Development of Measures to Assess the Extent to Which an Information Technology Application Provides Competitive Advantage

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In order to measure the extent to which information technology provides competitive advantage, the construct "Competitive Advantage Provided by an Information Technology Application" (CAPITA) was operationalized. A field survey gathered data from 185 top information systems executives regarding information technology applications which had been developed to gain competitive advantage. A confirmatory analysis revealed that CAPITA may be conceptualized in terms of nine dimensions which satisfy key measurement criteria including unidimensionality and convergent validity, discriminant validity, predictive validity, and reliability.

The nine dimensions form the basis of a preliminary multidimensional measure or index of competitive advantage which has practical uses for competitive assessment. These include justifying and evaluating applications and acting as dependent variables in empirical competitive advantage research.

Extensions entail formulating alternative measures of CAPITA to clarify the theoretical foundations of the construct, validating the latent-structure model on another data set, use of multiple informants for data collection, and exploring complex factor structures for the construct.
(*Information Technology; Competitive Advantage; Measurement Scales; Multidimensional Modeling*)

Expenditures on computer resources amount to nearly one third of the annual capital investment made by U.S. businesses (Bryan 1990). By 1986, more than half a trillion dollars had already been spent on information systems (*Business Week*, 1986). According to Ian (1989), firms spend between 1.5% and 3% of their revenue on information technology (IT). Information systems expenditures are now recognized as a significant balance sheet item (Sullivan-Trainor 1989).

It has always been difficult to assess the benefits and the impact of IT investments (Chervany and Dickson 1970). Measuring the effectiveness of information systems has consistently ranked as one of the top ten issues in major surveys of information systems management (Ball and Harris 1982, Dickson et al. 1984, Brancheau and Wetherbe 1987). As increased competition has forced firms to scrutinize closely all investments, the issue has become even more critical.

Although IT evaluation measures have been developed in the past (King and Epstein 1983, Bailey and Pearson 1983, Ives et al. 1983, Srinivasan 1985), a new requirement has emerged. This is the need to assess the strategic role of technology, the impact of IT on competitive advantage (King et al. 1986). Researchers and practitioners have recognized that it is critical to define and operationalize this concept (Pedersen 1990, Kauffman and Weill 1989).

Measurement of competitive advantage (CA) is necessary for choosing between candidate IT applications during the information systems planning process (Geise 1984, Rackoff et al. 1985, Porter and Millar 1985). Impact assessment is also essential to recognize the risks

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and long-term consequences of IT applications (Vitale 1986). Perhaps most important, measures are required to demonstrate and justify the value of IT to top management; currently, two-thirds of Fortune 100 companies' chief executive officers believe that their firms are not getting the most for their IT investments (Rifkin 1989).

Measures of CA are also required in order to conduct empirical studies involving IT effectiveness (Bakos 1987). In addition, they are essential to further understand concepts such as sustainability and contestable competitive advantage (Ghemawat 1986). According to Wiseman (1988), the advancement of this field depends on giving priority to measurement. This is because theory construction and a cumulative tradition, the ultimate objectives of the field, are inseparable from measurement (Bagozzi 1982). Thus, in order to move from anecdotes and case-studies to testable models and hypotheses, it is critical to link theoretical concepts such as CA to empirical indicants.

Formulating measures that assess the strategic impact of IT is a challenging task. The limited, though useful, results from previous efforts are a testimony to the difficulty of the undertaking. Previous work in this area includes a seminar series by the International Center for Information Technology (Berger et al. 1988) and *Computerworld*'s (1989) attempt to develop an index of IT effectiveness.

Objectives of the Study

This study aims to develop a set of measures for the construct: Competitive Advantage Provided by an Information Technology Application (CAPITA). It is the first step in a program of substantive and methodological research on the strategic performance impacts of IT. In order to attain this objective, the CAPITA measures developed by this study must be empirically validated, compared with alternative measures, and if acceptable, subjected to careful replication.

The process of developing a construct measure that is used here is based on Churchill's (1979) approach and has been previously described in Sethi and King (1991). There the idea of developing an IT-based competitive advantage measure was used to illustrate the challenges and difficulties involved in construct measurement in information systems. In that presentation, a slightly different acronym—"CAITA"—was used to describe the construct, and the statistical method described was exploratory factor analysis. This paper focuses on the theoretical underpinnings of the CAPITA construct, the substantive issues in its operationalization, and uses confirmatory factor analysis to develop the measure.

Several alternatives for formulating CAPITA measures are described below. These are discussed from a substantive perspective in terms of various concepts and theories in the field, as well as from a methodological perspective—a consideration of the procedure for construct operationalization.

