



HAL
open science

IT centrality, IT management model, and contribution of the IT function to organizational performance: A study in Canadian hospitals

Guy Paré, Manon G. Guillemette, Louis Raymond

► To cite this version:

Guy Paré, Manon G. Guillemette, Louis Raymond. IT centrality, IT management model, and contribution of the IT function to organizational performance: A study in Canadian hospitals. *Information and Management*, 2020, 57, pp.103198 -. 10.1016/j.im.2019.103198 . hal-03489807

HAL Id: hal-03489807

<https://hal.science/hal-03489807v1>

Submitted on 22 Aug 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

IT Centrality, IT Management Model and Contribution of the IT Function to Organizational Performance: A Study in Canadian Hospitals

Guy Paré *

Research Chair in Digital Health
HEC Montréal
3000, chemin de la Côte-Sainte-Catherine
Montréal (Québec) H3T 2A7
Phone: (514) 340-6812
Fax: (514) 340-6132
guy.pare@hec.ca

Manon G. Guillemette

Faculty of Management
Université de Sherbrooke
manon.guillemette@usherbrooke.ca

Louis Raymond

Emeritus Professor
Université du Québec à Trois-Rivières
louis.raymond@uqtr.ca

* Corresponding author

August 17, 2019

IT Centrality, IT Management Model, and Contribution of the IT Function to Organizational Performance: A Study in Canadian Hospitals

Abstract

The characterization of the IT function in organizations represents a central topic of investigation in the information systems field. The main purpose of this study was to predict the contribution of the IT function to organizational performance by focusing on the centrality of IT and the IT management profile as primary determinants. A cross-sectional survey of CIOs working in Canadian hospitals reveals that IT centrality positively influences the strategic orientation of the IT management model. In turn, the stronger the strategic orientation of the IT management model in place, the greater is the IT function's contribution to organizational performance.

Keywords: IT centrality; IT management model; strategic IT orientation; organizational performance; hospital; CIO.

1. Introduction

As a result of the rapidly evolving digital world, it is becoming increasingly difficult for IT executives to define what the added value of IT is and what it should be. Today, IT is embedded in products and services, in customer and supplier relationships, and in business processes. Organizations must rapidly adapt to change, and they expect IT to help them succeed in doing so. Chief Information Officers (CIOs) are therefore under considerable pressure to elicit and support all aspects of the organization's existing and future strategies.

More precisely, CIOs face a double challenge when attempting to deliver value from the organization's investment in IT [1]. First, they must understand top managers' perceptions of the centrality or strategic significance of IT in their organization. The concept of IT centrality was first introduced by McFarlan and McKenny [2] and has since been taken up by other information systems researchers [3-5]. In simple terms, IT centrality refers to the idea that IT assets *'might or might not be viewed as "strategic" by top executives – that is, as being central and critical to achieving the organization's goals and implementing its strategies'* [5, p.290]. As such, IT centrality in an organization can be positioned anywhere along a continuum ranging from being a "strategic imperative" to "not mattering at all." Complexity may arise when IT centrality differs among top executives. For instance, while business unit A might perceive IT as having a high level of strategic impact on its performance and, hence, want the IT department to closely support its core activities and proactively propose new ways to improve its internal processes with technology, business unit B might prefer the IT department to play a traditional "back-office" support role, i.e., focus on selecting the best software on the market to support its information needs, and guaranteeing IT security. In this context, the CIO is left with the difficult task of

reconciling these expectations and elucidating exactly what the IT function's mission or role should be and what type of value it should achieve [6, 7].

Second, CIOs must not only identify and clarify expectations but also understand the implications of such expectations about the IT management model, that is, how the IT function is designed and managed [8-10]. In order to derive the theoretical configurations that best describe coherent IT management models in organizations, Guillemette and Paré [1] conducted a comprehensive search of the relevant literature and identified four recurring dimensions that characterize operational profiles of IT functions in organizations, namely, the range of activities performed by IT staff, the nature of the relationship between the IT function and business units and external partners, the skills and knowledge of IT professionals, and the forms of IT governance models. One of the problems CIOs encounter is making a coherent set of choices and decisions about the daily operations and activities of their IT function [11]. For example, the hiring criteria for IT professionals must consider the competencies and skills required for IT to best serve the organization. Similarly, the priorities given to different IT activities must also reflect such expectations. Further, constant changes in the IT function's environmental, organizational, and technological contexts exert more pressure on CIOs to rethink their IT management model in order to continuously improve the contribution of the IT function [12, 13].

Since IT functions are more important than ever to building the success of companies [14, 15], it is important to understand what CIOs can do to assure critical leadership. Designing effective IT functions (i.e. IT management models) has attracted the attention of several information systems researchers for more than four decades. Guillemette and Paré [1] recently shed new light on this topic by proposing a theory of the contribution of the IT function in

organizations based on a systematic review of the literature supplemented by in-depth interviews with CIOs from 24 large Canadian companies. As described in more detail later, their theory suggests that there exist five distinct IT management profiles in organizations, namely, system provider, partner, architecture builder, technological leader, and project coordinator. The theory also provides a compelling explanation of why a given IT management profile is adopted in an organization. More precisely, three contingency factors explain the adoption of specific IT management models in organizations, namely, the CIO's interpretation of how central IT is perceived by top executives, how influential he or she is in the organization, and how IT literate top managers are.

As do many information systems researchers [e.g. 16, 17], we believe that theory is not an end in itself and that theoretical contributions are only as good as their implications for future research [18]. As such, Guillemette and Paré [1] expressed their aspirations to provide a foundation for future research in the following manner: *"We need to push our theory one step further in order to advise CIOs on which profile to adopt, taking into account the environmental and/or organizational context in which the IT function operates. In other words, future research should go beyond the issue of profile adoption and investigate the appropriateness of the choices made in organizations"* (p.547). The present study attempts to fill this gap by investigating the influence of the IT function profile on organizational performance. Importantly, information systems theories need to be tested in different contexts to explore their boundaries and to identify issues that require further conceptual refinement. In this line of thought, the present study builds on and extends the work of Guillemette and Paré [1] by developing a quantitative measure for each IT management profile and further validating the relationships between the

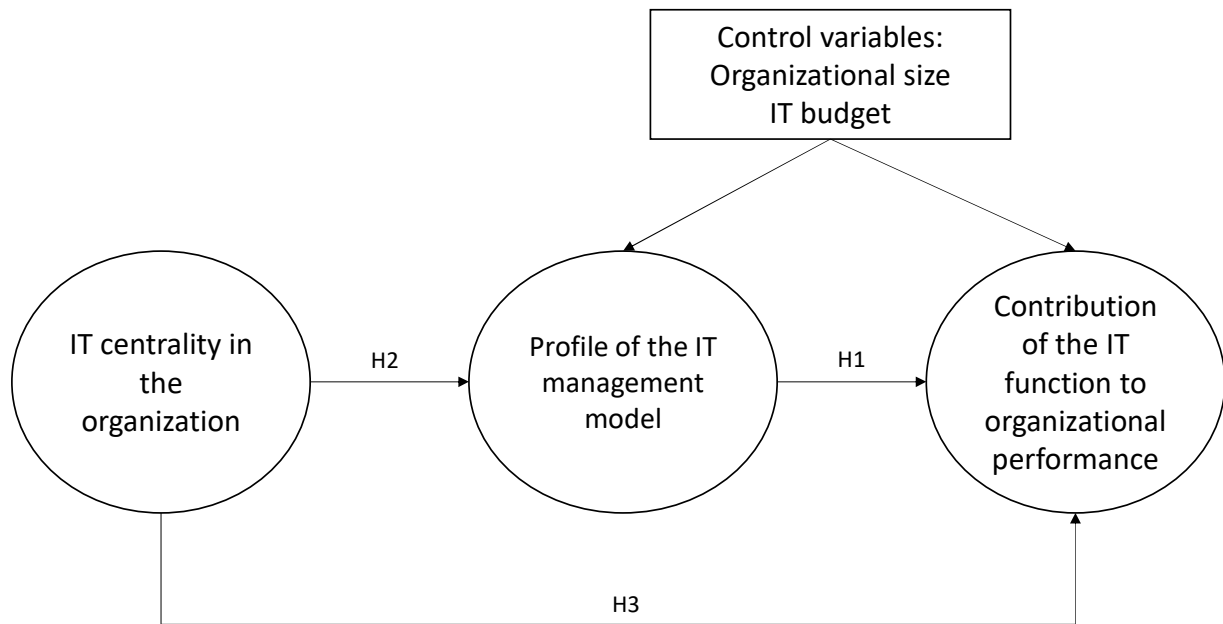
theory's core constructs against a new sample of organizations (i.e. public hospitals) using different (i.e. quantitative) analytic techniques. In doing so, we formulate and empirically validate a research model in the form of a three-construct nomological network, aiming for both clarity and parsimony [19] as we attempt to answer the following research questions: *Does IT centrality influence the IT function's contribution to organizational performance? To what extent is this association mediated by the IT management model in place?*

The remaining of this paper is structured as follows. In the following section, we define each of the core concepts included in our study and develop a series of research hypotheses. Next, the methodological approach is detailed followed by the presentation and discussion of our empirical findings. We conclude with a presentation of the study's limitations and contributions along with a few suggestions for future research.

