changes made to the quality construct, the other level II construct in our research model, system quality and information quality were added to the original quality variables in the CQP model since they have been identified as two of the major dimensions of IS success (DeLone and McLean 1992). Health care facilities use IS such as patient portals to deliver services to their patients. From a patient's perspective, the quality of the service provided is often synonymous with the quality of the system that delivers that service along with the quality of the information that the system delivers. System quality refers to characteristics of the IS such as reliability, response time, security features, flexibility, and ease of use (DeLone and McLean 1992). Information quality refers to the quality of the information that the IS delivers including accuracy, timeliness, relevance, readability, and usefulness (DeLone and McLean 1992). Deliverable quality was dropped since in the context of service-based health care providers, the essence of this variable is captured by service quality and partnership quality which were already a part of the original CQP model as developed by Palvia et al. (2010). While the original CQP model focused on service quality only from an interpersonal factors point of view (assurance, empathy, reliability, responsiveness etc.), our research model extends this by studying service quality from an IS success point of view by incorporating the system quality and information quality variables. The proposed research model and the main hypotheses are shown in Figure 2.

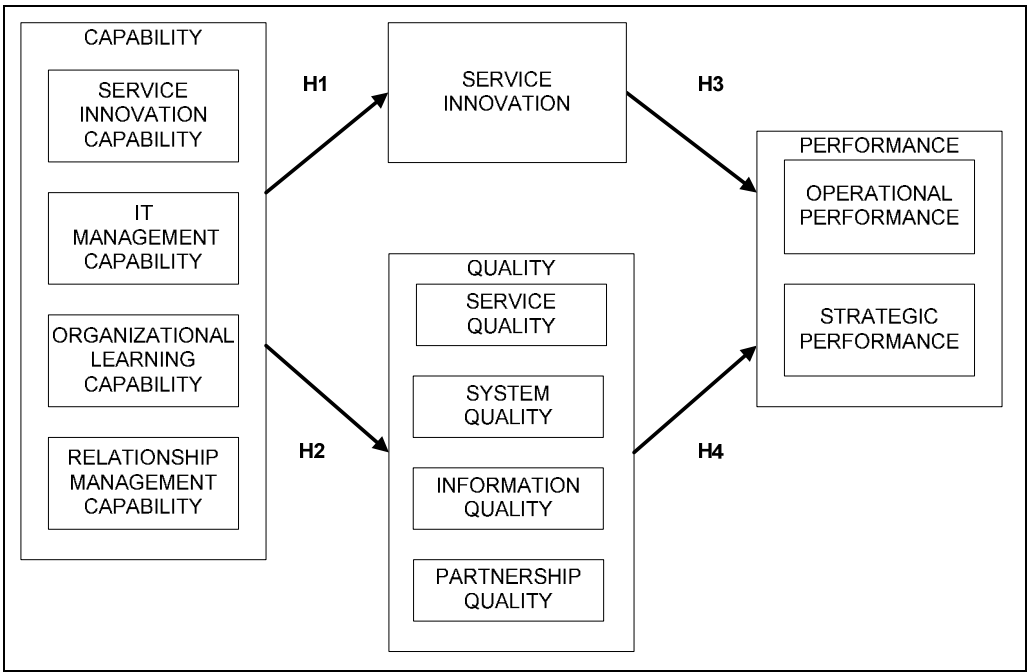

Figure 2. Research Model and Hypotheses

Capabilities

This construct refers to the capabilities of the health care provider. These capabilities include the service innovation capability, IT management capability, organizational learning capability and relationship management capability. *Service innovation capability* is the "organization's capability to reconfigure its products, services, sales channels, supply chain, etc. in a timely manner, or more simply, its ability to get the change done (Wheeler 2002, p. 133).

Palvia et al. (2010) define *IT management capability* as the "ability in areas related to computing facilities, software development, quality management, and knowledge integration" (p.236) and includes hardware, software, infrastructure, knowledge, and IS development processes. In the current context, it is defined as the health care facility's ability in areas related to computer hardware, information systems, network infrastructure, and IT services support.

Organizational learning capability is the improvement in skills and abilities achieved through learning within the firm (Bharadwaj et al. 1993; Weston et al. 1990). Bhatt and Grover (2005) define organizational learning as the "ability to search, explore, acquire, assimilate, and apply knowledge about resources, opportunities, and how resources can be configured to exploit opportunities" (p. 261). Cohen and Levinthal (1990) refer to this construct as absorptive capacity. Organizational learning communication processes are "essential to understand why firms may create or fail to create customer value from their net-enabled business efforts" (Wheeler 2002, p. 139).

