Antecedents and Effects of CIO Supply-Side and Demand-Side Leadership: A Staged Maturity Model

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ABSTRACT: As organizations' information technology (IT) investment goals evolve from improving operational efficiency to enhancing strategic growth, the chief information officer (CIO) is increasingly expected to play not only the traditional supply-side leadership role that focuses on exploiting existing IT competencies to support known business needs but also the demand-side leadership role that focuses on exploring new IT-enabled business opportunities that result in competitive advantage. Using matched CIO business executive responses from 174 firms, we test a staged maturity relationship between CIO supply-side and demand-side leadership and examine three

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antecedents (CIO human capital, CIO structural power, and organizational support for IT) and two effects (IT contribution to firm efficiency and strategic growth) of CIO leadership. The staged maturity model is supported by our findings and provides insight into how these two stages of CIO leadership influence IT impact within the organization and how they are influenced by these key antecedents.

KEY WORDS AND PHRASES: chief information officer, exploitation, exploration, IT functional impact, IT leadership, staged maturity model, strategic value of IT, structural equation modeling, survey research.

THE DEGREE TO WHICH INVESTMENTS IN INFORMATION TECHNOLOGY (IT) create value for an organization depends on how IT is deployed and managed by the organization [12, 60]. As the top executive who is responsible for a firm's overall IT deployment and operations, the chief information officer (CIO) plays a critical role in ensuring that the firm derives business value from its IT investments. As both the business and the technology environments have become increasingly complex and dynamic, the responsibilities of the CIO position have changed significantly over the years [19, 34, 54], from those of an operational IT provider to those of a strategic business leader [16, 73]. In their book, Broadbent and Kitzis [16] refer to supply-side leadership as the CIO's traditional responsibilities needed to ensure that the IT function delivers cost-effective services that run seamlessly, and demand-side leadership as the CIO's more recent responsibilities that entail enabling the firm to derive strategic value from IT, thereby allowing for business innovation and transformation.

Top management has recently made increasing demands for the CIO to contribute to the organization through demand-side leadership [54]. However, our interactions with CIOs and our observations of other researchers' findings suggest that, although CIOs have generally recognized the need to adjust to the new requirements of demand-side leadership, many of them have experienced great difficulty in making such a transition. For example, Westerman and Weill [84] report that many CIOs are ranked favorably by their business executive counterparts with regard to the supply-side requirements but unfavorably with regard to the demand-side responsibilities. The current study was motivated by an intention to better understand the relationship between the CIOs' supply- and demand-side leadership and the organizational antecedents and effects of such leadership. Prior literature suggests that the job performance of a CIO is evaluated by his or her colleagues on the business side [26, 73]. As such, we define CIO supply-side leadership as the top business executives' assessments of the extent to which the CIO leads the IT function to *exploit* existing IT resources to meet ongoing known business needs. In contrast, the CIO demand-side leadership is defined as the top business executives' assessments of the extent to which the CIO leads the entire firm in *exploring* IT-enabled innovations and new strategic opportunities.

The existing CIO research has generally assumed that CIO leadership influences organizational outcomes through the contributions of the IT function [1, 26, 27, 80]. However, most of this literature has been based on anecdotal observations. The distinction between supply- and demand-side leadership is now widely recognized, but there has been a lack of research that uses a systematic approach to empirically investigate whether CIO supply- and demand-side leadership affect organizational outcomes, and if they do, whether they have different levels of influence on the various organizational outcomes. Furthermore, the current research literature provides little insight into the key individual and organizational factors that affect CIO supply- and demand-side leadership. Understanding such factors provides important insights that help explain the difficulties that CIOs are experiencing in making adjustments to the new responsibilities of demand-side leadership. Researchers have recently called for more rigorous, theory-based empirical research to advance our knowledge in the domain of CIO leadership, especially theories that embed CIO leadership within a nomological network of antecedent and consequent variables [45].

To help fill the aforementioned gaps in the extant literature, we present a research model that examines the consequences as well as the antecedents of CIO supply- and demand-side leadership. More specifically, we employ the conceptual framework of exploitation/exploration[1] [55, 59] in the organizational learning literature and the recent findings of the IT management literature to propose that the development of CIO leadership reflects a staged maturity process from supply-side to demand-side capabilities. We then incorporate strategic leadership theory and the resource-based view to articulate why and how the two stages of CIO leadership have different effects on IT functional performance. In addition, we apply the human capital and power-influence literature to identify and categorize key antecedents of CIO leadership, which include CIO individual human capital, CIO structural power level within the organization, and organizational support for the IT function.

The study enriches our understanding of the nature of CIO leadership, the individual and organizational factors that facilitate the CIO's leadership capacity, and the organizational outcomes of such leadership. The empirical findings support our hypothesized staged maturity model. Furthermore, the results indicate that the two stages of CIO leadership have different levels of impact on the IT function's contribution to firm efficiency and strategic growth. In addition, we find that CIO human capital and organizational support for IT directly influence CIO supply-side leadership, while CIO structural power directly influences CIO demand-side leadership.

Theoretical Development

MULTIPLE STREAMS OF LITERATURE PROVIDE THE GROUNDWORK for our theoretical development. To keep the study within a testable scope, we consider the most salient antecedent and consequent variables identified from prior literature. Our research model is presented in Figure 1.

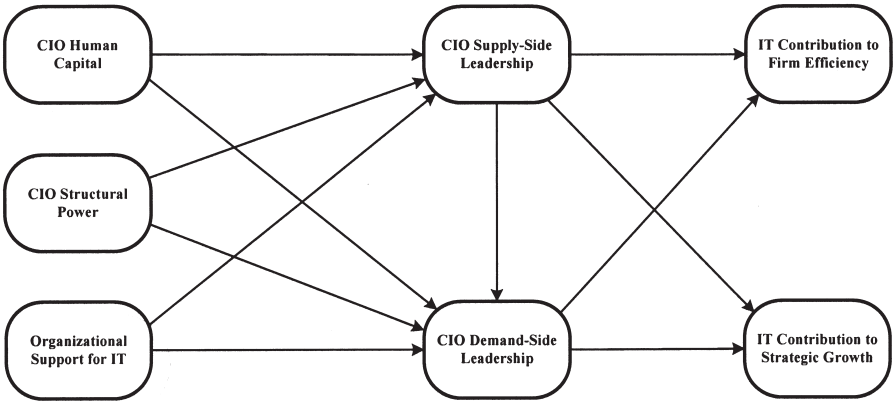

Figure 1. Research Model

Supply-Side and Demand-Side CIO Leadership

Although various prescriptive CIO responsibilities have been described in the IT literature [1, 26, 34, 46, 80], there is no universally accepted definition or conceptualization of CIO leadership, due to the multiple job responsibilities and fast-changing nature of the CIO position. Broadbent and Kitzis [16] are the first to categorize CIO leadership in terms of supply- and demand-side leadership. Given the prescriptive and descriptive nature of their book, the relationship between CIO supply- and demand-side leadership, as well as their consequences and antecedents, have not been theoretically and empirically investigated. In this paper, we use the conceptual framework of exploitation and exploration advanced by Levinthal and March [55] and March [59] in the organizational learning literature as a theoretical basis for understanding the distinction and relationship between CIO supply- and demand-side leadership and for categorizing the various CIO leadership responsibilities suggested in the existing IT literature.

Specifically, exploitation describes a process by which organizations create improvement and reliability within the *existing* competence base through refinement, selection, production, and focused attention [40, 55, 59]. Exploration refers to a process by which an organization develops a *new* competence base through search, experimentation, innovation, and risk taking [40, 55, 59]. In the context of IT management, supply-side leadership can be viewed as a CIO's capability to exploit existing IT resources and competencies to improve the efficiency of the firm's operations, whereas demand-side leadership relates to the CIO's capability to lead the organization to explore new IT-driven business opportunities that will lead to organizational innovations and business growth. Whereas CIO supply-side leadership tends to be internally focused on managing the IT function to deliver cost-effective IT support, demand-side leadership is more externally focused on partnering with business to innovate and change the business. Expanding on this conceptualization, as shown in Table 1, we categorize the various responsibilities of the CIO suggested by prior

Table 1. Categorization of CIO Leadership Responsibilities Suggested by Literature

Study	Type of study	Key findings/conclusions	Study's categorization of CIO responsibilities described*	
			Supply-side leadership (exploitation capabilities)	Demand-side leadership (exploration capabilities)
Applegate and Elam [1]	Descriptive	Senior IS executive must bring a broadened business perspective to the position; should develop IS professionals with both IS and business management experience.	Technology leader, human resources management, operations	Strategic business leader
Chatterjee et al. [19]	Event study (n = 96)	Announcements of newly created CIO positions provoke positive market reactions, particularly in industries undergoing IT-driven transformations.	Architect leader of an effective IT management capability	Facilitator-participant of senior executive envisioning IT-based strategic initiatives
Earl and Feeny [26]	Conceptual	The CIO should add value to the organization; the CEO's attitude and influence constitute the critical dependency of the CIO.	Integrator	Relationship builder
Feeny and Willcocks [27]	Conceptual	Organization should focus on developing and achieving the nine core IS capabilities (see the next two columns).	Informed buyer, contract facilitator, vendor development, contract monitoring, making technology work, architecture planner	Business leader, relationship builder, business systems thinker
Feeny et al. [28]	Descriptive/ conceptual	Successful CEO/CIO relationship is linked to a shared vision of the role of IT as a change agent.	N/A	Relationship building
Grover et al. [34]	Survey (n = 111)	CIOs differ from manufacturing and sales executives in the relative importance they place on managerial roles, defined by Mintzberg's model.	Monitor, resource allocator	Business leader, entrepreneur, spokesman, liaison

(continues)

Table 1. Continued

Study	Type of study	Key findings/conclusions	Study's categorization of CIO responsibilities described*	
			Supply-side leadership (exploitation capabilities)	Demand-side leadership (exploration capabilities)
Karimi et al. [46]	Survey (n = 213)	The rank and role of a firm's IT leader must be aligned with the firm's competitive strategy.	IT manager	Strategist, corporate officer, general business manager
McLean and Smits [61]	Conceptual	The CIO needs to play four key roles (see the next two columns).	Technologist	Enabler, innovator, strategist
Ross and Feeny [73]	Descriptive/ conceptual	The growth of CIO credibility and status within the organization is a function of the organizational learning process.	Operational manager, technology adviser, technology architect, informed buyer	Business visionary, executive team member, organizational designer
Smaltz et al. [79]	Survey (n = 100)	There are six salient CIO roles (see the next two columns), and CIO individual capabilities make CIO effective.	Relationship architect (IT contract oversight), utility provider, information steward	Strategist, educator, integrator
Stephens et al. [80]	Descriptive/ conceptual	The CIO should operate as an executive, rather than a functional manager.	Resource allocator	Executive communicator, interdepartmental network builder

* Most of the existing studies did not explicitly conceptualize the CIO responsibilities in terms of supply-side and demand-side leadership. The entries in the fourth and fifth columns are our categorization of the concepts/variables used in those studies. N/A = no relevant conceptualization was included in a particular study.

