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Antecedents of IS Strategic Alignment: A Nomological Network

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Alignment of information systems (IS) strategy with business strategy is a top concern of both the chief information officer (CIO) and the top management team (TMT) of organizations. Even though researchers and key decision makers in organizations recognize the importance of IS strategic alignment, they often struggle to understand how this alignment is created. In this paper, we develop a nomological network in which shared understanding between the CIO and TMT about the role of IS in the organization (which represents the social dimension of IS strategic alignment) is posited to be a proximal antecedent of the intellectual dimension of IS strategic alignment. We further posit that shared language, shared domain knowledge manifest in the CIO's business knowledge and the TMT's strategic IS knowledge, systems of knowing (structural and social), and CIO-TMT experiential similarity are important determinants of this shared understanding. Data were collected from 243 matched CIO-TMT pairs. Results largely support the proposed nomological network. Specifically, shared understanding between the CIO and TMT is a significant antecedent of IS strategic alignment. Furthermore, shared language, shared domain knowledge, and structural systems of knowing influence the development of shared understanding between the CIO and the TMT. Contrary to expectations and to findings of prior research, social systems of knowing, representing informal social interactions between the CIO and TMT, and experiential similarity did not have a significant effect on shared understanding.

Key words: IS leadership; chief information officer; IS strategic alignment; shared understanding; strategic management of IT; top management team; matched-pair questionnaire surveys
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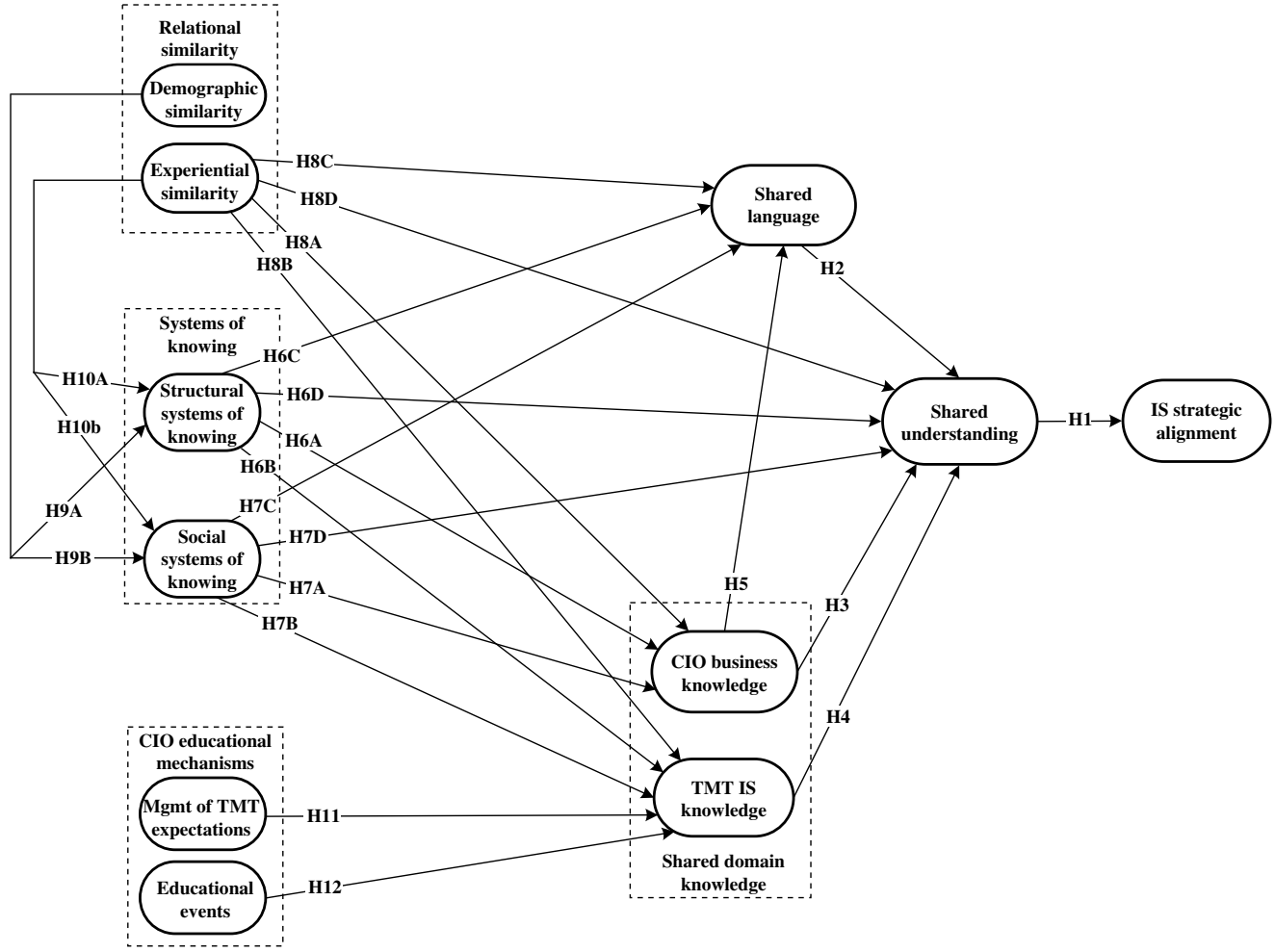
Introduction

Information systems (IS) strategic alignment is a key concern of chief information officers (CIOs) and the organization's top management team (TMT) (Chan and Huff 1993, Earl 1993, Chan et al. 1997, Chan 2002, Reich and Benbasat 2000). In fact, a recent study conducted by Luftman et al. (2006) found that strategic alignment of IS with the business is the top concern of industry CIOs. Prior research found that IS strategic alignment is necessary to allow organizations to capitalize on their IS investments and derive value (Chan et al. 1997, Sabherwal and Chan 2001). Despite its importance, IS strategic alignment has remained elusive for many organizations. For example, Luftman et al. (2006) state that "for over 20 years, IS and business alignment has been ranked as a top management concern" and that "it is clearly a persistent and pervasive challenge" (p. 95).

To achieve IS strategic alignment, organizations must first comprehend the factors that contribute to its development. Review of the IS strategic alignment literature reveals that the nature of the working relationship between the CIO and TMT is key to facilitating IS strategic alignment (Chan 2002, Keen 1991, Luftman and Brier 1999, Luftman et al. 2006). Notwithstanding its importance, this relationship has frequently been turbulent and has presumably contributed to the ineffectual use of IS and to poor IS strategic alignment (Chan 2002, Luftman and Brier 1999, Rockart et al. 1996).

Numerous factors have contributed to poor relationships between the CIO and the TMT and to poor IS strategic alignment, and a recurring theme has been

Figure 1 Research Model



the low level of common understanding between the CIO and the TMT on the role of IS in the organization (Armstrong and Sambamurthy 1999; Chan 2002; Reich and Benbasat 1996, 2000; Rockart et al. 1996; Tan and Gallupe 2006). In fact, extant academic and practitioner research recognizes this gap in understanding as a major obstacle to IS strategic alignment. To theoretically address the persistent and critical problem of IS alignment, the current study develops a nomological network that posits shared understanding between the CIO and TMT about the role of IS in the organization[1] as an important antecedent of IS strategic alignment and identifies a set of key antecedents that contribute to the development of this shared understanding.

The paper proceeds as follows. The next section provides the theoretical development of the research model and hypotheses. The research methodology, data analysis, and discussion of results follow. The paper concludes with a discussion of limitations and practical and theoretical implications.

Theoretical Development

Figure 1 presents the research model of the study, which places shared understanding in a nomological network of relationships that lead to IS strategic alignment.

[1] The term *shared understanding* hereafter refers to the shared understanding between the CIO and the TMT about the role of IS in the organization.

The rationale for the model is that antecedents of shared understanding facilitate knowledge exchange and integration between the CIO and TMT and thus enable the development of a shared understanding about the role of IS in the organization. Shared understanding is facilitated by four primary antecedents: (a) shared language; (b) shared domain knowledge manifest as the CIO's business knowledge and TMT's strategic IS knowledge; (c) systems of knowing (structural and social); and (d) experiential similarity. In addition, demographic and experiential similarity are posited to influence both structural and social systems of knowing. Further, CIO-orchestrated educational efforts (management of TMT expectations and CIO-organized educational events) provide the CIO with the opportunity to communicate the value of IS capabilities to the TMT. We provide theoretical support for the hypothesized relationships.