Relationship management capability is the ability of a firm to develop and nurture a relationship with the client. In the present context, it is the health care provider's ability to communicate and coordinate with the patient. Service providers "who have created favorable impressions can attempt to capitalize on ongoing relationships by allocating more effort to convincing their existing customers (rather than new customers) to try their new services" (Bharadwaj et al. 1993, p. 90).

Service Innovation

This construct refers to the ability of the health care provider to offer innovative services. Jansen et al. (2006) classify innovations into two: exploratory innovation and exploitative innovation. Exploratory innovations are radical in nature and aimed at meeting the needs of emerging customers or markets whereas exploitative innovations are aimed at meeting the needs of current customers or markets and are incremental in nature (Jansen et al. 2006). While exploratory innovations require new knowledge, exploitative innovations build on existing knowledge (Jansen et al. 2006). Both aspects of innovation are captured in our study.

Quality

This construct refers to the quality of service provided by the health care provider. Four components are considered.

Service quality refers to intangible and process activities involving the patient, including interpersonal factors such as reliability, responsiveness, assurance, and empathy. It is a subjective assessment of the excellence of the customer interaction with a service provider and how well the service needs have been met (Dabholkar et al. 2000; Parasuraman et al. 1985, 1988). Service quality provides guidance on how services should be provided (reliability, responsiveness, assurance, and empathy) (Cenfetelli et al. 2008). *System quality* describes "characteristics of the information system itself which produces the information" (DeLone and McLean 1992, p.62). *Information quality* represents characteristics of the information product including accuracy, meaningfulness, timeliness, and reliability (DeLone and McLean 1992; Pitt et al. 1995). *Partnership quality* refers to integrative and cooperative behavior between the health care facility and the patient, including factors such as trust, understanding and commitment (Grover et al. 1996; Lee and Kim 1999).

Performance

This construct refers to the performance of the health care provider. Both short-term operational performance and long-term strategic performance are considered. *Operational performance* includes efficiencies, utilization of IT resources, development of capabilities, and management of resources (Grover et al. 1996; Lee and Kim 1999). *Strategic performance* includes market growth, market dominance, business value, and customer referrals (Palvia et al. 2010).

Proposed Relationships and Hypotheses

The proposed relationship between the above constructs is that the capabilities of a health care organization lead to service innovation and improved quality. These process variables in turn lead to improved organizational performance. The link between capability and performance has been studied extensively and well established in the IS and strategic management literature (e.g., Bhatt and Grover 2005; Palvia et al. 2010; Ray et al. 2004). Our model provides an unfolding of this relationship to its constituent process elements. Some support exists for individual pieces of the model. For example, Zahra and George (2002) found that organizational learning influences a firm's decision to enter new markets or to provide new services; supporting the relationship between organizational learning capability and service innovation. Cenfetelli et al. (2008) established that service quality leads to improved organization performance as measured by satisfaction. The link between partnership quality and strategic performance has also been suggested in the literature. For example, Bharadwaj et al. (1993) proposed that "firms with well-established brand reputation diversifying into new services that its existing customers may buy from can be expected to enjoy a competitive advantage, because of the lower information acquisition costs to consumers" (p. 90). Arguments for the relationship between innovation and organizational performance have also been made, e.g., Bharadwaj et al. (1993) state that "process and managerial innovations can be used to gain a competitive advantage, to the extent that the technology underlying such innovations remain proprietary" (p. 89).

Given the above arguments, we propose the following four major hypotheses:

> *H1: The ability of a health care facility to use IT to develop and support organizational capabilities such as service innovation capability, IT management capability, organizational learning capability, and relationship management capability is positively related to its ability to offer innovative health care services using IT.*
>
> *H2: The ability of a health care facility to use IT to develop and support organizational capabilities such as service innovation capability, IT management capability, organizational learning capability, and relationship management capability is positively related to its ability to offer quality health care services using IT.*
>
> *H3: The ability of a health care facility to use IT to offer innovative health care services is positively related to improvements in organizational performance attributable to the use of IT.*
>
> *H4: The ability of a health care facility to use IT to offer quality health care services is positively related to improvements in organizational performance attributable to the use of IT.*

While the above four are the major hypotheses, a detailed exploration can be conducted by expanding each hypothesis into sub-parts. For example, H2 will have 16 sub-parts where each construct within Capability is related with each construct within Quality. In total, there are 30 sub-hypotheses. They are too numerous to list individually; two examples are provided below.

