Alignment of a Firm's Competitive Strategy and Information Technology Management Sophistication: The Missing Link

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***Abstract*—The need for establishing a link between information technology (IT) management strategies and a firm's competitive strategy has been identified and discussed in the literature. In this paper, factors for measuring IT management sophistication are identified first. Then the effects of the competitive strategy on IT management sophistication are tested empirically. According to a survey of 213 managers, this study finds that competitive strategy has a direct impact on IT management sophistication. This paper concludes with implications for both researchers and practitioners.**

***Index Terms*—Alignment of competitive strategy and information technology management sophistication, competitive strategy, information technology management sophistication.**

I. Introduction

TODAY, information technology (IT) is a critical organizational resource that must support a firm's competitive strategy [57]. The alignment of IT management strategies with a firm's competitive strategy has been cited as a critical management issue for both information systems (IS) executives and general managers [8]–[10], [49], [76]. In spite of this, the extent to which IT management strategies are aligned with a firm's business strategies varies widely among firms. This is often due to the lack of a clear plan [8], [49].

Previous research has suggested that there are significant variations among firms in the degree to which IT has been aligned with their business strategies [38]. These differences are reflected in three evolutionary roles that IT plays in firms: 1) the traditional role, i.e., IT supports operations but is not strategy related, 2) the evolving role, i.e., IT supports strategy, and 3) the integrated role, i.e., IT is integral to strategy [38], [46]. The firms' competitive strategies are also linked to this evolution [71]. The evolutionary role of IT and the extent to which IT management strategy can be pursued depends greatly on a firm's IT management sophistication [38], [40], [62], [71]. Higher levels of IT management sophistication or IT maturity[1] represent the evolution of a firm's IS function from the traditional role of supporting data-processing operations to that of being strategic to the firm [74].

Benbasat *et al.* [5], using Nolan's stage hypothesis model [51], [52] and a number of other independent research studies, developed a nine-item instrument for measuring IT maturity and classifying firms into "more mature" and "less mature" groups.[2] In a critique of the stage hypothesis model, Benbasat *et al.* [6] found problems associated with measuring "maturity" and suggested that "more work needs to be done to address the obvious measurement problems thus far encountered" [6, p. 485]. Their observation was in consonance with commonly documented measurement problems associated with single-item factors and factors with a small number of items [25], [44]. In spite of the existing problems with the IT management-sophistication instrument, it has recently been used in a number of other studies [62]–[64],[3] and no new alternative has been proposed. The objectives of this study are to address the issue of measuring IT management sophistication and to examine whether certain IT management strategies are more important for certain competitive strategies than for others.

In this paper, we have first defined the factors for measuring IT management sophistication and competitive strategy. Next, a research hypothesis is provided. This is followed by a discussion of the results obtained through our study of responses of 213 IT executives. We conclude with implications for both practitioners and researchers.

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[1] In this paper, we use "IT management sophistication" and "IT maturity" synonymously [12], [64].

[2] The nine items used were 1) the number of functions dependent on IS, scaled from 1 = very few to 7 = all of them; 2) the extent to which technology has penetrated the firm in impact/performance; 3) the extent to which mainframes, micros, and process-control devices are installed in the firm; 4) the basis for evaluating performance of IS, ranging from 1 = cost savings only to 7 = contribution to firm's overall objectives; 5) IT managers' knowledge of the firm's business plans, scaled ranging from 1 = uninformed to 7 = well informed; 6) top management's knowledge about information technology, similarly scaled from 1 = uninformed to 7 = well informed; 7) the extent of formalization in IS planning; 8) the extent to which the IS plan takes the business plan into account; and 9) the extent to which the IS plan involves top management.

[3] For example, in the recent studies for developing a taxonomy and a contingency approach for the decision-making processes concerning strategic applications of IS [62], [63], the nine-item measure based on [5] was used for measuring IS maturity. In a study of alignment between organizational critical success factors and IT capabilities in academic institutions [64], the IT management sophistication was measured using five items. These were the extent to which 1) the IS planning takes the institution's future plan into account, 2) the institution's top management is involved in the IS planning process, 3) the institution's top management is informed about the information technology, 4) the IS managers are informed about the institution's long-term plans, and 5) the bases for the institution's performance evaluation of IS.

II. Theory

A. IT Management Sophistication

IT management sophistication, or IT maturity, has been used in the literature to characterize the evolution of a firm's 1) data-processing expenditures, 2) IS function,[4] 3) IT use, 4) experience with IT, and 5) IT management strategies related to IT planning, organization, and control [45], [46], [51], [52], [63], [64]. Greater IT management sophistication is characterized by IT managers' being aware of the firm's long-term strategic plans [41], [64], [74], the firm's future strategic plans' being explicitly considered during IS planning [12], [24], and IS performance's being evaluated based on its contribution to the overall firm's objectives, and not on cost savings alone [12], [74]. In addition, in firms with a high level of IT management sophistication, the top management may be expected to have greater knowledge about IT [38], [41] and participation in IS planning [41], [63].

Furthermore, based on the technology-assimilation model, IT management strategies evolve as firms move toward IT maturity [45], [60]. Considering this model, the IT diffusion process is segmented into four phases: 1) technology identification and investment; 2) technology learning and adaptation; 3) rationalization/management control; and 4) maturity/widespread technology transfer. In the maturity phase:

1) benefits and experience with new technology are disseminated to other units within the firm;
2) learning is relatively complete;
3) long-term analysis and planning are emphasized;
4) the technology base is installed and integrated.

Other research has shown that:

1) firms vary substantially in the extent to which IT has been integrated into their business strategies;
2) integrated firms display more proactive orientation toward IT;
3) tight integration between business strategy and IT is cited as a key to success of firms [38].

IT management sophistication or maturity is used here to characterize firms in terms of their evolution in the planning, organization, control, and integration aspects of their IS function. Higher levels of IT management sophistication would imply a significant formalization of the planning, control, organization, and integration of IT activities. This, in turn, would suggest that the IS function in a firm with higher levels of IT maturity would have evolved from the data-processing orientation into the strategic IS orientation [45], [63], [74]. Research on IT management sophistication and the technology-assimilation model suggests using managerial practices concerning IT planning, control, organization, and integration as benchmark variables for measuring the progression of firms toward IT management sophistication.

[4] Although various parts of a firm may differ in the extent to which IS has matured in them, IS maturity is viewed at an aggregate level rather than individual subunits involved.