IS Strategic Alignment

Though there have been multiple conceptualizations and multiple definitions of IS strategic alignment, no agreed-on definition or model has emerged. Strategic "alignment is a nebulous concept that is difficult to understand" (Chan et al. 1997, p. 126), and "no comprehensive model of this construct is commonly used" (Reich and Benbasat 2000, p. 82). Nonetheless, two separate perspectives have emerged (Reich and Benbasat 2000). The more dominant perspective focuses on alignment between business and IS on various dimensions and combinations of dimensions such as alignment of strategy (e.g., Chan et al. 1997, Henderson and Venkatraman 1993, Luftman and Brier 1999, Sabherwal and Kirs 1994, Sabherwal and Chan 2001, Tallon et al. 2000), alignment of plans (e.g., Hirschheim and Sabherwal 2001, Lederer and Mendelow 1989, Reich and Benbasat 1996), and alignment of infrastructure and processes (Henderson and Venkatraman 1993). The other perspective focuses on shared knowledge and shared understanding among the salient IS and business actors about plans, objectives, and vision of the ways in which IS contributes to the success of the business unit (e.g., Nelson and Cooprider 1996; Reich and Benbasat 1996, 2000). Reich and Benbasat (1996, 2000) call the former perspective the "intellectual dimension of strategic alignment" and the latter "the social dimension of strategic alignment" (defined as "the level of mutual understanding and commitment to business and [information technology] mission, objectives, and plans" 1996, p. 58).

The causal structure between the social and intellectual dimensions of alignment is not clear. Although Reich and Benbasat (2000, p. 82) state that "both dimensions are important to study and are necessary for an organization to achieve high levels of alignment," the literature does not elaborate on how the two dimensions are related nomologically or whether each of them constitutes a second-order construct called IS strategic alignment. The literature has not specified the relationships among IS strategic alignment, social alignment, and intellectual alignment in a nuanced causal structure, but it provides valuable guidance toward this end by identifying social alignment, especially shared understanding, as an important *antecedent* of intellectual IS strategic alignment (see Table 1 for key antecedents of IS strategic alignment).

It follows that whether considered as a dimension or an antecedent, models of alignment should include critical aspects of social alignment. Furthermore, although antecedents of the "intellectual" dimension of IS strategic alignment have been studied to some degree by prior researchers, few studies have examined the effect of the social dimension of alignment, and there is no commonly accepted theoretical model to investigate its role in achieving intellectual IS alignment. Additionally, though prior research has provided conceptual insight into the antecedents of "intellectual" IS strategic alignment, few theory-based *empirical* studies have examined the relationship between IS strategic alignment and its antecedent variables (Chan et al. 2006).

This study contributes to the IS strategic alignment literature in several ways. First, we propose shared understanding as a construct that captures important aspects of what Reich and Benbasat (1996, 2000) call the social dimension of alignment. Second, we propose a causal relationship between shared understanding and the intellectual dimension of IS strategic alignment and embed the two in a nomological network of relationships, thus conceptually linking and empirically testing a relationship between the two aspects of alignment. Third, we identify

Table 1 Primary Antecedents of IS Strategic Alignment

Antecedents to IS strategic alignment	Related construct in research model	Conceptual support	Empirical support
Relationship/Partnership between CIO and TMT	Social systems of knowing Structural systems of knowing	Rockart et al. (1996), Luftman and Brier (1999), Chan (2002)	Luftman et al. (1999)
CIO-TMT communication, participation, and planning	Social systems of knowing Structural systems of knowing Educational mechanisms	Lederer and Mendelow (1989), Luftman and Brier (1999), Chan (2002)	Sabherwal and Kirs (1994), Luftman et al. (1999), Hussin et al. (2002), Chan et al. (2006)
Shared CIO-TMT domain knowledge	Shared domain knowledge (CIO business knowledge; TMT IS knowledge)	Lederer and Mendelow (1989), Chan and Huff (1993), Rockart et al. (1996), Luftman and Brier (1999)	Sabherwal and Kirs (1994), Luftman et al. (1999), Reich and Benbasat (2000), Hussin et al. (2002), Chan et al. (2006)
Shared CIO-TMT understanding	Shared understanding	Keen (1991), Rockart et al. (1996), Chan (2002)	Tan and Gallupe (2006)
CIO characteristics, attributes, and abilities	Relational similarity control variables of age, gender, tenure, experience	Rockart et al. (1996), Luftman and Brier (1999), Chan (2002)	Luftman et al. (1999)
Track record of IS department/CIO		Rockart et al. (1996), Luftman and Brier (1999), Chan (2002)	Luftman et al. (1999), Chan et al. (2006)

and empirically test key antecedents of the social dimension of alignment. Given that the focus is on shared understanding between the CIO and TMT, these antecedents focus on mechanisms to facilitate the exchange and combination of knowledge between the CIO and TMT to develop a shared cognition. The study focuses on how a shared understanding within the upper echelons of the organization (i.e., between the CIO and the TMT) contributes to intellectual IS strategic alignment. Because the focus is on the strategic level of the organization, we define IS strategic alignment as the congruence between an organization's business strategy and IS strategy (Chan et al. 1997). Thus, the term *IS strategic alignment* in the paper, as in many other studies (e.g., Sabherwal and Kirs 1994, Chan et al. 1997, Luftman and Brier 1999, Tallon et al. 2000, Sabherwal and Chan 2001), refers to the intellectual dimension of IS strategic alignment, and *shared understanding* represents important aspects of the social dimension.

Shared Understanding

Given that lack of understanding between the CIO and the TMT is a major obstacle to IS strategic alignment (Armstrong and Sambamurthy 1999; Chan 2002; Reich and Benbasat 1996, 2000; Rockart et al. 1996; Tan and Gallupe 2006) and given the recent emphasis on social aspects of alignment (Reich and Benbasat 1996, 2000; Tan and Gallupe 2006), we propose shared understanding as a key mechanism to achieve intellectual alignment. We define shared understanding as the degree of shared cognition between the CIO and the TMT on the role of IS in the organization[2] (e.g., Johnson and Lederer 2005, Preston et al. 2006, Tan and Gallupe 2006).

Although shared understanding has been examined by capturing the degree of shared knowledge between the TMT and CIO (e.g., Chan et al. 2006; Nelson and Cooprider 1996; Reich and Benbasat 1996, 2000), research suggests that shared understanding is distinct from shared knowledge. Shared understanding is derived when the CIO and TMT have higher levels of business and IS knowledge, respectively, and integrate their respective knowledge and perspectives (Armstrong and Sambamurthy 1999, Boynton et al. 1994). Thus, shared knowledge enables the CIO and TMT to create a shared understanding of how IS can be applied to enhance organizational capabilities.

Prior research suggests that shared understanding is a key antecedent of IS strategic alignment (Armstrong and Sambamurthy 1999, Chan and Huff 1993, Chan 2002, Rockart et al. 1996). For example, using cognitive

[2] Please see Table 1 in the online supplement for studies that have defined shared understanding and shared knowledge. The online supplement is available on the *Information Systems Research* website (http://isr.pubs.informs.org/ecompanion.html).

mapping techniques, Tan and Gallupe (2006) found a positive relationship between the shared cognitive structures and cognitive contents of business and IS executives and the intellectual dimension of strategic alignment. Further, Upper Echelons theory provides theoretical arguments linking TMT cognitions to organizational outcomes and thus between shared understanding and IS strategic alignment. Upper Echelons theory argues that strategic choices (i.e., business strategy, IS strategy, and their alignment) are a reflection of the cognitive bases of top executives. In this regard, shared understanding, which represents shared cognition of strategic decision makers on the role of IS in the organization, is expected to influence IS strategic alignment. Research has noted that shared understanding allows the CIO to influence the business strategy, prompts the CIO and TMT to reach common organizational goals and objectives through better organizational planning, and facilitates the alignment of the organization's IS strategy with its business strategy (Armstrong and Sambamurthy 1999, Chan 2002, Karimi and Gupta 1996, Keen 1991, Lederer and Burky 1988, Nelson and Cooprider 1996). Thus, we hypothesize as follows.

Hypothesis 1 (H1). *A shared understanding between the CIO and TMT about the role of IS within the organization will positively influence IS strategic alignment.*

Antecedents of Shared Understanding

Shared Language

Shared language is defined as the degree to which the CIO and TMT share a common language and terminology in their communication. Shared language is essential in communicating meaning, allowing for knowledge integration, providing convergence of meanings and opinions about situations, and creating a shared understanding among key organization members (Johnson and Lederer 2005, Madhavan and Grover 1998, Nahapiet and Ghoshal 1998, Nelson and Cooprider 1996). Shared language influences development of intellectual capital (e.g., shared cognitions between the CIO and TMT) by facilitating access to each other's information, providing common frames of reference for observing and interpreting the environment, and enabling combination of knowledge through social exchange (Nahapiet and Ghoshal 1998).

Language is particularly important for CIOs because, to effectively communicate with the TMT, exchange knowledge, and reach shared understanding, they must be fluent in the "language of business." The CIO must have the ability to communicate in business terms that the TMT can understand rather than technical language laden with acronyms (Feeny et al. 1992, Smaltz et al. 2006). CIOs who cannot adeptly speak in business language or who use "technolingo" tend to alienate members of the TMT, as exemplified by the following quote by a CEO: "I have a lot of confidence in him, whereas his predecessors used to talk arcane, impenetrable stuff" (Feeny et al. 1992, p. 435). Boynton et al. (1992) found that incongruent language hinders a common view between business managers and IS managers, as exemplified by the statement by one business manager that was interviewed: "We don't understand their language, and they don't understand ours" (p. 32). Further anecdotal evidence underscores the importance of shared language in the development of a shared perspective: "We talk good shorthand and have no difficulty talking to each other. He is a strong ally of mine in the drive to change this company" (Feeny et al. 1992, p. 435). Thus, we hypothesize as follows.