IT literature into CIO supply-side (exploitation capabilities) and CIO demand-side (exploration capabilities) leadership.

Relationship Between Supply-Side and Demand-Side CIO Leadership

Leaders of organizations need to understand the differences between the two learning processes of exploitation and exploration and allocate resources accordingly [59]. According to Levinthal and March [55], an organization that engages exclusively in exploitation will eventually suffer from obsolescence. Yet an organization that engages exclusively in exploration may not yield any directly implementable benefits. Similarly, we argue that a CIO who succeeds only in fulfilling supply-side requirements could easily become outdated and unable to keep up with the changing business environment. However, a CIO who discovers and experiments with new IT-enabled business opportunities without the capabilities to implement and convert them into business operations/values will fail to establish a necessary routine and focus [40]. Therefore, both the supply- and demand-side responsibilities are important to CIO leadership. Furthermore, we propose a staged maturity relationship between CIO supply- and demand-side leadership, contending that the CIO may not be ready to move to the more advanced strategic demand-side leadership unless he or she has successfully demonstrated capability in basic operational supply-side leadership.

The historical evolution of organizational IT investment goals over the past few decades as documented by the IT literature provides support for the staged maturity process from CIO supply-side leadership to demand-side leadership. As ITs advance rapidly, technological options and their business implications continue to expand at an accelerated speed. In the 1980s, organizations used IT mainly to improve efficiency through automating existing business processes in various individual business functions. The IT function was typically viewed as a cost center, and the CIO's role was to manage the IT function to provide reliable IT systems and service support to business functions. In today's environment, however, IT constantly provides new capabilities that can fundamentally change business processes and transform organizations, both internally and externally. Organizations that invest in IT expect to obtain not only operational efficiency but also transformative innovations that change the firm's market position. The IT function is expected to not only provide efficient and reliable technical support but also take a leading role in exploring new IT-enabled business innovations. As such, IT has become a strategically valuable organizational asset. The CIO's role has also dramatically changed from an internally oriented manager of a technical support function to an externally oriented executive who is responsible for aligning business and technology to produce competitive advantages for the firm [73]. Therefore, the historical evaluation of the CIO role suggests a staged maturity process from supply-side leadership to demand-side leadership.

The staged maturity relationship between CIO supply- and demand-side leadership is also supported by the exploitation/exploration framework in organizational theory.

For example, although the organizational learning literature is not explicit about the sequence in which exploitation and exploration occur, it is widely accepted that exploitation allows current viability while exploration ensures future viability [40, 55, 59]. In the case of the CIO, supply-side leadership represents the exploitation aspects that focus on routine operational support to business, whereas demand-side leadership represents the exploration aspects that focus on experimentation and innovation that may be considered new and risky. We note that the IT function has historically had a notoriously low success rate in completing IT projects with intended business outcomes on time and within budget. In addition, because the IT function and IT systems are generally not very flexible in responding to business changes, IT sometimes becomes an inhibitor rather than an enabler of business operational efficiency and growth. These problems often cause the IT function to lose credibility with top management [26]. We contend that if the CIO is still struggling with the requirements of supply-side leadership, he or she is often not given the opportunity to take the demand-side leadership responsibilities [53]. Karimi et al. [48] found that IT management practices became more sophisticated and IT leader roles became more advanced as firms transitioned from a focus on improving operational efficiency to growing marketing opportunities. Ross [72] asserts that CIOs need to focus on integrating the existing systems within the organization to provide efficiency through technology and data standardization before they can move on to build a more flexible modular IT architecture which allows innovation while preserving standards across the organization. Accordingly, we propose:

Hypothesis 1: CIOs who have achieved supply-side leadership are more likely to move toward demand-side leadership.

Consequences of Supply-Side and Demand-Side CIO Leadership

The CIO supply-side leadership and demand-side leadership can add value to the organization through different paths. However, there are few published studies that blend theoretical reasoning with empirical testimony to support the view that a CIO leader is personally instrumental in organizational exploitation and exploration of IT [26]. The conceptualization of transactional and transformational leadership in the strategic leadership literature [30, 85] provides a useful basis for discussing the different consequences of CIO supply- and demand-side leadership. According to Yukl [85], leadership can be described as the effort of a leader to (1) influence and facilitate the current work of the group or organization, and (2) ensure that the group or organization is prepared to meet future challenges. In general, leadership can be described by two categories: (1) transactional or managerial leadership and (2) transformational or visionary leadership [8]. Waldman et al. [83] summarized that a transactional leader is one who operates within an existing system or culture (as opposed to trying to change this culture). On the other side, transformational leaders influence major changes in the attitudes and assumptions of organizational members and build commitment for the organization's mission or objectives [8, 85].

Consistent with the strategic leadership literature, CIO supply-side leadership implies a transactional leader, whereas demand-side leadership implies a transformational leader. The strategic leadership literature also suggests that transactional and transformational leadership can have important but different influences on organizational performance [30]. Although transactional leadership may not generally create wealth directly for the firm [74], it is valuable because it can maintain wealth by helping shape structures, rewarding subordinates' efforts and commitment, and correcting mistakes and deviations from expectations, which therefore helps foster better performance of the firm [83]. Transformational leaders, on the other hand, not only influence followers by arousing strong emotions and identification with the leader but also empower and elevate followers to add value to the organization with the support of transactional leadership [8, 74].

The outcomes of leadership can be assessed using multiple criteria. The most commonly used criterion is the extent to which the leader's organizational unit performs its tasks successfully and attains its goals [85]. In our study, we examine the effect of CIO leadership by assessing how the two stages of CIO leadership influence the contributions of the IT function to the firm. While various criteria were used to evaluate IT functional performance [77], it is generally agreed upon in the literature that IT functional contribution can be assessed along the lines of internal (i.e., operational efficiency) and external (i.e., growth and differentiation) foci [62]. For example, Sabherwal et al. [75] described two primary thrusts for the IT function to support business strategy—low cost and growth. Premkumar and King [68] argued that the roles of the IT function are to improve operational efficiency and support strategic initiatives to increase market share. Barua et al. [7] developed and tested a model of IT performance that incorporated first-order effects on operational-level variables such as inventory turnover as well as on higher-order variables such as market share. Tallon et al. [81] examined IT performance within the value chain of the organization in terms of operational efficiency versus strategic positioning. From the above findings, we distinguish between two types of contributions of the IT function at the organization level: *firm efficiency* (e.g., cost savings, operating efficiency, and process improvement) and *strategic growth* (e.g., return on investment, sales revenue increase, and market share growth).

The constantly changing nature of both technology and business has made it difficult for chief executive officers (CEOs) and other business executives to clearly define CIO roles and to assess CIO performance. Building on the resource-based view of the firm, IT researchers [12, 60] have suggested that a major way for an organization to develop a competitive advantage via IT is through the development and use of superior managerial IT skills. As the leader of the organizational IT function, the CIO "determines the values and cultures of the IT function and instills the belief that an IT staff's first duty is to the contribution of achieving business solutions" [27, p. 12]. In other words, a successful CIO is the impetus behind the IT function that delivers value to the entire firm. Therefore, we propose that CIO leadership positively influences the IT function's contribution to firm performance, along the two dimensions of firm efficiency and strategic growth. This argument is consistent with the transactional/transformational

leadership theory that describes a leader as responsible for both efficiently executing current operational tasks as well as effectively dealing with future challenges that the firm faces [85]. However, supply- and demand-side leadership may have different effects on the efficiency and growth aspects of the IT functional contribution.