> *Sub-hypothesis of H1: The ability of a health care facility to use IT to develop and support the organization's relationship management capability is positively related to its ability to offer innovative health care services using IT.*
>
> *Sub-hypothesis of H2: The ability of a health care facility to use IT to develop and support the organization's IT management capability is positively related to its ability to offer health care services with improved service quality using IT.*

Methodology

A survey research methodology was employed to address the above research questions. The unit of analysis for the study is the health care facility. The unit of data collection is the individual, i.e., the CIO or the senior IT manager of the health care facilities.

The first step of the research process involved reviewing the extant literature and coming up with multi-item measures for the variables in the research model. In the instrument design, existing validated scales were used wherever possible and were adapted for the health care context. After the preliminary instrument was prepared, it was followed by a pre-test, a pilot test, and then the full study.

The instrument was pre-tested using the help of researchers at the authors' university. Pre-test procedures included making the instrument available online, identifying six researchers for the pre-test, sending e-mails to the subjects, collecting pre-test data, and analyzing pre-test data to refine the measures. The goal of the pre-test was to ensure that the questions in the instrument were easy to understand and were not misleading or biased in any way. Minor changes were made as a result. The objective of the pilot test was to refine the measures using a field-based validation of the instrument. Eight CIOs of health care facilities serving on the advisory board of the local research center were invited to fill the online survey. While the results are not reported here, once again minor changes were made to the instrument.

The full study procedures included identifying the target sample, sending emails to the subjects in the sample, collecting data, and analyzing the data for further instrument refinement as well as for hypotheses testing. The Healthcare Information and Management Systems Society (HIMSS) Analytics database of health care executives sponsored by the Dorenfest Institute was used for data collection. As an incentive, a $10 Barnes and Noble gift certificate was offered to those completing the questionnaire. In total, 4097 email requests were sent and we received 178 responses. Many of these were incomplete and effectively there were 79 complete responses. This sample size is comparable to other such surveys. For example, the Health Data Management 2008 CIO survey attracted 90 participants (Health Data Management 2008). Similarly, the Frost and Sullivan 2010 U.S. Healthcare CIO survey solicited responses from the CIOs and top IT management professionals representing 100 health care organizations across the U.S. (Frost and Sullivan 2010). Low response rates are endemic to health care IT research (Hikmet and Chen 2003); therefore tests were conducted for response bias. Finally, structural equation modeling (SEM) was used for most of the data analysis and hypotheses testing.

Measures

A brief description of the measures and instrument items is as follows.

Service Innovation Capability (SIC) refers to the capability of the health care facility to reconfigure its products, services, sales channels, supply chain, etc. in a timely manner, or more simply, its ability to get the change done. It is based on the literature on business innovation (Wheeler 2002). A five-item measure was used.

IT Management Capability (IMC) includes hardware, software, infrastructure, knowledge, and IS development process. It is based on components of IT capability (Bharadwaj 2000; Bharadwaj et al. 2002; Subramani 2004; Swinarski et al. 2006), competencies (Levina and Ross 2003), and knowledge sharing (Lee 2001). This construct was measured using three items.

Organizational Learning Capability (OLC) refers to improvement in skills and abilities achieved through learning within the firm. The organizational learning (Bharadwaj et al. 1993; Bhatt and Grover 2005; Weston et al. 1990) and absorptive capacity (Cohen and Levinthal 1990) literature forms the basis for this construct. OLC was measured using two items.

Relationship Management Capability (RMC) refers to developing and nurturing a relationship with the patient. Emphasis is on communication and coordination. It is based on literature from coordination and collaborative communication (Goles and Chin 2005; Holmström et al. 2006; Kumar and Palvia 2002), relationship theories (Dibbern et al. 2004), client-specific capabilities (Ethiraj et al. 2005), customer orientation (Bharadwaj 2000; Levina and Ross 2003). A three-item measure was employed.

Service Innovation (SI) refers to the organization's use of IT to come up with new services. The explorative and exploitative innovation literature (Jansen et al. 2006) forms the basis for this construct. Service innovation was measured using six items.

Service Quality (SQ) refers to intangible and process activities involving the patient, including interpersonal factors such as reliability, responsiveness, assurance, and empathy. This construct is based on the literature on components of service quality (Parasuraman et al. 1988) and vendor service quality (Grover et al. 1996; Kim et al. 2005; Lin 2007). A six-item measure was used for assessing service quality.

System Quality (SYSQ) describes characteristics of the information processing system. It is based on the work on system quality (DeLone and McLean 1992), system effectiveness (Srinivasan 1985), and computer user satisfaction (Bailey and Pearson 1983). System Quality was measured using five items.