2. Research Model and Hypotheses

As shown in Figure 1, we first hypothesize a relationship between the profile of the IT management model and the contribution made by the IT function to organizational performance (H1). As mentioned earlier, our conceptualization of the IT management model is based on the work of Guillemette and Paré [1] which comprises four dimensions.

Figure 1. Research model



First, prior research has shown that the IT function is responsible for a rich collection of *core activities* such as system development and support, outsourcing management, strategic planning, project management, technological experimentation, business process improvement, and IT infrastructure development [20]. Of utmost importance, Peppard [21] suggested that IT functions with different strategic missions may have similar activities yet be differentiated in terms of how they carry out these activities. Second, the nature and diversity of IT professionals' *knowledge and skills* are distinctly related to different IT management profiles and directly influence the nature of the IT function's contribution to the organization. While technical skills are usually at the core of IT specialists' know-how, managerial skills, i.e. interpersonal, leadership, project management, change management and business skills appear to be equally important [22, 23], as well as the ability to evaluate IT and find creative ways to improve an organization's products, services, processes and managerial decision-making [24]. Third, the

relationships of the IT function with business units and with its organizational environment may take various forms and can change depending on the primary mission of the IT function [25]. Both communication and collaboration are important forms of relationships here, and they may vary according to the profile of the IT function [3]. For example, in some relationships, the IT function leads, whereas in others, it follows orders from the organization. Sometimes the firm is heavily involved in IT projects; in other cases, it simply reviews and approves the decisions and activities of the IT function, and sometimes the relationship between the two is episodic or distant. Lastly, *IT governance* refers to how decisions about IT investments are made and who is accountable for IT project success and/or organizational performance [26]. For example, IT executives can make all IT-related decisions for the organization, or representatives of the organization's other business units may collaborate with the IT function in the decision-making process. Alternatively, business units may make their own IT-related decisions based on their specific needs.

Using these four dimensions, Guillemette and Paré [1] conceptually derived and then empirically validated five distinct profiles of the IT function: *Systems Provider*, *Architecture Builder*, *Project Coordinator*, *Partner*, and *Technological Leader*. Each of these archetypes is succinctly described below and summarized in Table 1.

Table 1. Profiles of the IT Management Model
(adapted from [1])

	←—————→				
	Operational orientation			Strategic orientation	
	Systems Provider (SP)	Architecture Builder (AB)	Project Coordinator (PC)	Partner (P)	Technological Leader (TL)
Primary Mission of the IT function consists of...	Providing IT applications that meet the needs of employees and managers along	Ensuring the performance of the IT infrastructure and maximizing the integration	Implementing an optimal procurement strategy for IT applications and coordinating	Supporting departments to improve and optimize their work processes	Stimulating innovation and supporting the strategic objectives of the

	with high quality technical support.	of IT applications.	their deployment in the various departments.	with the help of IT.	organization with the help of IT.
Core Activities are focused on ...	The acquisition / configuration of software packages or the development of information systems, as well as the technical support provided to users via a help desk.	The development and deployment of a reliable and flexible technological architecture, and management of IT applications' data integrity.	IT project management as well as the development of long-term relationships with system providers and integrators through the negotiation of outsourcing contracts.	The revision, reengineering and optimization of business processes as well as the implementation of technological solutions in business units.	Technology scanning and experimentation with emerging technologies. Active participation of the CIO in the development of the business strategy.
Relationships with business units and external partners can be characterized as follows ...	The IT department responds to requests from business units through an effective help desk. IT professionals stay outside of business units.	IT staff stay outside of business units but respond to their requests via a standardized IT architecture and they oversee communication with external partners.	The IT department acts primarily as an intermediary between business units and external partners and reacts quickly to business units' requests.	There is a close collaboration between the IT department and business units. There is a significant permanent presence of IT staff in business units.	The IT department maintains a close relationship with the top management team.
Knowledge and Skills most important for IT professionals to have are ...	Technical (programming, configuration) and interpersonal skills.	Deployment and management of IT architecture, IT infrastructure and data integration.	In-depth knowledge of IT project management principles with good negotiation and interpersonal skills.	Knowledge of the business processes in place, principles and methods of process optimization, and interpersonal skills.	Knowledge of emerging IT trends and of the main issues or challenges facing the organization and its environment.
IT Governance - Accountabilities are assigned as follows...	The IT department is responsible for developing IT systems on time and within budget. The business units are responsible for realizing the benefits	The IT department is responsible for setting up a robust and flexible IT architecture that enables the organization to adapt quickly to changing	The IT department is primarily responsible for ensuring strong IT project management and the success of the outsourcing strategy (costs and availability).	The success of IT projects is a responsibility that is fully shared between the IT department and business units.	The responsibility of the IT department goes beyond the success of IT projects and concerns the achievement of the organization's strategic objectives.

	associated these systems.	environmental conditions.			
--	------------------------------	------------------------------	--	--	--

First, the primary mission of the *System Provider (SP)* is to provide the organization with high-quality information systems that meet its needs at the lowest possible cost. It therefore places great emphasis on system development, acquisition and maintenance activities. In its day-to-day operations, the help desk serves as a link with the other business units. IT staff have strong technical skills (e.g., systems analysis and design, programming, networks). The IT function is mainly accountable for compliance with IT budgets and systems quality.

Second, the *Architecture Builder (AB)* seeks to design a flexible and integrated IT architecture that provides proper support to the organization’s present and future activities. The AB typically receives broad strategic direction from the organization and designs an architecture with which the organization can implement its strategy. IT professionals have solid technology management skills to fully grasp strategic intent and respond with appropriate architecture. The AB function takes full responsibility for IT project success and oversees communication between all business units and external partners affected by IT projects.

Third, the *Project Coordinator (PC)* primarily manages relationships between external suppliers (outsourcers) and business units in order to meet the organization’s needs. The primary value it delivers is organizational flexibility through the IT outsourcing strategy it establishes. IT staff work with the business units, helping them formalize their information requirements, and then finds one or several suppliers to develop and implement the needed systems. The IT function is responsible for controlling IT costs, ensuring systems availability, and maintaining the level of IT service for business units.

Fourth, the *Partner* (P) aims to create IT capabilities to support current and future organizational visions and strategies. IT professionals have an excellent understanding of the organization's processes and can evaluate where and how IT may be deployed to support organizational objectives. They work collaboratively with business managers and employees to understand their needs, seek new opportunities, determine needed system functionalities, and choose from among available IT options. Because of its strategic mission, the IT function assumes considerable responsibility for the organization's profitability.

Last, the primary mission of the *Technological Leader* (TL) is to identify emerging technologies, find innovative applications for them, and then implement IT-based innovations as required. Its focus is long-term and on deriving new IT-based business strategies. IT professionals have in-depth knowledge of the organization's strategy and environment as well as a deep understanding of the competitive dynamic in the industry. The IT function is very proactive in its relationship with business units and has considerable influence over them. It takes full responsibility for IT projects that it sets in motion, assuming the project leadership role until completion.

As presented in Figure 1, the first hypothesis (H1) posits that the more strategically-oriented the profile of the IT management model (i.e. IT core activities, IT skills and knowledge, IT relationships and IT governance profile corresponding to the archetypes on the right of the operational-strategic continuum illustrated in Table 1), the greater is the contribution of the IT function to organizational performance. In support of H1, Cross et al. [27] analyzed a major transformation of the IT function at British Petroleum which was led by a new CIO. At the start of the transformational trajectory, the CEO believed that IT was key to creating a global

organization and delivering higher productivity but felt that “the IT function was too heavy, pursuing its own agenda and not fully exploiting the IT marketplaces” (p. 402). Six years later, the IT function had undergone dramatic changes, moving from a SP to an AB profile. In terms of results, the IT budget had been reduced by 63% and the headcount by almost 90%. The new IT function delivered \$460 million savings to the business “without any visible loss of value” (p. 402). Another revealing case is the transformation of the IT function at Intel which went from “a mediocre IT operation to one approaching world-class status, where it was consistently rated as a strategic business partner by a majority of Intel executives” [28, p. 155]. The transformational journey, which lasted six years, also began with a new CIO who created a vision for the IT function to “enable” Intel and focused on developing leadership skills within IT. A key objective of the transformation was to run the IT function like a business by adopting best practices to improve performance, alignment, and efficiency. Following its transformation, the IT function significantly contributed to Intel’s growth, both through systems availability and improved profitability.