Specifically, we argue that supply-side leadership will have a direct effect on the efficiency aspect of the IT functional performance. This is because on the supply side CIOs are responsible for developing high-performing IT teams, building integrated information systems (IS), and keeping systems operational while managing enterprise-level IT risks [16]. These responsibilities represent the exploitation mind-set of the CIO and have direct implications to increase the efficiency and productivity of the IT function. For example, most of the IT staff work in teams with other IT members, with internal business users, and with external service providers. Thus, the IT staff's business and IT knowledge, as well as their skills in working with different stakeholders of the enterprise, are critical for completing objectives and delivering business results [9]. In addition, according to Davenport [25], if an organization's IS are fragile, so are its business processes. In other words, building integrated IS to enable seamless planning and coordination is critical to reduce business communications costs and increase business process efficiency. Further, because business and technology are highly intertwined in today's global economy, a firm must keep its key IS running continuously in sync with business operations. Thus, the quality and reliability of the IS ensure business continuity, which will in turn affect firm operational efficiency and reliability. Accordingly, we propose:

> *Hypothesis 2a: CIO supply-side leadership is positively associated with the IT function's contribution to firm efficiency.*

On the other hand, the effect of CIO supply-side leadership on the strategic growth aspect of the IT contribution is less obvious and may be indirect rather than direct as we explain below. March [59] posits that the essence of the exploitation behavior is the refinement and extension of existing competencies and technologies and therefore its returns are incremental. The resource-based view [5] provides a useful lens for understanding a staged maturity linkage from CIO supply-side leadership to IT's contribution to firm strategic growth. According to this theory, the extent to which improved IT-enabled operational efficiencies through CIO supply-side leadership can lead to competitive advantage in the marketplace is determined by how much such IT efficiency improvements are heterogeneous and inimitable [60]. In a comprehensive review of IT business value research, Melville et al. [62] categorize IT contribution as a first-order process-oriented efficiency effect and a higher-order market-oriented competitive effect. Efficiency effects emphasize an internal perspective with a focus on cost reduction and productivity enhancement of specific business processes. In contrast, competitive effects denote the attainment of competitive advantage in relation to a firm's external environment (i.e., achieving strategic growth through a unique value-creating strategy that is difficult for competitors to imitate) [5]. By exercising supply-side leadership, the CIO may enable a firm to exploit IT competence to improve process efficiency regardless of whether imitated by competitors or not [70]. However,

as process-oriented technology capabilities become widely available to all firms, such exploitation-oriented efficiency gains turn into competitive parity that may not lead to direct strategic growth. In order to obtain competitive advantage from IT investment, it has been suggested that CIOs must explore new opportunities to develop unique competitive strategies by combining IT capabilities with other complementary non-IT strategic resources and capabilities of the firm [62]. For example, Karimi et al. [47] and Mooney et al. [63] propose three separate but complementary effects of IT on business processes—automational, informational, and transformational. Barua et al. [7] report that the impact of IT on strategic performance is mediated by intermediate processes. Competitive strategies based on complementary non-IT strategic resources and capabilities are often manifested by IT-enabled business innovations and organizational transformations [17, 23]. In order to be able to identify and successfully implement organizational changes that are enabled by IT, CIOs must go beyond their internally oriented supply-side leadership to develop and exercise externally oriented demand-side leadership. Therefore, consistent with our staged maturity model, CIO supply-side leadership will not affect IT contribution to firm strategic growth unless the CIO has moved into the demand-side leadership role.

The indirect effects of CIO supply-side leadership on IT contribution to firm strategic growth can also be supported by the staging process of CIO leadership as proposed in Hypothesis 1. Sambamurthy et al. [76] argue that reliable and integrated IT infrastructure is a platform for firms to generate digital options and agility that allow business growth particularly for firms frequently engaged in more entrepreneurial actions. Kettinger et al. [50] found that firms make investments in strategic IS via their established IT base and competencies. Karimi et al. [48] report that IT leaders in firms with an IT-enabled market growth focus have a higher-level role in the organization's hierarchy than those in firms with an IT-enabled operations focus. Although CIO supply-side leadership may not have a direct effect on strategic growth, such leadership is a necessary precondition for the CIO to have the opportunity to develop and exercise demand-side leadership. Thus, we propose:

> *Hypothesis 2b: The influence of CIO supply-side leadership on IT contribution to strategic growth is completely mediated by CIO demand-side leadership.*

CIO demand-side leadership, the more advanced stage of leadership, is concerned with assessing and predicting unanticipated business needs (in the form of product and process innovations/transformations) and forming partnerships with business to identify areas for business improvements through IT. As explained by Broadbent and Kitzis, the CIO needs to set both reasonable and ambitious expectations by helping business colleagues "see what is actually possible today as well as what is unimaginable today, but will be possible tomorrow" [16, p. 35]. Specifically, to fulfill the demand-side requirements, the CIO needs to be a visionary within the organization who, based on his or her enterprise knowledge, is in charge of developing a vision of how IT can empower and revolutionize the organization [16, 19]. The CIO also needs to be recognized as a strategic leader within the organization who can shape and inform the expectations about IT-enabled business opportunities and market growth

possibilities. The CIO should be involved with business planning and create a clear IT governance structure that fits into the organizational structure to execute a shared IT vision [71]. By effectively exercising demand-side leadership, the CIO will be able to bring everybody on board to develop and implement unique competitive strategies by combining IT competencies with complementary non-IT strategic resources and changes. Such competitive strategy based on complementary resources and changes is difficult for competitors to imitate, and therefore has the potential to provide the firm with competitive advantage and strategic growth [5, 26, 27, 62]. Thus, we propose:

Hypothesis 3a: CIO demand-side leadership is positively associated with the IT function's contribution to strategic growth.

In addition to its impact on IT contribution to firm strategic growth, we contend that CIO demand-side leadership affects IT contribution to firm operational efficiency. We develop this hypothesis based on two main rationales. First, as the more advanced leadership in the maturity process, CIO demand-side leadership encompasses supply-side leadership. As we discussed earlier, a CIO cannot properly engage in strategic demand-side leadership and lead business changes and innovations if he or she is still struggling with the operational supply-side leadership in cost-effectively running a reliable IT operation. Accordingly, the effects of CIO demand-side leadership would encompass those of CIO supply-side leadership on IT contribution to firm operational efficiency, as we proposed in Hypothesis 2a.

Second, some of the new opportunities and innovations that result from CIO demand-side leadership are focused directly on fundamentally changing business processes, which will lead to dramatic improvements in the firm's operational efficiency. For example, IT has been a major driver and enabler for business process reengineering [2]. By identifying opportunities to eliminate/minimize process inefficiencies through better standardization and integration across functions within the organization and across its external value chain [35, 58], IT can greatly improve organizational control, communication, and coordination, which in turn can significantly improve firm efficiency. Successful business process reengineering involves identifying, initiating, and executing fundamental business changes that require the CIO to effectively exercise demand-side leadership.

In addition, the CIO must proactively reach out to the business executives to educate and persuade them about new process engineering opportunities that can be enabled by advanced IT capabilities. IT-enabled business process reengineering efforts cannot succeed unless business and IT understand, support, and are aligned with each other. Bassellier et al. [10] found that the more business managers know about IT, the more likely they will champion IT. Keen contends that "the CIO position is a relationship, not a job" [49, p. 55]. CIO demand-side leadership directly affects the firm's ability in successfully identifying, initiating, and executing business process reengineering efforts that are targeted at improving operational efficiency. The above rationales lead us to propose:

Hypothesis 3b: CIO demand-side leadership is positively associated with the IT function's contribution to firm efficiency.

Antecedents to Supply-Side and Demand-Side CIO Leadership

CIO leadership is normally shaped by individual attribute-based factors as well as situational factors within the organization. Whereas both levels of factors have been widely studied, Yukl [85] points out that most researchers have treated them separately in prior leadership studies and has called for a more integrative approach that includes more than one theoretical explanation to examine the antecedents to leadership. Accordingly, we propose that both CIO individual attributes and other important organizational situational factors need to be considered as antecedents of CIO leadership. Specifically, through an extensive review of the IT literature, we identified three categories of salient antecedents—the CIO's human capital, the CIO's structural power within the organization, and organizational support for the IT function (see Table 2 for a summary). Below, we employ two theoretical perspectives—the human capital perspective and the power-influence perspective—to describe the effects of the three antecedents.

CIO Human Capital

Finkelstein and Hambrick [30] argue that a good manager may be able to see or capitalize on alternatives that others cannot see due to his or her experiences and level of knowledge. This assessment is congruent with human capital theory, which suggests that a manager's human capital attributes (i.e., education, work experience, etc.) influence his or her managerial capabilities and productivity [22, 37]. Human capital of a firm, defined as the knowledge and skills of its members that can be used to produce professional services [11, 65], is recognized as a vital resource for the implementation of a firm's strategy [52]. Prior research suggests that human capital attributes, in particular those of top managers, affect firm strategies and outcomes [30, 38].

Top managers build their human capital by bringing explicit knowledge derived from formal education into their firms and by building tacit knowledge through work experience and learning on the job [38]. In this study, we examine the extent of a CIO's human capital along two dimensions—CIO educational level and CIO work experience. The strategic management literature suggests that the human capital of top executives, in the form of a knowledge base, directly influences their leadership capabilities and thereby their productivity [22, 37]. The same argument applies to CIOs. IT activities are generally considered knowledge intensive and require IT professionals to possess specific IT skills as well as industry- and firm-specific business knowledge [18]. Prior IT literature has shown that a higher level of human capital provides the capacity for CIOs to ensure that they can successfully lead the IT function and add value to the firm [3, 79].

In fact, both supply-side and demand-side leadership require the CIO to be highly knowledgeable and skillful in both IT and business domains. On the supply side, the CIO's job is to effectively exploit existing IT competencies to support business. Research has shown that past experience plays a significant role in creating *reliability* in the exploitation process (e.g., the refinement and extension of existing organizational capability) [55, 59]. Therefore, we argue that a more knowledgeable and

Table 2. Categorization of Key Antecedents to CIO Leadership Suggested by Literature

Study	CIO human capital	CIO structural power	Organizational support for IT
Applegate and Elam [1]	CIO business and IT experience	CIO power: reporting relationship and membership on the senior management strategic policy committee	
Armstrong and Sambamurthy [3]		CIO reporting relationship, top management team (TMT) membership	
Earl and Feeny [26]	CIO's loyalty to business, IS function analyst experience	CIO's TMT membership	Business sponsorship to IT
Feeny and Willcocks [27]	CIO technical and business skills		
Feeny et al. [28]	CIO's career background, CIO business orientation	CIO position in organization	CEO perception of and support for the IT function
Grover et al. [34]			Resource allocation responsibilities of IS function
Kaarst-Brown [44]		CIO's involvement in high-level business meetings	Organizational assumptions about IT
Karimi et al. [46]		The rank and role of the CIO	
Li et al. [56]	CIO tenure, education level		
Preston et al. [70]		CIO rank and TMT membership	Organizational provision of support and key resources
Ross and Feeny [73]			Executive attitudes to IT
Smaltz et al. [79]	CIO capabilities (IS and business knowledge)	Hierarchical level of CIO, TMT membership	
Stephens et al. [80]			CIO's organizational authority of resource allocation; CIO's acceptance by senior executives

experienced CIO will be more successful in demonstrating supply-side leadership. Stated formally:

Hypothesis 4a: CIO human capital is positively associated with CIO supply-side leadership.