Hypothesis 2 (H2). *Shared language between the CIO and TMT will positively influence the development of shared understanding between the CIO and TMT about the role of IS in the organization.*

CIO-TMT Shared Domain Knowledge: CIO Business Knowledge and TMT Strategic IS Knowledge. Shared understanding is developed through knowledge integration between the CIO and TMT. The literature suggests two key components of the structures for knowledge integration: systems of knowing (discussed in the next section) and objective knowledge (CIO business knowledge and TMT IS knowledge) (Armstrong and Sambamurthy 1999, Spender 1996), both of which are included in the research model.

According to Armstrong and Sambamurthy (1999), objective knowledge includes the explicit and visible domain knowledge of the CIO and TMT. Shared understanding presupposes overlapping knowledge structures, with some knowledge held in common

(Mohammed et al. 2000). Although the knowledge structures need not be identical, they need to be compatible and lead to common expectations (Cannon-Bowers et al. 1993). Thus, for shared understanding to develop, the CIO needs business knowledge and the TMT needs some strategic IS knowledge. The CIO's business knowledge and the TMT's strategic IS knowledge enable the "IT and business executives, at a deep level, to understand and be able to participate in the others' key processes and to respect each others' unique contribution and challenges" (Reich and Benbasat 2000, p. 86). Additional support for the relationships is provided by studies that have attributed the conceptual incongruence between the CIO and TMT about the role of IS in the organization to lack of strategic IS knowledge on behalf of the TMT on one hand and limited business knowledge by the CIO on the other (Armstrong and Sambamurthy 1999, Chan and Huff 1993, Feeny et al. 1992, Gupta 1991). Thus, we hypothesize as follows.

Hypothesis 3 (H3). *The CIO's level of business-related knowledge will positively influence the development of shared understanding between the CIO and TMT about the role of IS in the organization*.

Hypothesis 4 (H4). *The TMT's level of strategic IS knowledge will positively influence the development of shared understanding between the CIO and TMT about the role of IS in the organization*.

In addition, we posit that CIO business knowledge will influence the development of a shared language between the CIO and TMT. As discussed, the language of the TMT is a business language, and the CIO must become adept at using business language to work effectively with the TMT. Research shows that a manager's level of communication competence is contingent on his or her level of business knowledge (Szpekman 2000) and that a higher level of common knowledge between organizational members improves communication (Cohen and Levinthal 1990). The CIO's level of business knowledge will allow the CIO to understand how to communicate in business terms and to converse in shared language with the TMT. Thus, we hypothesize as follows.

Hypothesis 5 (H5). *The CIO's level of business-related knowledge will positively influence the development of a shared language between the CIO and TMT.*

Systems of Knowing. *Systems of knowing* refers to organizational arrangements that enable interaction among team members for sharing their perspectives, pooling knowledge, and developing shared understanding (Nahapiet and Ghoshal 1998, Armstrong and Sambamurthy 1999). Thus, systems of knowing allow for knowledge exchange, the transfer of business knowledge and strategic IS knowledge between TMT and CIO, and the development of shared language and understanding of the role of IS within the organization (Johnson and Lederer 2005). Sharing of knowledge requires a deeper form of managerial interaction than the simple communication of facts (Nelson and Cooprider 1996). Organizations afford a variety of structural and social means of interaction, knowledge sharing, and knowledge integration collectively termed *systems of knowing* (Spender 1996), which are fundamental in facilitating knowledge exchange among organizational members, particularly senior executives (Armstrong and Sambamurthy 1999). We propose two types of systems of knowing that facilitate knowledge exchange and integration between the CIO and TMT: structural systems of knowing and social systems of knowing.

Structural Systems of Knowing. Structural systems of knowing allow for structured and *formal* interactions, which enable the CIO to interact and thereby exchange and integrate knowledge with the TMT (Armstrong and Sambamurthy 1999, Nahapiet and Ghoshal 1998). They are, therefore, critical in the development of shared domain knowledge (CIO business knowledge and TMT strategic IS knowledge), shared language, and shared understanding. Structural systems include organizational arrangements such as formal reporting relationships and formal coordinating structures. In the CIO-TMT context, the hierarchical level of the CIO (i.e., whether the CIO directly reports to the chief executive officer [CEO]) and the degree of formal CIO participation in the TMT are two key structural systems of knowing, because they represent significant formal opportunities for CIO-TMT interactions and knowledge exchange. The hierarchical level of the CIO affords him or her greater opportunities for engagement and rich communication with the CEO, thereby allowing greater understanding of organizational goals (Smaltz

et al. 2006, Watson 1990). The degree of CIO participation in the TMT enables the CIO to obtain a global and holistic perspective of the organization, its goals, and strategies, and enhances the CIO's understanding of the TMT's vision of the organization (Armstrong and Sambamurthy 1999, Earl and Feeny 1994, Feeny et al. 1992, Lederer and Mendelow 1987, Rockart et al. 1996). It also enables the CIO to discuss with the TMT how IS can add value and enable business strategy. Thus, increased interaction allows for sharing of perspectives, pooling of knowledge, and knowledge integration (Armstrong and Sambamurthy 1999, Nahapiet and Ghoshal 1998). This both helps increase the CIO's business knowledge and the TMT's strategic IS knowledge and helps develop a shared view of business strategy and the role of IS in the organization (Armstrong and Sambamurthy 1999, Earl and Feeny 1994, Lederer and Mendelow 1987, Rockart et al. 1996). In addition, Nickerson and Zenger (2004) argue that the organizational hierarchy possesses a distinct advantage in promoting the formation of shared language among organization members. Increased interaction and discussion of both business and IS issues allow the CIO to develop a business vocabulary and learn how to articulate points in a business language that is understandable by the TMT (Armstrong and Sambamurthy 1999, Wheeler et al. 2002). Thus, we hypothesize as follows.

Hypothesis 6A (H6A). *Structural systems of knowing will positively influence the CIO's level of business knowledge.*

Hypothesis 6B (H6B). *Structural systems of knowing will positively influence the TMT's level of strategic IS knowledge.*

Hypothesis 6C (H6C). *Structural systems of knowing will positively influence the development of a shared language between the CIO and TMT.*

Hypothesis 6D (H6D). *Structural systems of knowing will positively influence the development of a shared understanding between the CIO and TMT about the role of IS within the organization.*

Social Systems of Knowing. In addition to interactions facilitated by structural systems of knowing, we posit that social systems of knowing influence the development of shared domain knowledge (CIO business knowledge and TMT strategic IS knowledge), shared language, and shared understanding. Informal interactions facilitate the ease and frequent flow of communication among team members and allow for rich communication processes that drive knowledge transfer in organizations (Alavi and Leidner 2001); they also create opportunities to exchange ideas, increase each other's domain knowledge, and improve understanding (Armstrong and Sambamurthy 1999, Lederer and Burky 1988, Watson 1990). Social interaction and participation in social events are the principal means by which employees become socialized to their organizations, learn to speak the language of their company, and gain a better appreciation of its values and mission (Feldman 1984). Successful CIOs informally communicate and socialize with the TMT and in return can evaluate the TMT's motivations, meanings, and priorities; know the mind of the business; develop and test their vision of the business; and communicate to the TMT the capabilities and value of IS (Earl and Feeny 1994). Further, the CIO's interaction and networking with top management have been shown to lead to shared understanding (Armstrong and Sambamurthy 1999) and to provide the CIO with a greater understanding of the goals of the firm (Madhavan and Grover 1998). Thus, we hypothesize as follows.

Hypothesis 7A (H7A). *Social systems of knowing will positively influence the CIO's level of business knowledge.*

Hypothesis 7B (H7B). *Social systems of knowing will positively influence the TMT's level of strategic IS knowledge.*

Hypothesis 7C (H7C). *Social systems of knowing will positively influence the development of a shared language between the CIO and TMT.*

Hypothesis 7D (H7D). *Social systems of knowing will positively influence the development of a shared understanding between the CIO and TMT about the role of IS within the organization.*

Relational Similarity. *Relational similarity* is defined as the similarity of background characteristics between the CIO and TMT. Prior research of upper echelons suggests two sets of observable background characteristics that define relational similarity: demographic characteristics (e.g., age) and experiential

characteristics (e.g., functional specialization and organizational tenure) (Michel and Hambrick 1992, Tsui and O'Reilly 1989). The term *relational demography* refers to comparative demographic characteristics of members of dyads or groups who are in a position to engage in regular interactions (Tsui and O'Reilly 1989, Young and Buchholtz 2002).