Information Quality (IQ) represents features of information systems' output including accuracy, precision, currency, timeliness, and reliability of information provided. The literature on information quality (Pitt et al. 1995) and information systems value (King and Epstein 1982) forms the basis for this construct. IQ was measured using a six-item scale.

Partnership Quality (PQ) refers to integrative and cooperative behavior between the health care facility and its patients and includes such factors as trust, understanding and commitment. It is based on the literature from components of partnership (Grover et al. 1996; Lee and Kim 1999), relationship quality (Levina and Ross 2003), shared goals (Lee 2001), and strategies for partnership (Kumar and Palvia 2002). A four-item measure was used.

Strategic Performance (SP) includes market growth, market dominance, business value, and customer referrals. Literature on long term and competitive performance (King and Malhotra 2000; Subramani 2004; Swinarski et al. 2006), strategic impact (Grover et al. 1996; Lee and Kim 1999), business value (Richmond and Seidmann 1993) provide the background for SP which was measured using three items.

Operational Performance (OP) refers to efficiencies, utilization of IT resources, development of capabilities, and management of resources. It is based on literature from technology and economic perspectives (Grover et al. 1996; Lee and Kim 1999), operational and tactical impacts (King and Malhotra 2000; Subramani 2004). A six-item measure was used.

Analysis and Results

The questionnaires were reviewed for completeness and consistency. As indicated earlier, this resulted in an effective sample size of 79 complete responses. This sample size is comparable to other such surveys. For example, the Health Data Management 2008 CIO survey attracted 90 CIO participants (Health Data Management 2008) and the Frost and Sullivan 2010 U.S. Healthcare CIO survey solicited responses from 100 health care organizations across the U.S. (Frost and Sullivan 2010).

Table 1. Comparing Early and Late Respondents

Demographic	Group	Mean	T-value	Sig (2-tailed)
Health Care Experience	Early	20.08	1.27	0.2102
	Late	16.71		
IT Experience	Early	19.52	1.43	0.1573
	Late	15.45		
Health Care Facility Size	Early	5024	1.66	0.1015
	Late	2443		
Health Care Facility Age	Early	69.48	0.83	0.4085
	Late	60.81		
Health Care Facility Location	Early	1.48	-1.29	0.2023
	Late	1.65		

The next step of the data analysis was to assess the sample response bias.

Sample Response Bias

Given the low response rate in this study and prevalent in health care IT research (Hikmet and Chen 2003), it was especially important to check for sample response bias. A common method to check for this bias is to compare characteristics of the early respondents with those of late respondents. The sample was therefore divided into two groups of early and late respondents based on the time each response was completed. Their comparison is shown in Table 1.

The respondent characteristics are very similar for both early and late respondents and there are no significant differences between the two groups. Thus the response bias is not a significant issue that could confound our results.

Demographics

As shown in Table 2, the sample respondents represent senior IS management in health care facilities. They have significant health care experience (median of 20 years) as well as much IT experience (median of 11.5 years).

Table 2. Respondents by Job Title	
CIO	48%
Director of IT/IS	19%
Director of HIM	19%
Senior IT/IS Manager	8%
Other	6%

The sample represents different types of health care facilities nationwide (Table 3) and include community, for-profit, university and government hospitals. Generally these are large and established facilities with the median number of employees being 1000 and the median age of the facility being 60 years old.

Table 3. Type of Health Care Facility	
Community/Not-for-Profit	73%
For Profit	13%
University	9%
Government	5%

Instrument Validation

The first step in instrument validation was to estimate the initial reliability for the instrument. This is a two-step process where the reliability is estimated for the whole instrument as well as for each construct in the research model. A reliability score of 0.8 or above is considered good for confirmatory purposes (Doll and Torkzadeh 1988; Straub 1989). These are shown in Table 4. The initial reliabilities for all constructs, except IT Management Capability, Organizational Learning Capability, Relationship Management Capability, and Service Quality, satisfy the suggested cutoff requirement of 0.8.

In the next stage of instrument validation, item-to-corrected total correlations were estimated at the construct level. Doll and Torkzadeh (1988) suggest using 0.5 as the cutoff for item-to-corrected total correlations. Using this criterion, five items were eliminated (IMC1, RMC1, SQ2, SQ4, and SYSQ1. Please contact the authors for a copy of the instrument and the measurement items).

Table 4. Initial Construct Reliabilities		
Construct	Number of Items	Cronbach's α (Standardized)
Service Innovation Capability	5	0.880
IT Management Capability	3	0.657
Organizational Learning Capability	2	0.742
Relationship Management Capability	3	0.676
Service Innovation	6	0.925
Service Quality	6	0.756
System Quality	5	0.815
Information Quality	6	0.856
Partnership Quality	4	0.812
Strategic Performance	3	0.834
Operational Performance	5	0.898
Environmental Dynamism	4	0.835
Environmental Competitiveness	4	0.857
Entire Instrument	56	0.978

A confirmatory factor analysis was performed next. The factor loadings for each item are greater than 0.60 as recommended by Hair et al. (1998). Thus the items are representative of their respective constructs.