On the demand side, the CIO needs to lead the organization to explore alternative approaches in order to leverage IT to enable changes. Organizational studies suggest that knowledge and experience are important for creating *variety* in the exploration process (e.g., the discovery and experimentation of new ways to conduct business) [55]. Extant IT management and CIO literature also suggest that the CIO needs to be equipped with both IT and business knowledge to educate and persuade business executives and build strong IT/business partnerships to identify the best IT-enabled initiatives [9, 46, 48, 71]. We therefore argue that CIO human capital also contributes to CIO demand-side leadership. Thus,

Hypothesis 4b: CIO human capital is positively associated with CIO demand-side leadership.

CIO Structural Power

The CIO functions within a specific organizational context; therefore, the ability of the CIO to act as a leader is influenced not only by his or her individual capability but also by organizational factors that either facilitate or hinder his or her level of leadership. The power-influence research examines the influence processes between leaders and other organizational actors. According to Yukl [85], to understand the factors that influence effective leadership, researchers need to analyze the complex power relationships and influence processes found in all organizations. Because power is viewed as important not only for influencing subordinates but also for influencing peers, superiors, and other individuals outside the organization (e.g., clients and vendors) [15], the power-influence perspective helps us identify and examine factors that affect the leadership of a CIO who has multiple responsibilities across the organization.

Structural power, a power based on formal organizational structure and hierarchical authority [24], is perhaps the most commonly cited type of executive power [29]. As pointed out by Hofstede [39], the hierarchy within an organization creates the power distance between the organizational members, including that between business executives. Prior research has suggested that structural power, as compared to alternative constructs of power, is most strongly associated with an executive's overall power level [24, 29].

We define CIO structural power as the CIO's level of legitimate power due to his or her formal position within the hierarchy of the organization. Because the legitimacy of the CIO position has not been fully established in many organizations [44], the structural power of the CIO (in the form of the formal membership in the top management team [TMT] and the reporting level to the CEO) is essential [3]. For the CIO to be able to act as both a supply- and demand-side leader, he or she must have appropriate levels of structural power within the organization.

As we described earlier, the supply-side leadership requires the CIO to develop a successful IT organization, build integrated enterprise systems, and keep the systems operational. The IT management literature has suggested that the introduction of most systems would cause business changes in terms of processes, structure, employee job specifications, employee skills, incentives, and so forth. Consequently, the assessment of the effectiveness of these IS is largely dependent on business users' acceptance and use of the systems [51]. Therefore, it is important that the CIO have sufficient structural power, which allows the CIO not only to exercise his or her supply-side leadership to provide the right IT services to meet business operational needs but also to educate and encourage the business users to adopt and utilize the technology [14]. Therefore, we posit:

Hypothesis 5a: CIO structural power is positively associated with CIO supply-side leadership.

Hofstede [39] points out that a smaller power distance reduces the emotional distance between the boss and the staff and encourages an organizational culture in which the staff feels more comfortable to challenge the boss. At the same time, a smaller power distance enables the boss to be able to more frequently consult with the staff. Accordingly, we argue that a higher level of structural power will not only reduce the power distance but would be more likely to facilitate a collaborative relationship between the CIO and the CEO and other top business executives [9, 10]. Therefore, a higher level of structural power will more likely provide the CIO with the legitimacy, opportunity, and leeway to bridge the gap between business and IT and shape the perceptions of other business executives about the strategic value of IT. Applegate et al. [2] suggest that as IT activities become more strategically important to the firm, the position of the CIO should match the amount of strategic thinking that is required. Karimi et al. [46] found that to be successful, the rank and role of a firm's IT leader must be aligned with the firm's competitive strategy. Thus,

Hypothesis 5b: CIO structural power is positively associated with CIO demand-side leadership.

Organizational Support for IT

Organizational support for the IT function is another key situational factor that influences the CIO's level of leadership [44]. Prior research suggests that the CIO simply cannot achieve performance goals without the necessary resources and support from the firm [26]. In addition, organizational support can have important signaling effects. Organizational support for the IT function provides a signal to the rest of the firm about the instrumental worth and effective valuation of the CIO and about the importance of IT to achieve the overall firm goals [42]. Further, if the CIO perceives that the organization supports IT initiatives, he or she is more likely to develop greater organizational commitment and will thereby increase his or her productivity and facilitate his or her level of leadership [31]. Specifically, if the firm provides adequate financial support

and resources to the IT function, it will enable the CIO to more effectively fulfill the supply-side responsibilities (i.e., building high-quality IT staff teams, delivering integrated systems across the organization, and keeping the systems operational and secure). We therefore propose:

Hypothesis 6a: Organizational support for IT is positively associated with CIO supply-side leadership.

In terms of the effects of the organizational support on the CIO demand-side leadership, prior studies have shown that a leader's vision cannot be effectively implemented unless the leader is backed with the proper resources [13]. In addition, sufficient organizational support for IT also increases the capacity of the IT function to explore as well as carry out strategic initiatives and allows the CIO to pursue and exercise a wide range of strategic options to lead other business executives toward building a more agile and flexible organization [76]. We therefore propose:

Hypothesis 6b: Organizational support for IT is positively associated with CIO demand-side leadership.

Research Methodology

Measurement

To test the research model and hypotheses, we employed a two-stage field study approach to collect survey data from matched CIOs and top business executives. The questionnaires contained a number of existing valid measures that were adapted to our research context. Where validated scales did not exist, new items were created following standard instrument development procedures. All constructs were measured using multi-item scales. The questionnaires were validated using a three-step process. First, semistructured interviews were held with five CIOs and business executives to assess content validity and to gain richer insights into the phenomenon. Second, we conducted an item-sorting exercise to qualitatively evaluate the discriminant validity of each of the measured constructs [64]. Finally, the psychometric properties of the scales were statistically assessed using the survey data. For each of our constructs, we provide a summary of definitions, measures, respondents, and sources in Appendix A.

Survey and Data Preparation Procedure

As described earlier, the target respondents include both CIOs and top business executives. Consistent with prior research, the CIO is defined as the highest-ranking IT executive within an organization and top business executives are defined as business executives who are either formal members of the TMT or report directly to the organization's CEO [3, 34]. Our population of interest consisted of U.S.-based organizations. A matched sampling strategy consisting of two rounds was employed for the distribution of the CIO and business executive surveys. The contact information for the CIOs and

corresponding business executives was derived from the Dun & Bradstreet (D&B) Million Dollar Database and from several professional industry associations.

In the first round of the survey, we obtained responses from 451 of the 3,763 CIOs to whom we sent a questionnaire, yielding a response rate of 12 percent.[2] In the second round, a second questionnaire was sent to multiple business executives in each of the 451 firms for which we had received a completed CIO survey (four weeks after receiving the CIO response). Out of the 451 firms, we received at least one usable business executive response that matched the CIO response from 174 firms, yielding a response rate of 38.6 percent[3] for the second round of the survey. Out of the 174 firms, we obtained a response from a single business executive in 107 organizations and a response from multiple business executives in 67 organizations. We provide a summary of our sampling procedure in Table 3. The characteristics of the CIO and business executive respondents and their organizations are summarized in Appendix B. Summary statistics for responses to each questionnaire item are provided in Appendix C.

For each the 67 firms with multiple matching business executive responses, we computed an aggregated average score for the four constructs (i.e., CIO supply-side leadership, CIO demand-side leadership, IT contribution to firm efficiency, and IT contribution to strategic growth) for which business executives were the respondents. Before this procedure, we assessed the interrater agreement between multiple business executive responses by calculating the r_{wg} coefficient [41] (ranging from 0 = "complete disagreement" to 1 = "complete agreement") on these four constructs. Prior research suggests that r_{wg} values that are greater than or equal to 0.60 warrant the aggregation of individual responses [33]. We found that none of the 67 firms with multiple business executive responses had an r_{wg} value smaller than 0.60 on all four constructs and that only five of these firms had an r_{wg} value slightly less than 0.60 on two or three of these constructs for which they were respondents. Because we have CIO responses for each of the antecedent variables for these 67 firms and we have acceptable levels of agreement for the majority of the leadership and IT contribution constructs in each firm, we included all 67 firms with multiple business executive responses in our analysis. For the five instances where adequate agreement could not be reached between a set of business executives for a particular variable, we treated that particular response as a missing value and eliminated it from the analysis with listwise deletion. We note that the high level of agreement among multiple business executives within the same organization provides support for allowing us to combine these top business executives' assessments to produce averaged, aggregated scores for the respective firms [83]. This approach also provides additional evidence that data obtained from single top business executive respondents are valid reflections of team and organizational phenomena.