Substantive Research Stream for CAPITA Measures

The definition and operationalization of the construct CAPITA may be rooted in several different concepts. They include competitive efficiency (the impact of an IT application on enterprise level performance (Bakos and Treacy 1986)), business value (impact on profitability, market share, and market size (Berger et al. 1988)), operational efficiency (impact on intermediate operating costs (Banker and Kauffman 1988)), management productivity (impact on return-on-management (Strassman 1988)), competitive forces (impact on buyers, suppliers, substitute products, new entrants, and rivalry (Porter 1985)), strategic thrusts (impact on differentiation, cost, innovation, growth, and alliance (Wiseman and MacMillan 1984)), value activities (impact on technologically and economically distinct organizational activities (Porter and Millar 1985)) and customer resource life cycle (impact on activities undertaken by customers to acquire a resource (Ives and Learmonth 1984)).

These different concepts signify two fundamental approaches to the measurement of competitive advantage. The first, which may be labeled the *outcome approach*, is reflected in concepts such as competitive efficiency, business value, and management productivity. This approach suggests assessing CA using outcomes as the dominant criterion. Past studies on measuring IT impact (e.g., Weill and Olson 1989, Cron and Sobol 1983) have relied mainly on outcome measurement, a trend also seen in the broader area of organizational effectiveness research (Cameron 1986). The problem with this approach is that outcome measures at the enterprise level[1] (e.g., revenue growth rate, return on investment, return on assets, profits, net worth) have many limitations. The variables are very aggregate and thus insensitive to the effects of a single IT application (Crowston and Treacy 1986). In addition, they are totally inappropriate in some cases (Cash and Konsynski 1985). Furthermore, they are of little help in understanding "how" IT affects CA (Crowston and Treacy 1986). On the other hand, the drawback of outcome measures that gauge the impact of IT at lower operational levels at or near the site of the technology (e.g., operating costs, inventory turnover, capacity utilization, production rate, management costs) is a lack of reliance on any underlying theory for variable selection (Crowston and Treacy 1986). Also, these measures have limited applicability in contexts other than the one studied, i.e., lack of generalizability.

The second approach, which may be called the *trait approach*, identifies key traits or attributes that characterize competitive advantage. It is reflected in concepts such as competitive forces, strategic thrusts, value activities, and customer resource life cycle. The trait approach suggests that CA is embodied by the degree to which an IT application possesses certain key attributes. The trait approach is an application of the broader systems resource model, which defines effectiveness as the attainment of a normative state and advocates the measurement of "means" (Hamilton and Chervany 1981). The predominant advantage of this approach is that it would provide insights into how and why IT affects CA; its measurement would show in detail CA components and subcomponents as well as describe the interrelationships among them. This knowledge is indispensable for building sophisticated causal models and theories regarding the impact of IT on CA. The difficulty in this measurement scheme is the lack of guidance regarding how to select only those attributes that have both the germane theoretical content and adequate operational measures. Compounding the problem is the fact that attributes and their measures may depend on factors such as the level at which the impact of IT is examined (Bakos 1987).

Thus, each of the two measurement options has advantages and limitations, and neither is universally preferable over the other. In this study, the trait approach is adopted because construct development and measurement, the underpinnings of the trait approach, can lay the foundation for theory construction and thus contribute more to the development of the field at the current stage. Nonetheless, the results must be compared with those of the outcome approach in the future.

Methodological Research Stream for CAPITA Measures

This study is a planned methodological research program based on Churchill's (1979) guidelines for developing measures that have desirable reliability and validity properties. Churchill recommends an eight-step procedure: (1) specify the domain of the construct, (2) generate a sample of items, (3) collect data, (4) purify measures, (5) collect new data, (6) assess reliability, (7) assess validity, (8) develop norms. A modified version of this approach was followed by collecting data from a single large sample because, as Churchill (1979) recognized, it is infeasible to complete the entire eight-step procedure at one time. Further, given the objectives of this study, the modified version was adequate because execution of the eight-step procedure with one-time cross-sectional data is sufficient to indicate "whether one or more isolatable traits are being captured by the measures as well as the quality with which these traits are being assessed" (Churchill 1979, p. 73). It is assumed that future studies will provide evidence related to the other steps.

The Domain of the CAPITA Construct

A construct, also called a theoretical concept, has been defined as an abstract entity which represents the "true," nonobservational state or nature of a phenomenon (Bagozzi and Fornell 1982). The first step in construct operationalization is to delineate its domain. One major factor largely circumscribes the domain of CAPITA: the level of impact of IT.