B. Competitive Strategy

Competitive strategy is the match between the opportunities and risks inherent in the environment and the internal competencies (resources and skills) possessed by the firm. Research in much of the strategy and organizational behavior literature has highlighted that 1) strategy alone can contribute to good performance if it maintains alignment with a firm's environment [22], [31] and 2) more than one strategy can be successful in a given environment, provided that the firm acts consistently in that strategy [29], [30], [32], [33], [68].

There are several frameworks for defining competitive strategy in the strategic management and organizational behavior literature [2], [13], [48], [55], [65]. Porter [54], for example, proposed three generic strategies a firm can adopt: differentiation, cost leadership, and focus. Subsequent research, however, suggested that 1) Porter's generic strategies of differentiation and cost are not mutually exclusive [22], [35] and 2) business units within a firm may have very different competitive positions in their sector, and thus may have quite different generic competitive strategies [12].

Miles and Snow [48] viewed a firm as a complete and integrated system in dynamic interaction with its environment. They suggested that 1) more than one strategy type can be successful in a given environment and 2) it is important for a firm to be organized appropriately and to plan and implement relevant strategies for a particular strategic type.

The Miles and Snow framework is especially appropriate for this study because it is useful for analyzing the ways in which firms interact with their environment, it focuses on a firm's behavior at the total system level rather than subunit levels, and it builds around the "distinctive competence." Distinctive competence refers to those things that a firm does especially well in comparison to its competitors. It is an aggregate of numerous specific activities that the firm tends to perform better than other firms within a similar environment. Miles and Snow [48] posited that top managers in firms with different business strategies develop different distinctive competence in their firms to support the desired strategy. A firm may have distinctive competence in IT, and that competence therefore is referred to the degree to which IT supports the firm's business strategy.

Miles and Snow [48] further postulated that competing firms within an industry exhibit patterns of behavior representative of four basic strategic types: 1) Defenders, 2) Prospectors, 3) Analyzers, and 4) Reactors (see Appendix B for the descriptions of the four strategy types originally developed by Miles and Snow [48]). The key dimension underlying this typology is the rate at which a firm changes its products or markets to maintain alignment with its environment. Miles and Snow [48] argued that any strategy (except the Reactors) can be successful in any given environment if the firm acts consistently in all areas of its operation.[5] For example, a firm following a

[5] Since reactors lack a consistent strategy and simply respond to environmental pressures when forced to do so, this is not considered a viable strategy in the long run. Miles and Snow [48] further suggested that organizations were often forced into this strategy when their top managers were unable (or unwilling) to develop any distinctive competence, organizational structures, and management processes required by a particular strategy.

TABLE I
STRATEGIC MANAGEMENT, ADMINISTRATIVE, AND TECHNOLOGICAL CONCERNS FOR EACH COMPETITIVE STRATEGY

Competitive Strategy	Strategic Management Concerns	Administrative Concerns	Technological Concerns
Defenders	How to "seal off" a portion of the total market to create a stable set of products & customers?	How to maintain strict control of the firm in order to ensure efficiency?	How to make continuous improvement in the single core technology to maintain efficiency?
	How to cope with a major shift in the market?	How to achieve production & cost control efficiencies with little or no scanning of the environment for new areas of opportunity?	How to protect heavy investment in single core technology by requiring technological problems to remain familiar & predictable for long periods of time?
		How to produce & distribute goods or service as efficiently as possible?	
Prospectors	How to allocate & exploit new product & market opportunities?	How to facilitate & coordinate numerous & diverse operations?	How to avoid long-term commitments to a single technology & to manage multiple technologies?
	How to protect the firm from a changing environment?	How to maintain flexibility & effectiveness in decentralized units & projects?	How to maintain a good deal of technological flexibility?
	How to deal with low profitability & overextension of the firm's resources & at the same time sustain product & market innovation?	How to manage risk associated with low profitability & over-extension of resources?	How to maintain decentralized control?
Analyzers	How to locate & exploit new product & market opportunities while maintaining a firm base of traditional products & customers?	How to differentiate the firm's structure & processes to accommodate both stable & dynamic areas of operation?	How to achieve & protect an equilibrium between conflicting demands for technological flexibility & for technological stability?
	How to minimize risk while maximizing the opportunity for profit by imitating most successful product or market innovations?	How to coordinate intensive planning between marketing, production & engineering?	How to deal with technological base that is not completely effective or efficient?
	How to keep the balance between stability & flexibility?	How to maintain a moderately centralized control system with vertical & horizontal feedback loops?	
Reactors	How to articulate the firm's strategy?	How to maintain the firm's structure & processes despite overwhelming changes in environmental conditions?	How to control cost?
	How to adjust to an environment that is both inconsistent & unstable?		

Defender strategy can be just as successful as Prospector and Analyzer firms carrying out their respective strategies.

Each of these strategy types is richly described as a unique configuration of contextual, structural, and strategic factors. Miles and Snow posited that at least three of these ideal types—the Prospector, Analyzer, and Defender—are effective forms of organization, and that the relative effectiveness of the types varies with the context. Snow and Hrebiniak [71], for example, found that in most environments, firms classified as Analyzers generally were the most effective, and that in highly regulated environments, Reactors were more effective than Prospectors and Defenders. As shown in Table I, firms pursuing different competitive strategies have different sets of strategic management, administrative, and technological concerns [47], [48], [71].

Both Defenders and Reactors are concerned about cost reduction and efficiency. Defenders, however, have a clear strategy to control cost by depending on their internal resources. Like Prospectors, Analyzers must also engage in environmental scanning. Since both Prospector and Analyzer firms engage heavily in environmental scanning, IT may play a more strategic role in these firms compared to Defenders and Reactors.

III. RESEARCH HYPOTHESIS

Competitive strategy is an important factor in predicting a firm's IT use, structure, IT strategic orientation, IT management decision-making strategies, and ultimately the level of IT management sophistication. Alignment is the proximity of the firm's IT capability to the ideal IT capability for its competitive strategy [64]. Previous research on the impact of competitive strategy on IT management strategies has shown that

1) a firm's competitive strategy is strongly related to the degree of centralization of IT structure [7], [70];
2) multiple competitive strategies can cause multiple forms of IT adoption [16], [37], [39], [40], [56];
3) competitive strategy has a significant impact on the correlation between IT adoption and business performance [27].

A misalignment between competitive strategy and IT management strategy could result in situations where IT becomes a "competitive burden" [75] and may result in decreased business performance [27], [64].

A firm's competitive strategy can be distinguished by a particular set of distinctive competencies [43], [48], [68]. Therefore, we suggest that depending on competitive strategy, a firm may have distinctive competence in different aspects of IT management sophistication.