Individuals with common functional backgrounds and experiences are likely to have an overlapping knowledge base (Cohen and Levinthal 1990), which is necessary for the development of a shared understanding. Experience in similar functional groups facilitates the development of shared language among employees by exposing them to the jargon and perspectives used by those functional areas of their firm (Collins and Smith 2006). In addition, individuals with similar experiences, interests, and cultural backgrounds have similar attitudes, perceptions, values, and beliefs (Markides 1997, Tsui and O'Reilly 1989, Young and Buchholtz 2002). Because one's background and experiences influence one's knowledge base and views, common experiences and interests imply a higher level of shared knowledge that is manifest in a higher level of CIO business knowledge and TMT strategic IS knowledge, common vocabulary, and common perceptions (Madhavan and Grover 1998, Markides 1997). Thus, we hypothesize as follows.

Hypothesis 8A (H8A). *CIO-TMT experiential similarity will positively influence the CIO's level of business knowledge*.

Hypothesis 8B (H8B). *CIO-TMT experiential similarity will positively influence the TMT's level of strategic IS knowledge*.

Hypothesis 8C (H8C). *CIO-TMT experiential similarity will positively influence the development of a shared language between the CIO and TMT*.

Hypothesis 8D (H8D). *CIO-TMT experiential similarity will positively influence the development of a shared understanding between the CIO and TMT about the role of IS within the organization*.

Based on prior research in relational demography and on the similarity-attraction paradigm, we posit that relational similarity between the CIO and TMT facilitates both structural and social systems of knowing (i.e., the level of formal and informal interactions between the CIO and TMT). The similarity-attraction paradigm suggests that individuals tend to be attracted to those more similar to themselves (Byrne 1971). Interpersonal attraction is based on similarity between individuals on demographic and experiential dimensions (Tsui and O'Reilly 1989). Therefore, individuals are more likely to formally interact and socialize with those who have greater demographic similarity (age and gender) and experiential commonalities (e.g., organizational tenure, level of education, industry experience, and functional specialization) (Tsui and O'Reilly 1989, Young and Buchholtz 2002). Thus, we hypothesize as follows.

Hypothesis 9A (H9A). *Demographic similarity between the CIO and TMT will be positively related to structural systems of knowing*.

Hypothesis 9B (H9B). *Demographic similarity between the CIO and TMT will be positively related to social systems of knowing*.

Hypothesis 10A (H10A). *Experiential similarity between the CIO and TMT will be positively related to structural systems of knowing*.

Hypothesis 10B (H10B). *Experiential similarity between the CIO and TMT will be positively related to social systems of knowing*.

CIO Educational Mechanisms and TMT IS Knowledge. Transfer of IS knowledge from the CIO to the TMT can occur through CIO-orchestrated educational events. CIOs need to proactively create opportunities for the TMT to learn about the capabilities of IS as they relate to business strategy and to help avoid a "disconnect" between IS and business goals (Gupta 1991, Lederer and Mendelow 1987, Smaltz et al. 2006). Successful CIOs realize that "attitudes, visions, and values of the TMT seldom change quickly" (Earl and Feeny 1994, p. 16) and must be able to "communicate with these top business executives by translating new ideas into pictures and understandable benefits" (Earl and Feeny 1994, p. 15). Therefore, CIO educational mechanisms specifically address the TMT's limited understanding of IS strategic capabilities. Although the CIO may educate the TMT on the capabilities of IS through many interaction opportunities created by systems of knowing,

CIO educational mechanisms capture formal educational efforts that he or she initiates. It is essential that the CIO manage the TMT's expectations so this upper echelon does not underestimate or overestimate IS capabilities. In fact, a 2004 *CIO Magazine* survey lists "managing the unrealistic expectations of CEO and business executives" (Wailgum 2004, p. 96) as the top challenge for CIOs. In addition, formal educational events (seminars, presentations, workshops, and retreats) facilitate an understanding of IS capabilities and help TMT members develop their IS-related strategic knowledge (Lederer and Mendelow 1987, Markides 1997). Thus, we hypothesize as follows.

Hypothesis 11 (H11). *Management by the CIO of TMT expectations of IS capabilities will positively influence the development of the TMT's strategic IS knowledge.*

Hypothesis 12 (H12). *CIO-sponsored educational events will positively influence the development of the TMT's strategic IS knowledge.*

Methodology

Data were collected via a field study that used matched-pair surveys of CIOs and a TMT peer executive. Consistent with prior research, we define the CIO as the most senior IS executive within the organization (Armstrong and Sambamurthy 1999, Grover and Jeong 1993) and the TMT as the CEO and those senior-most executives in the organization who report directly to the CEO (Finkelstein and Hambrick 1996).

Instrument Pretest and Operationalization of Research Variables

A mail and corresponding Web-based survey were developed for the study. Where validated scales did not exist, new items were created. All constructs were measured using multi-item scales. In Appendix A, we provide the definition of the constructs, the items used grouped by construct, and the sources of each item. The survey was validated in a three-step process. First, semistructured interviews were held with six CIOs to assess content validity and to gain richer insights into the phenomenon. Second, an item-sorting exercise was used to qualitatively evaluate the discriminant validity of each of the constructs (Moore and Benbasat 1991). Finally, the psychometric properties of the scales were statistically assessed.[3]

Table 2 Summary of Key Informants

Construct	Key informant
CIO demographic and experiential characteristics	CIO and secondary data sources
TMT demographic and experiential characteristics	TMT members and secondary data sources
TMT strategic IS knowledge, systems of knowing (structural and social), management of TMT expectations, educational events	CIO
Shared language, shared understanding, IS strategic alignment	CIO and TMT members
CIO business knowledge	TMT members

Questionnaire Distribution

Table 2 provides a summary of key informants for each construct. A dual-stage matched sampling strategy was used for the distribution of the CIO and TMT surveys.

In Stage I, the CIO survey was distributed to a sample of CIOs. The CIO contact information was obtained from the Dun & Bradstreet Million Dollar Database (D&B Database) and from several professional industry associations. A total of 7,195 surveys were distributed to CIOs as follows: 4,500 mail surveys, 2,643 electronic surveys, and 52 hand-delivered surveys (for return via mail) at an IS conference. There were 746 CIO surveys returned, for a response rate of 10.4%.[4] Of these 746 CIO surveys, 621 were traceable.[5] In Stage II, the TMT instrument was sent

[3] Details of the interviews and card-sorting exercise can be obtained from the first author.

[4] Of these, 418 were mail surveys (9.3% response rate), 298 were electronic surveys (11.3% response rate), and 30 were hand-delivered surveys (57.7% response rate). Potential differences in response rates across the three methods of survey administration were assessed via a chi-squared test (Dillman 2000). Response rates were significantly different between each of the three methods of distribution ($p < 0.01$). Despite differences in the responses rates, a comparison of the samples collected via each of the three distribution methods showed no significant differences in the mean values of the variables included in this study.

[5] All surveys included an identifying code that could be removed by the respondent if he or she wished to remain anonymous. In addition, we provided CIOs with the opportunity to provide their email address if they wished to receive an electronic copy of the

via mail to the TMT members of each organization for which we had received a completed CIO questionnaire. TMT members were identified through secondary data sources (D&B Database, American Hospital Directory, American College of Healthcare Executives, and corporate websites). Data from TMT members were collected within three months of collecting the CIO data. To increase response rates (and consistent with Armstrong and Sambamurthy 1999 and Smaltz et al. 2006), questionnaires were sent to all TMT members. TMT membership was confirmed by asking TMT respondents about TMT membership and the reporting structure of the organization on the survey. In addition, each TMT respondent was asked to confirm the name of the organization's CIO. A total of 243 of the 621 (39.1%) organizations returned at least one TMT member survey. Multiple TMT responses were obtained from 64 of the 243 responding organizations (26.3%). For those organizations for which we obtained multiple TMT responses, we assessed within-team agreement with r_{wg} (James et al. 1984) for variables for which the TMT member was a key respondent. Within-team agreement was found to be acceptable and suggests substantial agreement among the TMT members,[6] which provides support for combining TMT members' perceptions to produce averaged, aggregated scores for respective firms (Waldman et al. 2001). Therefore, we evaluated multiple TMT member responses through a consensus evaluation by taking the mean of answers from all responding TMT members of an organization. In addition, this approach supports that data obtained from single TMT respondents are valid reflections of team and organizational phenomena (Armstrong and Sambamurthy 1999, Smaltz et al. 2006). A summary of characteristics of the CIO-TMT respondents and their organizations and summary statistics for CIO and TMT responses to each questionnaire item can be respectively found in Tables 2 and 3 of the online supplement.[7]

The response rate is typical of research involving CIO and TMT respondents (Chan et al. 1997, Armstrong and Sambamurthy 1999), yet it is important to test for nonresponse bias. We assess nonresponse bias (via ANOVA) by comparing mean annual sales and mean total number of employees for the 243 responding organizations to that of all nonresponding organizations in the same primary SIC code (listed in the D&B Database). This revealed no significant differences between responding and nonresponding organizations in the same industry.