The impact of IT is experienced at a number of different organizational levels. According to Bakos and

[1] These measures have been called an assessment of the "realistic value" of information systems (Ahituv et al. 1981).

Treacy (1986), there are three levels for studying IT's impact: internal strategy (effect on the efficiency and effectiveness of organizational structures and processes so as to achieve goals and objectives); competitive strategy (effect on the ability to outmaneuver competitors in the industry in which the organization does business); and business portfolio strategy (effect on which industries to compete in and how to position the organization in these industries). Bakos (1987) proposes an expanded five-level classification: impact at the level of individuals, on work groups composed of many individuals, on organizations seen as consisting of several work groups, on an industry comprising several organizations, and on the entire economy/society as a whole.

CAPITA was defined at the level of competitive strategy, the level of organizations competing in an industry, because competitive advantage, as commonly defined (Porter 1980), is most directly manifested at this level. Thus, the traits underlying CAPITA pertain to the impact of an IT application on the competitive position of the organization in the industry.

Within the above domain, the following conceptual definition was adopted: *"CAPITA" refers to benefits accruing to a firm, in terms of changes in the firm's competitive position, that are caused by a single IT application.* As described above, the phrase "changes in competitive position" includes a variety of effects that enable a firm to compete better, such as gains in market share and attainment of parity with competitors. The term "IT application" was defined as the support of business activities through the use of hardware and software that collects, transmits, processes, and disseminates information (King et al. 1986). Thus, only organizational uses of hardware and software lie within the domain of CAPITA. The definition of CAPITA was therefore made precise so that it would clearly indicate what is included and what is excluded from its domain (Kerlinger 1964).

The literature describes a number of different types of benefits that may be gained from an IT application. A review of the academic literature, case studies, and anecdotes of IT yielded a comprehensive initial list of different potential benefits. However, many were judged to be components of the same underlying theme and thus grouped together; e.g., cost leadership (Porter 1980, Parsons 1983, McFarlan 1984), internal and interorganizational efficiency (Bakos and Treacy 1986), comparative efficiency (Bakos 1987), and productivity (Synnott 1987). Also, some concepts were subsumed under other, more general ones, e.g., Ives and Learmonth's (1984) customer service attribute circumscribes specific ways in which an IT application may attend to customer needs, such as by providing new products or services (Parsons 1983, McFarlan 1984), unique product features (Bakos and Treacy 1986, Bakos 1987), new distribution channels, and personalizing/tailoring products. Furthermore, some concepts were only indirectly related to competitive position because they express the impact of an IT application at organizational levels other than competitive strategy.

An assessment of the uniqueness and similarities between concepts resulted in the delineation of five distinct types of benefits from an IT application. They are listed in Table 1 along with similar characteristics described in the literature. The relevance of each concept to CAPITA (i.e., its characterization in the literature as an element of a firm's competitive position) is also explicated.

A detailed discussion of the benefits, conceptualized as the five underlying dimensions of CAPITA, follows.

Identifying and Operationalizing the Key Dimensions of CAPITA

The CAPITA construct is conceptualized in terms of the five dimensions described below. Table 2 shows the measures for each dimension, operationalized using the definitions provided in the referenced studies.

Efficiency: Efficiency refers to the extent to which an IT application enables a firm to produce products at a lower price relative to competing products. It is conceptualized as resulting from improvements in the firm's structure/processes, leading to a decrease in the input/output conversion ratio. Efficiency enables a firm to maintain its overall cost leadership or its cost advantage in a narrow strategic industry segment (Porter 1980). Efficiency is based on the following descriptions in the literature: use of IT to reduce the cost of product design, development, operations, marketing, sales, and administration (McFarlan 1984); internal and interorganizational efficiency (Bakos and Treacy 1986); comparative