In light of the above examples and other cases of IT function transformation at DBS Bank [15] and Kaiser Permanente [29], to name but a few, we expect that IT function profiles such as SP, PC and AB, which play a support role without any potential for dramatically altering the organization’s strategic position or direction, will exhibit a lower contribution to organizational performance than IT management models characterized by more strategic profiles such as TL (which aims to derive new IT-based strategic opportunities) or P (which aims to be an active partner in organizational transformation initiatives). In short, H1 proposes that the contribution of the IT function to organizational performance improves when its IT management model has a more strategic orientation.

Next, we posit that there is a link between IT centrality, which manifests the importance of the IT function in an organization, and the profile of the IT management model (H2). Following Guillemette and Paré [1], it is presumed that the centrality of IT in organizations is reflected in three main elements: (1) top-management's perception of the centrality of IT to the organization, (2) the CIO's influence or status in the organization, and (3) top executives' knowledge of IT. In business firms where IT centrality is very high, IT assets are viewed as imperative to corporate success. In organizations where IT centrality is very low, IT are not viewed as being significant and are considered simply as a cost of doing business. In organizations in-between these two opposites, IT assets are considered important to operational and tactical goals mainly at the business level [5]. Now, prior research shows that IT centrality differs not only from one organization to the next but may also evolve over time in any given firm [2, 30].

In support of H2, prior studies reveal that the centrality of IT in a given organization influences its need for strategic IT management. For instance, in organizations where IT is viewed by top managers as central to business strategy (such as the P and TL profiles of the IT management model), IT planning is closely aligned with corporate planning, and a considerable degree of top-management commitment to IT activities is required [2, 3]. Conversely, in firms where IT assets are not considered vital to achieving the organization's strategic objectives (such as the SP and AB profiles), the IT function is more likely to adopt a traditional 'back-office' support model [3, 30].

IT centrality is also reflected in the CIO's credibility, status, and strategic influence in the organization. These aspects are related to the organization's recognition of the IT function's capabilities and value [5, 31]. Strategic influence concerns management decisions that have a

significant and lasting impact on the organization's performance [32]. In this sense, it is distinct from tactical or operational decision-making influence. When a CIO reports directly to the CEO and plays an active role at board meetings (rather than sitting in as an observer), he or she is able to influence the organization's strategic direction [33] and, as a result, the role that the IT function plays in the organization [34]. The informal influence exercised by a CIO on other top executives may also influence the IT function's role in an organization [4, 35]. Finally, when the CIO's strategic influence is low, the IT function often plays a support role without any potential for dramatically altering the organization's direction [36]. A final aspect of IT centrality relates to the sharing of responsibility for the acquisition and management of IT systems between IT professionals and line managers [8, 37]. In fact, when members of senior management have extensive IT knowledge, they are more inclined to form partnerships with the CIO and his or her staff [21] and to actively participate in the development and implementation of IT projects that are strategic in nature [38, 39].

In short, we hypothesize that the more central the role played by IT in an organization, i.e. the more critical it is to the mission and the success of the firm, the core activities performed by IT staff, the skills and knowledge of IT specialists, the IT function's relationships with the other organizational units, and the governance of IT in the organization will correspond more to those archetypes on the right side of the operational-strategic continuum, that is, the P and TL profiles (cf. Table 1).

Last, past research has shown that IT investments can fulfill different roles for different organizations, as each firm has specific expectations regarding IT [e.g. 40-42]. In his seminal article, Venkatraman [43] proposed a framework of IT-enabled business transformation which

goes from level 1 (localized exploitation) where “no single IT application – however powerful - is strategic in its generic form” (p. 76) to level 5 (business scope redefinition) where IT is a fundamental source of business scope reconfiguration to redefine the “rules of the game” (p. 84). A fundamental assumption underlying this framework is that the range of potential organizational benefits increases from one level to the next.

As stressed by Venkatraman [43], one of the most common questions about this framework is “Which level of transformation is appropriate for our company?” This author argues that a critical issue in deciding on the desired transformational level is to evaluate whether top executives view IT assets or capabilities as a source of opportunity or as a threat to the status quo. In this line of thought, the third hypothesis posits a direct and positive link between the centrality of IT and the contribution made by the IT function to organizational performance (H3). Precisely, we argue that the more IT capabilities are considered vital to achieving the strategic mission of the organization, and hence are perceived by top-managers as a lever that can significantly alter the organization’s strategic position and orientation, the greater is the IT function’s contribution to organizational performance. Conversely, the more IT assets are considered unessential to the organization’s mission, the poorer is the IT function’s performance in terms of its contribution to the organization. This hypothesis is also congruent with past studies that have shown that a strategic vision of IT emanating from top management is a necessary condition to achieve added value from IT [e.g. 44].

To sum up, we propose the following research hypotheses:

H1. The more strategic the profile of the IT function’s management model, the greater is the contribution made by the IT function to organizational performance.

H2. The more central IT is to the organization, the more strategic is the profile of the IT function's management model.

H3. The more central IT is to the organization, the greater is the IT function's contribution to organizational performance.

As shown in Figure 1, our research model also includes two control variables. First, organizational size has been widely investigated as an antecedent of IT management [45-47]. Second, financial resources represent another major factor recognized in the extant literature. More specifically, the IT budget has been significantly and positively related in prior studies to IT structures and IT processes [e.g. 48] and to the attainment of IT-business value [e.g. 49]. In specific sectoral or institutional contexts, organizational size has been observed to influence the strategic adoption of managerial information systems [e.g. 50], whereas the IT budget has been found to influence the effective use of mission-critical information systems [e.g. 51].

3. Methods

As many countries expend extraordinary efforts to digitize their healthcare systems, and as policy makers across the world look to IT as a means of making care services safer, more accessible, and more affordable, a significant opportunity has emerged for IT researchers to leverage their knowledge in order to both advance theory and influence practice and policy [52, 53]. In recent years, IT has become critical to achieving several healthcare organizational reform priorities, including home care, primary care, and integrated care networks [54, 55]. Hospitals, which represent core constituents of most healthcare systems, are constantly exploring IT investment opportunities to improve efficiency and promote patient safety and better quality of

care [56, 57]. Nowadays, IT is embedded in the services offered by the hospital, in its patient, supplier and other partner relationships, and in most if not all its managerial and clinical processes [58]. Be they small or large, public or private, hospitals must rapidly adapt to change, and IT is expected to enable them to do this successfully [59, 60]. A Delphi study conducted in rural, community, and academic hospitals in Canada revealed that the top IT management issues faced by CIOs were related to the strategic positioning of IT within their hospital [59]. These issues include: (1) managing demands and expectations for IT services in light of the multiple internal and external stakeholders' demands and growing user expectations, (2) information technologies competing with other clinical priorities for scarce resources in light of the fixed hospital budget and increased spending on IT, and (3) recognizing IT as a key stakeholder in major hospital decisions in light of the pressure on IT to deliver solutions. In short, CIOs in hospitals are under considerable pressure to first elicit and then support all aspects of their hospital's existing and future strategies, i.e. to manage IT strategically [61, 62].

In light of the above, it was considered both relevant and important to conduct a preliminary test of our research model in hospital settings. Our field study was conducted in Canada where specialized care services are delivered by publicly funded hospitals. The management of most Canadian hospitals is overseen by community boards of trustees, volunteer organizations or regional health authorities established by provincial governments. Hospitals are generally funded through annual, global budgets that set overall expenditure targets or limits negotiated with the provincial ministries of health or with a regional health authority or board [63].

The measures of the three core variables shown in Figure 1 were developed for the purpose of this study. First, the IT centrality measure consists of three 7-point Likert scales that characterize, from the CIO's point of view, top managers' perceptions of the centrality of IT to the organization, the extent of the CIO's strategic influence in the organization, and top managers' knowledge of the management and governance of IT. Second, the IT management model measure is based on Guillemette and Paré's [1] conceptualization of the IT function (cf. Table 1). Respondents were asked to choose, from among five statements, the one that best characterizes the IT function's management profile (1=SP; 2=AB; 3=PC; 4=P; 5=TL) in each of the profile's four dimensions (i.e., IT core activities, IT skills and knowledge, IT relationships with other organizational units, and IT governance). Third, the measure of the dependent variable consists of eleven 7-point Likert scales (1: very low performance, 7: very high performance) based on the various criteria proposed in the literature for evaluating the contribution of the IT function to organizational performance [64-66].

Following the recommendations of Boudreau et al. [67] and Straub et al. [68], the initial version of the questionnaire instrument was pre-tested with five hospital CIOs. The participants completed the questionnaire in the presence of the first author and provided their opinions about its instructions, its length, and the phrasing of the items. Following a few minor adjustments to the survey instrument, the study received final approval from the ethics committee of the first author's academic institution. The final survey items are presented in Appendix A. The revised questionnaire, with a cover letter indicating the purpose and importance of the study, was then sent to the CIOs of all acute care hospitals in the province of Quebec, Canada (N = 94). CIOs were chosen as key respondents given their in-depth knowledge of the

centrality of IT in their setting, the IT management model, and the overall contribution of the IT function to their organization's performance. A reminder letter was sent to all potential respondents four weeks after the initial mailing. In total, 72 valid responses were received (response rate of 77%).