Analysis and Results

To establish the nomological validity of shared understanding, we used partial least squares (PLS), because it allows use of both formative and reflective constructs. The psychometric properties of all scales were assessed within the context of the structural model through assessment of discriminant validity and reliability.

Measurement Model

Several variables (structural systems of knowing, demographic similarity, and experiential similarity) are modeled as formative constructs (as per the criteria of Jarvis et al. 2003). Specifically, structural systems of knowing include the following items: level of formal interaction with TMT, hierarchical level of the CIO, and formal participation in the TMT. The three aspects of the construct are not necessarily correlated and changes in one do not necessarily imply changes in another. Similar arguments hold for the measures of demographic similarity (age and gender) and experiential similarity (educational level,

research findings. Using the identifying code and/or email address, 621 of the 746 were considered complete and usable based on the following criteria: the identity of the CIO/company was traceable; the survey questions were properly answered; the CIO was identified as the most senior IS executive in the organization; the CIO's organizational tenure exceeds one year. We assessed response bias via analysis of variance (ANOVA) for each of the constructs in the study for differences between the 621 CIO respondents who revealed their identity and the set of CIOs who chose to remain anonymous. Results revealed no significant differences.

[6] For CIO business knowledge, shared language, shared understanding, and IS strategic alignment, the median within-team agreement (r_{wg}) was 0.91, 0.85, 0.95, and 0.91, respectively; the mean r_{wg} was 0.85, 0.81, 0.92, and 0.88, respectively. Further, the proportion of TMT with r_{wg} greater than or equal to 0.70 for CIO business knowledge, shared language, and shared understanding; IS strategic alignment was 0.86, 0.89, 1.00, and 0.96, respectively.

[7] Additional information is contained in an online supplement can be downloaded at http://sbuweb.tcu.edu/dpreston/ISRonlinesupplement.pdf.

Table 3 Results of Factor Analysis

Indicators	StratAl	ShUnd	ShLang	CIOBusknow	TMTISknow	SocSK	MgExp	EdEv
StratAl1	**0.917**	0.661	0.521	0.512	0.295	0.277	0.319	0.172
StratAl2	**0.948**	0.649	0.467	0.450	0.284	0.264	0.330	0.234
StratAl3	**0.957**	0.651	0.477	0.465	0.281	0.220	0.296	0.220
ShUnd1	0.637	**0.879**	0.527	0.487	0.260	0.277	0.389	0.175
ShUnd2	0.629	**0.872**	0.461	0.446	0.322	0.311	0.387	0.257
ShUnd3	0.567	**0.872**	0.465	0.429	0.239	0.291	0.340	0.237
ShUnd4	0.549	**0.811**	0.541	0.423	0.289	0.257	0.309	0.197
ShLang1	0.480	0.610	**0.850**	0.371	0.188	0.232	0.239	0.141
ShLang2	0.397	0.403	**0.819**	0.379	0.131	0.243	0.103	0.075
ShLang3	0.331	0.292	**0.694**	0.313	0.001	0.115	0.052	0.026
CIOBusknow1	0.530	0.512	0.390	**0.882**	0.067	0.177	0.142	0.083
CIOBusknow2	0.399	0.445	0.402	**0.908**	0.028	0.079	0.182	0.099
CIOBusknow3	0.393	0.406	0.391	**0.842**	0.149	0.072	0.221	0.070
TMTISknow4	0.460	0.477	0.302	0.184	**0.900**	0.351	0.437	0.313
TMTISknow5	0.378	0.451	0.247	0.157	**0.885**	0.370	0.381	0.302
TMTISknow6	0.375	0.427	0.245	0.165	**0.843**	0.313	0.359	0.273
SocSK1	0.283	0.284	0.164	0.101	0.292	**0.824**	0.331	0.242
SocSK2	0.188	0.276	0.281	0.101	0.199	**0.800**	0.337	0.338
SocSK3	0.201	0.254	0.174	0.115	0.237	**0.842**	0.399	0.242
MgExp1	0.160	0.230	0.062	0.132	0.230	0.351	**0.670**	0.187
MgExp2	0.197	0.308	0.116	0.071	0.209	0.288	**0.707**	0.311
MgExp3	0.345	0.391	0.155	0.204	0.328	0.394	**0.850**	0.221
MgExp4	0.255	0.316	0.172	0.175	0.250	0.281	**0.782**	0.207
MgExp5	0.263	0.281	0.188	0.156	0.202	0.260	**0.713**	0.161
EdEv1	0.136	0.210	0.088	0.042	0.216	0.276	0.265	**0.760**
EdEv2	0.151	0.157	0.087	0.031	0.200	0.226	0.222	**0.703**
EdEv3	0.134	0.162	0.085	0.071	0.171	0.196	0.171	**0.730**
EdEv4	0.214	0.187	0.066	0.140	0.160	0.268	0.159	**0.681**

Notes. For Tables 3 and 4: StratAl = strategic alignment; ShUnd = shared understanding; ShLang = shared language; CIOBusknow = CIO business knowledge; TMTISknow = TMT strategic IS knowledge; SocSK = social systems of knowing; MgExp = management of expectations; EdEv = educational events; StrSK = structural systems of knowing; DemSim = demographic similarity; ExpSim = experiential similarity.

common interests, functional background, and organizational tenure), which are also formatively modeled. All other constructs were reflectively modeled. The psychometric properties of the scales are assessed in terms of item loadings, internal consistency, and discriminant validity (Tables 3 and 4). Item loadings and internal consistencies greater than 0.70 are generally considered acceptable (Fornell and Larcker 1981).[8]

As can be observed from the factor analysis results in Table 3 and composite reliability scores in Table 4, scales used in the study largely meet these guidelines. Three loadings are below (but close to) 0.70: ShLang3 (0.694), MgExp1 (0.670), and EdEv4 (0.681). However, because these items do not cross-load, the scales exhibit good internal consistency, and there is no theoretical reason to drop the items, they were

[8] The guidelines for item loading are relevant only for constructs that are modeled as reflective (IS strategic alignment, shared understanding, shared language, CIO business knowledge, TMT strategic IS knowledge, social systems of knowing, management of TMT expectations, and educational events).

Table 4 Interconstruct Correlations

	Composite reliability (no. of items)	StratAl	ShUnd	ShLang	CIOBusknow	TMTISknow	SocSK	MgExp	EdEv	StrSK	DemSim	ExpSim
StratAl	0.959 (3)	**0.941**										
ShUnd	0.918 (4)	0.695	**0.859**									
ShLang	0.832 (3)	0.519	0.580	**0.791**								
CIOBusknow	0.909 (3)	0.506	0.521	0.448	**0.876**							
TMTISknow	0.907 (3)	0.462	0.514	0.302	0.193	**0.875**						
SocSK	0.860 (3)	0.270	0.331	0.259	0.128	0.392	**0.820**					
MgExp	0.856 (5)	0.335	0.416	0.186	0.205	0.448	0.431	**0.739**				
EdEv	0.805 (4)	0.221	0.251	0.114	0.095	0.338	0.341	0.291	**0.713**			
StrSK	N/A	0.401	0.410	0.255	0.134	0.397	0.500	0.353	0.319	**0.738**		
DemSim	N/A	0.048	0.026	0.107	0.051	0.024	0.158	0.007	0.065	0.296	**0.681**	
ExpSim	N/A	0.251	0.266	0.293	0.116	0.368	0.399	0.298	0.269	0.095	0.130	**0.506**

Notes. N/A: formative constructs; so reliability measures are not relevant. The bold numbers on the leading diagonal are the square root of the AVE.

retained in the analysis. To assess discriminant validity (Chin 1998), indicators should load more strongly on their corresponding construct than on other constructs in the model and the square root of the average variance extracted (AVE) should be larger than the interconstruct correlations. As shown by the factor analysis results and comparison of interconstruct correlations and AVE (bold numbers on the leading diagonal) in Table 4, the constructs meet these guidelines pointing to the discriminant validity of the constructs in the model.