Prospectors tend to pursue an aggressive competitive strategy pioneering products and markets. They operate in an environment characterized by rapid and unpredictable changes. Understanding the changes and innovation in the industry and the uncertainty of the actions of competitors and customers

will require firms' leaders to spend more time scanning their firm's environment [19], [20]. Prospectors are therefore expected to focus their scanning activities toward opportunities for differentiation of products, markets, and services. The firms' IT should be designed to facilitate the acquisition and distribution of such information. Because of the firms' continuous dependence on new and multiple technologies for product and market development, IT leaders are expected to be more involved in IT planning and IT integration activities.

Analyzers are a "unique combination of Prospector and Defender types" [48, p. 68]. Analyzers adopt some characteristics of Prospectors and some characteristics of Defenders, seeking effectiveness through both efficiency and new products and markets. Analyzers are expected to make choices typical of Prospectors in their newer and more dynamic endeavors (such as spending more time in IT planning) while adopting a strategy typical to Defenders in their traditional and stable lines of business [72]. Analyzers need to keep a balance in locating new market opportunities and maintaining their existing customer base. The IT leaders in these firms, in turn, need to engage more in IT planning and IT organization activities in order to keep an equilibrium between conflicting demands for technological flexibility and stability.

A Defender is a less dynamic form of firm operating in an environment that is more stable and predictable than that of the Prospector. This more stable environment allows Defenders to engage in less environmental scanning. Defenders are expected to depend on single-core technology for cost reduction, favor IT developed internally, form a limited alliance with external sources for their technology, and overlook new market development in IT [72]. Hence, IT leaders in these firms are expected to engage more in IT planning and control activities for cost-reduction purposes and more in IT organization activities for continuously improving existing technology to maintain efficiency.

Reactors are firms with no distinct competitive strategic orientation. In the absence of a clear strategy in a Reactor firm, decisions are made in a reactive rather than proactive mode. The need for environmental scanning, long-range forecasting, and planning is minimal because the environment will favorably support almost anything the firm does or does not do [21]. As a result, there is no reason to believe that Reactors will follow a specific strategy to secure IT resources. In such firms, IT leaders are more likely to spend more time in IT organization activities (to run efficient data centers) than to spend more time impacting the firm's business strategy.

Therefore, a hypothesis relating competitive strategy and IT management sophistication can be formulated as follows.

Hypothesis 1: Firms in the four strategic types differ with respect to the degree of their IT management sophistication.

This hypothesis relates the four basic strategic types with IT management sophistication. The hypothesis is of fundamental importance to an understanding of the issues that affect the relationship between competitive strategy and IT management sophistication.

IV. The Study

A field study using a questionnaire was deemed appropriate to collect the necessary data from senior IT executives. The limitations of using a single source to represent a firm's position are well recognized. This problem was resolved, in part, by establishing an "expert" within the firms as the single source—the senior IT executive. Therefore, in most firms surveyed, the individual who completed the survey was the person most knowledgeable about the firm with regard to the variables of interest. In the questionnaire, the senior IT executives were asked about IT planning mode, IT control mode, IT organization, and the extent of IT integration in their firms. Second, in addition to the questions on the five-point Likert-type scale, IT executives were asked to assess the competitive strategy of their firms. Last, demographic data about the respondents and their firms were obtained.

The questionnaire was pretested, and several recommended changes were incorporated into the final instrument. Using information in a directory, we were able to determine that the largest concentrations of financial-services firms were located in approximately 11 states. The total number of financial-services firms residing in these states was identified using a mailing-list directory. The questionnaire (and explanatory cover letters) was sent to approximately 1035 randomly selected financial-services firms in the following states: New York, New Jersey, Ohio, Michigan, Pennsylvania, Florida, California, Wisconsin, Minnesota, Illinois, and Texas. Of those mailed, 34 questionnaires were postmarked undeliverable and 213 were completed and returned, yielding a response rate of 21.30%. This is a typical response rate for studies of this kind [42], [60], [73]. We performed two tests to check for nonrespondent bias. No statistically significant differences were found between responding and nonresponding firms using the categorical variables of firm type and number of employees (chi square $=$ 10.77 and 9.21, respectively, $p >$ .05). There was little reason to suspect that IT executives who did not respond to the questionnaire perceived their firms much differently from the managers who did respond, since the mix of the respondents included all the sectors within the financial-services industry.

The financial-services industry was selected primarily because it is an information-intensive industry in which IT is playing a strategic role [4], [17], [34]. It has been undergoing dramatic changes that have affected its entire structure; the industry is now faced with market conditions completely different from those prevailing less than a decade ago [61]. Since the Miles and Snow typology focuses on the innovative behavior of firms in product and market development, it is appropriate for studying the effects of competitive strategy on IT management sophistication in the financial-services industry.[6] In the financial-services industry, IT is the means of delivering the goods and services, the infrastructure of the business is often IT itself, and each firm's IT infrastructure is a major component of its asset base [22].

[6] In a recent study, to test the usefulness of the Miles and Snow strategic typology in the field of marketing strategy, the financial-services industry was also selected as a representative of an industry responding to recent environmental changes [43].

V. Measurement of Research Variables

A. IT Management Sophistication

Based on the feedback received from IS managers in the pretesting of the instrument, it was clear that factors affecting IT management sophistication include more than the nine items [6], [62] or the five items [64] used before. To measure IT management sophistication, we used four criteria, e.g., IT planning mode, IT control mode, IT organization, and IT integration, represented by a total of 20 items. Respondents were asked to indicate the level of IT planning, control, organization, and integration in their firms. The response options, anchored on a five-point Likert-type scale, ranged from 1 = strongly disagree to 5 = strongly agree. The following paragraphs provide the theoretical reasons for the four criteria identified for measuring IT management sophistication. (Appendix A contains the items used to measure IT management sophistication.)

1) IT Planning Mode: IS planning has been a key management issue for practitioners as well as researchers since the mid-1980's [49]. The need to integrate IS planning with business planning so that information systems provide support for the business strategies of the firm has been the focus of IS planning research. Firms' characteristics and the role played by IS within them have been shown to have a significant influence on the quality of the planning process and planning effectiveness [58], [59], [69].

As a firm's IT continues to mature, the nature of the planning mode changes from a computing plan oriented toward technology management to a long-range strategic plan involving data resource management [23], [52]. Researchers have identified appropriate planning characteristics for the stages of Nolan's model [23], [28]. The primary objectives of IT planning in the maturity stage are to align the IT plans with a firm's business plans [77] and to extend the infusion and diffusion of IT within a firm [69]. As a firm moves toward IT management sophistication, new concerns are:

- What information systems do the firm's competitive strategies demand?
- What strategic opportunities are presented by IT?
- How should IT project priorities be set?

