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INFORMATION TECHNOLOGY RELATEDNESS, KNOWLEDGE MANAGEMENT CAPABILITY, AND PERFORMANCE OF MULTIBUSINESS FIRMS[1]

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Abstract

Business value of information technology is an enduring research question. The elusive link between IT and financial firm performance calls for further research into intermediate organizational variables through which IT may influence firm performance. This study proposes that knowledge management (KM) is a critical organizational capability through which IT influences firm performance. In the context of multibusiness firms, the study examines how the IT resources of a firm should be organized and managed to enhance the firm's KM capability, and whether and how KM capability influences firm performance. The study develops two hypothesizes: (1) IT relatedness of the firm's business units enhances cross-unit KM capability; (2) KM capability, in turn, leads to superior firm performance. Data from 250 Fortune 1000 firms provide empirical support for these hypotheses. IT relatedness of business units enhances the cross-unit KM capability of the firm. The KM capability creates and exploits cross-unit synergies from the product, customer, and managerial knowledge resources of the firm. These synergies increase the financial performance of the firm. IT relatedness also has significant indirect effects on firm performance through the mediation of KM capability.

Keywords: IT relatedness, knowledge management capability, complementarity, corporate performance, multibusiness firms, diversification, coordination, synergy

Introduction

The firm-level performance implications of information technology have been an enduring research theme in the information systems literature (Kohli and Devaraj 2003). While some studies have found a significant link between IT and firm performance, others have failed to do so (Devaraj and Kohli 2003). One explanation for the inconsistent findings is that the causal link from IT to

[1]V. Sambamurthy and Mani Subramani were the accepting senior editors for this paper.

firm performance is too long and that most studies have overlooked important intermediate organizational capabilities that mediate the relationship between IT and firm performance (Barua and Mukhopadhyay 2000; Sambamurthy et al. 2003). Recent research interest in the knowledge management (KM) phenomenon indicates that KM capability could be a critical mediator between IT and firm performance. IS researchers posit that IT enhances the KM capabilities of organizations (Alavi and Leidner 2001; Gold et al. 2001; Schultze and Leidner 2002). Further, organizational theorists and strategists suggest that KM capabilities, in turn, provide competitive advantages and increase financial firm performance (Eisenhardt and Santos 2002; Teece 1998). Collectively, the two propositions suggest that IT may impact firm performance through the mediation of KM capability.

Despite widespread belief that IT enables KM and KM improves firm performance, researchers have attempted very little theoretical work on the development of nomological relationships among IT, KM capability, and firm performance. Systematic empirical investigations of these relationships are also scarce. Reviews of the IS literature do not identify any study that establishes a link from IT to KM capability, or from KM capability to financial firm performance (Alavi and Leidner 2001; Schultze and Leidner 2002). Moreover, reviews of organizational theory and strategic management literatures point out that KM studies have not yet addressed the key issues of strategic management such as the nature of competitive advantage and implications for firm performance (Eisenhardt and Santos 2002).

The objective of this study is to advance our understanding of the relationships among IT, KM, and firm performance by addressing the following research questions at the firm level of analysis: (1) How should IT resources of the firm be organized and managed to enhance the KM capability of the firm? (2) How does KM capability improve financial firm performance? This study examines these questions in the context of multibusiness firms operating in multiple product markets. Since knowledge is usually applicable beyond a single product market (Sampler 1998), and there are few external markets for efficient exchange of knowledge (Teece 1980), the internal market of a multibusiness firm provides opportunities for exploiting knowledge in multiple product markets, creating knowledge-based synergies, and improving the overall performance of the firm (Grant 1996b; Robins and Wiersema 1995; Teece 1980). IT organization and management in a multibusiness firm have important implications for the firm's ability to exploit such cross-unit synergies (Brown and Magill 1994, 1998; Sambamurthy and Zmud 1999, 2000; Weill and Broadbent 1998; Weill and Ross 2004). Thus, large multibusiness firms provide a rich context for investigating the research questions of this study.

The paper proceeds as follows. The theoretical foundations section introduces the key constructs of the study and develops hypotheses linking KM capability to firm performance and IT relatedness to KM capability. The methods section presents the procedures used for data collection, validation of the measurement properties of the constructs, and the test of the proposed research model. Findings are presented in the results section. The paper concludes with a discussion of the findings and suggestions for future research.

Theoretical Foundations

In the context of a multibusiness firm, it is important to distinguish between knowledge management *within* and *across* business units. *Within-unit* knowledge management is important for improving the performance of individual business units. However, it does not suffice to justify why individually well-performing business units should exist under the governance of a corporate parent rather than as separate firms in the market. *Cross-unit* knowledge management seeks to create cross-unit knowledge synergies and make the joint value of the corporation greater than the sum of the values of the individual businesses (Tanriverdi and Venkatraman 2005). Since this study seeks to understand corporate level performance effects of IT and KM in multibusiness firms—as opposed to

the performance effects at the business unit level—it focuses on *cross-unit* knowledge management capability.

Cross-Unit Knowledge Management Capability

What Are the Sources of Cross-Unit Knowledge Synergy in Multibusiness Firms?

In multibusiness firms, there are two major sources of cross-unit knowledge synergy: (1) knowledge relatedness and (2) knowledge complementarity (Tanriverdi and Venkatraman 2005). The concept of *knowledge relatedness* is rooted in the resource-based view (RBV) of multibusiness firms (Farjoun 1994; Robins and Wiersema 1995). It refers to the exploitation of knowledge resources across multiple business units. When multiple business units exploit the same knowledge resources (i.e., they use knowledge as a common factor of production), their joint production costs become less than the sum of their stand-alone production costs. Thus, knowledge relatedness creates sub-additive cost synergies. The concept of *knowledge complementarity* is rooted in the economic theory of complementarities (Milgrom and Roberts 1990, 1995). A set of knowledge resources is defined to be complementary when doing more of any one of them increases the returns to doing more of the others. Returns to a knowledge resource vary in the levels of returns to complementary knowledge resources. Jointly, a set of complementary knowledge resources produces greater returns than the sum of their individual returns. Thus, knowledge complementarity creates super-additive value synergies (Barua et al. Whinston 1996; Barua and Whinston 1998).

Knowledge Resources: Which Knowledge Resources Should a Multibusiness Firm Manage for Cross-Unit Synergy Exploitation Purposes?

The creation, exploitation, and the renewal of related and complementary knowledge resources across multiple business units entails significant costs (Hill and Hoskisson 1987). If the benefits do not exceed those costs, the pursuit of cross-unit knowledge synergy can reduce firm performance rather than increase it (Gupta and Govindarajan 2000). Given that firms possess a variety of knowledge resources (Schulz 2001), managers must carefully choose which ones they should focus on for exploiting cross-unit knowledge synergies. Tanriverdi and Venkatraman (2005) identify product, customer, and managerial knowledge as the most-strategic knowledge resources of multibusiness firms. ***Product knowledge*** refers to research and development and operations knowledge by which the firm develops and produces its products and services (Markides and Williamson 1994; Robins and Wiersema 1995; Rumelt 1974). ***Customer knowledge*** refers to the needs, preferences, and buying behaviors of customers and markets of the firm (Woodruff 1997). It resides in the marketing and advertising skills and policies of the firm. ***Managerial knowledge*** refers to the knowledge required for governing business units of the firm (Prahalad and Bettis 1986; Rumelt 1974). It resides in corporate level managerial practices, policies, and processes of the firm (Grant 1988). Product, customer, and managerial knowledge resources also complement each other (Tanriverdi and Venkatraman 2005).