Next, the construct validities are assessed using convergent and discriminant validities. Each factor loading (from Table 5) is above 0.50 and the AVE of each construct (from Table 5 below) is above 0.50, as suggested by Fornell and Larcker (1981). Therefore convergent validity is established.

Table 5. Average Variance Extracted (AVE)	
Construct	AVE
SIC	0.678
IMC	0.801
OLC	0.792
RMC	0.730
SI	0.730
SQ	0.586
SYSQ	0.675
IQ	0.582
PQ	0.641
SP	0.752
OP	0.714

To assess discriminant validity, Chin (1998) suggests checking whether the SAVE (square root of AVE) is greater than the correlations between each construct and all other constructs. An examination of the correlation matrix (Table 6) indicates that this is true for all constructs except in 5 of the total 55 comparisons. This is within the accepted range and thus discriminant validity is established.

The final step in instrument validation is to assess final reliabilities. Table 7 presents the composite reliabilities for each construct in the research model. Composite reliability is a better measure of internal consistency than Cronbach's alpha (Werts et al. 1974). The composite reliability for each construct is well above 0.70, as suggested by Nunnally and Bernstein (1978). Hence the instrument is considered reliable.

Table 6. Correlation Matrix

	IMC	IQ	OLC	OP	PQ	RMC	SI	SIC	SP	SQ	SYSQ
IMC	**0.895**										
IQ	0.541	**0.763**									
OLC	0.412	0.782	**0.890**								
OP	0.749	0.616	0.514	**0.845**							
PQ	0.492	0.804	0.729	0.589	**0.801**						
RMC	0.464	0.844	0.738	0.621	0.716	**0.854**					
SI	0.668	0.651	0.691	0.779	0.726	0.649	**0.854**				
SIC	0.642	0.674	0.734	0.798	0.641	0.657	0.873	**0.823**			
SP	0.664	0.632	0.628	0.813	0.663	0.608	0.868	0.818	**0.867**		
SQ	0.620	0.735	0.563	0.705	0.708	0.667	0.580	0.582	0.603	**0.766**	
SYSQ	0.775	0.574	0.569	0.715	0.501	0.519	0.662	0.738	0.654	0.670	**0.821**

(Note: The numbers in the diagonal are the square root of the AVE)

Table 7. Composite Reliabilities

Construct	Composite Reliability
SIC	0.912952
IMC	0.889539
OLC	0.884041
RMC	0.843996
SI	0.941576
SQ	0.847188
SYSQ	0.892281
IQ	0.892577
PQ	0.876705
SP	0.900836
OP	0.925307

Hypotheses Testing

Hypotheses testing were conducted using SmartPLS-Version 2.0 M3. A two-stage procedure was followed to test the research model. In the first stage, the major hypotheses (H1, H2, H3, and H4) were tested. Results from testing the overall model are shown in Figure 3. All paths are significant at the 0.01 level of significance. Thus the four major hypotheses are supported by our evidence.

The R-square values for the three dependent constructs namely service innovation, quality, and organizational performance are also presented in Figure 3. Service innovation had an R-square value of 0.78. Quality had an R-square of 0.77. Organizational performance had an R-square of 0.77. Thus our model is effective in explaining much of the variance in the dependent variables.