2) IT Control Mode: Control of IT activities has changed drastically during the past two decades, from being loose/informal, project based, and technical based to being more tight/refined and managerial based [11], [12], [24].[7] New methods of control are based on benefits, priorities (selective charge-out), technical standards [3], and the organizational goals rather than cost [5], [12]. As firms progress toward IT management sophistication, they are as confident in managing computing as they are in managing other resources, the application's development pursues economic benefit, and IT managers seek to manage the balance between short-term delivery and investment for the future [24].[8] This often requires new mechanisms for line influence in IT, in addition to new reporting relationships [38]. Firms with a high level of IT management sophistication can derive a significant benefit from strategic use of IT by establishing mechanisms to permit key line managers to exercise control over budgeting, priority setting, and resource planning for the IS function. New concerns are:

- How much should they spend on IT?
- How should IT proposals be evaluated?
- How should the responsibility and authority for IT direction, development, and operations be set?

3) IT Organization: Organizing IT is a key management issue [11], [49]. Previous research reported that

1) IT organization has a significant impact on overall IT effectiveness [7], [58];
2) not every IT organization is an effective choice for every firm [11];
3) the changes in overall IT organization can be triggered by changes in overall organizational variables (e.g., corporate strategy, business strategy, and overall firm structure) [11].

In the early stages of data processing, firms could organize IT activities autonomously because early applications were limited to transaction-oriented functions requiring only limited user awareness and involvement. In the IT era, however, end-user computing continues to grow and spread rapidly, and users' ideas need to be given special attention in the planning and implementation of applications [1], [14]. New concerns in IT management-sophistication eras include:

- How will IT affect a firm's organizational structure?
- Should IT have a director?
- If so, what are his roles and responsibilities?

4) IT Integration: Traditional management strategy for automation has been a bottom-up approach, in which various functional areas were automated on an application-by-application basis, without consideration for integration and optimization at the firm level.[9] As a firm moves toward IT management sophistication:

1) there is a top-down planning process for linking IS strategy to business needs;
2) the technology is transferred to a wider spectrum of applications;

[7] An explained in [12], many potential IT financial-control procedures (such as unallocated cost center, allocated cost center and charge-out, profit center, and transfer pricing) are possible. The challenge is to pick the one that best fits the company's general management control culture, present user-IT relationships, and current state of IT sophistication. The typical firm has approached the control issues in an evolutionary fashion rather than having selected the right procedure the first time.

[8] Earl [24] suggests that the control arrangements for IT tend to be a mix solution as firms move toward IT maturity. Accordingly, firms will realize the advantages and disadvantages of each of the IT financial-control procedures and tend to adopt a hybrid approach. The hybrid approach states that in the same firm, some activities should be managed as cost center, some as service center, and some as profit or investment center, and these may change over time.

[9] As a result, organizations discovered that these application systems were becoming increasingly interdependent, incompatible, redundant, and, in many cases, incomprehensible [36].

3) there is a high degree of technology integration, leading to an effective exploitation of IT within the firm [12], [58].[10]

Integrated firms use IT to create new products and services, alter linkages with suppliers and customers, and establish new standards of performance in their industries. They also display a more proactive orientation toward IT [38].[11] Integration often is achieved by employing processes to identify and exploit IT opportunities. This often requires basic changes in business practices and culture [38]. The challenges to firms with a high degree of IT management sophistication are adaptation to and adoption of new technologies [12], [24].

B. Competitive Strategy

To measure competitive strategy, Snow and Hambrick [66] suggested at least four alternative approaches: 1) investigator inference, 2) self-typing, 3) external assessment, and 4) objective indicators. In this study, we use the self-typing approach, where IT executives assessed their firms' strategies using descriptions of the four strategies in the Miles and Snow framework. The descriptions (see Appendix B) originally developed by Miles and Snow [48] have been used in a number of other studies in this area [43], [68], [70]. The terms "Defender," "Prospector," "Analyzer," and "Reactor" were not used in this questionnaire. Rather, each description was prefaced by a categorization of "Type 1," "Type 2," "Type 3," or "Type 4," each corresponding to the appropriate strategic type. Recently, extensive reliability and validity studies were conducted by Shortell and Zajac [67] on the Miles and Snow strategy typologies, with excellent results.

C. Reliability and Construct Validity Assignments

Each of the constructs was represented by multiitem measures of that construct. Since multiitem measures were used for all of the constructs, for further analyses, each construct was computed by averaging the items used to measure it. Construct validity refers to whether the measures truly describe what they are intended to describe. One can purify the construct by eliminating the suspect items prior to factor analysis of the items [15].

The first step in the development of items that measure a construct should be to examine the item-to-total correlations to identify items that may display measurement error or do not share the core of the construct [15], [53]. Thus, the extent to which the item correlates with the total score is indicative of construct validity for the item. On examination of the item-to-total correlations for IT management-sophistication variables, items from each of the scales were deleted if the correlations with the corrected item total were below 0.50. After dropping these items, the item-to-total correlations were recalculated and alpha coefficients were computed. For internal validity, reliability for each measure was evaluated using Cronbach's coefficient alpha [15], [18]. The coefficient alpha values for the IT management-sophistication variables, shown in Appendix A for items measuring each construct, comfortably exceeded the lower limits of acceptability (generally suggested by Nunnally [53] to be around 0.50–0.60). This confirmed the internal consistency of homogeneity of the measures.

Factor analysis was used to determine if the 20 items measuring each of the four constructs of IT management sophistication cluster together and load onto the correct construct. A four-factor solution was obtained for IT management sophistication using the "eigenvalue greater than one" criterion [53]. The varimax rotation of the solution suggested that four factors, represented by high factor loadings, confirmed that the set of indicators measuring the underlying four constructs initially envisaged for IT management sophistication was established. The factors, which explained 66.7% of the variance, empirically corresponded to the expected factors. (Appendix A contains the factors used for IT management sophistication, the items for each factor and their loadings, the eigenvalue, and the variance explained by each of the four factors.)

VI. Analysis and Results

The level of data collection and analysis for all three components of our research model is that of the firm level, because the IT management strategies implemented by corporate IS groups address organization-wide concerns rather than those of specific subunits within a firm. Table II contains general information about the firms and personal information about the respondents. To ensure that the questionnaires were answered by the intended informants, that is, by a top-level executive, the respondents were asked to indicate their job title at the end of the questionnaire. Table II also shows the tabulation and classification based on those titles. Thus, it appears that the respondents are top-level IT executives and can be expected to provide adequate answers to questions on IT management-sophistication variables as well as on their firms' competitive strategy.