Knowledge Processes: Which Organizational Processes Facilitate the Exploitation of Cross-Unit Knowledge Synergies?

Exploitation of cross-unit knowledge synergies requires coordination across business units (Brown and Magill 1998). To develop a KM capability that creates, exploits, and renews cross-unit knowledge synergies on an ongoing basis, the multibusiness firm must institute a set of organizational processes (Stalk et al. 1992). In a review of KM studies in the strategic management literature, Venkatraman and Tanriverdi (2004) identify four interrelated organizational processes that are critical for managing cross-unit knowledge synergy: (1) creation (Nonaka 1994), (2) transfer (Argote and Ingram 2000; Szulanski 1996; Zander and Kogut 1995), (3) integration (Grant 1996;

Grant 1996), and (4) leverage (Menon and Varadarajan 1992; Spender 1996).

Creation of knowledge resources that are relevant and applicable across multiple business units is essential for generating cross-unit knowledge synergies or renewing the existing ones. ***Transfer*** of related knowledge resources from source businesses to destination businesses where they are needed is important for extending the range of applicability of the firm's knowledge resources (Sambamurthy et al. 2003; Szulanski 1996). ***Integration*** of the transferred knowledge resources with the existing knowledge bases of the recipient business units is important for creating the synergies (Grant 1996a, 1996b). And ***leverage*** of the received and integrated knowledge resources for changing the behavior of the recipient businesses is important for converting the performance potential of the synergies into actual performance results (Menon and Varadarajan 1992; Spender 1996). If recipients of knowledge do not act on it to change their behaviors, the multibusiness firm cannot realize the performance potential of the cross-unit knowledge synergies (Tsai 2001). These four knowledge processes complement and mutually support each other (Venkatraman and Tanriverdi 2004). Collectively, they enable the firm to create and exploit the cross-unit knowledge synergies, and to renew them as they depreciate and become obsolete.

Conceptualizing the Cross-Unit Knowledge Management Capability of a Multibusiness Firm

The theoretical foundations reviewed above provide the following building blocks for conceptualizing the cross-unit KM capability of a multibusiness firm:

1. Related knowledge is a major source of cross-unit knowledge synergy in a multibusiness firm (Tanriverdi and Venkatraman 2005).

2. Product, customer, and managerial knowledge are the most strategic types of knowledge in a multibusiness firm (Tanriverdi and Venkatraman 2005).

3. Within a given type of knowledge, the exploitation of cross-unit synergy requires four interrelated processes: creation of related knowledge, transfer of related knowledge, integration of related knowledge, and leverage of related knowledge (Venkatraman and Tanriverdi 2004).

4. Complementary knowledge is another major source of cross-unit synergy (Tanriverdi and Venkatraman 2005).

5. The exploitation of the complementarities among product, customer, and managerial knowledge for cross-unit synergy requires the simultaneous implementation of KM capabilities in each of the three knowledge domains (Tanriverdi and Venkatraman 2005).

Building on these foundations, a cross-unit KM capability is defined as *the firm's ability to create, transfer, integrate, and leverage related knowledge across its business units.* The firm may have a unique cross-unit KM capability in each of its strategic knowledge domains. Thus, the overall cross-unit KM capability of a multibusiness firm is specified as a higher-order construct that comprises three first-order KM capabilities: (1) product KM capability, (2) customer KM capability, and (3) managerial KM capability. Each first-order KM capability, in turn, manifests itself through four knowledge processes: (1) creation of related knowledge, (2) transfer of related knowledge, (3) integration of related knowledge, and (4) leverage of related knowledge. The higher-order KM capability captures the complementarities among the three first-order KM capabilities by accounting for their interactions and co-variations.[2] Figure 1

[2]The associate editor and a reviewer of this article suggested that an alternative approach is to specify the higher-order KM capability as comprising of the four knowledge processes (creation, transfer, integration, and leverage), which in turn manifest themselves in three knowledge domains (product, customer, and managerial). A comparison of the two specifications indicates that the original specification (χ^2 = 693.28, d.f. = 51) has higher degrees of freedom and lower chi-square than the suggested alternative (χ^2 = 1583.20, d.f. =50) indicating that the original specification is a more parsimonious model.

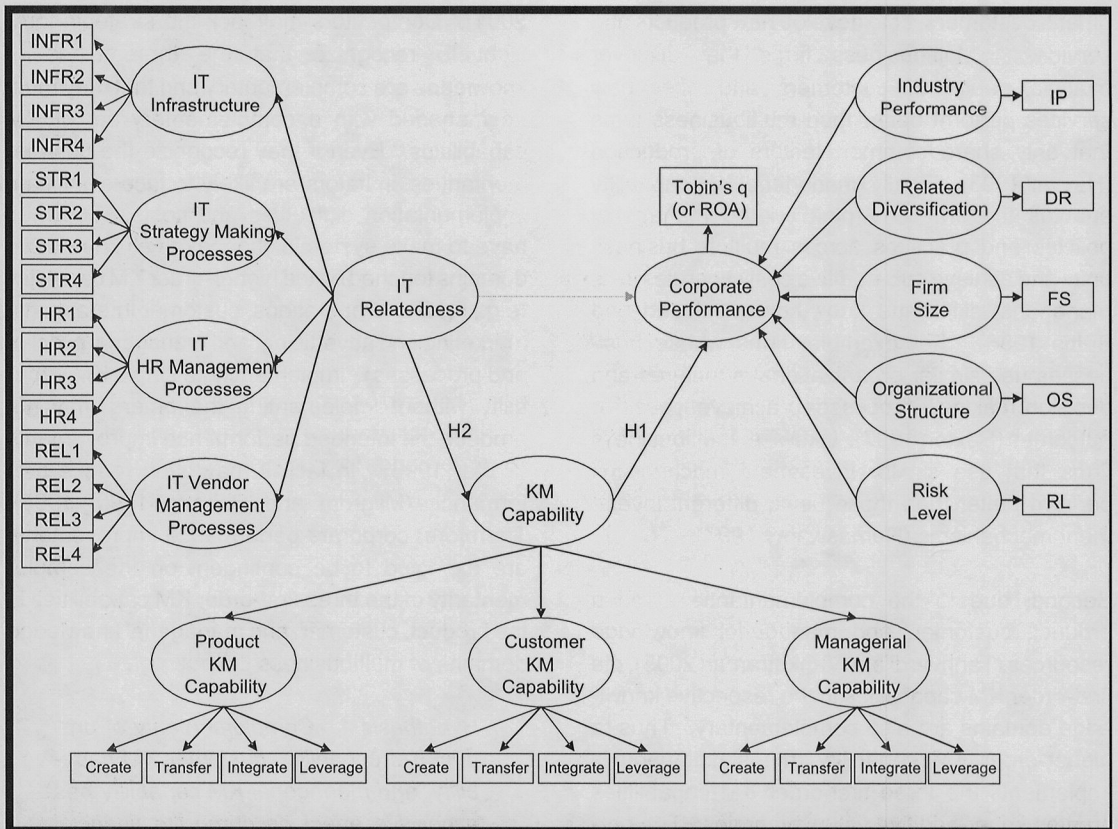

Figure 1. Research Model

provides a pictorial depiction of the higher-order KM capability construct.