Because CIO leadership and IT contribution were both assessed by business executives, to further assess potential common method variance, following the guidelines suggested by Podsakoff et al. [67], we conducted a Harmon's one-factor test [36, 66] and a latent common method factor test [57]. Results of the Harmon's one-factor test using principal component factor analysis did not reveal the presence of a general factor in the unrotated factor structure that accounts for the majority of covariation in

Table 3. Summary of Sampling Procedure

Survey distribution	Number of organizations targeted	Number of organizations with responding CIOs	Organizational response rate (percent)
Round 1: CIO	3,763	451	12.0
	Number of organizations targeted (responding organizations from round 1 survey)	Number of organizations with a minimum of one responding business executive	Organizational response rate (percent)
Round 2: Business executive	451	174*	38.6

* Because we obtained multiple business executive respondents in 67 of the 174 organizations, we have a total of 285 business executive respondents across 174 organizations.

the variables, indicating that there is not a significant level of common method variance between CIO leadership and IT contribution. Second, we included a common method factor (consisting of all the principal constructs' indicators) in the research model and calculated the variances of each construct indicator that were substantively explained by the principal construct and by the method. We observe that the average substantively explained variance of the indicators is 0.858, whereas the average method-based variance is 0.003. The ratio of substantive variance to method variance is approximately 286:1. The above testing results suggest that common method bias is not a significant issue for this study [67]. These collective test results suggest that nonrespondent bias is not a significant issue for our sample.[4]

Results

To test our research model, we used partial least squares (PLS) with a two-step analytic approach to assess the measurement validity and the strength of the hypothesized links in the structural model.

Measurement Model

Two variables—CIO human capital and CIO structural power—were modeled as formative constructs based on the established criteria in the literature as suggested by Jarvis et al. [43].[5] All other variables in the research model were modeled as reflective constructs. Table 4 summarizes the psychometric properties of the measurement scales. Table 5 presents the intercorrelations among the constructs. The psychometric properties of the scales of the reflectively modeled constructs were assessed in terms of item

Table 4. Measurement Model

Variable	Item mean	Item standard deviation	Loadings[1]	Weights[2]	Standard error	*t*-statistic
Organizational support for IT[3]						
OrgSup1	3.52	0.97	0.788	N/A	0.061	5.085**
OrgSup2	3.59	0.96	0.876	N/A	0.059	6.517**
OrgSup3	3.52	0.85	0.878	N/A	0.043	7.774**
CR = 0.885; AVE = 0.720						
CIO supply-side leadership[3]						
SupplyLead1	3.79	0.92	0.852	N/A	0.026	32.614**
SupplyLead2	4.10	0.83	0.880	N/A	0.017	50.938**
SupplyLead3	4.29	0.71	0.825	N/A	0.032	25.731**
CR = 0.889 ; AVE = 0.727						
CIO demand-side leadership[3]						
DemandLead1	3.68	0.99	0.945	N/A	0.009	105.762**
DemandLead2	3.67	0.97	0.952	N/A	0.009	110.340**
DemandLead3	3.58	1.05	0.954	N/A	0.008	113.334**
CR = 0.966; AVE = 0.903						
IT contribution to firm efficiency[4]						
EfficContrib1	2.98	0.98	0.828	N/A	0.031	27.003**
EfficContrib2	3.51	0.87	0.934	N/A	0.010	92.456**
EfficContrib3	3.53	0.90	0.910	N/A	0.012	75.694**
CR = 0.921; AVE = 0.795						

IT contribution to strategic growth[4]						
GrowthContrib1	3.09	0.97	0.883	N/A	0.019	47.538**
GrowthContrib2	2.63	1.06	0.922	N/A	0.014	68.383**
GrowthContrib3	2.53	1.05	0.906	N/A	0.024	37.167**
CR = 0.930; AVE = 0.817						
CIO human capital						
CIO organizational tenure[5]	8.80	6.87	N/A	0.619	0.222	3.452**
CIO IT experience[5]	21.90	8.60	N/A	0.227	0.283	0.802
CIO educational level[6]	3.34	0.95	N/A	0.766	0.259	2.390*
CIO structural power						
Reporting level[7]	2.45	0.53	N/A	0.982	0.350	2.804**
Formal TMT membership[8]	0.77	0.42	N/A	0.049	0.459	0.107

Notes: [1] Loadings for reflective indicators. [2] Weights for formative indicators. [3] Five-point scale ranging from "strongly disagree" (1) to "strongly agree" (5). [4] Five-point scale ranging from "no extent" (1) to "very great extent" (5). [5] Measured in years. [6] High school (1), associate's degree (2), bachelor's degree (3), master's degree (4), Ph.D./JD/MD (5). [7] Directly report to CEO (3), one reporting level between the CEO (2), two or more reporting levels between the CEO (1). [8] Formal TMT member (1), not formal TMT member (0). N/A = Not Applicable; CR = composite reliability; AVE = average variance explained; TMT = top management team. * Significant at 0.05; ** significant at 0.01.

Table 5. Intercorrelations Among Constructs

	Human capital	Structural power	Organization support	Supply-side leadership	Demand-side leadership	Efficiency contribution	Growth contribution
Human capital	**N/A**						
Structural power	0.043	**N/A**					
Organizational support	0.095	0.005	**0.848**				
Supply-side leadership	0.194	0.008	0.231	**0.856**			
Demand-side leadership	0.230	0.200	0.157	0.638	**0.950**		
Efficiency contribution	0.029	0.012	0.026	0.498	0.490	**0.892**	
Growth contribution	0.036	0.144	0.064	0.393	0.469	0.681	**0.904**

Notes: Boldface numbers on the leading diagonal are the square root of the AVE. N/A = AVE values are not relevant for formatively modeled constructs.

loadings, internal consistency, convergent validity (average variance extracted), and discriminant validity. As can be seen from Tables 4 and 5, all the reflectively modeled constructs have appropriate levels of measurement validity.

For the formative constructs, it is appropriate to check for convergent and discriminant validity together by examining the factor-loading matrix provided in PLS because formative measurements should not be highly correlated [20, 32]. As shown in Table 6, there were no significant issues with regard to excessive correlations or cross-loadings of the human capital items (organizational tenure, educational level, and IT experience) and of the structural power items (reporting level and TMT membership) with the other construct items.

There was a relatively high correlation (0.638) between supply-side and demand-side leadership. This is not surprising, as we have theorized that both constructs represent parts of the CIO maturity process. Although the correlation between these two variables is below the suggested maximum allowable correlation value of 0.90 for discriminant validity criterion as suggested by Bagozzi [4], to ensure that these two constructs are distinct, we followed the procedure used by Venkatraman [82] to test the discriminant validity of the measures of the two variables.[6] Specifically, we ran two competing confirmatory factor analysis (CFA) models in LISREL: one with the correlation between the two constructs unconstrained (i.e., supply-side and demand-side leadership are two distinct variables), and the other with the correlation constrained to 1 (i.e., supply-side and demand-side leadership are set to be one factor). We observed that the chi-square difference between the two models is 15.85, which is significant at the $p < 0.001$ level. In addition, the CFA results show that measures of the two stages of CIO leadership converge on their respective factors without noticeable cross-loadings and the factors are distinct from each other. Thus, these measurement test results support convergent and discriminant validity of the various constructs in the model.

Structural Model

Before testing the structural model, using Cohen's [21] power analysis procedure for multiple regression analysis, we calculated the statistical power of our sample.[7] The results suggested that our sample provides sufficient statistical power for testing our research model. When testing the structural model, we included CIO demographic variables (age and gender) as controls for both stages of CIO leadership and a set of organizational characteristics (annual revenue, firm age, geographic location, industry, public/private ownership) and IT vision as control variables for both facets of IT contribution. We observed that the only significant effect observed from the inclusion of the control variables was IT vision on IT contribution to strategic growth. The path coefficients for the structural model are shown in Figure 2. Table 7 presents a summary of the hypothesis testing results.

As hypothesized, we found that CIO human capital and organizational support for IT were both significant predictors of the CIO's supply-side leadership. Contrary to our hypothesis, structural power did not directly influence supply-side leadership. The antecedents in our model explained 8.6 percent of the variance in CIO supply-

Table 6. Interitem Correlation Matrix

	OrgTen	ITexp	EdLev	RepLev	TMTmem	OrgSup1	OrgSup2	OrgSup3	Supply-Lead1	Supply-Lead2	Supply-Lead3
OrgTen	1										
ITexp	0.105	1									
EdLev	0.049	0.080	1								
RepLev	0.037	–0.005	0.017	1							
TMTmem	–0.018	0.148	0.040	0.357**	1						
OrgSup1	0.042	0.063	0.088	0.017	0.080	1					
OrgSup2	0.054	0.167*	0.024	0.039	0.085	0.539**	1				
OrgSup3	–0.009	0.201**	0.026	0.030	0.122	0.517**	0.706**	1			
SupplyLead1	0.189*	0.077	0.077	–0.019	0.058	0.093	0.141	0.141	1		
SupplyLead2	0.150*	0.055	0.015	0.057	0.076	0.075	0.072	0.105	0.654**	1	
SupplyLead3	0.123	0.024	–0.096	–0.048	–0.013	0.091	0.040	0.108	0.685**	0.670**	1
DemandLead1	0.136	0.012	0.073	0.215	0.070	0.025	0.011	0.008	0.472**	0.545**	0.426**
DemandLead2	0.163*	0.014	0.142	0.176*	0.106	0.065	0.058	0.042	0.496**	0.581**	0.424**
DemandLead3	0.221	0.015	0.056	0.175*	0.078	0.098	0.093	0.098	0.498**	0.498**	0.480**
EfficContrib1	0.051	0.012	–0.140	0.070	–0.113	–0.049	–0.096	–0.128	0.247**	0.324**	0.238**
EfficContrib2	0.048	0.072	–0.097	0.002	–0.137	–0.011	–0.007	–0.034	0.404**	0.461**	0.361**
EfficContrib3	0.109	0.077	–0.097	0.011	–0.081	0.089	0.055	0.024	0.413	0.482**	0.377**
GrowthContrib1	0.081	–0.30	0.018	0.119	–0.074	0.070	0.069	0.052	0.274**	0.346**	0.269**
GrowthContrib2	0.072	0.031	–0.076	0.164*	–0.003	0.067	0.019	0.006	0.267**	0.347**	0.288**
GrowthContrib3	0.050	0.046	–0.034	0.138	0.006	–0.009	0.003	0.027	0.327**	0.327**	0.264**

	Demand-Lead1	Demand-Lead2	Demand-Lead3	Effic-Contrib1	Effic-Contrib2	Effic-Contrib3	Growth-Contrib1	Growth-Contrib2	Growth-Contrib3
OrgTen									
ITexp									
EdLev									
RepLev									
TMTmem									
OrgSup1									
OrgSup2									
OrgSup3									
SupplyLead1									
SupplyLead2									
SupplyLead3									
DemandLead1	1								
DemandLead2	0.847**	1							
DemandLead3	0.846**	0.863**	1						
EfficContrib1	0.395**	0.315**	0.370**	1					
EfficContrib2	0.448**	0.358**	0.403**	0.715**	1				
EfficContrib3	0.516**	0.416**	0.477**	0.705**	0.778**	1			
GrowthContrib1	0.430**	0.421**	0.474**	0.523**	0.536**	0.539**	1		
GrowthContrib2	0.386**	0.391**	0.420**	0.511**	0.598**	0.540**	0.682**	1	
GrowthContrib3	0.365**	0.358**	0.355**	0.566**	0.558**	0.590**	0.672**	0.825**	1

* Significant at the 0.05 level (two-tailed); ** significant at the 0.01 level (two-tailed).