From the 213 financial institutions responding to the survey, the self-typing approach yielded the following breakdown of strategic types: 60 Defenders, 30 Prospectors, 100 Analyzers, 16 Reactors, and seven unclassified. The sample characteristics by strategy and firm type are shown in Table III. Table III(a) and (b) supports our expectations that all four strategies were pursued in the financial-services industry, with Defenders, Prospectors, and Analyzers far outnumbering Reactors. The data also support the basic assumptions regarding the existence of (significant) linkages between a firm's competitive strategy, size (number of employees), and type. In general, since Reactors do not use IT strategically, they not only have smaller IT departments but also a lower mean number of years that

[10] Integration has been identified as a key factor influencing the success of strategic planning for information systems [45].

[11] A recent study in [26] found eight characteristics that distinguished firms with high integration from those with low integration. All these factors were present where integration was high; none was present where integration was low. 1) Business unit management perceived that future exploitation of IT was of strategic importance. 2) An IT executive was established as part of the executive team. 3) There was ongoing education for business unit management in IT capability. 4) There was a top-down planning process for linking IS strategy to business needs. 5) The business mandate for IT was centrally planned. 6) Some IT development resource was positioned within the business unit. 7) The introduction of new technologies took place at the business unit level under business unit control. 8) There was a cost-center rather than profit-center orientation in controlling IT activities, with relatively unsophisticated charge-out procedures.

TABLE II
GENERAL INFORMATION ABOUT FIRMS AND PERSONAL INFORMATION ABOUT RESPONDENTS, $n = 213$

General Information:

A. Firm Type

Finance Company	4.7%	Brokerage Firm	2.3%
Banking	42.3%	Others	10.3%
Insurance	40.4%		

B. Number of Employees		**C. Annual Sales**	
Under 50	1.4%	Less Than $25million	10.9%
51 to 100	5.2%	25mm to 50mm	7.3%
101 to 250	16.2%	51mm to 100mm	12.4%
251 to 500	21.9%	101mm to 250mm	18.1%
501 to 1000	16.2%	251mm to 500mm	18.7%
1001 to 5000	29.5%	501mm to 1000mm	12.4%
5001 to 10000	2.4%	Over 1000mm	20.2%
Over 10000	7.1%		

Number of Levels the IT Functional Head Is Below the CEO: Mean 2; ST. Dev. =.9
Number of Employees Solely or Primarily Involved In IT Department or Function: Mean 129; ST. Dev. =23.67
Size of IT Budget Per Year: Mean17.88mm; ST. Dev. = 7.91

Personal Information:

D. Educational Level of Respondents:

High School	8.5%	Masters Degree	27.5%
Undergraduate Degree	62.1%	Doctorate	1.9%

E. Title of Respondents:

Chairman, CEO, SR V.P., V.P., SR V.P. of IS, Dir of IS, V.P. of CIS, V.P./MIS Dir, V.P. of DP, IT V.P., Dir of EDP, Dir of MIS, Dir of System Development, V.P. of Systems / operations 50.2%

CIO, Managing Partner of IS, Div Chief for IS, Regional Mgr for IS, Regional MIS Director, DP Dir, Mgr of IS & Automation, V.P. System Analyst 39.5%

MIS Dir of Development, V.P. of IS, Dir of Data Communication, Strategic Systems Mgr 10.3%

Number of Years Respondents Have Been With The Current Company : Mean 13.64; ST. Dev.=8.53
Number of Years Since Respondents Graduated With Highest Diploma: Mean 17.83; ST. Dev. = 8.97
Number of Years Respondents Have Been In Their Current Position:Mean 6.71; ST. Dev. = 6.59

strategic planning has been carried out compared to firms using other competitive strategies.

The summary data show the wide diversity of firm characteristics. We performed two tests to determine the differences between small and large firms and between bank and nonbank firms with respect to the competitive strategy and IT management-sophistication variables. Table IV(a) and (b) shows that there are no significant differences between small and large firms and between bank and nonbank firms with respect to competitive strategy and IT management-sophistication variables. Therefore, in the remaining analysis, firms are not distinguished based on size and type.

A. Competitive Strategy and IT Management Sophistication

Our research hypothesis suggests that the four strategic types would differ with respect to the degree of IT management sophistication. This was tested by performing a series of F-tests to compare the means of the strategic types on each of the IT management-sophistication variables. One IT management-sophistication variable served as the dependent variable for each analysis. The four strategic types determined the levels for the independent variable.

Several interesting and significant findings can be discerned from the results summarized in Table V(a). For each of the IT management-sophistication variables, there were significant differences ($p < .05$) across the four strategic types, implying that the firms differ in their emphasis on the dimensions of IT management sophistication depending on strategic orientation. The level of IT management sophistication was consistently higher for Analyzers and lowest for Reactors. These results indicate that our research hypothesis was supported by the data.

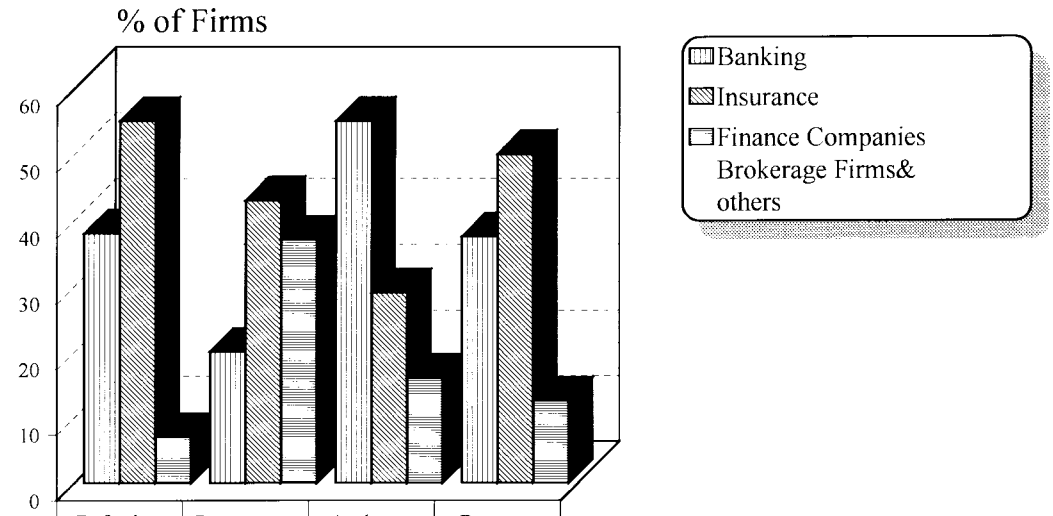
Scheffe's range test was used to conduct follow-up analyses to determine which group means were different. The Scheffe results are displayed in Table V(b). Defenders differed significantly from Prospectors and Reactors on IT control mode