We recognize that measuring the abovementioned variables through a self-administered questionnaire with a single respondent may pose a risk of common method bias (CMB) [69]. As precautionary measures, we placed the dependent, independent, and control variables in different sections of the questionnaire and chose different question formats and, most importantly, different scale types. Moreover, we examined the construct correlation matrix to determine if any two of our research constructs were correlated above 0.90, as this could signal the presence of CMB in our data [70]. As revealed in Table 4, there were no construct correlations above this threshold. We also employed Harman's single-factor test to check for CMB, examining the unrotated factor solution for all research variables in the measurement model. As more than one factor emerged from the principal component analysis and as no single factor accounted for 50% or more of the covariance among the variables, this further suggests the absence of CMB [71]. However, because Harman's test [69] as well as the ULMC ("unmeasured latent method construct") technique [72] remain problematical with respect to their CMB-detecting ability, we further applied the "marker variable" technique [73]. As recommended for the post hoc application of this technique, we used the smallest correlation among the research variables (cf. Appendix C) as a reliable estimate of common method variance (CMV) in order to calculate CMV-adjusted correlations [74]. Given that a high proportion (62%) of these adjusted correlations were found to be nonsignificant ($p > 0.05$) and that the originally significant correlations among the

research variables remained so when adjusted for CMV [75], it further appears that CMB is not a major threat in the present study.

4. Results

The descriptive statistics and correlation matrix for all research variables are presented in Appendices B and C, respectively. As shown in Table 2, the first result concerns the nature of the sampled hospitals' IT management model, showing mostly "hybrid" rather than "pure" profiles. This finding supports the idea that the IT function archetypes proposed by Guillemette and Paré [1] are not mutually exclusive. More specifically, whereas a majority of hospital CIOs assess their IT function's relationships (38%) and IT governance (50%) to be situated at the *Partner* level, a strong majority also assess their IT function's core activities (79%) and IT knowledge and skills (63%) to be associated with either the *System Provider* or *Architecture Builder* profile.

Table 2. Nature of IT management models (n=72)

	←—————→				
	Operational orientation			Strategic orientation	
	Systems Provider n (%)	Architecture Builder n (%)	Project Coordinator n (%)	Partner n (%)	Technological Leader n (%)
Primary mission of the IT function	21 (29%)	16 (22%)	2 (3%)	29 (40%)	4 (6%)
Core dimensions					
IT core activities	31 (43%)	26 (36%)	5 (7%)	8 (11%)	2 (3%)
IT relationships	20 (28%)	6 (8%)	9 (12.5%)	27 (37.5%)	10 (14%)
IT knowledge and skills	23 (32%)	22 (31%)	12 (17%)	5 (7%)	10 (14%)
IT governance	5 (7%)	17 (23.5%)	5 (7%)	36 (50%)	9 (12.5%)

Next, since the measure of the dependent variable was developed specifically for this study, its reliability and validity were assessed by subjecting it to an exploratory (principal

components) factor analysis with varimax rotation. As presented in Table 3, this led to the identification of two sub-dimensions: “enablement of organizational competitiveness” and “enablement of organizational agility.” The first dimension is more outward-looking and strategy-oriented, as the use of IT is meant to enable the organization to remain competitive in a more demanding institutional environment that is both service-based and knowledge-based [76]. The second dimension is more inward-looking, i.e., resources-oriented, as the use of IT is meant to enable the organization to stay agile in the face of greater environmental uncertainty and dynamism [77, 78].

Table 3. Principal components analysis of the dependent variable

Dependent construct: Contribution of the IT function to organizational performance	Components (Kaiser-Meyer-Olkin index = 0.87)	
	Enablement of organizational competitiveness	Enablement of organizational agility
Coordination of organizational units	-. ^a	.77
Realization of innovative projects	-	.69
More proactive management	-	.75
Improved productivity of personnel	-	.59
Greater agility of processes and structures	.51	.63
Improved circulation of information	.84	-
Decrease in operational costs	.56	-
Greater transfer of knowledge	.72	-
Achievement of the organization's strategic goals	.70	-
Greater ability to respond to external stakeholders' demands or requirements	.66	-
Percentage of explained variance	48.8%	9.8%
Cronbach's α	0.80	0.81

^a A dash indicates that the loading is less than 0.50.

Structural equation modeling was used to validate the research model using a component-based technique, Partial Least Squares (PLS), which is more appropriate for small samples and measurement models with endogenous formative constructs than covariance structure analysis techniques, such as LISREL and EQS [79]. As the standard reliability and validity

criteria applicable to reflective constructs do not apply to formative constructs, one must confirm that there is no multicollinearity among the formative construct indicators, that is, among the four variables that measure the “profile of the IT management model” construct. To this end, one uses the variance inflation factor (VIF) statistic, the rule being that the VIF must not be greater than 3.3 [80]. As can be seen in Appendix B, the VIF value for all four formative indicators is below this threshold, confirming the absence of multicollinearity.

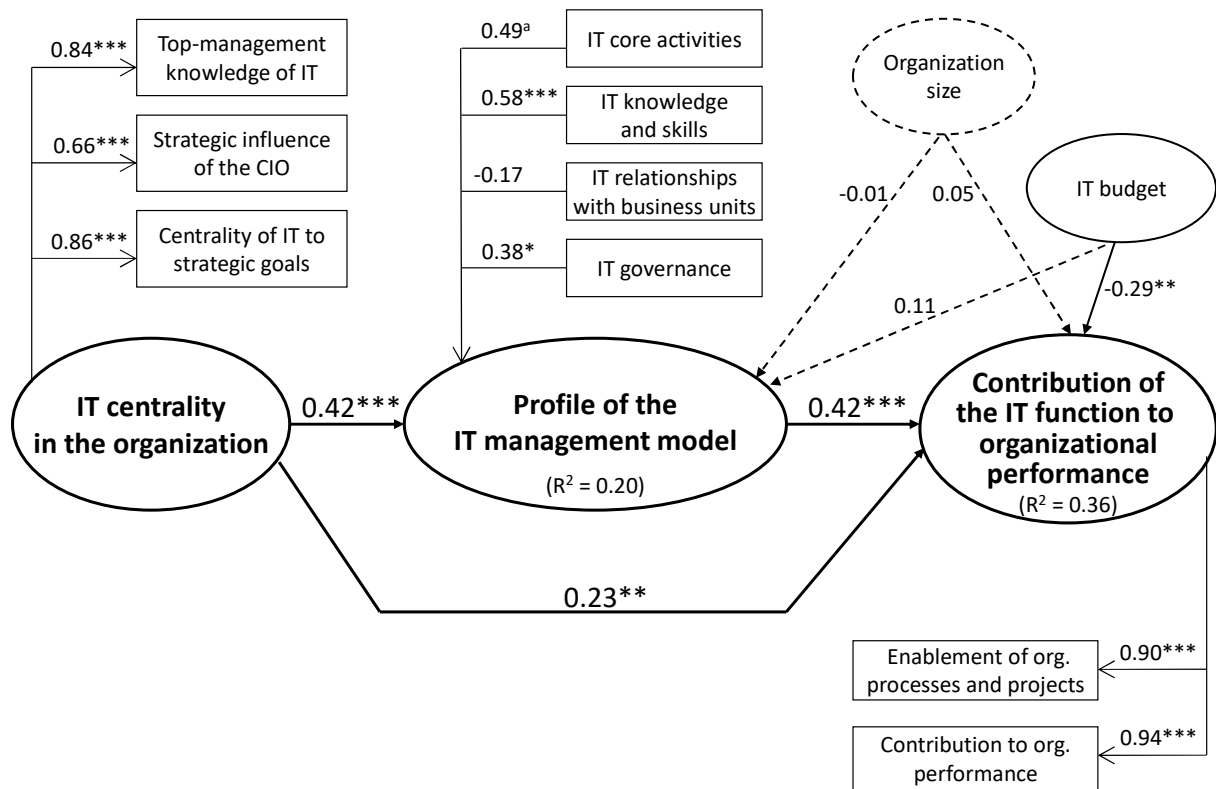
Having assessed the validity of the formative construct, we then evaluated the unidimensionality and reliability of the two reflective constructs, IT centrality and the IT function’s contribution to organizational performance. As shown in Figure 2, the fact that the indicator loadings (λ) on these constructs were greater than 0.65 confirmed their unidimensionality. The composite reliability coefficient values presented in Table 4, above the 0.80 threshold, confirm their internal consistency. There is also evidence of the convergent validity of the reflective construct because their average variance extracted is above the 0.50 threshold.

The last property to be verified is discriminant validity, which shows the extent to which each construct in the research model is unique and different from the others. In the case of formative constructs, evidence of such validity is provided by the fact that each construct shares less than 50% of its variance with any other construct (inter-construct correlation less than 0.71), as seen in Table 4 [81]. For a reflective construct, discriminant validity is verified when the variance it shares with any other construct is less than its average variance extracted.