Performance Effects of Cross-Unit Knowledge Management Capability

A cross-unit KM capability that exploits related and complementary knowledge resources across business units is likely to improve the overall corporate performance of a multibusiness firm by creating cross-unit knowledge synergies (Tanriverdi and Venkatraman 2005).

First, the exploitation of related knowledge creates sub-additive cost synergies within the product, customer, and managerial knowledge domains of the firm. Product KM capability enables the firm to exploit related R&D and operations knowledge across multiple business units and to reduce the overall R&D and operations costs of the firm (Markides and Williamson 1994). Firms that do not leverage their existing R&D in new offerings suffer from high costs because new technologies and processes often require major investments in research, design, engineering, and manufacturing (Nobeoka and Cusumano 1997). Customer KM capability enables the firm to exploit related customer knowledge across multiple business units. If customers exhibit similar needs, preferences, and behaviors across different business units, the firm can reduce its overall marketing and advertising costs by redeploying its general marketing expertise, brands, and sales force among those businesses (Capron and Hulland 1999). Exchanging knowledge about expressed and latent needs of customers can also allow the business units to cross-sell their offerings to each

other's customers, or to develop new products and services. Multibusiness firms that discover multiple needs of customers and offer new services perform better than multibusiness firms that only share common factors of production (Nayyar 1993). Finally, managerial KM capability enables the firm to exploit related managerial policies and practices across multiple business units and achieve sub-additive cost synergies in its managerial skills and know-how (Prahalad and Bettis 1986). For example, firms whose businesses use similar organizational structures and decision-making processes achieve positive outcomes (Saxton 1997). Likewise, multibusiness firms that use similar investment mechanisms perform better than those using different investment mechanisms (Ramaswamy 1997).

Second, due to the complementarities among product, customer, and managerial knowledge resources (Tanriverdi and Venkatraman 2005), the first-order KM capabilities in the respective knowledge domains are also complementary. Thus, a higher-order KM capability that simultaneously implements the three first-order KM capabilities creates super-additive value synergies. The performance advantages provided by a system of complements are sustainable (Porter 1996). Imitating such a system is difficult because of the sheer number of elements to be imitated, the complex interactions among the elements, and the challenges entailed in the simultaneous implementation of all elements (Rivkin 2000).

In the case of the overall cross-unit KM capability of a multibusiness firm, there are three elements to be imitated: product KM capability, customer KM capability, and managerial KM capability. Competitors may be able to observe that the individual KM capabilities create and exploit synergies out of related product knowledge (e.g., use of similar R&D and operations knowledge), related customer knowledge (e.g., the sharing of similar marketing and advertising skills and knowledge), and related managerial knowledge (e.g., the use of similar managerial policies and processes). However, unlike the synergies arising from related knowledge, synergies arising from complementary knowledge are not easy to observe (Harrison et al. 2001). Competitors may lack the strategic foresight to recognize that the three types of knowledge are complementary and that they must be managed with a complementary set of KM capabilities. Even if they recognize the complementarities, imitators are likely to face significant implementation difficulties and costs. They will have to make systemic changes to all knowledge domains touched by the higher-order KM capability (e.g., R&D and operations, customer interactions, marketing and advertising, and managerial policies and processes). Implementing a single KM capability without implementing the others may not produce the intended performance improvements (Porter 1996). In fact, it may even reduce performance (Milgrom and Roberts 1990, 1995). Therefore, corporate performance improvements are expected to be contingent on the complementarity of the three first-order KM capabilities in the product, customer, and managerial knowledge domains of multibusiness firms.

Hypothesis 1. Complementarity of product KM capability, customer KM capability, and managerial KM capability has a positive effect on corporate financial performance of a multibusiness firm.

Information Technology Relatedness

Cross-unit coordination mechanisms are critical for enhancing the cross-unit KM capabilities of multibusiness firms (Brown 1999; Brown and Magill 1998; Sambamurthy and Zmud 1999). There are several nontechnical, human-intensive coordination mechanisms that a multibusiness firm can use to enhance its cross-unit KM capability: liaison roles, integrating managers, cross-unit groups, task forces, direct contact among managers, and so forth (Brown 1999). However, human-intensive mechanisms are limited in their information processing and coordination capabilities (Brown 1999). They are also costly to maintain (Hansen 2002). IT-based coordination mechanisms are less subject to such limitations. The information processing theory of the firm views IT as an important cross-unit coordination mechanism (Galbraith

1973). Confirming this view, IS studies have uncovered that IT has had its greatest impact on the productive processes of the firm in its role as a coordination mechanism (Dedrick et al. 2003).

Although the literature recognizes the role of an IT-based coordination mechanism in enabling cross-unit synergy exploitation, it falls short of articulating dimensions of an IT-based coordination mechanism and explaining how a multibusiness firm can create and sustain it. This is not a trivial problem for a multibusiness firm because the objectives of the corporate center and the business units often conflict with each other (Brown 1999; Brown and Magill 1998; Sambamurthy and Zmud 1999). While the corporate center seeks to exploit cross-unit synergies that maximize corporate performance, business units seek to maximize their own objectives and performances. Allowing business units to manage their IT resources autonomously can maximize business unit performance. But it can also lead to disparate IT systems across the firm and constrain the center's ability to facilitate cross-unit KM capabilities. Conversely, imposing a uniform IT strategy and infrastructure across all business units and centralizing the management of IT resources can serve the center's objectives, but it can also constrain business unit autonomy and performance. Thus, in creating and sustaining an IT-based coordination mechanism, the key challenge is to balance the conflicting objectives of the center and the business units.

Tanriverdi (forthcoming) proposes the concept of *IT relatedness* for understanding how multibusiness firms balance the conflicting objectives of the center and the business units and achieve superior performance through IT resources. Although focusing on IT relatedness as a source of cross-unit *IT synergy* and examining the direct performance effects of IT relatedness, Tanriverdi also argues that IT relatedness can enable the exploitation of cross-unit *business synergies*. He posits that IT relatedness can have indirect effects on firm performance through the mediation of cross-unit KM capabilities. This study builds on Tanriverdi and extends it by explaining how IT relatedness creates an IT-based coordination mechanism that enhances cross-unit KM capabilities of multibusiness firms.

The Four Dimensions of IT Relatedness

IT relatedness of a multibusiness firm is defined as the "the use of common IT infrastructures and common IT management processes across business units" (Tanriverdi forthcoming). IT relatedness is a second-order construct comprised of four complementary first-order dimensions: (1) relatedness of IT infrastructures, (2) relatedness of IT strategy-making processes, (3) relatedness of IT-human resources management processes, and (4) relatedness of IT vendor management processes. Figure 1 includes a pictorial depiction of the IT relatedness construct.

Relatedness of IT Infrastructures. Standardized IT infrastructures that are shared by business units enable boundary-spanning business processes and provide a foundation for knowledge exchange (Broadbent et al. 1999; Gold et al. 2001). It is not appropriate to standardize all aspects of the IT infrastructure since business units need autonomy for meeting their specific IT needs. For example, application development initiatives are better left to business units (Brown and Magill 1998). However, it is appropriate to use common standards for general-purpose hardware, software, and communications technologies.