TABLE III
(a) SAMPLE CHARACTERISTICS BY STRATEGY TYPE. (b) SAMPLE CHARACTERISTICS BY FIRM TYPE

Strategy Type	No of Employees 500<– 500> n (%)	IT Budget (in Millions) $ 4<= $4 > n(%)	Sales (in Millions) $250<= $250> n(%)	Strategic Planning Mean no of YRS	Mean no of Employees in IT Dept
Defenders	30(53%) 27(47%)	35(58%) 25(42%)	23 (41%) 33(59%)	13.68	120.11
Prospectors	4(13%) 26(87%)	17(57%) 13(43%)	10(37%) 17(63%)	16.21	183.2
Analyzers	51(51%)49 (49%)	49(49%) 51(51%)	52(55%) 42(45%)	13.03	134.61
Reactors	9(56%) 7(44%)	12(75%) 4 (25%)	9(64%) 5(36%)	8.33	24

- Notes:
  - 1) Although there are 213 firms in the sample, there are missing observation in all the categories
  - 2) The relationship between strategic type and number of employees is significant: (Chi Square– 15.55781; d.f. =3; significance= 0.00140; n=203)
  - 3) Means for number of employees soley or primarily involved in IT department are not significantly different among four strategic types; (F-Ratio– 1.6004; F-Prob= .1907; not significant at p<.05)
  - 4) The relationship between strategic type and sales is not significant : (Chi Square– 5.76151; d.f.=3, Significance = 0.12381; n=191)
  - 5) The relationship between strategic type and IT budget is not significant : (Chi Square= 4.33915; d.f. =3; Significance = 0.22709; n =206)
  - 6) Means for number of years strategic planning has been carried out in organizations are significantly different among four strategic types: (F- Ratio– 2.8452; F- Prob= .0389; significant at p<.05)

(a)



	Defenders	Prospectors	Analyzers	Reactors
Banking	38	20	55	37.5
Insurance	55	43	29	50
Finance Companies Brokerage Firms& others	7	37	16	12.5

Note: The Relationship Between Strategy and Firm type is Significant (Chi Square– 25.52880; d.f. = 6; Significance = 0.00027; n= 206)

(b)

and organization. Defenders are known to have a centralized control and vertical IS. On the operational side, dependencies on single-core technology and continuous improvements in technology are the key characteristics of a Defender's competitive strategy. Prospectors, however, have decentralized control and distributed IS [48]. They typically rely on multiple, flexible, and prototypical technologies to enable their firms to respond to a changing business environment rapidly.

TABLE IV
(a) DIFFERENCES BETWEEN SMALL AND LARGE FIRMS WITH RESPECT TO COMPETITIVE STRATEGY AND IT MANAGEMENT SOPHISTICATION

Competitive Strategy	IT Management Sophistication	Small Firms	Large Firms	T-test (2-tail Prob.)
Defenders (n=30*/27)**	Planning Mode (Mean, S.D.)	(3.51, 0.90)	(3.66, 0.69)	[.730] (.471)
	Control Mode (Mean, S.D.)	(3.50, 0.58)	(3.24, 0.73)	1.48 (.145)
	Organization (Mean, S.D.)	(3.57, 0.73)	(3.47, 0.81)	.450 (.651)
	Integration (Mean, S.D.)	(3.90, 0.55)	(3.77, 0.86)	0.640 (.523)
Prospectors (n=4*/26)**	Planning Mode (Mean, S.D.)	(2.94, 1.40)	(3.52, 0.77)	[1.26] (.218)
	Control Mode (Mean, S.D.)	(3.20, 0.54)	(3.67, 0.74)	[1.20] (.239)
	Organization (Mean, S.D.)	(3.19, 0.52)	(3.59, 0.75)	[1.02] (.317)
	Integration (Mean, S.D.)	(3.80, 0.16)	(3.12, 0.93)	1.45 (.159)
Analyzers (n=57*/49)**	Planning Mode (Mean, S.D.)	(3.93, 0.66)	(3.80, 0.56)	.96 (.338)
	Control Mode (Mean, S.D.)	(3.57, 0.83)	(3.39, 0.65)	1.18 (.239)
	Organization (Mean, S.D.)	(3.41, 0.71)	(3.58, 0.64)	[1.28] (.203)
	Integration (Mean, S.D.)	(3.25, 0.81)	(3.52, 0.72)	[1.76] (.081)
Reactors (n=9*/7)**	Planning Mode (Mean, S.D.)	(3.33, 1.14)	(3.74, 0.99)	[0.74] (.471)
	Control Mode (Mean, S.D.)	(2.74, 0.66)	(2.26, 1.07)	[1.20] (0.251)
	Organization (Mean, S.D.)	(2.83, 0.89)	(3.39, 0.76)	[1.32] (0.209)
	Integration (Mean, S.D.)	(2.45, 1.04)	(3.64, 0.54)	[2.77] (.015)***

Notes:
1) * Number of small firms
2) ** Number of large firms
3) *** $p<0.05$
4) Negative numbers are in brackets

(a)

The results also show that the means of Prospectors and Reactors are not significantly different for any of the IT management-sophistication variables. Although this was an unexpected result, this similarity can be explained by competitive strategy. Previous research reported that Prospector firms:

1) typically avoid long-term commitments to a single type of technological process;
2) usually create multiple, prototypical technologies, which have a low degree of routinization and mechanization;
3) have a level of technological adoption contingent upon both the firm's current and future product mix;
4) do not select or develop appropriate technologies until late in the process of product development [48], [68].

Prospectors and Analyzers, however, differed on IT planning and control. In addition, as expected, Analyzers and Reactors differed on IT organization and control.

Defenders usually choose to grow through market penetration and perhaps some limited product development. Typically, Defenders are able to do so by developing a single core technology that is highly cost efficient and by intensive planning oriented toward cost and other efficiency issues. For Defenders, this competitive strategy is associated with a higher level of IT organization and control.

As mentioned, Prospectors were known to have decentralized control and multiple technologies, and the major administrative problem for these firms seems to be how to facilitate and coordinate numerous and diverse operations. Therefore, because of continuous exploration of rapidly changing technology, and also because of reliance on technological flexibility, a higher level of IT integration, planning, and organization is essential for the Prospector firms. For Prospectors, however, complete integration may not be possible because of the presence of multiple technologies.