Returning to Figure 2, the research hypotheses were tested by ascertaining the path coefficients (β) estimated by PLS. In PLS, the validity of the structural model can be assessed

through the path coefficients' strength and significance and through the research constructs' proportion of explained variance [82]. Furthermore, only those path coefficients greater than 0.20 should be considered truly significant, given that the PLS technique generally underestimates structural paths, in comparison to covariance structure analysis techniques [83].

Figure 2. Main research findings



^ap < 0.1 * : p < 0.05 ** : p < 0.01 *** : p < 0.001

Table 4. Reliability, validity, and inter-correlations of the research constructs

Construct	c.r. ^a	AVE ^b	1.	2.	3.	4.	5.
1. IT centrality in the organization	.84	.85	.92 ^c				
2. Profile of the IT management model	*	*	.43	-			
3. Contribution of IT function to org. performance	.92	.63	.41	.48	.79		
4. IT budget	-	-	.05	.14	-.21	-	
5. Hospital size	-	-	.11	.03	-.05	.33	-

^a Composite reliability = $(\sum \lambda_i)^2 / ((\sum \lambda_i)^2 + \sum (1 - \lambda_i^2))$

^b Average variance extracted = $\sum \lambda_i^2 / n$

^c Diagonal: $(AVE)^{1/2} = (\sum \lambda_i^2 / n)^{1/2}$

Sub-diagonals: correlation = $(\text{shared variance})^{1/2}$

* Inappropriate for formative constructs

4.1. Test of Hypothesis 1

A positive and highly significant path coefficient ($\beta_1 = 0.42$; $p < 0.001$) confirms our first research hypothesis, i.e., the more strategic the orientation of the IT function's management model, the greater is the contribution made by the IT function to organizational performance. Furthermore, the weight (γ) of each of the four dimensions of this orientation provides some indication of the breadth and depth of its influence on the IT function's contribution to hospital performance. Returning to Figure 2, one sees that the most influential dimension relates to the IT personnel's skills and knowledge ($\gamma = 0.58$), followed by the core activities carried out by the IT personnel ($\gamma = 0.49$) and by IT governance issues ($\gamma = 0.38$). Surprisingly, the relationships between the hospital's IT function and other organizational units appears to have no influence on the dependent variable ($\gamma = -0.17$). A plausible explanation for this might be related to the fact that this dimension represents the one over which CIOs have less control, compared to the other three.

4.2. Test of Hypothesis 2

A strong path coefficient ($\beta_2 = 0.42$; $p < 0.001$) confirms our second hypothesis, i.e. the more central IT is in the organization, the more strategic is the profile of the IT function's management model. When, in the eyes of top-management, IT constitutes a strategic necessity or a competitive lever (i.e. when IT innovation is used to improve the efficiency and effectiveness of clinical, communicational and administrative processes), hospitals are found to act in a strategically coherent manner by providing the IT function with the resources, competencies and capabilities required to leverage health IT solutions, such as EHR (electronic health record) systems, to transform and renew the healthcare organization [84].

4.3. Test of Hypothesis 3

A positive and significant path coefficient ($\beta_3 = 0.23$; $p < 0.01$) confirms the third research hypothesis, i.e. the more central IT is to the organization, the greater is the IT function's contribution to organizational performance. Here, we find a significant mediating effect of the strategic orientation of the IT management model ($\beta_1 \times \beta_2 = 0.18$; $p < 0.01$), indicating that IT centrality has both a direct effect (0.23) and an indirect effect (0.18) on the IT function's contribution to organizational performance (total effect = $0.23 + 0.18 = 0.41$) [85]. Moreover, if one removes the mediating effect and the effects of the control variables, IT centrality taken alone still explains a significant proportion of the variance in the dependent construct (18%). The value obtained from IT thus flows directly from a vision of IT as a mean for the hospital to enable clinical, communicational and administrative processes and improve overall performance. This

vision manifests in extensive IT knowledge in top management and in strong support for and high autonomy accorded to the hospital's IT function and to its CIO.

4.4. Influence of control variables and overall validity of the research model

As shown in Figure 2, the only significant control effect is the negative influence of the IT budget on the IT function's contribution ($\beta = -0.29$; $p < 0.01$). While this result may initially seem surprising, if not counter-intuitive, it could be understood in light of the absence of any significant effect of the IT budget on the strategic orientation of the IT function's management model ($\beta = 0.11$; $p \geq 0.1$). Hence, invoking the IT "alignment paradox" [77], a major IT investment that is not matched by a concomitant increase in managerial competencies in the IT function could be detrimental to attaining added value from such an investment.

Finally, in estimating the overall validity of the research model, one finds that a significant proportion of variance is explained by both the strategic orientation of the IT management model ($R^2 = 0.20$) and the IT function's contribution to organizational performance ($R^2 = 0.36$), the effect size being medium-to-large ($f^2 = 0.25$) and large ($f^2 = 0.56$), respectively. In both cases, the hospital's size and IT budget also do not add much in explained variance (3% and 4%, respectively).

5. Discussion

As mentioned earlier, the contribution of the IT function to organizational performance represents a central topic in the information systems domain. Our main intent was to contribute to the existing body of knowledge by investigating the relationships between IT centrality, the IT

function's management profile and the contribution of the IT function to organizational performance. As a preliminary test of our research model, we surveyed a sample of CIOs in Canadian hospitals.

Our results first indicate that the more strategically-oriented the IT management model, the greater is the IT function's contribution to the hospital's performance. This confirms that the strategic management of IT in hospitals requires the IT function to evolve toward a more strategic profile, i.e., a profile that provides greater enablement of organizational agility and competitiveness than is found in operational profiles [86]. CIOs should then try to develop their IT management model to bring it into closer alignment with the attributes of the *Partner* (P) or *Technological Leader* (TL) profile. As explained above, these profiles are characterized by greater attention to organizational issues and challenges and they do not strictly focus efforts on IT-related matters. In the more strategic archetypes, IT professionals have the knowledge and capacity to integrate IT and clinical/business processes so as to enable the transformation of these processes (P profile) and find innovative applications for IT that will improve hospital performance (TL profile). This finding is in line with prior studies that have shown the importance for IT functions of focusing on strategic IT alignment in order to successfully deploy IT-enabled organizational changes and achieve IT business value [e.g. 87, 88] and of creating a vision on how to use digital technologies to transform or reinvent organizations [e.g. 29, 89]. This finding is also congruent with Johnson and Lederer's [90] observation that a reactive IT strategy (as found in the *SP* and *AB* profiles) is not perceived by top executives as significantly contributing to their organization's performance.

Second, our empirical study reveals that the more central the role played by IT in a hospital, the more strategic is the profile of its IT management model. This indicates that the organizational context in which the IT function operates strongly influences the nature of the current IT management model. More specifically, our study demonstrates that the adoption of a specific model is most strongly influenced by top management's knowledge and expectations of IT and, to a lesser extent, by the CIO's influence in the hospital. One CIO clearly articulated this finding in an earlier study we conducted on this same issue: *'I believe the CIO has some influence over how the IT function is positioned in the hospital. His or her past experiences, interests and preferences certainly all play a role. However, when an influential leader such as a CEO takes a position, or the hospital's executive committee pushes the IT function in a given direction, more often than not the CIO has little latitude left. CIOs need to pay close attention to what hospital executives want. If top-management wants you to be a technological leader, then you need to be able to implement that profile, with everything that it involves. If top-managers would rather have IT as a partner, you need to find the means to assume that role.'*

Third, our study confirms that the more central the role played by IT in the organization, the greater is the IT function's contribution to the hospital's performance. As mentioned earlier, this is congruent with prior studies that have shown that a strategic orientation of IT emanating from top executives is a necessary condition to achieve significant value from IT [e.g. 44]. Other studies have also shown that the centrality of IT in an organization is highly correlated with top-managers' IT knowledge, and that both conditions have been associated with an improvement in the strategic contribution of the IT function [e.g. 91]. In short, our findings show that the IT function's contribution to hospital performance is influenced both directly and indirectly by the

centrality of IT, as perceived by hospital executives, the indirect influence being through the strategic orientation of the IT function's management model.

In terms of practical implications, our findings indicate that the hospitals that gain more value from IT are those that assign a more central role to these technologies and manage them in a more strategic manner. This underscores the importance for top executives in hospitals of developing higher levels of IT literacy and having realistic expectations if they want their IT function to better enable their hospital's agility and performance. They must also allow the CIO to play an active role at board meetings, thus enabling him or her to align the IT management model with the hospital's needs and expectations. Indeed, as shown in the above quote, it is the CIO who is accountable for aligning the IT management model with top management's strategic vision and goals. Only when all these conditions are met can hospital managers realistically expect the IT function to make a significant contribution to their organization. Hence, it is the responsibility of the CIO to convince hospital leaders of this.