Relatedness of IT Strategy-Making Processes. A common IT strategy across the firm constrains autonomy and the performance of individual business units (Sawhney 2001), while unique IT strategies in the business units constrain boundary-spanning IT initiatives. One approach for achieving a balance between corporate intervention and business unit autonomy is to use a common IT strategy-making process that provides a general strategic direction for the IT decisions of the business units (Tanriverdi forthcoming). A common IT strategy-making process allows the business units to develop their unique IT strategies, but it also increases their adherence to corporate objectives. It fosters a holistic understanding of knowledge needs across business units, facilitates identification of knowledge resources that are applicable across multiple units, and entices the business units to invest not only in their own IT infrastructures, but also in boundary-spanning IT initiatives that are critical for cross-unit KM capabilities.

Relatedness of IT Human Resource Management Processes. Sharing of common goals, principles, values, and language among the IT talent in the business units is important for creating and maintaining a common IT infrastructure across a multibusiness firm (Tanriverdi forthcoming). The firm can instill common goals and values in the IT talent within business units and foster cross-unit partnerships and perceptions of mutual benefit by using common recruiting, training, incentive alignment, and retention processes (Brown 1999). When IT professionals understand the overall needs and expectations of the corporation, and share common values, goals, and incentives, they are more likely to contribute to the creation and maintenance of an IT-based coordination mechanism across the firm.

Relatedness of IT Vendor Management Processes. Business units develop relationships with IT vendors for sourcing their technology and service needs. They are usually autonomous in determining the strategic goals of the relationships, negotiating terms of the contracts, making deals, and managing the relationships (Useem and Harder 2000). Firms usually lack a systematic coordination of the vendor relationships of their business units. The lack of coordination can lead to redundant investments, incompatible hardware and software, and deviations from the firm's common IT infrastructure. However, using common vendor management processes enables the firm to manage the vendor relationships of its business units as an interrelated portfolio of relationships while allowing the business units to source their IT needs from the vendors of their choice. When the firm coordinates the vendor relationships of its business units, externally acquired IT resources are more likely to adhere to corporate standards. Thus, the firm is more likely to maintain a firm-wide IT infrastructure that enhances cross-unit KM capabilities.

IT Relatedness and the Cross-Unit Knowledge Management Capability of a Multibusiness Firm

An IT-based coordination mechanism can connect business units to each other, open up opportunities for collaboration, and increase the reach and richness of the firm's knowledge resources (Sambamurthy et al. 2003). It can enable business units to learn about knowledge sharing opportunities with each other, establish boundary-spanning processes (Broadbent et al. 1999), and exploit cross-unit synergies (Brown and Magill 1998; Weill and Broadbent 1998; Weill and Ross 2004). In the absence of such a mechanism, some business units may remain isolated, making it difficult for other business units to reach them and exchange knowledge with them (Hansen 2002).

The IT relatedness concept informs us that a common IT infrastructure is just one requirement for creating an IT-based coordination mechanism in a multibusiness firm. It also needs to be complemented with common IT strategy-making, IT human resource management, and IT vendor management processes. In a system of complements, the performance of the overall system depends not only on the individual variables but also on their interactions (Milgrom and Roberts 1990, 1995). Complementary variables mutually support and reinforce each other such that the performance of one variable depends on the performances of the others. Thus, the creation and maintenance of an IT-based coordination mechanism requires the successful implementation of all four dimensions of IT relatedness simultaneously.

The absence or poor performance of one dimension can negatively influence the other dimensions of IT relatedness (Tanriverdi forthcoming), start a downward performance spiral in the system, and inhibit the cross-unit KM capabilities of the firm. For example, when business units ignore firm-wide IT infrastructure standards and invest in business unit-specific standards and technologies, the common IT infrastructure of the firm starts disintegrating. A disparate set of IT infrastructures is likely to reduce the cross-unit KM capabilities of the firm because it hinders cross-unit connectivity, boundary-spanning processes, and identification and exchange of related knowledge across the units. Further, it makes it difficult for the firm to justify the benefits of using related IT strategy-making, IT human resource management,

and IT vendor management processes. As a result, the IT infrastructures, strategies, and human resource and vendor management processes of the business units are likely to become independent and cease to function as mutually supportive elements of a firm-wide coordination mechanism.

On the other hand, due to the complementarities, positive reinforcement among the four dimensions can increase the system's ability to serve as an IT-based coordination mechanism. For example, when business units adhere to common IT infrastructure standards, the firm is able to build IT-based cross-unit connectivity and boundary-spanning processes and facilitate the identification and exchange of related knowledge. To sustain such benefits, the firm has an incentive to entice the units to invest not only in their own IT needs but also in boundary-spanning IT initiatives. Using common IT strategy-making processes across the units becomes important for providing general strategic direction and ensuring that the units invest in the cross-unit IT initiatives. A common IT infrastructure also increases the value of managing the IT talent of the units with similar human resource management policies and processes. An IT workforce that shares common goals, values, language, skills, and expertise is more likely to sustain the common IT infrastructure and engage in cross-unit partnerships that enhance cross-unit KM capabilities. Managing IT vendor relationships of the units as an interrelated portfolio also becomes attractive for ensuring that externally acquired information technologies and services are compatible and supportive of the common IT infrastructure. Thus, managing the complementarities among the four dimensions of IT relatedness brings coherence to what would otherwise be a haphazard, disconnected collection of IT strategies, operations, services, and engagements across the firm (Sambamurthy and Zmud 2000). Firms that manage those complementarities well are likely to create and sustain an IT-based coordination mechanism that enhances cross-unit KM capabilities.

Hypothesis 2. Complementarity of the four dimensions of IT relatedness is positively associated with cross-unit KM capability of a multibusiness firm.

Methods

Sample and Data

The sample for this study was multibusiness firms in the *Fortune 1000* list in the year 2000. Three distinct data sources were used to measure IT relatedness, KM capability, and financial performance of firms. IT relatedness data were obtained with an IT survey that was sent to senior IT executives of *Fortune 1000* firms (Tanriverdi forthcoming). KM capability data were obtained with a separate business survey that was sent to senior business executives of the same firms. The objective measures of financial firm performance were computed with data from the COMPUSTAT database. Control variables such as industry profitability, firm size, relatedness of firm's businesses, and risk levels of firms were also computed with objective data from the COMPUSTAT database. A multi-way match of these data sources produced a unique dataset for testing the research model of this study.

Operationalization of Variables

IT relatedness. The development and validation of measurement instruments for the IT relatedness construct are reported in detail in Tanriverdi (forthcoming).

KM capability. As described in Table 1, informants assessed the extent to which their firms create, transfer, integrate, and leverage related product, customer, and managerial knowledge resources across their business units using a five-point Likert scale ranging from 1= very small extent through 3 = moderate extent to 5 = very large extent.