Structural Model

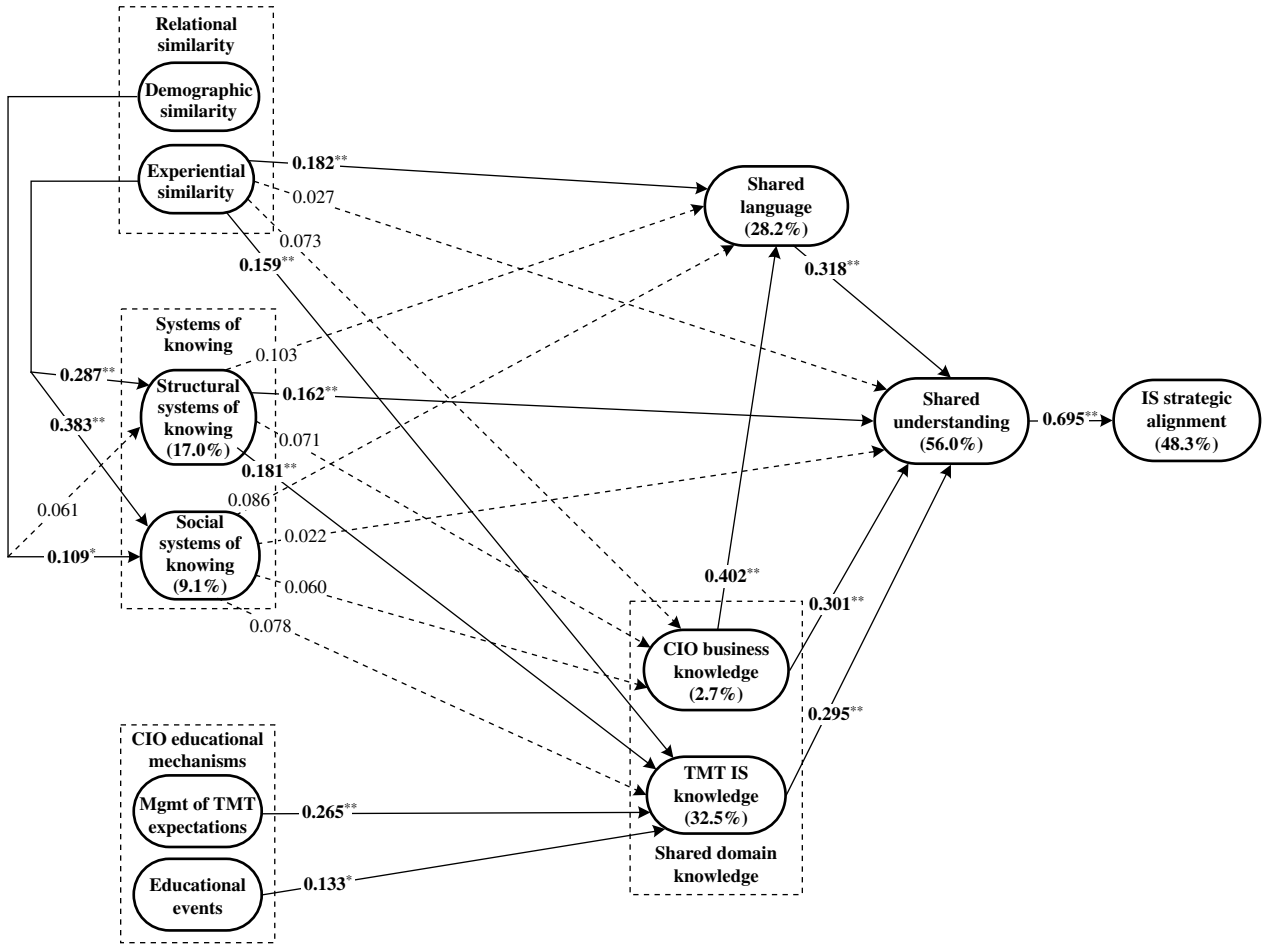
The path coefficients and explained variances for the structural model are shown in Figure 2. Organizational variables (organizational size, geographic location, and industry) and CIO individual characteristics (age, gender, functional background, organizational tenure, and tenure in the CIO position) were included in the analysis as controls for IS strategic alignment. As none of the controls were significant, they were dropped from the model.

The weights for the indicators of the formatively modeled constructs are shown in Table 5. Formal CIO participation in the TMT and the level of formal interaction between the CIO and TMT were significant indicators of structural systems of knowing; the reporting level of the CIO was not. "Common interests" were the only significant indicator for experiential similarity, and both age and gender were significant indicators of demographic similarity. The percent of explained variance in the dependent variables and their significant antecedents are summarized in Table 6. The hypothesis test results are summarized in Table 7.

Post Hoc Mediation Analysis

Post hoc analyses were conducted to examine whether shared understanding fully mediates the influence of antecedent variables on IS strategic alignment. In our first analysis, we assess whether shared understanding mediates the influence of shared language and shared domain knowledge (CIO business knowledge and TMT IS knowledge) on IS strategic alignment. Results of the mediation analysis (Baron and Kenny 1986) show that shared understanding partially mediates the effect of shared language, CIO business knowledge, and TMT IS knowledge on IS strategic alignment (each construct has a significant direct effect). Furthermore, when the shared understanding construct was removed from the model, the percent of explained variance in IS strategic alignment is reduced from 48.3% to 40.0% (an 8.3% reduction). An F-test comparison of these two models showed that the difference in explained variance of IS strategic alignment was statistically significant ($p < 0.001$). In our second analysis, to further examine the contribution of shared understanding to IS strategic alignment, we ran a model with all direct shared

Figure 2 PLS Results



*Significant at 0.05; **significant at 0.01.

understanding antecedents in the model (after removing shared understanding) as direct determinants to IS strategic alignment. These six direct antecedents collectively explained 43.8% of the variance in IS strategic alignment (4.5% lower than when shared understanding is the sole determinant of IS strategic alignment). Therefore, the post hoc analyses suggest that shared understanding is an important proximal antecedent of IS strategic alignment beyond other potential determinants and is appropriately placed in the nomological network.

Discussion of Results

As predicted, results show that IS strategic alignment is influenced by a shared CIO-TMT understanding. Furthermore, shared language, CIO business knowledge, and TMT strategic IS knowledge (i.e., shared domain knowledge) directly impact the development of this shared understanding. The findings also suggest that formal organizational structures provide greater leverage than informal interactions in promoting TMT strategic IS knowledge and a shared understanding. Specifically, the CIO's formal participation and interaction with the TMT emerged as significant structural arrangements, although CIO reporting level was surprisingly not significant. This finding is inconsistent with findings by Watson (1990), but it is consistent with Armstrong and Sambamurthy (1999), who found that CIO membership in the TMT is more important than reporting level with respect to

Table 5 PLS Weights of Formatively Modeled Constructs

Construct	Weight	Construct	Weight
Structural systems of knowing		Experiential similarity	
StrSK1 (TMT formal participation)	0.65**	RelSim (common interests)	0.95**
StrSK2 (formal interactions with TMT)	0.48**	Functional background similarity	0.02
StrSK3 (CIO reporting level)	0.13	Organizational tenure similarity	0.03
Demographic similarity		Educational level similarity	0.10
Age similarity	0.63*		
Gender similarity	0.84**		

*Significant at 0.05; **significant at 0.01; StrSK = structural systems of knowing; RelSim = relational similarity.

communication and knowledge exchange. Therefore, results of the study suggest that granting the CIO membership in the TMT is likely the most effective structural means of promoting the development of TMT IS knowledge and shared understanding. Reporting directly to the CEO enables direct CIO-CEO interactions, but it does not ensure CIO-TMT interactions and exchange of knowledge and perspectives. This occurs when the CIO is a member of the TMT.

Structural systems of knowing had no effect on the development of shared language or CIO business knowledge. This suggests that knowledge exchange enabled by such formal systems appears to be somewhat one sided because it influences TMT strategic IS knowledge but not CIO business knowledge or the CIO's use of shared business language with the TMT. However, these formal systems have a direct impact on the level of shared understanding between the CIO and TMT above and beyond their impact through increasing TMT IS knowledge. This suggests that these formal systems both enable the CIO to impart IS knowledge to the TMT and create the forum for the CIO and TMT to integrate their knowledge and perspectives and arrive at a shared understanding.

Table 6 Variance Explained in Dependent Variables

Dependent variable	Variance explained (%)	Antecedents with significant paths
IS strategic alignment	48.3	Shared understanding**
Shared understanding	56.0	Shared language**, CIO business knowledge**, TMT IS knowledge**
Shared language	28.2	CIO business knowledge**, experiential similarity**
CIO business knowledge	2.7	No significant antecedents
TMT IS knowledge	32.5	Structural systems of knowing**, experiential similarity**, management of TMT expectations**, educational events*
Social systems of knowing	17.0	Demographic similarity*, experiential similarity**
Structural systems of knowing	9.1	Experiential similarity**

*Significant at 0.05; **significant at 0.01.

Surprisingly, social systems of knowing had no effect on CIO business knowledge, TMT strategic IS knowledge, shared language, or shared understanding. This contradicts findings of prior research that social interaction is a critical mechanism of knowledge exchange and allows the opportunity to build a deeper level of understanding (Lederer and Burky 1988, Nelson and Cooprider 1996, Watson 1990). However, it is consistent with findings by Smaltz et al. (2006). Our CIO interviews provide additional evidence that social arrangements may be less important. One CIO interviewee stated that to understand business strategy, objectives, and concerns, he would prefer "10 minutes in a TMT meeting [over] 10 hours of informal interaction." Though our results suggest that formal mechanisms are more effective in creating a shared understanding, informal interactions may be important in building trusting relationships that facilitate the development of CIO business knowledge, TMT IS knowledge, shared language, and shared understanding (Nahapiet and Ghoshal 1998).