Our results must be interpreted with some caution due to the study's inherent limitations. First, given the small size of the sample, its representativeness of all publicly funded as well as private hospitals is necessarily limited. Indeed, hospitals in our sample could differ from the general population of hospitals in terms of IT centrality, the IT management model, and the IT function's contribution to performance. Second, while making comparisons between IT functions in the same industry should be viewed as a legitimate approach, we acknowledge that the homogeneity of our sample also limits the generalizability of our findings to organizations in other contexts and industries. It is highly probable that IT centrality and IT management models differ significantly across industries. Third, the fact that we only considered the points of view of

one group of actors, namely CIOs, represents another limitation of our work. While we do not doubt the wisdom of this choice, we nevertheless believe that future research should cast a wider net, considering and contrasting the perceptions of CIOs and business managers when assessing the contribution of the IT function. Fourth, our research model included only two control variables, one of which was not statistically significant. Hence, future research should consider other control variables such as environmental uncertainty, industry and the CIO's professional experience, and possibly test for the moderating effects of these variables. Fifth, while the measure developed for our dependent variable had sound psychometric properties, we acknowledge that items related to the speed and quality of medical diagnoses, the shortening of waiting lists, and the efficiency of healthcare professionals could be added to the existing ones to better capture the contribution of the IT function to hospital performance. Sixth, the fact that all measures were taken at a single point in time means that causality cannot be inferred. Seventh, notwithstanding the results of our post hoc verifications for the presence of common method bias, there may yet remain some common method variance among these measures. Last, as our model explains 36% of the variance in the dependent construct, future research should investigate additional constructs, such as the hospital's IT governance and IT alignment capabilities, to better predict the contribution of the IT function to organizational performance.

6. Conclusions

The present study reveals that the contribution of the IT function to hospital performance is mainly influenced by the IT management profile which, in turn, is influenced by the degree of IT centrality in the hospital. Prior research on strategic IT management has not properly

investigated the efforts required of CIOs to build and develop a high-performing IT function. Considering this, our empirical research has shown that hospitals must manage IT strategically if they are to attain higher levels of performance through their implementation and use of IT platforms and applications. We hope that this study provides a baseline for future studies of this important and relevant topic for IT research and practice.

References

- [1] M.G. Guillemette, G. Paré, Toward a new theory of the information technology function in organizations, *MIS Quarterly*, 36 (2012) 529–551.
- [2] W.F. McFarlan, J.L. McKenny, The information archipelago - governing the new world, *Harvard Business Review*, 61 (1983) 91–99.
- [3] J. Peppard, J. Ward, 'Mind the Gap': diagnosing the relationship between the IT organisation and the rest of the business, *Journal of Strategic Information Systems*, 8 (1999) 29-60.
- [4] R. Agarwal, V. Sambamurthy, Principles and models for organizing the IT Function, *MIS Quarterly Executive*, 1 (2002) 1–16.
- [5] M.L. Kaarst-Brown, Understanding an organization's view of the CIO: the role of assumptions about IT, *MIS Quarterly Executive*, 4 (2005) 287–301.
- [6] H. Moghaddasi, A. Sheikhtaheri, CEO is a vision of the future role and position of CIO in healthcare organizations, *Journal of Medical Systems*, 34 (2010) 1121-1128.
- [7] A. Wilson, J.J. Baptista, R.D. Galliers, Performing strategy: Aligning processes in strategic IT, in: *Proceedings of the 34th International Conference on Information Systems*, Milan, Italy, 2013.
- [8] D.Q. Chen, D.S. Preston, W. Xia, Antecedents and Effects of CIO Supply-Side and Demand-Side Leadership: A Staged Maturity Model, *Journal of Management Information Systems*, 27 (2010) 231-272.
- [9] M.G. Guillemette, G. Paré, M. Mignerat, The role of institutional work in the transformation of the IT function: A longitudinal case study in the healthcare sector, *Information & Management*, 54 (2017) 349–363.
- [10] J. Vidal de Carvalho, Á. Rocha, J. Vasconcelos, Towards an Encompassing Maturity Model for the Management of Hospital Information Systems, *Journal of Medical Systems*, 39 (2015) 99.
- [11] E. Daniel, J. Ward, A. Franken, A dynamic capabilities perspective of IS project portfolio management, *Journal of Strategic Information Systems*, 23 (2014) 95–111.
- [12] I. Haffke, B. Kalgovas, A. Benlian, Options for Transforming the IT Function Using Bimodal IT, *MIS Quarterly Executive*, 16 (2017) 101–122.
- [13] L.S. Petersen, The Role of the IT Department in Organizational Redesign, *Studies in Health Technology and Informatics*, 218 (2015) 132-137.
- [14] J.W. Ross, Creating a Strategic IT Architecture Competency: Learning in Stages, *MIS Quarterly Executive*, 2 (2003) 31-43.

- [15] S.L. Woerner, P. Weill, Companies with a Digitally Savvy IT Unit Perform Better, MIT CISR Research Briefing, XIX (2019) 1-4.
- [16] D. Avison, J. Malaurent, Is Theory King? Questioning the Theory Fetish in Information Systems, *Journal of Information Technology*, 29 (2014) 327-336.
- [17] L. Willcocks, S. Gregor, O. Hendfridsson, S. Chatterjee, Panel on “Is Theory King? Questioning the Theory Fetish in Information Systems”, Special Interest Group on Philosophy and Epistemology in IS (SIGPHIL) Workshop on IS Theory: Whence Cometh, Whither Goeth? Auckland, NZ, Dec 14-15.
- [18] M.L. Markus, A. Majchrzak, L. Gasser, A Design Theory for Systems that Support Emergent Knowledge Processes, *MIS Quarterly*, 26 (2002) 179-212.
- [19] S.B. Bacharach, Organizational theories: Some criteria for evaluation, *Academy of Management Review*, 14 (1989) 496–515.
- [20] A. Masli, V.J. Richardson, M.W. Watson, R.W. Zmud, Senior Executives' IT Management Responsibilities: Serious IT-related Deficiencies and CEO/CFO Turnover, *MIS Quarterly*, 40 (2016) 687–708.
- [21] J. Peppard, Managing IT as a portfolio of services, *European Management Journal*, 21 (2003) 467–483.
- [22] D.F. Feeny, L.P. Willcocks, Core IS capabilities for exploiting information technology, *Sloan Management Review*, 39 (1998) 9–21.
- [23] G. Ray, W.A. Muhanna, J.B. Barney, Information Technology and the Performance of the Customer Service Process: A Resource-Based Analysis, *MIS Quarterly*, 29 (2005) 625-652.
- [24] P. Setia, V. Venkatesh, S. Joglekar, Leveraging digital technologies: how information quality leads to localized capabilities and customer service performance, *MIS Quarterly*, 37 (2013) 565–590.
- [25] H.A. Smith, J.D. McKeen, Developments in Practice XXXV: Building a Strong Relationship with the Business, *Communications of the Association for Information Systems*, 26 (2010) 14.
- [26] A.L. Smith, R.V. Bradley, B.C. Bichescu, M.C. Chiarini, IT governance characteristics, electronic medical records sophistication, and financial performance in U.S. hospitals: An empirical investigation, *Decision Sciences*, 44 (2013) 483–516.
- [27] J. Cross, M.J. Earl, J.L. Sampler, Transformation of the IT Function at British Petroleum, *MIS Quarterly*, 21 (1997) 401-423.
- [28] M. Curley, The IT Transformation at Intel, *MIS Quarterly Executive*, 5 (2006) 155-168.

- [29] A. Singh, T. Hess, How Chief Digital Officers Promote the Digital Transformation of their Companies, *MIS Quarterly Executive*; 16 (2017), Article 5.
- [30] B. Raghunathan, T.S. Raghunathan, Q. Tu, Dimensionality of the strategic grid framework: the construct and its measurement, *Information Systems Research*, 10 (1999) 343–355.
- [31] W. Luo, The Inclusion of CIOs in Top Management Teams: A Longitudinal Study of the Strategic Role of IT, *Information Resources Management Journal*, 29 (2016) 37–52.
- [32] D.S. Preston, D. Leidner, D. Chen, CIO leadership profiles: implications of matching CIO authority and leadership capability on IT impact, *MIS Quarterly Executive*, 7 (2008) 57–69.
- [33] L.M. Applegate, J.J. Elam, New information systems leaders: a changing role in a changing world, *MIS Quarterly*, 16 (1992) 469–490.
- [34] J. Karimi, Y.P. Gupta, T.M. Somers, The congruence between a firm's competitive strategy and information technology leader's rank and role, *Journal of Management Information Systems*, 13 (1996) 63–88.
- [35] D.H. Smaltz, V. Sambamurthy, R. Agarwal, The antecedents of CIO role effectiveness in organizations: an empirical study in the healthcare sector, *IEEE Transactions on Engineering Management*, 53 (2006) 207–222.
- [36] E. Karahanna, D.S. Preston, The effect of social capital of the relationship between the CIO and top management team on firm performance, *Journal of Management Information Systems*, 30 (2013) 15–55.
- [37] J. Ross, P. Weill, Six IT decisions your IT people shouldn't make, *Harvard Business Review*, 80 (2002) 85–91.
- [38] G. Bassellier, B.H. Reich, I. Benbasat, Information technology competence of business managers: a definition and research model, *Journal of Management Information Systems*, 17 (2001) 159–182.
- [39] D.H. Smaltz, The elevation of CIO roles: organizational barriers and organizational enablers, *Journal of Healthcare Information Management*, 14 (2000) 81–91.
- [40] G. Philip, M.E. Booth M.E, A new six 'S' framework on the relationship between the role of information systems (IS) and competencies in 'IS' management, *Journal of Business Research*, 51 (2001) 233-247.
- [41] R. Nolan, F.W. McFarlan, Information technology and the board of directors, *Harvard Business Review*, 83 (2005) 96-106.