Analyzer strategy is difficult to pursue, particularly in financial-services industries (which are characterized by rapid market and technological change). Analyzer firms attempt to minimize the risk associated with new technologies while maximizing the opportunity for profit. Through a higher level

TABLE IV *(Continued.)*
(b) DIFFERENCES BETWEEN BANK AND NONBANK FIRMS WITH RESPECT TO COMPETITIVE STRATEGY AND IT MANAGEMENT SOPHISTICATION

Competitive Strategy	IT Management Sophistication	Bank	Non-bank	T-test (2-tail Prob.)
Defenders (n=23*/37)**	Planning Mode (Mean, S.D.)	(3.45, 0.53)	(3.69, 0.62)	[1.60] (.114)
	Control Mode (Mean, S.D.)	(3.41, 0.91)	(3.76, 0.70)	[1.67] (.099)
	Organization (Mean, S.D.)	(3.44, 0.82)	(3.71, 0.61)	[1.36] (.178)
	Integration (Mean, S.D.)	(2.96, 0.99)	(3.28, 0.73)	[1.43] (.157)
Prospectors (n=6*/24)**	Planning Mode (Mean, S.D.)	(3.75, 0.69)	(3.36, 0.90)	.97 (.339)
	Control Mode (Mean, S.D.)	(2.84, 0.97)	(3.30, 0.87)	[1.13] (.269)
	Organization (Mean, S.D.)	(3.44, 0.83)	(3.00, 0.95)	1.05 (.303)
	Integration (Mean, S.D.)	(3.38, 0.92)	(3.57, 0.69)	[.59] (.561)
Analyzers (n=55*/45)**	Planning Mode (Mean, S.D.)	(3.51, 0.85)	(3.46, 0.67)	.35 (.725)
	Control Mode (Mean, S.D.)	(3.72, 0.58)	(3.55, 0.84)	1.19 (.236)
	Organization (Mean, S.D.)	(3.89, 0.59)	(3.85, 0.65)	.32 (.75)
	Integration (Mean, S.D.)	(3.81, 0.73)	(3.78, 0.57)	.16 (.873)
Reactors (n=6*/10)**	Planning Mode (Mean, S.D.)	(3.72, 0.68)	(3.38, 1.26)	0.60 (0.560)
	Control Mode (Mean, S.D.)	(3.42, 0.80)	(2.70, 0.84)	1.68 (0.120)
	Organization (Mean, S.D.)	(3.17, 1.17)	(3.03, 0.68)	0.31 (0.760)
	Integration (Mean, S.D.)	(3.42, 1.12)	(2.70, 0.93)	1.38 (0.190)

Notes:
1) * Number of Banking Firms
2) ** Number of Non-banking Firms
3) Negative numbers are in brackets

(b)

of IT planning, organization, and control, Analyzer firms are able effectively to exploit the IT opportunities.

Reactors exhibit a pattern of adjustment to their environment that is both inconsistent and unstable, and the management in these firms do not fully shape the organization's structure and processes to fit a chosen strategy [48].

VII. SUMMARY AND CONCLUSIONS

IT management sophistication or maturity is used here to characterize firms in terms of their evolution in the planning, organization, control, and integration aspects of their IS function. This study proposed and validated a new instrument for measuring IT management sophistication within firms. Four criteria, represented by a total of 20 items, were identified for measuring IT management sophistication within firms. These are IT planning mode, IT control mode, IT organization, and IT integration. The proposed IT management-sophistication instrument eliminates the obvious measurement problems so far encountered in measuring IT management sophistication. This study finds that the IT management-sophistication variables explained 66.7% of the variance among the firms.

Alignment between a firm's competitive strategy and IT management strategies has been regarded as an important issue for a number of years. This alignment occurs in a dynamic environment, and it is one of the critical challenges facing management today. This study shows that such an alignment can be translated into a particular set of distinctive competencies in IT management for each competitive strategy. Moreover, none of the competitive strategies could be distinguished on the basis of a single aspect of IT management strategies.

The successful introduction and implementation of IT requires many management processes. A key point in carefully managed alignment is for the top management to limit their concern to a few critical IT management processes, depending on the firm's competitive strategy. Such an alignment offers the best opportunity for firms to identify and then implement

TABLE V
(a) ANOVA OF COMPETITIVE STRATEGY AND IT MANAGEMENT-SOPHISTICATION VARIABLES. (b) SCHEFFE'S PAIR-WISE COMPARISON OF STRATEGY TYPES

Variables	Defenders (G1) Mean (S.D.)	Prospectors (G2) Mean (S.D.)	Analyzers (G3) Mean (S.D.)	Reactors (G4) Mean (S.D.)	F-Ratio (F-Prob)
1. IT Planning Mode	3.6028 (0.5927)	3.5194 (0.6079)	3.8700 (0.6153)	3.5104 (1.0671)	3.8945* (0.0098)
2. IT Control Mode	3.6222 (0.8013)	3.0889 (0.9303)	3.6450 (0.7078)	2.9687 (0.8761)	6.8265* (0.0002)
3. IT Organization	3.8625 (0.7002)	3.4417 (0.8677)	3.7950 (0.6575)	3.0781 (0.8598)	6.8619* (0.0002)
4. IT Integration	3.1542 (0.8501)	3.5333 (0.7293)	3.4817 (0.7504)	2.9688 (1.0323)	3.8211** (0.0108)

Note: * p<.01 ** p<.05

(a)

Variables	G1 & G2	G1 & G3	G1 & G4	G2 & G3	G2 & G4	G3 & G4
1				**		
2	*		*	*		*
3	**		*			*
4						

Note: * p<.01 ** p<.05

(b)

IT solutions that consistently and successfully address critical business opportunities and threats [8].

A. Implications

This study shows that the effect of competitive strategy on IT management sophistication is significant. Further, firms differ in their emphasis on the dimensions of IT management sophistication depending on strategic orientation. In responding to a strategic necessity, a wide range of organizational capabilities may be feasible or required. Typically, however, firms choose to develop only some of them. Although firms within every industry may choose different competitive strategies and have different IT capabilities from their competitors, each competitive strategy must be aligned with appropriate IT capabilities. For example, this study finds that for Defender firms, particular attention must be paid to IT control and organization.

One of the major contributions made by this study is in the identification of IT capabilities that must be pursued for a given competitive strategy. It provides guidelines to senior managers on how they should allocate their time and energy in their firms to make their IT more responsive to their firm's success. For example, the executives in firms pursuing a Prospector strategy should concentrate more on IT integration than those who are pursuing a Defender strategy. This implies that they should work toward:

1) improving top management understanding of planning processes that link information strategy to business needs;
2) providing IT development resources;
3) creating an environment for introduction of or experimentation with the information technologies.