Firm performance. Market-based firm performance was measured with Tobin's q (Chung and Pruitt 1994). Tobin's q is a forward-looking measure that is appropriate for capturing the value of intangibles such as IT relatedness and KM capability (Bharadwaj et al. 1999). Return on assets (ROA) was used to measure accounting-based firm performance. ROA is a backward-looking per-

Table 1. Knowledge Management Capability: Instructions, Response Scale and Purified Measurement Items

Instructions: To what extent does the corporate headquarters of <<CompanyName>> actually engage in or support the following activities?
Response scale
1. Very small extent
2. Small extent
3. Moderate extent
4. Large extent
5. Very large extent
Measurement items
Product knowledge management capability
CREATE. *Creating R&D and operations skills and knowledge that are applicable across multiple business units*
TRANSFER. Transferring relevant R&D and operations knowledge among business units
INTEGRATE. Integrating relevant R&D and operations knowledge of multiple business units to create new products/services
LEVERAGE. Changing R&D and operations policies of business units based on relevant lessons learned in other business units
Customer knowledge management capability
CREATE. Creating marketing skills and knowledge that are applicable across multiple business units
TRANSFER. Transferring relevant customer knowledge among business units
INTEGRATE. Integrating relevant customer knowledge of multiple business units to gain new customer insights
LEVERAGE. Changing marketing & product policies of business units based on relevant customer knowledge discovered in other business units.
Managerial knowledge management capability
CREATE. Creating managerial skills and knowledge that are applicable across multiple business units
TRANSFER. Transferring relevant managerial best practices among business units
INTEGRATE. Integrating relevant managerial policies and processes across multiple business units
LEVERAGE. Changing managerial policies and processes of business units based on managerial lessons learned in other business units

formance measure. Since IT relatedness and KM capability were measured in the beginning of the year 2000, their impacts on Tobin's q and ROA were examined in the following three years. To smooth out performance fluctuations in unusually good or bad years, 3-year averages of Tobin's q and ROA values of firms were taken over years 2000, 2001, and 2002.

Control Variables

Factors that have a bearing on both a firm's decision to exploit cross-unit knowledge synergies and the performance of the firm can create the endogeneity problem. Thus, such factors were identified from the literature on diversified multi-business firms and used as controls.

Relatedness of firm's businesses. Relatedness of business units provides opportunities for exploiting cross-unit knowledge synergies. Thus, this study controlled for Palepu's (1985) relatedness measure (DR).

Firm size. Larger firms may have higher potential for exploiting knowledge-based synergies. Large size may also influence firm performance because managerial diseconomies can increase costs. This study controlled for firm size by computing the logarithm of the total number of a firm's employees.

Organizational structure. Organizational structure can influence both the way the firm manages knowledge and the performance of the firm (Van den Bosch et al. 1999) This study measured organizational structure by asking business executives whether they organize their business units by products, customers, geographic regions, or functional areas.

Risk level. Studying returns without controlling for risks is potentially an erroneous approach due to the tradeoffs between risks and returns (Tanriverdi and Ruefli 2004). This study controlled for risk level of a firm by computing standard deviation of the firm's ROA values over the previous 5-year period.

Industry profitability. Industry profitability is an important deriver of firm performance (McGahan and Porter 1999). To assess if IT relatedness and KM capability explain additional variance in firm performance above and beyond the variance explained by industry profitability, controls for average return on sales (ROS) of industries were also used.

Survey Development and Administration

The survey instruments were pretested with 10 academic domain experts and 25 practicing managers in *Fortune1000* firms in meetings, each lasting about 45 minutes. The pretest assessed the face and content validity of the operational measures and ensured that informants understood instructions, questions, and response scales of the study in the intended ways.

The surveys utilized a key informant approach (Bagozzi et al. 1991). Potential measurement error was minimized by implementing the suggestions in prior research (Huber and Power 1985). A direct mailing company customized the surveys and cover letters to individual firms and informants, and mailed four follow-up letters on the second, fourth, eighth, and twelfth weeks after the initial survey mailing (Dillman 2000). All mailings informed recipients that Web-based versions of the surveys were also available for their convenience, and provided them with unique passwords to the survey Web sites.

Response Rates

Thirty-two firms were dropped from the sample because they merged with other firms, were acquired, or declared bankruptcy during the data collection period. Eighty-two firms declined to participate due to company policy. Of the remaining firms, 356 firms (40 percent) responded to the IT survey (Tanriverdi forthcoming) and 336 firms (38 percent) responded to the business survey. The match between the two data sets yielded 250

firms, a joint response rate of 28 percent. Responding firms represent a total of 50 industries: 118 firms (47 percent) operate in manufacturing industries and 132 firms (53 percent) operate in service industries. Independent t-tests did not show any statistically significant difference between respondents and nonrespondents, or between early and late respondents in terms of firm size, diversification level, and performance. The average sales volume of this sample was $9.2 billion. The average number of people employed in these firms was 37,562.

Assessment of Informant Competency

In the IT survey, 81 percent of informants were at chief information officer or higher levels (i.e., vice president, senior vice president, or executive vice president of information services), 6 percent were chief technology officers, and 13 percent had "other job titles" such as chief financial officer, director of information systems, and so forth. Average organizational tenure of the informants was 10.8 years. On average, they had been involved in corporate IT strategy formulation for 5.8 years. They were also highly active in the formulation of corporate IT strategies (average = 4.73 on a 5-point scale, 5 representing "very active") at the time of the study (Tanriverdi forthcoming). In the business survey, 87 percent of respondents had job positions at vice president or higher levels. Average organizational tenure of the respondents was 13.61 years. On average, they had been involved in managerial policy making for 7.62 years, marketing policy making for 5.32 years, and product policy making for 6.31 years. Collectively, these measures indicate that the informants were highly competent to answer the questions of this study.

Results

Measurement Properties of Constructs

Internal consistency of measures. Tanriverdi (forthcoming) reports the procedures used for validating the measurement properties of the IT relatedness construct. Table 1 reports the instructions, response scales, and measurement items used for capturing KM capability. Table 2 summarizes coefficient Alpha, composite measure reliability, and goodness of fit indices for the first-order dimensions of both constructs. Coefficient Alpha values range from 0.81 to 0.95, providing strong evidence of measure *reliability* (Nunnally 1978). Composite measure reliability (r_c) scores are all above 0.77, demonstrating internal consistency of the measures. Goodness of fit index (GFI), normed fit index (NFI), and comparative fit index (CFI) are all above the suggested threshold of 0.90. These findings provide strong support for the validity of the operational measures and response scales of the study.

KM capability was modeled as a reflective second-order construct comprised of the three first-order dimensions: (1) product KM capability, (2) customer KM capability, and (3) managerial KM capability. According to the underlying theory, the first-order KM capabilities are complementary (i.e., they interact and co-vary with each other). A reflective second-order construct is appropriate for capturing the complementarities (Tanriverdi and Venkatraman 2005). The alternative approach of using a formative second-order modeling is not appropriate because it does not assume any interactions or covariance among the first-order dimensions of a higher-order construct (Chin 1998).

Dimensionality, convergent validity, and discriminant validity of constructs. Alternative first-order and second-order measurement models were compared to test for the dimensionality, convergent validity, and discriminant validity of KM capability. Model 1 hypothesizes that a unidimensional first-order factor accounts for the variance among all measurement items of the construct. Model 2 hypothesizes that the measurement items form into three uncorrelated first-order factors: product KM capability, customer KM capability, and managerial KM capability. Model 3 hypothesizes that these first-order factors are freely correlated with each other. Finally, Model 4 hypothesizes a second-order factor that accounts for the patterns of interactions and covariance (complementarity) among the first-order factors.