The development of shared understanding requires at least some level of shared domain knowledge. Given that neither structural nor social systems of knowing had a significant effect on CIO business knowledge and shared language, this may suggest that to be the top IS executive, the CIO may already need to have sufficient business knowledge and ability to communicate in business terms. Thus, interactions with the TMT may not necessarily result in an increase in their level of business knowledge or ability to communicate in business terms. Rather, in such forums, their extant business knowledge and

Table 7 Summary of Hypothesis Tests

Hypotheses	Path coefficient	Support for hypothesis
Impact of shared understanding on IS strategic alignment		
H1: Shared understanding → IS strategic alignment	0.695**	Supported
Impacts of shared language and shared domain knowledge		
H2: Shared language → Shared understanding	0.318**	Supported
H3: CIO business knowledge → Shared understanding	0.301**	Supported
H4: TMT strategic IS knowledge → Shared understanding	0.295**	Supported
H5: CIO business knowledge → Shared language	0.402**	Supported
Impacts of structural systems of knowing		
H6A: Structural systems of knowing → CIO business knowledge	0.071	Not supported
H6B: Structural systems of knowing → TMT strategic IS knowledge	0.181**	Supported
H6C: Structural systems of knowing → Shared language	0.103	Not supported
H6D: Structural systems of knowing → Shared understanding	0.162**	Supported
Impacts of social systems of knowing		
H7A: Social systems of knowing → CIO business knowledge	0.060	Not supported
H7B: Social systems of knowing → TMT strategic IS knowledge	0.078	Not supported
H7C: Social systems of knowing → Shared language	0.086	Not supported
H7D: Social systems of knowing → Shared understanding	0.022	Not supported
Impacts of experiential similarity		
H8A: Experiential similarity → CIO business knowledge	0.073	Not supported
H8B: Experiential similarity → TMT strategic IS knowledge	0.159**	Supported
H8C: Experiential similarity → Shared language	0.182**	Supported
H8D: Experiential Similarity → Shared understanding	0.027	Not supported
Impacts of relational similarity on systems of knowing		
H9A: Demographic similarity → Structural systems of knowing	0.061	Not supported
H9B: Demographic similarity → Social systems of knowing	0.109*	Supported
H10A: Experiential similarity → Structural systems of knowing	0.287**	Supported
H10B: Experiential similarity → Social systems of knowing	0.383**	Supported
Impacts of CIO educational mechanisms on TMT strategic IS knowledge		
H11: Management of TMT expectations → TMT strategic IS knowledge	0.265**	Supported
H12: Educational events → TMT strategic IS knowledge	0.133*	Supported

Notes. Common method bias was tested for H6B, H7B, H11, and H12. In these relationships, the CIO was the informant for both the independent and dependent variables. As such, common method variance was assessed based on Podsakoff and Organ (1986) and does not appear to be a problem.

*Significant at 0.05; **significant at 0.01.

language may help them effectively communicate the business value of IS to the TMT and integrate their knowledge with that of the TMT's to create a shared understanding of the role of IS in the organization.

CIOs' management of TMT expectations and CIO-orchestrated educational events had an effect on TMT strategic IS knowledge, pointing to the efficacy of CIO educational efforts. Further, although experiential similarity between the CIO and TMT also had an effect on TMT strategic IS knowledge, it did not affect CIO business knowledge. Common CIO-TMT interests emerged as the only significant aspect of experiential similarity; similarity in functional experience, organizational tenure, and educational level were nonsignificant. Therefore, the CIO having common interests with members of the TMT, managing their expectations, and educating them on IS capabilities can facilitate the TMT's level of strategic IS knowledge and thereby indirectly influence shared understanding.

Both experiential similarity and demographic similarity had effects on social systems of knowing, which is consistent with the similarity-attraction paradigm and prior research (Byrne 1971, Tsui and O'Reilly 1989, Young and Buchholtz 2002). Experiential similarity, but not demographic similarity, had a significant effect on structural systems of knowing. These

findings indicate that common interests influence the CIO's structural position within the organization and the level of formal CIO-TMT interaction, but demographic similarities are not relevant. These findings are in line with the research of Harrison and Price (1998), who suggest that experiential similarity becomes more important than demographic similarity as the duration of group membership increases. The organizational and positional tenure for CIOs in our sample was, respectively, 7.5 years and 4.6 years, which may help explain the nonsignificant findings for demographic similarity. In addition, several of the CIO interviewees in our pretest did not agree that demographic similarity was a relevant variable.

Limitations

Prior to discussing implications, limitations of the study must be acknowledged. Though the response rate for the study is comparable with that of other studies that require matched-pair responses from top executives (Armstrong and Sambamurthy 1999, Chan et al. 1997), it raises the issue of nonresponse bias. Though no significant differences (in annual sales and number of employees) were found between responding and nonresponding organizations, other organizational differences may exist. Further, the sampling frame for the study was not random because organizational access constraints precluded full randomization (Boynton et al. 1994). An attempt was made to contact organizations across industries, but because of researchers' industry contacts, a large percentage (62.6%) of the organizations for which we obtained completed CIO-TMT matched pairs were within the health care industry. The health care industry is information intensive and complex and thereby provides an excellent population in which IS strategic alignment is important (Smaltz et al. 2006). Nonetheless, though our data analysis indicated that industry type did not significantly influence the dependent variables in the model, results may not generalize to less information-intensive industries. Finally, the majority of the matched pairs included single TMT respondents. Using a single member of the TMT as an informant is common practice in research of this nature, and the data showed a high level of within-group agreement among TMT members when multiple responses were obtained. However, ideally responses should be obtained from all members of the TMT. Finally, the operational measures of shared language focused on shared business language between the CIO and TMT. Though this is the language of interaction for the TMT and thus adequately captures shared language in this context, a better measure of shared language would also include TMT's use of IS technical language.

Implications

The study's findings show that (1) shared understanding (representing the social dimension of IS strategic alignment) is an important antecedent of the intellectual dimension of IS strategic alignment; (2) shared understanding partially mediates the impact of shared language, CIO business knowledge, and TMT strategic IS knowledge on IS strategic alignment; (3) components of systems of knowing, CIO-orchestrated educational efforts, and relational similarity are important antecedent variables in the nomological network.

There are several theoretical implications that derive from the study. First, this is the only study we know of that empirically investigates, via a large-scale field study, how shared understanding leads to IS strategic alignment. We thus contribute to the IS strategic alignment literature by delineating a causal structure between social alignment (i.e., shared understanding) and intellectual IS strategic alignment. We further contribute to the literature by testing antecedents of social alignment focusing on social and structural arrangements and CIO-TMT relational similarity that facilitate knowledge integration and shared cognition and integrate the social dimension of alignment, the intellectual dimension of alignment, and these antecedents in a nomological network. Empirical results highlight the importance of shared understanding (and social alignment) to IS strategic alignment and suggest directions for future research.

Second, this is one of few studies that empirically investigates how cognitive elements of the CIO and TMT (i.e., shared understanding) lead to alignment of business and IS strategies—which are strategic choices made by top executives. To date, most scholarly research on Upper Echelons theory

has focused on the effects of top executive background (demographic and experiential) characteristics on strategic choice. These background characteristics serve as a proxy for underlying cognitive elements. There is a paucity of research that explores the underlying cognitions within the "black box" that links these salient background characteristics to strategic decisions (Finkelstein and Hambrick 1990, 1996). Results of this study, as well as those by Tan and Gallupe (2006), suggest that directly examining cognitive elements of executives to assess their strategic choices has great promise as an area for future research.

In terms of practical implications, the significant antecedents provide important levers to CIOs and top management to foster the development of shared understanding between the CIO and TMT and thereby to influence IS strategic alignment. First, the CIO should pay particular attention to the language used when communicating with the TMT, articulating issues in business terms and avoiding technical jargon. In addition, the organization should make conscious efforts to build the CIO's level of business knowledge and the TMT's level of IS knowledge. The TMT has the power to directly influence its own level of IS knowledge by engineering the structure of the organization such that the CIO is a formal TMT member. To further enhance the TMT's level of IS knowledge, the CIOs should focus on managing and shaping the TMT's expectations of the capabilities of IS and sponsoring formal events designed for the edification of the TMT. Finally, from a human resources perspective, the influence of experiential similarity on TMT IS knowledge and shared language has important implications. The organization can either select a CIO based on common interests with the TMT or develop programs to allow the CIO to develop interests and experiences in certain areas where there is a gap in background or experiential similarity.