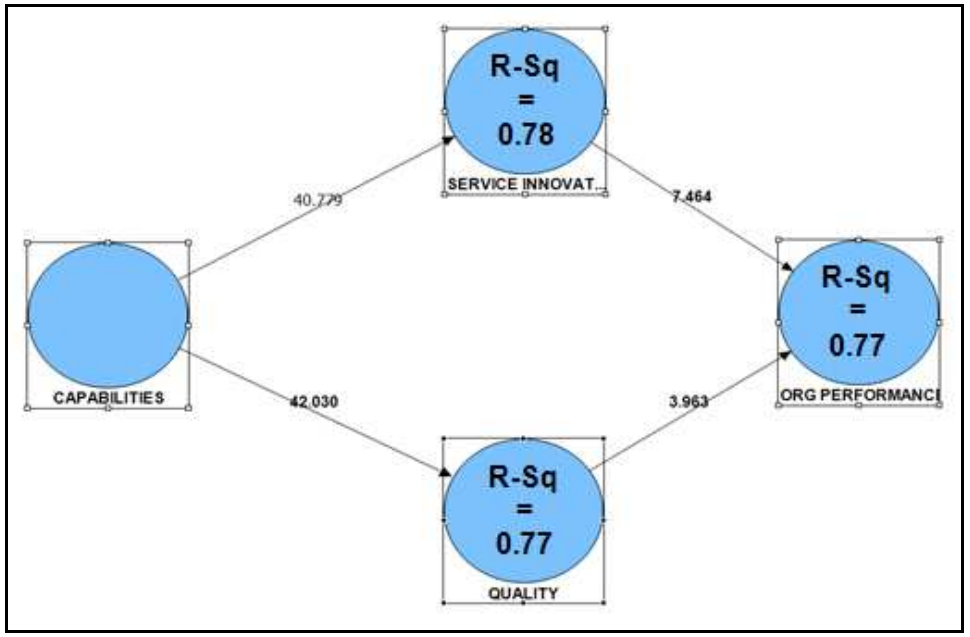

Figure 3. Testing the Main Hypotheses

In the second stage of the hypotheses testing, all of the 30 sub-hypotheses were tested using SmartPLS. Figure 4 shows these results. For clarity, only the supported sub-hypotheses are included in the figure.

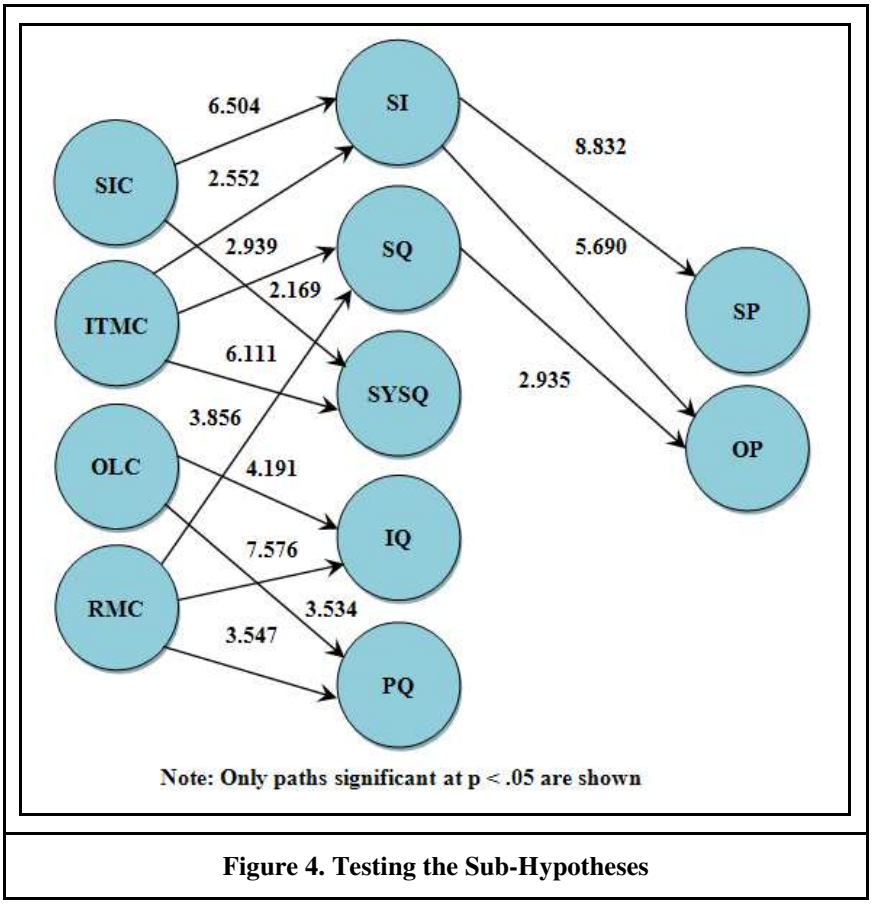

Figure 4. Testing the Sub-Hypotheses

R-Square values for the dependent constructs in the model are given in Table 8. Once again the model explains significant amount of variance.

Table 8. R-Square Values for Full Model	
Construct	R-Square
Strategic Performance	0.7717
Operational Performance	0.7356

Thirteen sub-hypotheses are supported at the 0.05 level of significance. These relationships are summarized in Table 9.