Similarly, the firms that pursue a Defender strategy must work toward improving IT organization variables by making the responsibility and authority for IT direction, development, and operation clear and explicit. In addition, they should build confidence among IT executives that IT proposals are properly appraised and should continuously monitor the IT function based on clear performance criteria, goals, and responsibilities.

To perform such an alignment, a variety of mechanisms may be employed.

1) The CEO and the IT executives develop a partnership so that there is two-way communication between them.
2) The IT executive should be an individual with strong business, technical, and organizational experience.
3) The CEO's develop mentoring programs to provide a broad knowledge of the firm and to access a broad network of organizational contacts to strengthen the IT executives' business understanding
4) The IT executives use their firm's competitive strategy in assessing the appropriateness of a particular IT management strategy decision.

B. Limitations

As pointed out by Snow and Hambrick [66], the self-typing approach is not without shortcomings. First, many executives

TABLE VI
RESULTS OF FACTOR ANALYSIS OF IT MANAGEMENT-SOPHISTICATION VARIABLES

IT Maturity Variable	IT Planning Mode Factor 1	IT Control Mode Factor 2	IT Organization Factor 3	IT Integration Factor 4
Our IT projects support the business objectives and strategies of our company.	0.89383			
We continuously examine the innovative opportunities IT can provide for competitive advantage.	0.87325			
We are adequately informed on the current use of IT by competitive forces (e.g., buyers, suppliers and competitors) in our industry.	0.83333			
We are adequately informed on the potential use of IT by competitive forces (e.g., buyers, suppliers and competitors) in our industry.	0.82416			
We have an adequate picture of the coverage and quality of our IT systems.	0.73876			
We are content with how our IT project priorities are set.	0.67992			
In our organization, the responsibility and authority for IT direction and development are clear.		0.83335		
In our organization, the responsibility and authority for IT operations are clear.		0.79007		
We are confident that IT project proposals are properly appraised.		0.78884		
We are constantly monitor the performance of IT functions.		0.77006		
Our IT function is clear about its goals and responsibilities.		0.71847		
Our IT function is clear about its performance criteria.		0.69858		
In our organization, user ideas are given due attention in IT planning and implementation.			0.86935	
Our IT specialist understand our business and the firm.			0.85328	
The structure of our IT function fits our organization.			0.85019	
The IT specialist-user relations in our firm are constructive.			0.80611	
In my firm top management perceives that future exploitation of IT is of strategic importance.				0.80985
There is a top-down planning process for linking information systems strategy to business needs.				0.80811
Some IT development resource is positioned within the business unit.				0.79885
The introduction of, or experimentation with, new technologies takes place at the business unit level under business unit control.				0.61297
Eigen Values	4.6725	3.584	3.2916	1.77
Percentage of Variance	23.407	17.9	16.5	8.9
Reliability	0.8848	0.8595	0.8019	0.7792

are reluctant to classify their firms. In this study, however, the number of respondents who did not self-type their firms was less than 4%. A second limitation of self-typing is a possible variance among executives' perceptions of strategy within the same firm. Snow and Hrebiniak [68], in a study of 88 companies, found "substantial agreement on strategy among top managers within a given organization." Because of the similarity in questioning between this study and the Snow and Hrebiniak [68] studies, we believed that responses from only one individual within the firm, in this case the senior IT executive, would be sufficient.

A third limitation of self-typing noted by Snow and Hambrick [66] is that executives may tend to report their firms' intended rather than emergent or realized strategies. If there is no intended strategy, an executive may even create one for the benefit of the researcher. As noted by Nisbett and Wilson [50], this tendency is a common problem in the social sciences. A fourth limitation of the self-typing approach is the lack of external confirmation of the respondent's answers. The notion of response bias resulting from employing the self-typing approach was minimized by employing some general guidelines. For example, to the extent to which anonymity of responses was ensured by us in the cover letter, the self-typing approach should not be strongly influenced by lack of frankness on the part of the respondents. While that is true, the use of the self-typing and key informant's method enabled us to collect data from a large number of financial institutions. Because of the size and nature of our sample, however, we could not obtain external confirmation of the self-typing done by the IT executives. The results should be interpreted with these limitations in mind. Ideally, future research into the effect of a firm's competitive strategy on IT management sophistication should attempt to avoid this limitation by pragmatically obtaining multiple sources within single firm.

Last, in this study, we did not control for the industry. The financial-services industry is a very "information-intensive" industry, in which IT is considered to have a high degree of strategic relevance [45]. Banks have very information-enriched product lines that focus considerable corporate attention on effective IT management. The findings of this study may not apply to firms in less information-intensive industries, in which IT plays a more supportive role. The statistical significance of these results, however, provides us with a reasonable level of protection against spurious and unreliable findings. Future research needs to test the generalizability of our findings and

seek better understanding of the mechanisms governing the effects of the competitive strategy on information management sophistication.

APPENDIX A

See Table VI.

APPENDIX B
STRATEGY TYPES

Now we would like to assess the Competitive Strategy of your organization. Please circle one of the following types of competitive strategies that best describes your organization.

1) *Defender:* An organization with this type of strategy attempts to locate and maintain a secure niche in a relatively stable product or service area. The organization tends to offer a more limited range of products or services than its competitors, and it tries to protect its domain by offering higher quality, superior service, lower prices, and so forth. Often an organization with this type of strategy is not at the forefront of developments in the industry—it tends to ignore industry changes that have no direct influence on current areas of operations and concentrates instead on doing the best job possible in a limited area.
2) *Prospector:* An organization with this type of strategy typically operates within a broad product-market domain that undergoes periodic redefinition. The organization values "first in" in new-product and market areas even if some of these efforts prove not to be highly profitable. The organization responds rapidly to early signals concerning areas of productivity, and these responses often leads to a new round of competitive actions. However, an organization with this type of strategy may not maintain market strength in all areas it enters.
3) *Analyzer:* An organization with this type of strategy attempts to maintain a stable, limited line of products or services, while at the same time moving out quickly to follow a carefully selected set of the more promising new developments in the industry. The organization is seldom a major competitor in areas compatible with its stable product-market base; the organization can frequently be "second in" with a more cost-efficient product or service.
4) *Reactor:* An organization with this type of strategy does not appear to have a consistent product-market orientation. The organization is usually not as aggressive in maintaining established products and markets as some of its competitors, nor is it willing to take as many risks as other competitors. Rather, the organization responds in those areas where it is forced to by environmental pressures.

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