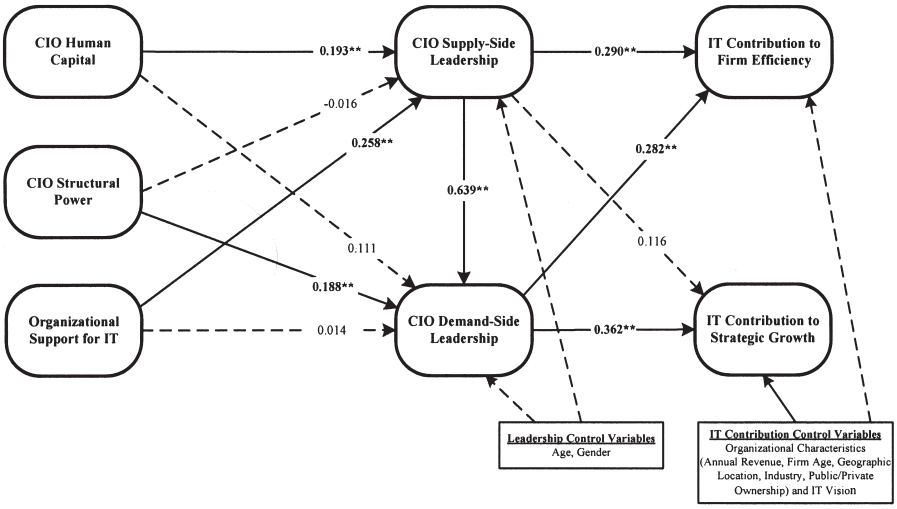

Figure 2. Structural Model
Notes: Solid lines represent significant paths and dashed lines represent nonsignificant paths. Control variables for supply-side and demand-side leadership include CIO age and gender. Control variables for the IT contribution constructs include organizational characteristics (number of employees, annual revenue, firm age, geographic location, industry, public/private ownership) and IT vision. The only significant control variable was found to be IT vision on IT contribution to strategic growth. * $p < 0.05$; ** $p < 0.01$.

side leadership. The findings regarding the factors that influence CIO demand-side leadership are interesting. As hypothesized, supply-side leadership was a significant predictor of demand-side leadership. However, of the three antecedents in our model, structural power was the only direct significant predictor of demand-side leadership. The antecedents in conjunction with supply-side leadership collectively explained 47.6 percent of the variance in demand-side leadership. Also as hypothesized, we found that CIO supply-side leadership significantly influenced IT contribution to firm efficiency but did not directly influence IT contribution to strategic growth. In addition, as hypothesized, CIO demand-side leadership significantly influenced both IT contributions to firm efficiency and strategic growth. The CIO leadership variables were found to explain 28.0 percent and 23.6 percent of the variance in IT contribution to firm efficiency and strategic growth, respectively.

We also conducted a set of post hoc mediation analyses using the methods recommended by Baron and Kenny [6]. First, to examine if CIO supply-side leadership mediates the influence of antecedent variables on demand-side leadership, we removed the supply-side variable from the model and tested the direct influence of the antecedent variables on demand-side leadership. We observed that the path coefficients from both human capital and organizational support to demand-side leadership became significant ($p > 0.01$ and $p > 0.05$, respectively). Therefore, these results indicate that the effects of human capital and organizational support on demand-side leadership were completely mediated by supply-side leadership. Second, to examine

Table 7. Summary of Hypothesis Testing

Hypotheses	Path coefficient	Critical ratio[1]	Support for hypotheses
H1: Supply-side leadership → demand-side leadership	0.639	12.323	Supported
H2a: Supply-side leadership → firm efficiency	0.290	2.666**	Supported
H2b: Supply-side leadership → strategic growth (mediated by demand-side leadership)	0.116	N/A[2]	Supported
H3a: Demand-side leadership → strategic growth	0.362	4.713**	Supported
H3b: Demand-side leadership → firm efficiency	0.282	3.288**	Supported
H4a: Human capital → supply-side leadership	0.193	2.712**	Supported
H4b: Human capital → demand-side leadership	0.111	1.670	Not supported
H5a: Structural power → supply-side leadership	–0.016	0.183	Not supported
H5b: Structural power → demand-side leadership	0.188	2.609**	Supported
H6a: Organizational support → supply-side leadership	0.258	3.513**	Supported
H6b: Organizational support → demand-side leadership	0.014	0.240	Not supported

Notes: [1] The critical ratio represents the parameter estimate divided by its standard error and therefore operates as a *z*-statistic in testing whether the parameter is statistically different from zero. [2] This hypothesis examines mediations rather than a direct path coefficient. * Significant at 0.05; ** significant at 0.01.

if CIO demand-side leadership mediates the influence of supply-side leadership on IT contribution to strategic growth, we removed the demand-side variable from the model and tested the direct influence of the supply-side leadership on IT contribution to strategic growth. We observed that the path coefficient from supply-side leadership to strategic growth also became significant ($p > 0.01$), which indicates that the influence of supply-side leadership on strategic growth was completely mediated by demand-side leadership. Furthermore, we conducted a Sobel test for both mediating paths. The results showed that both indirect effects were significant, providing further support for these mediating relationships. Third, to examine if CIO leadership mediates the influence of the antecedent variables on IT contribution, we removed the two leadership constructs from the model and created direct links from the three antecedent variables to the two IT contribution variables. The results showed that none of the antecedents had a direct significant effect on either of the IT contribution variables, suggesting that CIO leadership was an essential step between the antecedent variables

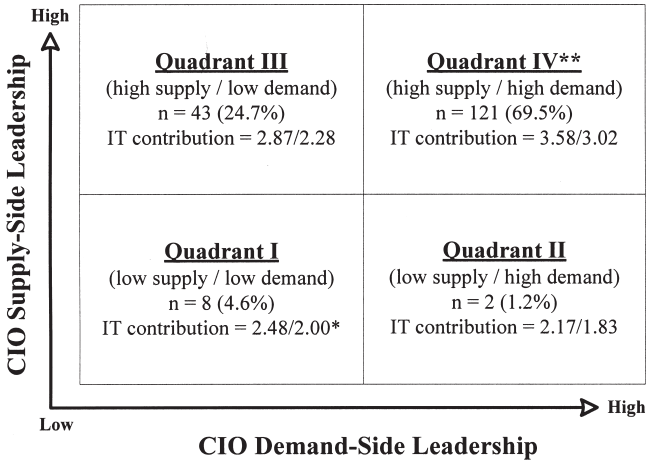

Figure 3. Leadership Matrix
Notes: * The two numbers of IT contribution in each quadrant (e.g., 2.48/2.00 in quadrant I) refer to IT contribution to firm efficiency (2.48 out of a scale of 5 in quadrant I) and IT contribution to strategic growth (2.00 out of a scale of 5 in quadrant I), respectively. ** An ANOVA test suggests that CIOs in quadrant IV have a significantly higher level of IT contribution to both efficiency/strategic growth than the CIO in quadrants I, II, and III.

and IT contribution and that these leadership constructs were appropriately placed in the nomological network.

To further validate the distinction between CIO supply- and demand-side leadership, we partitioned our sample into four groups according to the levels of the two CIO leadership scores[8] and compared the differences among the groups on IT contributions to firm operations and strategic growth. As noted in Figure 3, the results of an analysis of variance (ANOVA) test suggest that these quadrants had differential effects on IT contribution (average of IT contribution to firm efficiency and strategic growth). Firms in quadrant IV (high supply-side leadership and high demand-side leadership) had significantly higher levels of IT contribution than firms in the other three quadrants. Firms in quadrants I and II (both with low supply-side leadership) had the lowest levels of IT contribution. These findings provide further support to the maturity process between CIO supply-side leadership and demand-side leadership and their respective influence on organizational outcomes.

Discussion

Although both researchers and practitioners have stressed the importance for the CIO to transition from the supply-side to demand-side leadership, no research has empirically examined this phenomenon. We proposed and tested a staged maturity model that addressed the relationships between the CIO supply- and demand-side leadership, their antecedents, and their effects. First, our results have shown that

supply-side leadership has a direct and significant influence on demand-side leadership, which supports our hypothesized staged CIO leadership maturity model.