Future Research

The results support the importance of shared understanding (social alignment) in the nomological network leading to the intellectual dimension of IS strategic alignment and point to directions for further research. From a theoretical perspective, it is important to explore both the concept of shared understanding and its antecedents more fully. The current study frames shared understanding antecedents as elements that facilitate knowledge exchanges and integration between the CIO and TMT. Additional types of structural and social arrangements and CIO-orchestrated educational mechanisms are possible. Though the types we included were supported by the literature and validated through interviews with CIOs, future research can identify additional structural and social arrangements that promote CIO-TMT knowledge exchange and integration. Further, characteristics of the CIO such as trust, credibility, communicative ability, and political savvy (Smaltz et al. 2006) may be important antecedents or moderators to some relationships.

Second, the findings of this study indicate that there are several mechanisms in our research model that explain a substantial amount of the variance in the TMT's level of IS knowledge; however, none of the antecedents in the model influenced the CIO's level of business knowledge, and only business knowledge and experiential similarity influenced shared language. Future research may wish to examine organizational arrangements or human resource practices aimed at enhancing the CIO's business knowledge and shared language. Third, communication frequency between the CIO and TMT and channel richness may play important roles in the nomological network from systems of knowing to shared understanding. In fact, Johnson and Lederer (2005) found that communication frequency had an effect on CEO/CIO convergence for certain roles of IS, though channel richness emerged as a key consideration only to some extent about the future role of IS. Johnson and Lederer (2005) suggest that context, frequency, and equivocality of communication may need to be considered simultaneously. Based on our results, we posit that the context of the communication (e.g., formal TMT meeting versus social interaction or one-on-one meeting) may be an important consideration. Thus, the nomological network should include systems of knowing, processes of knowledge exchange and knowledge integration, and frequency of knowledge exchange to further enhance our theoretical understanding of the phenomenon.

Appendix A. Operational Definitions, Scales, and Sources of Construct Items

Strategic alignment: The congruence of the business strategy and IS strategy. *Sources*: Chan et al. (1997, 2006), Reich and Benbasat (2000), CIO interviews.

Scale: Five-point scale ranging from "strongly agree" (5) to "strongly disagree" (1). (1) *StratAl1*: The IS strategy is congruent with the corporate business strategy in your organization; (2) *StratAl2*: Decisions in IS planning are tightly linked to the organization's strategic plan; (3) *StratAl3*: Our business strategy and IS strategy are closely aligned.

Shared understanding: The degree to which the CIO and TMT have a shared view and understanding about the role of IS within the organization. *Sources*: Boynton et al. (1994), Reich and Benbasat (2000), CIO interviews.

Scale: Five-point scale ranging from "strongly agree" (5) to "strongly disagree" (1). CIO and TMT members have: (1) *ShUnd1*: Shared understanding of the role of IS in our organization; (2) *ShUnd2*: Shared view of the role of IS as a competitive weapon for our organization; (3) *ShUnd3*: Shared understanding of how IS can be used to increase productivity of our organization's operations; (4) *ShUnd4*: Common view about the prioritization of IS investments.

Shared language: The degree to which the CIO and TMT share a common language and terminology in their communication. *Source*: CIO interviews

Scale: Five-point scale ranging from "strongly agree" (5) to "strongly disagree" (1). (1) *ShLang1*: CIO and TMT members share a common language in our conversations; (2) *ShLang2*: CIO primarily uses business terminology when interacting with TMT members; (3) *ShLang3*: CIO avoids using IS jargon when interacting with TMT members.

CIO business knowledge: CIO's level of business-related knowledge. *Sources*: Armstrong and Sambamurthy (1999), Smaltz et al. (2006), CIO interviews.

Scale: Five-point scale ranging from "extremely well informed" (5) to "not well informed" (1). For each area, please evaluate the CIO's level of knowledge: (1) *CIOBusknow1*: Your firm's present and future products, markets, business strategies, and business; (2) *CIOBusknow2*: Your industry's practices; (3) *CIOBusknow3*: Your firm's competitors.

TMT strategic IS knowledge: TMT's level of IS-related strategic knowledge. *Sources*: Armstrong and Sambamurthy (1999), Smaltz et al. (2006), CIO interviews.

Scale: Five-point scale ranging from "extremely well informed" (5) to "not well informed" (1). (1) *TMTISknow1*: How knowledgeable is the TMT about the potential and limitations of current IS? (2) *TMTISknow2*: How knowledgeable is the TMT about the potential and the limitations of "next-generation" IS? (3) *TMTISknow3*: How knowledgeable is the TMT about how your competitors are applying IS?

Structural systems of knowing: The structural position of the CIO within the organization that allows for official access to the TMT. *Sources*: Armstrong and Sambamurthy (1999), Smaltz et al. (2006), CIO interviews.

(1) *StrSK1* (TMT participation): Which of the following best describes your involvement with the TMT? [scale: formal member (5) to never involved (1)]; (2) *StrSK2*: I interact with TMT members on a formal basis (e.g., official meetings, work-related phone calls, etc.) [5-point scale ranging from "strongly agree" (5) to "strongly disagree" (1)]; (3) *StrSK3*: How many reporting levels are between you and the CEO? [scale: "direct report" (3) to "two or more levels" (1)].

Social systems of knowing: Frequency of informal interaction of the CIO with the TMT. *Source*: Smaltz et al. (2006).

Scale: Seven-point scale ranging from "daily" (7) to "never" (1). (1) *SocSK1*: I have informal contact with TMT members; (2) *SocSK2*: I socialize with the TMT members (e.g., social gatherings, golf, tennis, etc.); (3) *SocSK3*: I have informal exchanges with TMT members.

Managing TMT expectations: Degree to which the CIO personally manages the expectations of the TMT about the capabilities of how IS can support corporate strategy. *Sources*: Smaltz et al. (2006) CIO interviews.

Scale: Five-point scale ranging from "strongly agree" (5) to "strongly disagree" (1) . (1) *MgExp1*: I provide insight to the TMT members on emerging information technologies; (2) *MgExp2*: I assist the TMT members in improving their computer literacy; (3) *MgExp3*: I educate the TMT members about the capabilities of IS; (4) *MgExp4*: I work to manage the expectations of the TMT with regard to the capabilities of IS; (5) *MgExp5*: I try to give TMT members realistic expectations about the capabilities of IS.

Appendix A. (Continued)

Educational events: Degree to which the CIO organizes educational events for the TMT to inform them of how IS can support corporate strategy. *Sources*: CIO interviews, Smaltz et al. (2006).

Scale: Seven-point scale ranging from "daily" (7) to "never" (1). How often do you organize the following events for the TMT to increase their IS knowledge? (1) *EdEv1* (seminars); (2) *EdEv2* (vendor demonstrations); (3) *EdEv3* (workshops); (4) *EdEv4* (retreats).

Experiential similarity: Similarity between the CIO and TMT with regard to: Common interests/experiences, functional background, educational level, and organizational tenure. *Sources*: Finkelstein and Hambrick (1990), Michel and Hambrick (1992), Young and Buchholtz (2002), CIO interviews.

(1) *RelSim*: TMT members and I share many common interests (sports, hobbies, cultural interests, etc)—5-point Likert scale; (2) *Functional BG*: List the number of years in each of the functional areas (HR, Marketing, Finance/Accounting, Manufacturing, Engineering, General Management, Other; (3) *EducSim*: What is your Level of Education?; (4) *OrgTenSim*: How long have you been with your current organization?

Demographic similarity: Similarity between the CIO and TMT with regard to age and gender. *Sources*: Finkelstein and Hambrick (1990), Michel and Hambrick (1992), Young and Buchholtz (2002), CIO interviews.

(1) AgeSim: What is your year of birth? (2) GenderSim: What is your gender?

Notes. (1) IS strategic alignment, shared CIO-TMT understanding, and shared understanding are based on the average of the CIO and TMT responses. Before averaging across responses, CIO and TMT agreement was assessed via r_{wg} (James et al. 1984). The r_{wg} was calculated for *all* scales where responses were averaged across the CIO and the TMT. In all cases, median and mean responses on level of agreement were above 0.80, indicating substantial agreement between the CIO and TMT.

(2) The similarity of common interests/experiences was measured via a five-point Likert scale (strongly agree—strongly disagree). Functional background similarity was calculated based on the average distance between a focal executive's (the CIO) functional experience profile (years of experience in each functional area) and the functional experience profiles of each other member of the TMT (Chattopadhyay et al. 1999). We assess the functional difference between the CIO and TMT members based on years of work experience in the following functional areas: IS, personnel/human resources, marketing, finance/accounting, manufacturing/operations, research and development, engineering, general management, and any additionally noted functional areas. The other similarity measures (educational level, organizational tenure, age, and gender) were calculated using a modified version of Euclidian distance (O'Reilly et al. 1989, Young and Buchholtz 2002), which measures an individual's (CIO's) similarity compared to a group (the TMT). Experiential and demographic background data were obtained directly from the CIO and *responding* TMT members, but to assess CIO similarity with the entire TMT, we obtained demographic and experiential data for *nonresponding* TMT members from secondary sources (Dun & Bradstreet Million Dollar Database (D&B Database)) and company annual reports).

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