Table 9. Significant Relationships among Constructs
Service Innovation Capability to Service Innovation
Service Innovation Capability to System Quality
IT Management Capability to Service Innovation
IT Management Capability to Service Quality
IT Management Capability to System Quality
Organizational Learning Capability to Information Quality
Organizational Learning Capability to Partnership Quality
Relationship Management Capability to Service Quality
Relationship Management Capability to Information Quality
Relationship Management Capability to Partnership Quality
Service Innovation to Strategic Performance
Service Innovation to Operational Performance
Service Quality to Operational Performance

Control Variables

In order to test the robustness of the relationships, two control variables were added to the model: age of the health care facility and IT experience of the respondent. While the results are not included here due to space considerations, none of them significantly affected the path coefficients, thus providing further credibility to our results.

Discussion

This study helps us better understand the factors that affect the performance of health care facilities and how these facilities use IT-based capabilities to provide innovative services and improved service quality to their patients. The major contributions of this study are as follows: (i) this paper helps us get a better understanding of how capabilities lead to health care facility performance by shedding more light on the variables that mediate this relationship between capabilities and performance; (ii) it extends the CQP model, which is grounded in literature and theory, to examine the relationships between health care provider capabilities, quality, and performance by including the service innovation aspects; (iii) it adds to the interpersonal factors point of view of quality by incorporating IS success related variables such as system quality and information quality; and (iv) it empirically verifies the extended CQP model at the firm level using data from major health care facilities in the U.S., providing further support to the generalizability of the CQP model.

Of particular significance is the insight provided by noting that Level II variable groups (service innovation and quality) mediate the relationship between the health care facility's capabilities and its strategic and operational performance. While the link between capabilities and performance has been established in literature, the exact process by which that happens is often considered a "black box". By shedding more light on the mediator variables, this black box has been opened to facilitate a better understanding of how capabilities lead to health care facility performance. The capabilities by themselves do not lead to improved health care facility performance. It is how those capabilities are utilized that determines the competitive advantage those health care facilities can gain over their competitors. Thus by utilizing capabilities to focus on service innovation, service quality, system quality, information quality, and partnership quality, health care facilities can improve their strategic and operational performances.

Results of hypotheses testing provided strong support for the relationship between the Level I variables (capabilities) and the Level II variable group (service innovation) – H1 was supported. In terms of the relationships (sub-hypotheses) between the specific capability variables and the service innovation construct, we found support only for the relationships between service innovation capability and service innovation and between IT management capability and service innovation. This suggests that health care facilities use IT capabilities to quickly respond to patients needs for new services. The lack of support for the relationship between relationship management capability and service innovation can be understood having not found any direct literature references to support it. However, given that absorptive capacity is crucial to innovation (Rothaermel and Alexandre 2009; Tsai 2001), the lack of support for the relationship between organizational learning capability and service innovation is a little surprising. Further research should address this issue in a more incisive and comprehensive manner.

Hypotheses testing also provided strong support for the relationships between the Level I variables (capabilities) and the Level II variable group (quality) – H2 was supported. The quality variables included four types of quality: service quality, system quality, information quality, and partnership quality. We hypothesized relationships from each capability variable to the four quality measures, but only selected paths were found to be significant. We found support for the relationships between service innovation capability and system quality, between IT management capability and service quality, between IT management capability and system quality, between organizational learning capability and information quality, between organizational learning capability and partnership quality, between relationship management capability and service quality, between relationship management capability and information quality, and between relationship management capability and partnership quality. The important point to note is that not every capability is useful in improving every service dimension. For example, relationship management capability is helpful in several quality aspects, but seems to have no bearing on service innovation. Innovation capability influences actual innovation, which is not surprising, but also leads to higher system quality; but it seems to have no influence on other aspects of quality. Thus health care facilities may selectively build capabilities based on their desired service quality attributes.

The relationship between service quality and operational performance is well established in the literature (Grover et al. 1996; Kim et al. 2005; Lin 2007; Palvia et al. 2010). We also found support for the overall relationship - H4 was supported. However among the sub-hypotheses, only the relationship between service quality and operational performance was supported. There are several explanations. One reason is that in health care contexts, service quality to the patient is the overarching aspect of quality. Another explanation may be that service quality includes some aspects of system quality and information quality. Thus system quality and information quality may be secondary or complementary to service quality. Another observation is that system and information quality may have to do more with user satisfaction (Bailey and Pearson 1983; Srinivasan 1985) and IS value (King and Epstein 1982) than with strategic and operational performance. Contrary to our expectations based on the CQP model, we did not find support for the relationships between partnership quality and operational performance, and between partnership quality and strategic performance. An important lesson from these results is that "context matters". Most such studies have been performed in non-health care settings. The health care setting is both novel and unique; it offers its own challenges in the application of traditional concepts from other contexts. For example, while we included partnership quality as an intermediate construct, the construct may be inappropriate in the patient-provider relationship (Bell et al. 2002) as the patient is largely dependent on the provider. Summarizing, as per our evidence in the health care context, innovation impacts both operational and strategic performance while service quality only impacts operational performance.