Second, our findings provide insights about how the two stages of CIO leadership influence IT contribution to firm performance. The results indicate that CIO supply-side leadership has a direct influence on IT contribution to firm efficiency but not on strategic growth. This finding supports our hypothesis that CIO supply-side leadership can have a direct effect on organizational efficiency through a focus on providing cost-effective and reliable supporting service to meet known business needs. Although supply-side leadership does not have a direct effect on strategic growth, it has an indirect effect that is mediated by demand-side leadership. This finding supports not only our argument that a focus on exploiting existing IT competencies is unlikely to have a direct effect on strategic growth but also our proposed two-stage CIO leadership maturity model. The finding is also consistent with the resource-based view, which suggests that competitive advantage or strategic growth can be obtained only through valuable, heterogeneous, and inimitable organizational capabilities. Although supply-side leadership provides a necessary foundation for demand-side leadership, because it focuses on the exploitation and refinement of existing competencies to support business operations, it alone is not sufficient to create unique organizational capabilities that are difficult for competitors to replicate. On the other hand, by combining IT competencies with other complementary non-IT strategic resources and capabilities to create new strategic opportunities and business innovations, CIO demand-side leadership directly influences IT contribution to both firm efficiency and strategic growth. As such, demand-side leadership represents a more mature state of CIO leadership through which CIOs can have a greater influence on organizational outcomes. This finding not only explains why CIOs who effectively display demand-side leadership are highly sought after by today's organizations but is also consistent with the strategic leadership literature, which argues that organizational outcomes can be dictated by the actions of the firm's top executives [30].

Third, our findings provide insight into how key individual attributes and organizational situational factors affect the two stages of CIO leadership. Our results suggest that CIO human capital and organizational support for IT directly influence his or her supply-side leadership but not his or her demand-side leadership. Rather, their effects on demand-side leadership are completely mediated by supply-side leadership. This finding again provides support for our staged maturity model. Another interesting finding is that the CIO's structural power is a key predictor of demand-side leadership but not supply-side leadership. This finding is consistent with the IT management literature with regard to the congruence between the CIO rank and the strategic roles that the CIO is given [46]. Applegate et al. [2] suggest that, because IT activities represent different levels of strategic importance to different firms, CIOs in firms where IT primarily plays a mere supportive role will not be provided strategic positions to the same degree in firms where IT plays a strategic role. As such, our findings provide further theoretical and empirical support to the notion that a higher level of CIO structural power could be critical and necessary for firms to gain competitive advantage through IT investments.

Limitations

Our results should be interpreted with an awareness of the limitations of the study. During our conceptual development stage, drawing on extensive literature reviews and field observations and to ensure the parsimony of our research model, we selected only the most relevant antecedent and consequent variables of the CIO leadership that fit the framing of this study. With regard to the antecedents of the two stages of CIO leadership, additional individual (e.g., CIO and TMT knowledge levels), organizational (e.g., culture), and environmental (e.g., market competitiveness and turbulence) variables may need to be considered. On the dependent variable side, besides IT contributions to firm efficiency and to strategic growth, other types of dependent variables may need to be examined. For example, researchers have studied process-oriented outcome measures such as the effects of IT on the firm's ability to automate, informate, and transform [47, 63]. In addition, there may be variables that moderate the relationships between the two stages of CIO leadership and their antecedents and consequences. For example, competitive strategy may be an important moderator; Karimi et al. [46] found that misalignment between the CIO role and firm competitive strategy might have an adverse effect on the firm. Another limitation of our study is that we did not consider the extent to which IT is outsourced by the firm. Depending on what parts of the IT function are outsourced and how they are outsourced, the nature of the CIO roles and leadership may change significantly. As a result, the findings of our study may not be generalizable to firms that have extensively outsourced their IT activities. Last, the sampling frame of the study was not perfectly random because the difficulty of collecting data from top executives precluded full randomization [14]. Although the data collection included organizations from multiple industries, due to the researchers' availability to access contacts within health-care associations, an appreciable proportion (43.2 percent) of respondents were from the health-care industry. However, when included as a control variable, industry type was not shown to be a relevant factor. Furthermore, statistical analysis also revealed no significant differences between the responses derived from health-care organizations versus other industries for any of the constructs of the study.

Implications and Future Research

The findings of this work make several contributions to the existing body of knowledge. First, we conceptualized and operationalized the constructs of CIO supply- and demand-side leadership. The data collected from business executives support the validity and reliability of our proposed CIO leadership measures, which can be readily used in future CIO studies. Second, the study provides support for our argument that the development of CIO leadership represents a staged maturity model in which supply-side leadership represents a basic but necessary stage for the more advanced stage of demand-side leadership. The empirical findings of this study are not only consistent with prior descriptive studies but also raise several interesting questions that future empirical studies might pursue. For instance, an unanswered question is: What

are the conditions and processes through which the CIO can successfully transition from a supply-side leader to a demand-side leader?

Third, this study provides several implications regarding the factors that drive the stages of CIO leadership. We found that CIO demand-side leadership is directly influenced by structural power and is indirectly influenced by human capital and organizational support via supply-side leadership. While the mediating effects of supply-side leadership provide support for our staged maturity model, as we stated in the Limitations section, future research may extend our current research model to include additional factors that may influence the two stages of CIO leadership and IT's contribution to organizational performance. Future research might also examine if there are any complementary effects between the antecedent variables. In addition, future research may test if CIO leadership moderates the influence of selected antecedent variables on organizational outcomes.

Fourth, whereas prior descriptive studies have anecdotally implied that CIOs can influence firm performance, the current study provides insight into the differential effects of the two stages of CIO leadership on IT contribution to firm efficiency and strategic growth. Future research should examine how the two stages of CIO leadership influence organizational outcomes through a more granular approach. For example, future work would benefit from examining what specific exploitative and explorative mechanisms the CIO can use to influence different organizational outcomes. Future research should also examine how CIO leadership influences other IT-enhanced organizational outcomes. For instance, Karimi et al. [47] found that IT creates business value through its influence on business processes (i.e., process efficiency, process effectiveness, and process flexibility). Future research that studies how the two stages of CIO leadership influence these separate yet complementary effects would provide a valuable contribution.

Finally, this research has several practical implications. The measurement items of CIO supply- and demand-side leadership presented in this paper provide insights and guidelines for business executives to develop and assess the leadership capabilities of their CIOs. Our staged maturity model indicates that firms should define and evaluate CIO leadership based on what the CIO and the IT function are expected to contribute. If the IT function is still struggling with providing cost-effective and reliable systems and services to the business, the priority of the firm should be on developing CIO supply-side leadership to make sure that the CIO has the necessary ability to ensure effective exploitation of existing IT competencies to support ongoing business needs. Once the IT function has established operational efficiency, the firm can move on to developing the demand-side capabilities of the CIO, which is critical for creating new strategic growth and competitive advantages through IT investments. It is also important that top management understand that CIO leadership is best developed through identifying and providing the right mix of organizational and individual factors. While the right components of individual human capital and appropriate organizational support for IT are important for developing and enabling CIO supply-side leadership, proper rank and structural power are critical for developing and facilitating demand-side leadership.

Conclusion

THIS STUDY ADDS TO THE BODY OF THE WORK on IT leadership and IT strategic management by advancing our understanding of the nature of CIO leadership, the individual and organizational factors that facilitate the CIO's leadership capacity, and the organizational outcomes of such leadership. Empirical data collected from matched pairs of CIOs and business executives support a staged maturity model through which supply-side leadership is the basic stage of the leadership development process that subsequently facilitates demand-side leadership. The findings also provide further support for this staged model in which CIO leadership mediates the effect of key antecedent variables on the impact of IT. We hope our study will serve as a stepping-stone that stimulates and enables more studies to further examine how CIO leaders are developed and how these leaders can influence organizational outcomes.

NOTES

1. We thank an anonymous reviewer for contributing to this important theoretical perspective.

2. The CIO survey response was considered usable if (1) the survey questions were completed, (2) the CIO was identified as the highest-ranking IT executive within the organization, (3) the CIO had worked in his or her current position within the current organization for more than one year, and (4) the CIO's identity and organization were verifiable.

3. The business executive survey response was considered usable if (1) the survey questions were completed, (2) the respondent held an executive title, (3) the executive either was a formal member of the TMT and/or reported directly to the CEO, (4) the executive had worked in his or her current position within the current organization for more than one year, (5) the executive's identity and the organization were verifiable, and (6) the CIO of the respondent's organization could be confirmed.

4. We first assessed nonresponse bias of the CIOs, via analysis of variance (ANOVA), by comparing the total annual sales and number of employees of the 451 responding organizations to those of nonresponding (3,312) organizations within the same primary SIC code (listed in the D&B database). While controlling for industry, our assessment revealed no significant differences between the responding and nonresponding groups. Using ANOVA, we then assessed any differences between early- and late-responding CIOs on the three variables for which the CIO was the respondent: CIO human capital (organizational tenure, IT experience, and educational level), structural power (reporting level and TMT membership), and organizational support for IT. The results revealed no significant differences between early- and late-responding CIOs with regard to these variables. To assess any potential nonresponse biases in the second round of business executive survey, we tested for any significant differences between the 174 organizations for which we obtained at least one business executive response and the 277 organizations for which we obtained a CIO response but did not receive a response from a corresponding business executive. The ANOVA results revealed no significant differences between these two groups with regard to the total sales or total number of employees within the organization. In addition, we used ANOVA to assess potential differences between early and late respondents on those variables for which the business executive is the key respondent: CIO supply-side leadership, CIO demand-side leadership, IT contribution to firm efficiency, and IT contribution to strategic growth. This assessment revealed no significant differences between early- and late-responding business executives with regard to these variables. To further assess the possibility of nonresponse bias, we contacted several CIOs and business executives via e-mail and phone to inquire why they did not respond to the survey. The executives consistently indicated that either they did not have time to complete the survey or it was against company policy to complete surveys in general; however, there was no indication that there were any issues that would yield a nonresponse bias.