Table 2. Reliability Measures and Goodness of Fit Statistics

Construct Dimensions	Items	Coefficient Alpha	Composite Measure Reliability (r_c)	GFI	NFI	CFI
Knowledge Management Capability						
Product knowledge management capability	4	0.89	0.90	1.00	1.00	1.00
Customer knowledge management capability	4	0.86	0.85	0.97	0.97	0.97
Managerial knowledge management capability	4	0.81	0.81	0.99	0.99	0.99
IT Relatedness						
Relatedness of IT infrastructures	4	0.88	0.77	1.00	1.00	1.00
Relatedness of IT strategy-making Processes	4	0.88	0.79	0.94	0.96	0.96
Relatedness of IT human resources management processes	4	0.95	0.87	0.93	0.97	0.97
Relatedness of IT vendor management processes	4	0.91	0.87	0.90	0.95	0.95

Comparison of Model 1 (χ^2 = 1514.49, d.f. = 54) and Model 2 (χ^2 = 1003.11, d.f. = 54) indicates that Model 2 is a better-fitting model (lower chi-square for the same degrees of freedom), indicating that a multidimensional model comprised of three uncorrelated first-order factors is superior to a unidimensional first-order factor model. Hence, support for *multidimensionality* of KM capability is obtained.

Further comparison of Model 2 (χ^2 = 1003.11, d.f. = 54) with Model 3 (χ^2 = 693.28, d.f. = 51), which are nested models, indicates that Model 3, three freely correlated first-order factors (unconstrained model), is superior to Model 2 (constrained model), three uncorrelated first-order factors ($\Delta\chi^2$ = 309.83, $\Delta\chi$.f. = 3; $p < 0.0001$). In Model 3, standardized factor loadings of measurement items on their respective factors are all highly significant ($p < 0.001$), providing support for *convergent validity* of KM capability.

Superiority of Model 3 (unconstrained model) over Model 2 (constrained model) indicates that pairs of correlations among the first-order factors are significantly different from zero. They are also below the cut-off value of 0.90 (Bagozzi et al. 1991), demonstrating distinctiveness of theoretical content captured by the individual first-order factors. Since measurement items converge on their respective factors and the factors are distinct from each other, support for *discriminant validity* is obtained (Anderson 1987; Bagozzi et al. 1991).

The final test examines whether a second-order factor accounts for the patterns of interaction and covariance (complementarity) among the first-order factors. Since there are only three first-order dimensions, the second-order factor model for KM capability is just identified. Hence, an external criterion variable, firm performance (Tobin's q), was introduced, as suggested by Venkatraman (1990), to be able to compare two models: (1) Model 3 from the previous stage, which represents a direct-effects model and tests direct effects of the three first-order factors on firm performance, and (2) Model 4, which entails a second-order measurement model capturing inter-

actions and covariance (complementarities) among the three first-order factors and how they collectively impact firm performance. To test if the second-order factor model is superior to the first-order factor model, three criteria were used: (1) model statistics of the two specifications (Venkatraman 1990), (2) target coefficient (T) statistics (Marsh and Hocevar 1985), and (3) significance of the parameters reflecting the second-order factor loadings (Venkatraman 1990).

Model statistics of the first-order (χ^2 = 707.25, d.f. = 60) and second-order (χ^2 = 710.35, d.f. = 62) models are similar. The second-order factor model should be preferred because it is more parsimonious (fewer parameters to be estimated and more degrees of freedom) (Venkatraman 1990). The target coefficient value, T = 0.99, is very close to the theoretical upper limit of 1, indicating that the second-order factor accounts for 99 percent of the relations among the first-order factors. Hence, it also suggests acceptance of the second-order factor model (Marsh and Hocevar 1985). Finally, the structural link from KM capability to firm performance in the second-order factor model is positive and significant as predicted by the theory ($\gamma_{4,1}$ = 0.17, p < 0.01). All second-order factor loadings ($\gamma_{1,1}$ to $\gamma_{3,1}$) are highly significant (p < 0.001), providing further justification for the acceptance of the second-order factor model (Venkatraman 1990).

These results provide support for reliability, multidimensionality, and convergent and discriminant validity of the KM capability construct. In line with the underlying theory, a higher-order construct accounts for the complementarities among the first-order KM capabilities.

Descriptive Statistics and Correlations

Table 3 summarizes descriptive statistics and correlations among the constructs of the study. As expected, IT relatedness has a positive and highly significant association with KM capability (r = 0.34, p < 0.001), and KM capability has significant associations with both market-based and accounting-based measures of firm performance: Tobin's q (r = 0.15, p < 0.05); ROA (r = 0.18, p < 0.01). Consistent with the findings of Tanriverdi (forthcoming), IT relatedness has a direct effect on market-based performance—Tobin's q, (r = 0.14, p < 0.05)—but not on accounting-based performance: ROA, (r = 0.05, p > 0.1).

Hypotheses Testing

Hypotheses are tested within the structural equation model shown in Figure 1. In assessing the performance effects of KM capability (H1), the model was run with two different dependent measures (Tobin's q and ROA) to assess if the findings differ across market-based and accounting-based measures of firm performance. Table 4 presents parameter estimates and model statistics for the structural model.

H1: KM Capability→Firm performance. The structural link from KM capability to firm performance is positive and significant in both Tobin's q (structural link = 0.15, p < 0.05) and ROA models (structural link = 0.17, p < 0.05). These findings provide empirical support for H1.

H2: IT Relatedness→KM Capability. The structural link from IT relatedness to KM Capability is positive and highly significant in both Tobin's q (structural link = 0.36, p < 0.001) and ROA models (structural link = 0.36, p < 0.001). These findings provide empirical support for H2.

Mediation analysis. The two nested models were compared to test whether KM capability mediates the relation between IT relatedness and firm performance. The baseline model was the proposed research model in Figure 1. The EF procedure of LISREL showed that IT relatedness had significant indirect effects on firm performance through the mediation of KM capability in both Tobin's q (t = 2.12, p < 0.05) and ROA models (t = 2.37, p < 0.05). The alternative model added a direct link from IT relatedness to firm performance, as shown with the dotted line in Figure 1. The addition of this link did not significantly improve model fit in Tobin's q ($\Delta\chi^2$ = 0.27, Δd.f. = 1, p > 0.1) or in ROA models ($\Delta\chi^2$ = 0.05, Δd.f. = 1, p > 0.1), indicating