Table 1 The Basis of CAPITA: Concepts Described in the Literature

CAPITA Dimensions	Concepts Described in the Literature	Relevance to CAPITA
Efficiency	Use of IT to reduce cost in functional areas (McFarlan 1984)	Competitive advantage, change the basis of competition
	Internal and Interorganization Efficiency (Bakos and Treacy 1986)	Support competitive position
	Comparative Efficiency (Bakos 1987)	Efficiency gains relative to competitors
	Productivity (Synnott 1987)	Lowest prices, increased market share
Functionality	Differentiation (Porter 1980)	
	Customer Service (Ives and Learmonth 1984)	Build and maintain customer loyalty
	Add value for Customers (Clemons and Kimbrough 1986)	Increase innovator's market share
	New Products & Services (Parsons 1983, McFarlan 1984)	Change the nature of the industry
	Unique Product Features (Bakos and Treacy 1986, Bakos 1987)	Increase monopoly power
Threat	Buyer and Supplier Power (Parsons 1983)	Improve position in competitive environment
	Switching Costs and Search-Related Costs (Bakos and Treacy 1986)	Increase monopsony power
	Customer and Supplier Switching Costs (Bakos 1987)	Resolve conflictual situations against customers/ suppliers to own advantage
Preemptiveness	Preemptive Strikes (MacMillan 1983, Clemons 1986)	Harvest strategic benefits
	First Mover Effects (Clemons and Knez 1987)	Barriers to competitors
	Positional Advantages and Timing (Bakos 1987)	Sustain superior economic returns
Synergy	Integration with Company Strategy (King et al. 1986, *Information Week* 1987)	Sustained comparative advantage
	Leverage a Firm's Intrinsic Strength (Clemons 1989)	Gain and defend competitive advantage

efficiency (Bakos 1987); and productivity (Synnott 1987). Efficiency was operationalized by measures based on value chain activities (Porter 1985).

Functionality: This trait represents the extent to which an IT application provides the functionality desired by users. Functionality is a generalization of the following concepts: differentiation (Porter 1980), customer service (Ives and Learmonth 1984), and adding value for customers (Clemons and Kimbrough 1986). While these authors focus on the customer, the target of functionality is any internal or external user group (Benjamin et al. 1984). For applications whose targets are external (i.e., the entities who use the application are customers, suppliers, or channel members (Wiseman 1988)), functionality ensures that the application will be adopted and retained, thus enabling the firm to distinguish itself from its competition and to improve its market position. For applications whose target is internal (i.e., users are members of the enterprise), this trait leads to higher acceptance, utilization, and thus the attainment of intended strategic objectives (such as customer service or lowering costs). Functionality encompasses such specific notions as attending to needs by providing new products, services (Parsons 1983, McFarlan 1984), or product features (Bakos and Treacy 1986, Bakos 1987). Functionality is most similar to King's (1987) empirically derived system-effectiveness trait which embodies the extent to which IT enhances the quality of users' work. Measures of functionality were based on a generalization of the customer resource life cycle activities (Ives and Learmonth 1984).

Threat: Threat refers to the impact of the IT application on the bargaining power of customers and suppliers. It is based on the concept of switching and search-related costs (Bakos and Treacy 1986, Bakos 1987). Threat enhances the dependence of customers and suppliers on the firm, permitting higher profitability (Porter 1980, Clemons and Kimbrough 1986). Threat is therefore a surrogate measure of the benefits accruing to the firm due to its ability to exert leverage and clout over its customers and suppliers through the IT application.

Preemptiveness: Preemptiveness characterizes an early and successful preemption of the market by the application. This trait captures the notion of preemptive strikes (MacMillan 1983) and leadership technological strategy (Porter 1985). Preemptiveness enables a firm to enjoy first-mover advantages (Porter 1980), also called "advantages of occupancy" (Keen 1986), subsequently unavailable to competitors. These advantages are the result of both generic lead time as well as competitive asymmetries (Feeney and Ives 1990). Preemptiveness is therefore a surrogate measure of the benefits accruing to the firm by virtue of the application's ability to "define the competitive rules" (Porter 1985, p. 186) in the market.

Synergy: Synergy refers to the IT application's integration with business goals, strategies, and environment. Such an integration ensures that the application leverages an intrinsic strength of the business, making it difficult for competitors to benefit from copying the application (Clemons and Row 1987, King et al. 1986). This trait is therefore a surrogate measure of the benefits accruing to the firm because of the exploitation of a distinctive business competence by the IT application.

A Preliminary Model of CAPITA

The content validity of the proposed CAPITA dimensions may be justified by correspondence with CA models proposed in the literature. For instance, according to Porter (1985), three themes characterize CA: low cost, differentiation, and sustainability. The CAPITA dimension *efficiency* taps low cost, *functionality* corresponds to differentiation, *threat* enables both low cost and differentiation, while *preemptiveness* and *synergy* enable sustainability. A comparable association can be made with the constructs proposed by Bakos (1987): efficiency, market power, and sustainability. Similarities also extend to the constructs' comparative efficiency, unique product features, search-related costs, and switching costs integrated by Bakos and Treacy (1986) from a review of market power and industrial economics concepts. Thus, the proposed CAPITA model encompasses most of the important and fundamental concepts related to CA. It therefore represents a practical and tenable starting point for empirical testing.