- [42] C. Bart, O. Turel, IT and the board of directors: An empirical investigation into the "governance questions" Canadian board members ask about IT, *Journal of Information Systems*, 24 (2010) 147-172.
- [43] N. Venkatraman, IT-enabled business transformation: from automation to business scope redefinition, *Sloan Management Review*, 35 (1994) 73–88.
- [44] F. Ding, L. Dong, J.F. George, Investigating the effects of IS strategic leadership on organizational benefits from the perspective of CIO strategic roles, *Information & Management*, 51 (2014) 865–879.
- [45] L. Raymond, G. Paré, F. Bergeron, Matching information technology and organizational structure: implications for performance, *European Journal of Information Systems*, 4 (1995) 3–16.
- [46] G. Paré, C. Sicotte, Information technology sophistication in health care: an instrument validation study among Canadian hospitals, *International Journal of Medical Informatics*, 63 (2001) 205–223.
- [47] K.A. Pflughoest, K. Ramamurthy, E.S. Soofi, M. Yasai-Ardekani, F. Zahedi, Multiple conceptualizations of small business Web use and benefit, *Decision Sciences*, 34 (2003) 467–512.
- [48] Y. Lee, K.R. Larsen, Threat or coping appraisal: determinants of SMB executives' decision to adopt anti-malware software, *European Journal of Information Systems*, 18 (2009) 177–187.
- [49] A. Khallaf, M. Majdalawieh, Investigating the impact of CIO competencies on IT security performance of the U.S. federal government agencies, *Information Systems Management*, 29 (2012) 55–78.
- [50] B.B. Wang, T.T.H. Wan, D.E. Burke, G.J. Bazzoli, B.Y.J. Lin, Factors influencing health information system adoption in American hospitals, *Health Care Management Review*, 30 (2005) 44–51.
- [51] R. Amarasingham, M. Diener-West, L. Plantiga, A.C. Cunningham, D.J. Gaskin, N.R. Rowe, Hospital characteristics associated with highly automated and usable clinical information systems in Texas, United States, *BMC Medical informatics and Decision Making*, 8 (2008) 1–11.
- [52] R. Agarwal, G. Gao, C. DesRoches, A.K. Jha, Research Commentary: The Digital Transformation of Healthcare: Current Status and the Road Ahead, *Information Systems Research*, 21 (2010) 796–809.
- [53] F.C. Payton, G. Paré, C. LeRouge, M. Reddy, "Health Care IT: Process, People, Patients and Interdisciplinary Considerations" (editorial introduction), *Journal of the Association for Information Systems*, 12 (2011) pp. i-xiii.

- [54] Bureau of Health Information, Data Matters – Linking data to unlock information. The use of linked data in healthcare performance assessment, Bureau of Health Information, Sydney, New South Wales, 2015, pp. 1-39.
- [55] C. Sicotte, G. Paré, Success in Health Information Exchange Projects: Solving the Implementation Puzzle, *Social Science & Medicine*, 70 (2010) 1159–1165.
- [56] M. Jaana, M.M. Ward, G. Paré, D.S. Wakefield, Clinical Information Technology in Hospitals: A Comparison between the State of Iowa and Two Provinces in Canada, *International Journal of Medical Informatics*, 74 (2005) 719–731.
- [57] M.J. Wills, S. Sarnikar, O.F. El-Gayar, A.V. Deokar, Information systems and healthcare XXXIV: clinical knowledge management systems - Literature review and research issues for information systems, *Communications of the Association for Information Systems*, 26 (2010) 565–598.
- [58] C.K. Chow, Factors associated with the extent of information technology use in Ontario, *International Journal of Healthcare Management*, 6 (2013) 18–26.
- [59] M. Jaana, H. Tamim, G. Paré, M. Teitelbaum, Key IT Management Issues in Hospitals: Results of a Delphi Study in Canada, *International Journal of Medical Informatics*, 80 (2011) 828–840.
- [60] R.C. Leung, Health information technology and dynamic capabilities, *Health Care Management Review*, 37 (2012) 43–53.
- [61] J. Kuruzovich, G. Bassellier, V. Sambamurthy, IT governance processes and IT alignment: viewpoints from the board of directors, in: *Proceedings of the 45th Hawaii International Conference on System Sciences*, IEEE, Maui, HI, USA, 2012, pp. 5043–5052.
- [62] T.S. Waring, Information management and technology strategy development in the UK's acute hospital sector: a maturity model perspective, *Public Money & Management*, 35 (2015) 281–288.
- [63] Government of Canada, Canada's Health Care System, Health Canada, 2018.
- [64] G.G. Gable, D. Sedera, T. Chan, Re-conceptualizing information systems success: The IS-impact measurement model, *Journal of the Association for Information Systems*, 9 (2008) 377–408.
- [65] C. Ranganathan, G. Kannabiran, Effective management of information systems function: an exploratory study of Indian organizations, *International Journal of Information Management*, 24 (2004) 247–266.
- [66] C.S. Saunders, J.W. Jones, Measuring performance of the information systems function, *Journal of Management Information Systems*, 8 (1992) 63–82.

- [67] M.C. Boudreau, D. Gefen, D.W. Straub, Validation in Information Systems Research: A State-of-the-Art Assessment, *MIS Quarterly*, 25 (2001) 1–16.
- [68] D. Straub, M.C. Boudreau, D. Gefen, Validation guidelines in IS positivist research, *Communications of the Association for Information Systems*, 13 (2004) 51 p.
- [69] P.M. Podsakoff, S.B. MacKenzie, J.Y. Lee, N.P. Podsakoff, Common method biases in behavioral research: a critical review of the literature and recommended remedies, *Journal of Applied Psychology*, 88 (2003) 879–903.
- [70] P.A. Pavlou, H. Liang, Y. Xue, Understanding and mitigating uncertainty in online exchange relationships: A principal–agent perspective, *MIS Quarterly*, 31 (2007) 105-136.
- [71] P.B. Lowry, J. Gaskin, Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it, *IEEE Transactions on Professional Communication*, 57 (2014) 123-146.
- [72] W.W. Chin, J.B. Thatcher, R.T. Wright, Assessing common method bias: Problems with the ULMC technique, *MIS Quarterly*, 36 (2012) 1003-1019.
- [73] M.K. Lindell, D.J. Whitney, Accounting for common method variance in cross-sectional research designs, *Journal of Applied Psychology*, 86 (2001) 114–121.
- [74] N.K. Malhotra, S.S., Kim, A. Patil, Common method variance in IS research: A comparison of alternative approaches and a reanalysis of past research, *Management Science*, 52 (2006) 1865-1883.
- [75] H. Richardson, M. Simmering, M. Sturman, A tale of three perspectives: Examining post hoc statistical techniques for detection and correction of common method variance, *Organizational Research Methods*, 12 (2009) 762-800.
- [76] M.E. Booth, G. Philip, Technology driven and competency driven approaches to competitiveness: are they reconciliable?, *Journal of Information Technology*, 11 (1996) 143–159.
- [77] H. Liang, N. Wang, Y. Xue, S. Ge, Unraveling the alignment paradox: How does business-IT alignment shape organizational agility, *Information Systems Research*, 29 (2018) 863–879.
- [78] A. Chakravarty, R. Grewal, V. Sambamurthy, Information Technology Competencies, Organizational Agility, and Firm Performance: Enabling and Facilitating Roles, *Information Systems Research*, 24 (2013) 976-997.
- [79] N. Roberts, J.B. Thatcher, Conceptualizing and testing formative constructs: Tutorial and annotated example, *Data Base for Advances in Information Systems*, 40 (2009) 9–39.