Table 3. Descriptive Statistics and Correlations

		Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Market-based performance (Tobin's q)[a]	1.47	1.14	1.00															
2	Accounting-based performance (ROA)[a]	0.12	0.07	0.60***	1.00														
3	Knowledge management capability (KMC)[b]	3.05	0.84	0.15*	0.18**	1.00													
4	Product KMC	2.93	1.00	0.13*	0.18**	0.89***	1.00												
5	Customer KMC	2.93	0.96	0.15*	0.11+	0.92***	0.70***	1.00											
6	Managerial KMC	3.33	0.87	0.11+	0.17**	0.84***	0.59***	0.71***	1.00										
7	IT relatedness[b]	3.81	0.94	0.14*	0.05	0.34***	0.32***	0.28***	0.29***	1.00									
8	IT strategy making processes	3.71	1.11	0.17**	0.03	0.39***	0.37***	0.34***	0.32***	0.86***	1.00								
9	IT vendor relation management processes	3.87	1.06	0.03	-0.02	0.25***	0.23***	0.20***	0.23***	0.88***	0.68***	1.00							
10	IT HR management processes	3.64	1.20	0.14*	0.07	0.29***	0.26***	0.25***	0.26***	0.89***	0.68***	0.70***	1.00						
11	IT Infrastructures	4.03	0.91	0.14*	0.08	0.25***	0.26***	0.18***	0.22***	0.85***	0.66***	0.70***	0.65***	1.00					
12	Industry profitability	0.05	0.09	0.23***	0.50***	-0.01	-0.02	0.00	0.01	-0.01	0.00	-0.04	0.03	-0.03	1.00				
13	Organizational Structure	1.87	1.60	0.03	-0.02	0.18**	0.19**	0.16*	0.10	0.03	0.09	0.00	-0.02	0.05	-0.04	1.00			
14	Firm size (logarithm of # employees)	4.24	0.52	-0.01	0.17**	-0.06	-0.03	-0.06	-0.09	0.01	-0.04	0.10	-0.04	0.01	0.12*	-0.13*	1.00		
15	Relatedness of firm's businesses (DR)	0.41	0.46	-0.11+	-0.18**	-0.19**	-0.14	-0.23***	-0.10	-0.01	-0.02	-0.05	0.04	-0.02	-0.01	-0.14*	0.15*	1.00	
16	Risk level of the firm	0.03	0.03	0.08	0.00	0.02	0.05	0.00	0.00	0.05	0.00	0.04	0.04	0.12*	-0.22***	-0.16*	-0.06	-0.05	1.00

Note: N = 250
[a]Average of performance values at the end of years 2000, 2001, and 2002
[b]Measured at the beginning of year 2000
+ p < .1; *p < 0 05; **p < 0.01; ***p < 0.001

Table 4. Parameter Estimates and Model Statistics

Paths[a]	Firm Performance	
	Tobin's q	ROA
Structural model		
Hypothesized relationships		
IT Relatedness → KM Capability (H2)	0.36***	0.36***
KM Capability → Firm Performance (H1)	0.15*	0.17**
Controls		
Firm size → Firm Performance	0.01	0.18**
Industry profitability → Firm Performance	0.16**	0.24***
Organizational structure → Firm Performance	0.03	-0.02
Related diversification → Firm Performance	-0.08	-0.18**
Risk level → Firm Performance	0.05	-0.03
Measurement model[b]		
IT Relatedness → IT infrastructure	0.84***	0.84***
IT Relatedness → IT strategy-making processes	0.85***	0.85***
IT Relatedness → IT human resources management processes	0.84***	0.84***
IT Relatedness → IT vendor management processes	0.88***	0.88***
KM Capability → Product KM Capability	0.82***	0.82***
KM Capability → Customer KM Capability	0.94***	0.94***
KM Capability → Managerial KM Capability	0.87***	0.87***
Goodness of fit statistics		
$\chi 2$	1286.67***	1300.74***
d.f.	519	519
RMSEA	0.07	0.07
Non-Normed Fit Index (NNFI)	0.85	0.85
Comparative Fit Index (CFI)	0.86	0.87

*p < 0.05; **p < 0.01; ***p < 0.001

[a] Parameter estimates are standardized with t-values

[b] Only second-order factor loadings are shown for brevity. All first-order factor loadings are also significant at p < 0.001 level.

that the baseline model is superior. The superiority of the baseline model and the significant indirect effects of IT relatedness on firm performance indicate that KM capability mediates the relation between IT relatedness and firm performance.

Discussion and Conclusions

Because the link between IT and financial firm performance is not well understood, researchers have called for the study of intermediate organizational variables through which IT may be influencing firm performance (Barua et al. 1995; Devaraj and Kohli 2003) and the development of theoretical frameworks that facilitate such studies (Sambamurthy, Bharadwaj and Grover 2003). Since KM capability is an important organizational variable, researchers have further argued that the role of IT in organizational knowledge management should become a focal point of inquiry (Alavi and Leidner 2001). Finally, there have been calls for understanding the implications of KM for central concerns of strategic management such as competitive advantage and firm performance (Eisenhardt and Santos 2002).

This study is an attempt to heed these calls in the context of multibusiness firms. The exploitation of cross-unit synergy is a major determinant of the corporate performance of a multibusiness firm. Thus, this study conceptualized the KM capability of a multibusiness firm in terms of the firm's ability to exploit cross-unit knowledge synergies. The exploitation of cross-unit knowledge synergy requires the coordination of related and complementary knowledge resources across the firm's business units. Building on prior research, this study conceptualized IT as a major coordination mechanism (Brown 1999; Brown and Magill 1998; Dedrick et al. 2003; Dewett and Jones 2001; Weill and Broadbent 1998). It used the IT relatedness construct to conceptualize dimensions of an IT-based coordination mechanism, and to explain how such mechanisms can sustain themselves and enable cross-unit KM capabilities in multibusiness firms. Empirical findings support the study's hypotheses. IT relatedness has a significant effect on the KM capability, and KM capability, in turn, has significant effects on market-based and accounting-based firm performance. IT relatedness also has significant indirect effects on market-based and accounting-based performance of the firm through the mediation of KM capability. A few limitations should be kept in mind in interpreting the findings and implications of this study.

Limitations

First, this study focused on large multibusiness firms. Although the study's concepts are potentially applicable in smaller firms too, further research is needed to determine if the results hold in the context of smaller firms. Until such research is conducted, caution must be exercised in generalizing the results to smaller firms. Second, the IT relatedness construct explains about 13 percent of the variance in KM capability. While this is a significant amount of variance, clearly there are non-IT factors that influence the ability of multibusiness firms to exploit cross-unit knowledge synergies. For example, Brown (1999) discusses various nontechnical coordination mechanisms that enhance exploitation of cross-unit synergies. Further, Sambamurthy et al. (2003) discuss how entrepreneurial alertness can moderate the relation between IT and knowledge reach and richness of firms. Future work can extend this study and explain more variance in KM capability by incorporating non-IT factors that influence the exploitation of cross-unit knowledge synergies. Third, this study focused on knowledge resources that exhibit high levels of explicitness. While researchers assert that IT has a far greater impact on the management of explicit knowledge than on the management of tacit knowledge (Alavi and Leidner 2001; Markus 2001), there is clearly room for extending this study's initial conceptualization of the IT→KM linkage. Fourth, despite the various controls included, due to the study's cross-sectional research design, which collected the data at one point in time, the possibility of endogeneity cannot be ruled out entirely. Future studies can more effectively address potential endogeneity

problems by using panel data and a fixed effects model (Hamilton and Nickerson 2003). Notwithstanding these limitations, this study makes several important contributions.

Contributions to Research

This study contributes to the IS literature by introducing KM capability as a critical mediator between IT relatedness and performance of multibusiness firms. Tanriverdi (forthcoming) distinguished between cross-unit business synergies and cross-unit IT synergies of multibusiness firms. He proposed IT relatedness as a source of cross-unit IT synergy and showed that cross-unit IT synergies arising from the IT relatedness of business units have direct effects on market-based performance, but not on accounting-based performance of multibusiness firms. By introducing the KM capability construct, this study uncovers that IT relatedness also has significant indirect effects on market-based and accounting-based performance of multibusiness firms through the mediation of KM capabilities that exploit cross-unit business synergies. By studying the nomological relationships among IT relatedness, KM capability, and firm performance, this study improves our understanding of the true business value of IT relatedness for multibusiness firms.