The content validity of the measures for each dimension, on the other hand, may be argued based on a close adherence to guidelines for item generation (Loevinger 1967): the test pool must be constructed on the basis of a broad area of content, items should be scrutinized for their logical relationship to the construct, and the rationale for selection must be made explicit (presented in Table 2).

In choosing dimensions and items, this study has relied on past literature. Alternatives were to ask experts what they regard as typical trait manifestations or to adopt items from other questionnaires (Angleitner et al. 1986). The first strategy raised a number of difficult issues (e.g., how to define and choose experts) while the latter was not applicable.

It is acknowledged, however, that under the current measurement scheme some important traits may have been omitted,[2] some dimensions included that are not unique, or some overlapping measures selected. In spite of these limitations, the results are useful because they indicate whether meaning may be attributed to the trait CA by focusing on the characteristics and impact of an IT application. The evidence regarding the existence and structure of the CAPITA construct is necessary for future studies to refine the current conceptualization as well as to remove deficiencies and / or contaminations in the measures (Schwab 1980).

Data Collection Procedure and Sample Characteristics

Empirical verification of the CAPITA construct was undertaken using a mail questionnaire shown in Appendix 2. Measures of each dimension were phrased as questions on a seven-point Likert-type scale. They were anchored at the ends either with the terms "strongly agree" and "strongly disagree" or with "greatly increased" and "greatly decreased."

The questionnaire asked respondents to describe the IT application developed with the intention of making the most significant contribution to their firm's competitive position. However, such a solicitation could have invoked a negative response because many sys-

[2] Originally, CAPITA was conceptualized in terms of more than five dimensions. However, upon closer scrutiny, it was felt that five dimensions had more convincing theoretical support as well as a direct and clear relationship with an application's impact on CA. (A strong a-priori basis for this hypothesized five-dimensional model also mandated that we use confirmatory factor analysis for model testing (Venkatraman 1989) rather than exploratory factor analysis as in Sethi and King (1991). Nonetheless, it is possible that some relevant traits may have been excluded.

Table 2 Hypothesized Dimensions of CAPITA and Their Proposed Measures

EFFICIENCY	
	Impact of the application on the following (*Porter 1980*):
E1	Cost of activities associated with purchasing the inputs (raw materials) required by your company
E2	Cost of receiving, storing, and disseminating inputs to the product, e.g., material handling, warehousing
E3	Cost of transforming inputs into the final product, e.g., machining, assembly
E4	Cost of marketing the company's final product, e.g., advertising, promotion
E5	Cost of collecting, storing, and distributing the final product to customers, e.g., order processing, scheduling
E6	Cost of providing service to maintain or enhance the value of the product, e.g., installation, training, repair
E7	Cost of improving the company's products and processes, e.g., R&D
E8	Cost of recruiting, hiring, training, development, and compensation of personnel
E9	Cost of general management activities, e.g., planning, finance, accounting, legal, and government affairs
E10	Cost of coordinating different activities described above, such as purchasing, processing, marketing, sales, etc.
E11	Cost of interacting and coordinating activities with suppliers
E12	Cost of interacting and coordinating activities with customers
FUNCTIONALITY	
	Impact of the application on the ability of primary users to (*Ives and Learmonth 1984*):
F1	Determine how much resources they need, i.e., establish their requirements
F2	Determine the attributes of the desired resources, i.e., specify the nature of the desired resources
F3	Locate an appropriate source for buying or obtaining the resource
F4	Order or put in a request for the resource
F5	Pay for the resource or obtain authority for obtaining the resource
F6	Acquire the resource, i.e., be in physical possession of the resource
F7	Verify that the resource meets specifications, i.e., test the resource for a match with needs
F8	Add the resource to existing inventory, i.e., integrate the new resource with other resources
F9	Monitor the use of the resource, i.e., keep track of the utilization of the resource
F10	Upgrade the resource if necessary, i.e., add to the resource
F11	Repair the resource and keep it in good working condition
F12	Transfer or dispose of the resource
F13	Evaluate the overall effectiveness or usefulness of the resource
THREAT	
	Impact of the application of the following:
T1	Costs your company would incur if it changed to alternate suppliers (Parsons 1983)
T2	Your company's cost of locating alternate suppliers (Rackoff et al. 1985)
T3	Your company's ability to evaluate various suppliers and choose the most appropriate supplier (Porter 1980)
T4	Your company's ability to threaten vertical integration, i.e., threaten to perform some of the functions performed currently by its suppliers or customers (Cash and Konsynski 1985)
T5	Your company's ability to evaluate various customers and choose the most appropriate customer (Porter 1980)
T6	Costs which customers would incur if they change to alternate suppliers (Parsons 1983)
T7	Customers' cost of locating alternate suppliers (Bakos and Treacy 1986)
T8	Extent to which your company can use the system as a substitute for labor (Wiseman 1988)
PREEMPTIVENESS	
P1	Your firm has unique know-how regarding the system (Ghemawat 1986)
P2	The system provides unique access to channels such as brokers, distributors, or retailers (Porter 1985)
P3	The system provides unique access to resources (Ghemawat 1986)
P4	The system's market positioning is such that competitors are forced to adopt less favorable postures (Porter 1985)
P5	The system is protected from imitation by institutional barriers such as patents, copyrights, and trade secrets (Teece 1986)
P6	The system has influenced the development of technical standards and practices in the industry (Runge 1988)
SYNERGY	
S1	The system is aligned with your organization's business strategy (King et al. 1986)
S2	The system is aligned with your company's marketing policies and practices (Runge 1988)
S3	Your firm has technical expertise in the area of the system (Souder 1987)
S4	Top management is involved in and supports the system (Rockart and Crescenzi 1984)
S5	The system exploits unique resources (unavailable to competitors) possessed by your firm (Clemons and Row 1987)
S6	Your firm has the capability to continuously innovate and enhance the system (Porter 1980)