- [80] A. Diamantopoulos, J. Sigauw, Formative vs. reflective indicators in organizational measure development: a comparison and empirical illustration, *British Journal of Management*, 17 (2006) 263–282.
- [81] S.B. MacKenzie, P.M. Podsakoff, C.B. Jarvis, The problem of measurement model misspecification in behavioral and organizational research and some recommended solutions, *Journal of Applied Psychology*, 90 (2005) 710–730.
- [82] D. Gefen, D.W. Straub, M.-C. Boudreau, Structural equation modeling and regression: guidelines for research practice, *Communications of the Association for Information Systems*, 4 (2000) 1–76.
- [83] W. Chin, How to write up and report PLS analyses, in: W.C.V. Esposito, H. Wang, J. Henseler (Eds.) *Handbook of partial least squares: concepts, methods and applications*, Springer, Berlin, 2010, pp. 655–690.
- [84] A. Bharadwaj, O. El Sawy, P.A. Pavlou, N. Venkatraman, Digital business strategy: toward a next generation of insights, *MIS Quarterly*, 37 (2013) 471–482.
- [85] C. Leth-Steensen, E. Gallitto, Testing mediation in structural equation modeling: The effectiveness of the test of joint significance, *Educational and Psychological Measurement*, 76 (2015) 339–351.
- [86] T.C. Powell, A. Dent-Micallef, Information technology as competitive advantage: The role of human, business, and technology resources, *Strategic Management Journal*, 18 (1997) 375–405.
- [87] E. Iveroth, P. Fryk, B. Rapp, Information technology strategy and alignment issues in health care organizations, *Health Care Management Review*, 38 (2013) 188-200.
- [88] D.Q. Chen, M. Mocker, D.S. Preston, A. Teubner, Information Systems Strategy: Reconceptualization, Measurement, and Implications, *MIS Quarterly*, 34 (2010) 233.
- [89] I.M. Sebastian, J.W. Ross, C. Beath, M. Mocker, K.G. Moloney, N.O. Fonstad, How Big Old Companies Navigate Digital Transformation, *MIS Quarterly Executive*, 16 (2017), Article 6.
- [90] A.M. Johnson, A.L. Lederer, CEO/CIO mutual understanding, strategic alignment, and the contribution of IS to the organization, *Information & Management*, 47 (2013) 138–149.
- [91] J. Peppard, Unlocking the performance of the chief information officer (CIO), *California Management Review*, 52 (2010) 73–99.

Appendix A. Survey items

Construct #1: IT centrality in the organization

Item 1. Please check the box that best represents how information technologies are mainly perceived by other top executives in your hospital:

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A cost source or a necessary evil			Useful in attaining operational excellence			Necessary to attain the hospital's strategic aims

Item 2. Please check the box that best represents your own influence as CIO on the hospital's strategic direction:

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very weak			Moderate			Very strong

Item 3. Please check the box that best represents top management's degree of knowledge in matters of IT management and IT governance:

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very weak			Moderate			Very strong

Construct #2: Profile of the IT management model

IT core activities

Please indicate which of the following statements best characterizes the main activities performed by the IT professionals working in the IT function:

Acquiring and parameterizing software packages and developing information systems as well as providing technical support to users through a help desk	<input type="checkbox"/>
Developing and deploying a reliable and flexible technological infrastructure as well as assuring the integrity of the data used by the various software applications	<input type="checkbox"/>
Managing IT projects as well as developing long-term relationships with IT business partners (e.g. software vendors and integrators) and negotiating IT outsourcing contracts	<input type="checkbox"/>
Revising, reengineering and optimizing administrative or clinical processes as well as implementing technological solutions within the hospital's clinical and administrative units	<input type="checkbox"/>
Technological scanning and experimenting with emerging technologies and, in reference to the CIO, actively participating in the development of the hospital's strategy	<input type="checkbox"/>

IT knowledge and skills

Please indicate which of the following statements best characterizes the main focus of the IT knowledge and skills possessed by the IT professionals working in the IT function:

The parameterization of software packages or the development of information systems, their implementation and their technical support post-implementation	<input type="checkbox"/>
The systems architecture, the technological infrastructure and the integration of data	<input type="checkbox"/>
Deep knowledge of the principles of IT project management accompanied by strong negotiating or interpersonal skills	<input type="checkbox"/>
The administrative and clinical processes in place and the application of principles and methods of process optimization	<input type="checkbox"/>
Knowledge of new trends in information technologies and the main stakes or challenges faced by the hospital's IT function	<input type="checkbox"/>

IT relationships with business units

Please indicate which of the following statements best characterizes the overall relationship between the IT function, the clinical and administrative units that use IT, and top-management:

The IT function fulfills the IT requirements transmitted to it by the units that use IT, and IT professionals are never or almost never permanently present within these units.	<input type="checkbox"/>
The IT function has no or little presence within the hospital's clinical and administrative units; its relationships with technological infrastructure suppliers and computer equipment vendors are much more developed.	<input type="checkbox"/>
The IT function acts as an intermediary between the units that use IT and the external partners (e.g. software application vendors, integrators and trainers).	<input type="checkbox"/>
There is strong collaboration between the IT function and the units that use IT, and there is a strong permanent presence of IT professionals in one or more of these units.	<input type="checkbox"/>
The IT function maintains a close relationship with the top management of the hospital, and its links with the clinical and administrative units are much less developed.	<input type="checkbox"/>

IT governance

Please indicate which of the following statements best characterizes the type of accountability in your hospital with regard to IT in general and IT projects in particular:

The IT function must complete projects within budget and deliver applications on schedule; for their part, the clinical and administrative units are responsible for attainment of the benefits associated with their use of these applications.	<input type="checkbox"/>
The IT function is mainly responsible for deploying a robust and flexible technological infrastructure that allows the hospital to adapt to changing conditions in its environment.	<input type="checkbox"/>
The IT function is mainly responsible for sound management of IT projects and the success of the IT outsourcing strategy.	<input type="checkbox"/>
The success of IT projects is a shared responsibility, i.e. the IT function and the units concerned are jointly responsible for systems delivery (on time and within budget) and for the attainment	<input type="checkbox"/>

of expected benefits.	
The responsibility of the IT function goes beyond the success of IT projects, as it also concerns the achievement of the hospital's strategic aims.	<input type="checkbox"/>

Construct #3: Contribution of the IT function to organizational performance

Please indicate the extent to which you disagree or agree with the following statements regarding the contribution of the IT function to your hospital's performance.

	Totally disagree		Neither disagree nor agree			Totally agree	
	1	2	3	4	5	6	7
Better coordination within and between the hospital's units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Realization of innovative and mobilizing projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
More proactive management of the hospital	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improved productivity of personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Greater agility of processes and structures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Improved circulation of information within the hospital	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Decrease in operational costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Greater transfer of knowledge within the hospital	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Achievement of the hospital's strategic goals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Greater ability to respond to the demands or requirements of the Ministry of Health or other external stakeholders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix B. Descriptive statistics of the research variables (n = 72)

Construct Variable	mean	s.d.	min - max	VIF ^a
IT centrality in the organization				
1. Top management's IT knowledge	4.0	0.9	2 - 6	-
2. Strategic influence of the CIO	5.6	0.9	4 - 7	-
3. Centrality of IT to strategic goals	5.7	1.2	3 - 7	-
Profile of the IT management model				
4. IT core activities	1.9	1.1	1 - 5	1.32
5. IT knowledge and skills	2.4	1.4	1 - 5	1.11
6. IT relationships	3.0	1.5	1 - 5	1.19
7. IT governance	4.0	1.2	1 - 5	1.23
Contribution of IT function to org. perf.				
8. Enablement of organizational agility	4.7	0.9	2.4 - 7.0	-
9. Enablement of org. competitiveness	5.1	0.8	2.0 - 7.0	-
Control variables				
10. IT budget (% of total budget)	0.015	0.01	.001 - .05	-
11. Hospital size (total budget in millions of \$)	137	153	8 - 990	-

^aVariance inflation factor

Appendix C. Intercorrelations of the research variables (n = 72)

Construct Variable	1.	2.	3.	4	5.	6.	7.	8.	9.	10.	11.
IT centrality in the organization											
1. Top-management's IT knowledge	-										
2. Strategic influence of the CIO	.40	-									
3. Centrality of IT to strategic goals	.54	.42	-								
Profile of the IT management model											
4. IT core activities	.13	.13	.15	-							
5. IT knowledge and skills	.34	.32	.41	.24	-						
6. IT relationships	.14	.24	.09	.38	.08	-					
7. IT governance	.26	.27	.23	.39	.26	.23	-				
Contribution of IT function to org. perform.											
8. Enablement of org. processes	.40	.15	.38	.20	.37	.18	.53	-			
9. Contribution to org. performance	.31	.02	.34	.19	.34	.01	.32	.70			
Control variables											
10. IT budget	-.02	.20	.01	.23	.09	-.01	-.06	-.25	-.11	-	
11. Hospital size	-.02	.08	.22	.18	-.07	-.03	.04	.02	-.08	.19	-

Note. Coefficients greater than 0.23 / 0.30 / 0.37 are significant (at $p < 0.05$ / 0.01 / 0.001).