This study also contributes to the IS literature by developing theoretical dimensions of an IT-based cross-unit coordination mechanism and explaining how and why such a mechanism enables cross-unit KM capabilities of multibusiness firms. Previous literature recognizes the role of IT as a cross-unit coordination mechanism (Dedrick et al. 2003; Dewett and Jones 2001) and asserts that a common IT infrastructure is required for exploiting cross-unit business synergies (Bharadwaj et al. 1999; Brown and Magill 1998; Weill and Broadbent 1998). However, prior studies do not define the dimensions of an IT-based coordination mechanism, nor do they explain how and why such a mechanism enables the exploitation of cross-unit business synergies. This study articulates that an IT-based cross-unit coordination mechanism is comprised of four complementary dimensions: (1) common IT infrastructures, (2) common IT strategy-making processes, (3) common IT human resource management processes, and (4) common IT vendor management processes. It explains why a common IT infrastructure is necessary but not sufficient for creating and sustaining an IT-based cross-unit coordination mechanism, and why all four dimensions of IT relatedness are required for enabling cross-unit KM capabilities.

This study also contributes to the broader literature on knowledge management. The KM literature has focused on either knowledge resources or knowledge processes of the firm as derivers of firm performance (Venkatraman and Tanriverdi 2004). For example, in the context of multibusiness firms, Tanriverdi and Venkatraman (2005) argued that the relatedness of knowledge resources across business units has the potential to improve the corporate performance of a multibusiness firm. However, previous studies have not examined the organizational processes by which a multibusiness firm creates and exploits related and complementary knowledge resources across its business units. An organizational capability that seeks to exploit knowledge for superior firm performance requires a focus on both knowledge resources and the processes that create, exploit, and renew them. This study contributes to the KM literature by simultaneously incorporating strategic knowledge resources (i.e., product, customer, and managerial knowledge) and knowledge processes (i.e., creation, transfer, integration, and leverage) into the conceptualization of a firm-level KM capability.

This study also contributes to the strategy literature by showing that the complementarity of first-order KM capabilities is critical for understanding the implications of KM for central concerns of strategic management such as the nature of competitive advantage and firm performance (Eisenhardt and Santos 2002). Previous research argued that higher-order capabilities are comparatively more valuable and inimitable (Sambamurthy et al. 2003). Firm-level KM capability is a high-order capability comprised of a complementary set of first-order KM capa-

bilities within the product, customer, and managerial knowledge domains. The first-order KM capabilities exploit sub-additive cost synergies by managing relatedness within the respective knowledge domains. However, independently, the first-order KM capabilities are not sufficient for exploiting super-additive value synergies that arise from the complementarity of knowledge resources. For example, KM capability within the product knowledge domain can reduce costs and increase the speed of new product development across the firm. But these benefits do not ensure that the products meet customer needs and expectations (Stalk et al. 1992). In addition to managing its product knowledge, the firm must also manage its customer knowledge (e.g., customer needs, preferences, and purchase behaviors) and managerial knowledge (e.g., know-how for managing employees, suppliers, distributors, and partners of the firm) to develop products, bring them to the market, sell them, and service them. Complementarities among the product, customer, and managerial knowledge resources require the firm to develop a corresponding set of complementary KM capabilities.

Finally, this study informs us about why the competitive advantages provided by IT relatedness and KM capability are likely to be sustainable. Both IT relatedness and KM capability are systems of complements. Achieving IT relatedness in a multibusiness firm requires business units to simultaneously use a common IT infrastructure and to follow common managerial processes for developing IT strategy and managing IT human resources and IT vendor relations. Further, achieving KM capability requires the business units to manage their related product, customer, and managerial knowledge resources simultaneously. Thus, an imitator would have to simultaneously implement at least seven new managerial practices across business units. If the probability of successful implementation is 90 percent for one practice, the probability of successful imitation for all seven practices drops to 48 percent ($0.9^7 = 0.48$). Due to the complementarities, failure in one practice is likely to lead to the failure of the whole imitation effort. Thus, the complementarity structures within the IT relatedness and KM capability constructs theoretically inform us about how and why KM capabilities are relevant to the major concerns of strategic management such as competitive advantage and firm performance.

Contributions to Practice

This study also provides insights for understanding why some firms may not be realizing benefits from their IT and KM initiatives. As the IT relatedness and KM capability constructs reveal, IT management and knowledge management each comprises a system of complementary managerial practices. Investing in individual elements of the system in isolation is unlikely to achieve the desired results. Enterprise resource planning systems provide a good example. Some participants of this study commented that their corporations adopted ERP systems with the intention to create a firm-wide IT infrastructure. However, they allowed business units to use different IT strategy-making, human resource management, and vendor management processes. Over time, the business units diverged to using different instantiations of the ERP system. The result was multiple, isolated ERP instantiations across the corporation. The IT relatedness construct of this study informs managers that investing in enterprise-wide information systems such as ERP does not suffice to create and sustain a firm-wide IT infrastructure. Due to the complementarities, the firm must also invest in IT management processes that coordinate the IT strategy-making, human resource management, and vendor management practices of the business units.

Similarly, in building KM capabilities, investing only in product KM capabilities, customer KM capabilities, or managerial KM capabilities is not likely to return the expected benefits. Previous research argued that synergies do not always lead to benefits (Hansen 2002). This study provides a theoretical explanation as to why. Since product, customer, and managerial knowledge resources complement each other, they need to be managed as a system of complements. If the firm builds KM

capabilities that exploit product knowledge synergies, but it does not complement them by building KM capabilities that exploit customer and managerial knowledge synergies as well, it may not obtain firm-level performance improvements. Focusing on one element of a system of complements and overlooking the other elements can even lead to negative performance effects (Milgrom and Roberts 1990, 1995).

Finally, KM capability is an important intermediate organizational mechanism through which the benefits of IT relatedness are converted into performance effects at the corporate level. Firms are better off implementing IT relatedness and KM capabilities simultaneously. In justifying investments in firm-wide IT infrastructures and IT management processes, practicing managers may want to consider not only the direct effects of IT relatedness on firm performance, but also the indirect effects through intermediate organizational capabilities such as KM capability. As shown in Tanriverdi (forthcoming), IT relatedness may not have an observable direct effect on a firm's accounting-based performance (e.g., ROA). But as shown in this study, when a critical intermediate organizational capability such as KM capability is also considered in the analysis, the true business value of IT relatedness becomes more salient: IT relatedness has indirect effects on both market-based (Tobin's q) and accounting-based (ROA) performance of the firm through the mediation of KM capability.

In conclusion, this study developed the nomological relationships among IT relatedness, KM capability, and financial firm performance constructs in the context of multibusiness firms. It tested the proposed research model with a cross-section of 250 large multibusiness firms representing 50 different industries in the service and manufacturing sectors. It avoided the common method bias by collecting the IT relatedness data from senior IT executives, the KM capability data from senior business executives, and the financial performance data from the COMPUSTAT database. The results support the hypotheses of the study: IT relatedness enhances firm-level KM capability and KM capability improves corporate financial performance of multibusiness firms. The results hold with objective measures of accounting-based (ROA) and market-based (Tobin's Q) performance. The study ruled out alternative explanations to these findings by testing competing measurement models, and by controlling for relevant factors such as industry profitability, organizational structure, firm size, relatedness of firm's businesses, and risk levels of firms. Therefore, the theory, constructs, measurement schemes, and findings of this study are likely to be applicable to the population of large multibusiness firms.

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