tems are not developed with the intention of providing CA. Thus, if the response was negative, respondents were asked to describe the currently used system with the most significant impact on the firm's competitive position. Further, because examples of strategic IT applications can help users draw analogies (Rackoff et al.

1985, Gongla et al. 1989), the questionnaire contained a small anecdote as in King et al. (1986).

Target respondents were top information systems executives. This choice was considered the most appropriate single source because the measurement scheme is based on the traits and features of an IT application. A number of other studies have also relied on top information systems executives to gather data regarding IT-related factors (Vitale et al. 1986, Zmud et al. 1987, Tavakolian 1989). However, it is acknowledged that the use of multiple respondents, including senior business executives and IT users, would have enriched the data further and eliminated some biases and inaccuracies (Phillips 1981, Huber and Power 1985). Such a strategy was not adopted, however, because the response rate could have been depressed to a critical level. In addition, addressing such issues as lack of consistency between respondents was considered beyond the scope of this preliminary study. The intention was to establish the existence of the latent trait CAPITA rather than its precise structure.

Pilot testing: A preliminary version of the questionnaire was pilot-tested with seven target respondents. Each respondent completed the questionnaire in the presence of one of the researchers and provided feedback regarding the wording of items, their understandability, and the overall organization of the instrument. The respondents faced no apparent difficulty in identifying strategic IT applications in their companies; on the contrary, their predicament was determining the most appropriate application out of the several they considered relevant. However, they did find some of the questions trying, e.g., inquiries about the impact of the IT application on the cost of organizational value-chain activities. These items were reworded as well as illustrated with specific examples. Pilot testing was complete when the last two respondents did not recommend any significant changes.

Data collection: The sample was obtained from two sources: (1) *Corporate* 1000, a directory of the 1000 largest manufacturing and service companies in the United States, and (2) the Strategic Data Planning Institute.[3] The former yielded a list of 568 firms; most of the firms were contacted by phone to obtain the names of information systems executives. A mailing list of information systems executives within the latter's 251 member companies was already accessible to the researchers. A first mailing (received by a total of 769 companies) was followed by reminders after three weeks.

Sample characteristics: Fifteen respondents declined to participate in the study. Excluding these, a total of 206 replies were received (27% response rate) out of which 21 responses were unusable. Thus, the effective response rate was 24% (185 responses).

To investigate whether they belong to the same general population, responses from the two subsamples of 568 and 251 companies were compared with regard to the following: company revenue, number of employees, primary users of the application, duration of system use, and the underlying generic technology of the application. As there were no significant differences, the two samples were pooled.

To ensure that the respondent sample was not biased towards specific types of firms, responding and non-responding companies were compared with regard to company revenue and number of employees.[4] One-way ANOVAs showed no significant differences between the two groups. This evidence of lack of non-response bias, while limited,[5] does enhance the generalizability of the results to the larger population.

Some salient characteristics of the responding executives, their firms, and the applications are profiled in Table 3.

Assessment of Measurement Properties

From a theoretical perspective, the measurement properties of a construct are assessed using a variety of criteria, e.g., internal and external validity (Loevinger 1967), theoretical meaningfulness, internal consistency

[3] A Rockville, Maryland users' group, under the auspices of Barnett Data Systems.

[4] Data for this analysis were obtained from the annual reports of companies, as reported in financial directories, and databases such as the *Directory of Corporate Affiliations*, *Million Dollar Directory*, and *Standard and Poor's Register of Corporations, Directories, and Executives*.