Implications for Research

There are a number of opportunities for further research based on our study. First, we have not analyzed the relationships between the variable groups at each level. For example, one interesting research question could be to understand the relationship between IT management capability and the service innovation capability. By the same token, the relationships between the two mediator variable groups were not explored in this study. Future researchers could extend the study by exploring whether a relationship exists between service innovation and quality variables. Another avenue for research is to identify new capabilities and quality variables that were not included in this study. A fourth opportunity is to gain a further understanding of the service innovation construct. Researchers could split this into different types of service innovation and study the role of IT-based capabilities on those different types of service innovation. Finally, the extended CQP model can be tested in other business domains to validate its generalizability.

Implications for Practice

The findings of this research have implications for health care facilities that are looking for ways to improve their relationships with their patients. This study is aimed at providing a better understanding of how health care providers can use IT-based capabilities to increase competence in service delivery, service effectiveness, and improve quality of patient care. By acquiring such IT-based capabilities and harnessing them to improve innovation and quality, health care facilities can attract and retain more patients.

Specific recommendations to practicing health care facilities are highlighted below:

- Health care facilities should move from using IT to support the organization's functions to using IT to develop organizational capabilities related to service innovation, organizational learning, and relationship management.
- Health care facilities seeking competitive advantage in the industry can use IT to offer innovative services to their customers. Service innovation can take multiple forms including new services in the local market, services that are completely new to the health care facility, new information dissemination channels, refinements to existing services, services to increase economies of scale in existing markets, and expanded services for existing patients. Success in the health care industry is characterized by the ability of health care facilities to offer accurate, timely, meaningful information. More and more health care organizations are using IT strategically to achieve this objective. Examples of this include the use of patient portals and the use of social media tools such as Twitter by health care organizations.
- Health care facilities can use IT to enhance learning within their organization. This can be achieved through IS such as knowledge management systems which are designed to capture best practices.
- Health care facilities can also use IT to develop nurturing relationships with their patients, the emphasis being on transparent communication. IT tools designed for Customer Relationship Management (CRM) are designed specifically to achieve this.
- IT can also be used by health care facilities to improve quality of patient care by reducing the number of medical errors which is a historical problem associated with health care service providers.
- Health care facilities should keep track of the number and quality of innovative services that they offer using IT.
- IT can be used by health care facilities to improve service quality as measured by interpersonal factors such as assurance, empathy, responsiveness, and reliability. Health care organizations can use IT to provide personalized attention to their patients and to show sincere interest in solving their patients' issues.
- Health care facilities can evaluate the success of their IS by evaluating system quality and information quality and to shift the focus from IT investments to value realization from those

investments. Through the use of systems such as the patient portals, health care facilities can provide a means for patients to correct any inaccuracies in their records on their own.

- Health care facilities can use secure IT to increase patients' faith in protecting their personal information.
- Health care facilities can use IT-based capabilities to expand their market share, and increase their market dominance. They can do this by focusing on service innovation and service quality. Increased service quality will also lead to more new referrals from current patients.
- IT can also be used by health care facilities to improve their operational performance in terms of improved efficiency and effectiveness.

Thus health care facilities that use IT to improve their capabilities for service innovation and service quality have the potential to enhance their organizations' strategic and operational performance.

Limitations

The limitations of this study include issues common to the survey methodology (e.g., sample size and representativeness). While validated preexisting items were adapted from the literature, new ones that did not exist in the literature had to be created. Although the new measures were tested and validated, they can benefit from further validation.

Conclusion

This study helps us understand how health care facilities use IT-based capabilities for firm performance. Findings indicate that health care facilities use IT-based capabilities for service innovation, and for improving their service quality and this is what leads to enhanced performance at both operational and strategic levels. The recent CQP model from the literature was extended by including those IT-based capabilities that apply to a health care provider–patient relationship, by adding service innovation at Level II, and by including only those quality variables that are relevant to the health care context. The theory-based model was empirically tested with data from health care facilities in the U.S. Results of empirical testing provided strong support for the relationships between capability, service innovation, quality and performance. The study generalizes the CQP model by extending it to the health care setting, and thus has many implications for this industry which is in the throes of adopting information technology in unprecedented ways. Health care facilities that use IT to offer innovative services to their patients and that have higher levels of service quality stand to gain the loyalty of their patients thereby resulting in higher patronage from their existing patients as well as more opportunities through new referrals from their current patients.

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