5. According to Jarvis et al. [43], the criteria for formative constructs are (1) the indicators are viewed as defining characteristics of the construct, (2) changes in the indicators are expected to cause changes in the construct, (3) changes in the construct are not expected to cause changes in the indicators, (4) eliminating an indicator may alter the conceptual domain of the construct, and (5) a change in the value of one of the indicators is not necessarily expected to be associated with a change in all of the other indicators.

6. According to Venkatraman [82], the discriminant validity can be supported when measures of each variable converge on their corresponding true scores and it can be tested that the correlation between a pair of variables is significantly different from unity. Using structural equation modeling, we can compare a model with the correlation between the two variables constrained to one with an unconstrained model. A significantly lower chi-square value for the model with the unconstrained correlation, when compared with the constrained model, provides support for discriminant validity. A chi-square difference value with an associated *p*-value less than 0.05 supports the discriminant validity criterion.

7. Because PLS is executed via iterative regression analysis, power analysis on multiple regression is also applicable for PLS [20]. We calculated power values block by block in accordance with PLS estimates, with each block consisting of a dependent variable and its independent variables. In this power analysis, we have four major blocks associated with each of the four dependent variables (supply-side leadership, demand-side leadership, IT contribution to firm efficiency, and IT contribution to strategic growth) in our structural model. With significance level set at $\alpha = 0.05$, effect size at medium level, and a sample size of 174, the statistical power values for the four blocks ranged from 0.93 to 0.99, suggesting that our sample provides sufficient statistical power for testing our research model.

8. We categorized a CIO's leadership capability as low if the organization's business rated the CIO as "3" or below (on a Likert scale of 1 to 5) and high as greater than "3" (all survey items are listed in Appendix A). From executives' responses to these items, firms were assigned to one of the four quadrants shown in Figure 3. The resultant quadrants revealed the following: quadrant I: 8 CIOs (4.6 percent) were evaluated to have both low levels of supply- and demand-side leadership, quadrant II: 2 CIOs (1.2 percent) had a low level of supply-side leadership but high level of demand-side leadership, quadrant III: 43 CIOs (24.7 percent) had a high level of supply-side leadership but low level of demand-side leadership, and quadrant IV: 121 CIOs (69.5 percent) had both high levels of supply- and demand-side leadership. These findings provided further support for the two stages of CIO leadership since we observed that only 1.2 percent of the CIO in our sample fit into quadrant II (low supply-side/high demand-side). On the other hand, we observed that there was an appreciable percentage of CIOs who fit into quadrant III (high supply-side/low demand-side) and quadrant IV (high/high).

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Appendix A. Construct Operational Definitions and Scales

Construct Definitions	Measures
CIO human capital: CIO's accumulated knowledge and skills with the organization. *Source:* Bassellier et al. [10]; Hitt et al. [38]; CIO interviews. *Informant:* CIO	OrgTen:[1] How long have you been with your current organization? ITexp:[1] How many years of work experience do you have in IT? EdLev:[2] What is your level of education?
CIO structural power: TMT membership and reporting level. *Source:* Armstrong and Sambamurthy [3]; Preston and Karahanna [69]; Smaltz et al. [79]. *Informant:* CIO	TMTmem:[3] Are you a formal member of your organization's top management team (TMT)? (Yes/No). RepLev:[4] Do you directly report to the CEO. If not, how many reporting levels are between you and the CEO?
Organizational support for IT:[5] Degree to which the organization supports the IT department and IT initiatives. *Source:* Finkelstein and Hambrick [30]; Jarvenpaa and Ives [42]; CIO interviews. *Informant:* CIO	OrgSup1: The IT department in our organization is poorly funded (reverse coded). OrgSup2: Our organization provides the necessary resources for strategic IT initiatives. OrgSup3: The organization ensures that IT initiatives receive the proper support to be successful.
CIO supply-side leadership:[5] Degree to which the CIO leads the IT department to deliver the required IT services across the organization. *Source:* Broadbent and Kitzis [16]; CIO interviews. *Informant:* Business executives	SupplyLead1: Our CIO maintains an IT staff with skill sets that meet our current and future technology needs. SupplyLead2: Our CIO directs efforts to build integrated information systems. SupplyLead3: Our CIO is effective in keeping key systems operational.
CIO demand-side leadership:[5] Degree to which the CIO is recognized as an effective business leader within the organization. *Source:* Broadbent and Kitzis [16]; CIO interviews. *Informant:* Business executives	DemandLead1: Our CIO is an effective strategic leader within the organization. DemandLead2: Our CIO is effective as a strategic business planner. DemandLead3: Our CIO is an effective visionary within the organization.
IT contribution to firm efficiency:[6] Extent that IT contributes to organizational efficiency. *Source:* Premkumar and King [68]; Saunders and Jones [77]. *Informant:* Business executives	Please assess the extent that IT has contributed to each of the following in your organization: EfficContrib1: Cost savings. EfficContrib2: Operating efficiency. EfficContrib3: Process improvement.
IT Contribution to Strategic Growth:[6] Extent that IT contributes to organizational strategic growth. *Source:* Premkumar and King [68]; Saunders and Jones [77]. *Informant:* Business executives	Please assess the extent that IT has contributed to each of the following in your organization: GrowthContrib1: Return on investment. GrowthContrib2: Sales revenue increase. GrowthContrib3: Market share.

Construct Definitions	Measures
IT Vision:[7] Degree to which the organization uses IT to transform traditional ways of doing business. *Source:* Armstrong and Sambamurthy [3]; Chatterjee et al. [19]; Schein [78]. *Informant:* Top responding business executive	Please indicate which of the following statements best describes the business role of information technology (IT) within your organization: Automate: The role of IT is to replace human labor or at least transform its productivity. Informate up/down: The role of IT is to provide data and transactions that allow more clear and organized management views of the state and dynamics of the business or that yield a far fuller picture at the operation level and to provide members of the workforce greater insights into their own activities. Transformate: The role of IT is to fundamentally alter our organization through new products or business strategies, often including redefinition of relationships with customers and suppliers.

Notes: [1] Measured in years. [2] High school (1), associate's degree (2), bachelor's degree (3), master's degree (4), Ph.D./MD/JD (5). [3] Member (1), nonmember (0). [4] Two levels (1), one level (2), direct report (3). [5] Five-point scale ranging from "strongly disagree" (1) to "strongly agree" (5). [6] Five-point scale ranging from "no extent" (1) to "very great extent" (5). [7] Automate (1), informate up/down (2), transformate (3).

Appendix B. CIO, Business Executive, and Firm Characteristics

Executive characteristics	CIO mean (percent)	Business executive mean (percent)
TMT Member	77.5%	90.9%
Reporting level to CEO	174 CIOs	285 executives across 174 firms
CEO respondent	N/A	33 (11.6)
0 (direct report) / 1 / 2	82 (47.1) / 89 (51.2) / 3 (1.7)	223 (78.2) / 29 (10.2) / 0 (0)
Executive Title	174 CIOs	285 executives across 174 firms
	CIO/vice president/ senior vice president/ executive vice president: 130 (74.7)	CEO: 33 (11.6); CFO: 49 (17.2); COO: 45 (15.8); vice president/ senior vice president/ executive vice president/ other: 158 (55.4)
	IT director/manager: 44 (25.3)	

Firm characteristics number (percent)

IT vision (n = 165): automate 39 (23.6); informate up/down 98 (59.4); transformate 28 (17)

Industries: health care 75 (43.2); manufacturer 18 (10.4); banking/finance/insurance 16 (9.2); retailer/wholesaler 15 (8.6); consulting 15 (8.6); construction/development/real estate 8 (4.6); educational institutions 8 (4.6); miscellaneous service 19 (10.9)

Private/public: 151 (86.7) / 23 (13.3)

Appendix C. Summary Statistics of Variables

Variable	Respondent	*N*	Mean	Standard deviation	Minimum	Maximum
CIO human capital (3 questions)						
CIO organizational tenure[1]	CIO	174	8.80	6.87	1.00	33.00
CIO IT experience[1]	CIO	173	21.90	8.60	1.00	46.00
CIO educational level[2]	CIO	174	3.34	0.95	1.00	5.00
CIO structural power (2 questions)						
Reporting level[3] (scale = 1 to 3)	CIO	174	2.45	0.53	1.00	3.00
Formal TMT membership[4] (scale = 0 to 1)	CIO	174	0.77	0.42	0.00	1.00
Organizational support for IT[5] (3 questions)	CIO	174	3.54	0.85	1.33	5.00
CIO supply-side leadership[5] (3 questions)	Business executives	174	4.06	0.70	2.00	5.00
CIO demand-side leadership[5] (3 questions)	Business executives	174	3.64	0.96	1.00	5.00
IT contribution to firm efficiency[6] (3 questions)	Business executives	174	3.34	0.82	1.00	5.00
IT contribution to strategic growth[6] (3 questions)	Business executives	174	2.86	0.86	1.00	5.00
Organizational characteristics						
Corporate annual revenue (million $)	D&B database	165	$1,100	$2,823	$0.65	$24,455
Age of the organization[1]	D&B database	165	52	38	5	195

Notes: Annual revenue and age of the organization were used as control variables in our structural model. In accordance with listwise deletion procedures in PLS we used missing values for the values for annual revenue and firm age for those nine organizations where data for these control variables were unavailable. [1] Measured in years. [2] High school (1), associate's degree (2), bachelor's degree (3), master's degree (4), Ph.D./JD/MD (5). [3] Directly report to CEO (3), one reporting level between the CEO (2), two or more reporting levels between the CEO (1). [4] Formal TMT member (1), not formal TMT member (0). [5] Five-point scale ranging from "strongly disagree" (1) to "strongly agree" (5). [6] Five-point scale ranging from "no extent" (1) to "very great extent" (5).