[5] More direct variables of interest, such as whether the firm had CA applications or not, could not be compared because of the lack of such information for nonrespondents.

Table 3 Characteristics of the Study Sample

I. Characteristics of the Respondent	
Average number of years worked in the company:	11.5
Job Title:	
President/Vice President	40%
Director	33%
Manager	12%
Other/Not Available	11%
II. Characteristics of the Company	
Average number of employees (thousand)	100
Average annual sales (million)	$2.5
Industry Group:	
Manufacturing	34%
Banking	13%
Finance/Insurance	10%
Retail/Wholesale	7%
Utilities	5%
Other	31%
III. Characteristics of the Application	
Primary users of the application:	
Customers	31%
Company personnel	67%
Other	2%
Average length of time the application has been in use months)	41
Underlying generic technology that is most important for the application:	
Applications software other than expert systems	42%
Database management systems	19%
Long distance networks	11%
Information input technologies	7%
Computer hardware	7%
Other	14%

of operationalization, convergent validity, discriminant validity, and nomological validity (Bagozzi 1980). From an operational perspective, however, the following minimal subset is considered important (Peter 1981; Venkatraman, 1989): unidimensionality and convergent validity, reliability, discriminant validity, and nomological (i.e., predictive) validity.

The measurement properties of CAPITA were first assessed by testing the hypothesized CAPITA model using confirmatory factor analysis. The model was then iteratively modified to improve its fit. The modifications involved two phases. First, the measurement properties of each CAPITA dimension were examined separately, as by Venkatraman (1989), with the objective of isolating and locating the misspecifications in each dimension. After separately modifying each dimension to meet key reliability and validity criteria, the revised full CAPITA model was tested. This two-phase modification procedure is illustrated by Burnkrant and Page (1982). It has also been called "piecewise model fitting" (Bollen 1989) and is conceptually analogous to using limited-information analysis to develop submodels which show reasonable fit and then performing a full-information assessment for final specification and parameter estimation.[6]

Assessment of the Hypothesized Full CAPITA Model

The five-dimensional hypothesized CAPITA model was examined within the LISREL 7 framework (Joreskog and Sorbom 1989) using the following model:

$$X = \Lambda\xi + \delta \tag{1}$$

where X is a vector of q observed variables, ξ a vector of n ($n < q$) common factors, δ a vector of unique factors (error terms), and Λ is a $q \times n$ matrix of factor loadings. Under the usual assumptions (Joreskog and Sorbom 1978), the variance–covariance matrix of $X(\Sigma)$ can be written as:

$$\Sigma = \Lambda\phi\Lambda' + \varphi \tag{2}$$

[6] In "piecewise model fitting," a poorly fitting model is broken up into components and each part reestimated separately: "For instance, suppose a CFA (Confirmatory Factor Analysis) model has three factors, each measured with four indicators. If the CFA for the whole model is not adequate, then the analyst could estimate a separate factor analysis for each factor and its four indicators at a time. . . . The main benefit of this procedure is that it can aid finding that part of a complex model with a poor fit. The main limitations are that it cannot unambiguously identify the error within the problem sector, and it may involve the estimation of many submodels when the initial model is elaborate. It is also possible that the problem with the model is evident only when the complete model is fitted" (Bollen 1989, page 304).

Analogously, as described by Anderson and Gerbing (1982), the limited-information technique partitions a matrix on the basis of content into submatrices and analyzes each submatrix separately, whereas the full-information technique factors the matrix as a whole to arrive at parameter estimates. While not as theoretically viable, the limited-information approach is more effective in the presence of misspecification, i.e., when the initial model may be incorrectly specified. This is because a separate estimation of parameters means that misspecifications in one part of the model do not affect the estimation of parameters in another part.

where ϕ is the matrix of intercorrelations among the common factors and φ is a diagonal matrix of error variance (θ_δ) for the measures.

To determine the specific type of confirmatory method and matrix Σ that should be analyzed, the data were examined for the assumption of multinormality. The Kolomogorov D Statistic was used to test the hypothesis that the data are sampled from a population with a normal distribution. This hypothesis was rejected in every case, and one variable which showed an extreme departure from normality was dropped.[7] The presence of distributional anomalies may be ascribed to the data not exactly complying with the criteria of interval scaling. Thus, the matrix of polychoric correlations, instead of ordinary product moment correlations, was used for all analyses (Joreskog and Sorbom 1989). Polychoric correlation coefficients were calculated using PRELIS (Joreskog and Sorbom 1986).

Using equations (1) and (2) above, the fit of the hypothesized CAPITA model was evaluated,[8] and the results are displayed in Table 4. As shown by the various indices, the fit is unsatisfactory. Thus, modifications were undertaken based upon a separate assessment of the measurement properties of each individual dimension, starting with unidimensionality and convergent validity.

Table 4 Goodness-of-Fit Indices for the Hypothesized Full CAPITA Model

Number of Latent Variables	5
Total Number of Items	44
Degrees of Freedom (df)	892
χ^2 Statistic	2472.97
p-Value	0.000
χ^2/df	2.77
Root Mean Square Residual	0.102
Goodness of Fit Index	0.662

Assessment of Unidimensionality (and Convergent Validity) of Each Dimension

Unidimensionality has been defined as the existence of one latent trait or construct underlying a set of measures (Anderson et al. 1987). Based on an evaluation of the fit of a one-dimensional model for each dimension, iterative modifications were undertaken in the spirit of a specification search (Joreskog and Sorbom 1989), i.e., modifications were made to improve the model fit as well as to derive parameters that have real significance and substantive meaning. As recommended, only one parameter was changed at every step (Joreskog and Sorbom 1989). Model modifications were continued until all parameter estimates and overall fit measures were judged to be statistically and substantively satisfactory. The exact modification procedure that was undertaken to derive a set of relatively parsimonious and "pure" indicators is detailed in Appendix 1.

Table 5 shows the measures, grouped into seven dimensions, that satisfied the unidimensionality and convergent validity criteria.

Assessment of Reliability

Following Werts et al. (1974) as illustrated by Bagozzi (1981), the composite reliability (ρ_c) of n measures of a dimension A may be defined in terms of λ_i, the factor loading of item i, as follows:

$$\rho_c = \left(\sum_{i=1}^{n} \lambda_i\right)^2 \text{Variance}(A) \Bigg/ \left(\left(\sum_{i=1}^{n} \lambda_i\right)^2 \text{Variance}(A) + \theta_\delta\right).$$

[7] As reiterated by Tetrick and LaRocco (1987), extreme departures from normality can lead to nonrobust results.

[8] Following Joreskog and Sorbom's (1989) suggestion, the maximum likelihood method was used for estimation instead of weighted least squares (WLS) because the sample size was not sufficiently large to produce an accurate estimate of the asymptotic covariance matrix.

Maximum likelihood estimates are evaluated using a number of statistical measures of fit. Parameter estimates of Λ, ϕ, and φ should have the right sign and size and small standard errors, as indicated by their t-values (Joreskog and Sorbom 1989). Overall model fit measures include the χ^2 goodness of fit index whose associated value (p) must be greater than 0.10 (Lawley and Maxwell 1971). A number of researchers (Idaszak et al. 1988, Brooke et al. 1988) use a related measure, χ^2 divided by its degrees of freedom. The recommended value for this ratio ranges from 3, 2 or less (Carmines and McIver 1981) to as high as 5 (Marsh and Hocevar 1985). Another statistic is root mean square residual (RMSR), which should deviate minimally from zero, with values less than 0.1 indicating an acceptable fit (Meyer and Gellatly 1988). An additional overall fit measure is the goodness of fit index, (GFI) and its value should exceed 0.90. However, as with all other fit indices, caution must be exercised in interpreting GFI because of questions regarding its independence of sample size (Mulaik et al. 1989, Rock et al. 1988, Bollen 1989).

Table 5 The CAPITA Measures That Satisfy the Unidimensionality and Convergent Validity Criteria

Factor 1: PRIMARY ACTIVITY EFFICIENCY (PAE)	
	Impact of the application of the following:
E2	Cost of receiving, storing, and disseminating inputs to the product, e.g., material handling, warehousing
E3	Cost of transforming inputs into the final product, e.g., machining, assembly
E5	Cost of collecting, storing, and distributing the product to customers, e.g., order processing, scheduling
E6	Cost of providing service to maintain or enhance the value of the product, e.g., installation, training, repair
Factor 2: SUPPORT ACTIVITY EFFICIENCY (SAE)	
	Impact of the application on the following:
E8	Cost of recruiting, hiring, training, development, and compensation of personnel
E9	Cost of general management activities, e.g., planning, finance
E10	Cost of coordinating different activities, such as purchasing, processing, marketing, sales, etc.
Factor 3: RESOURCE MANAGEMENT FUNCTIONALITY (RMF)	
	Impact of the application on the ability of primary users to:
F9	Monitor the use of the resource, i.e., keep track of the utilization of the resource
F10	Upgrade the resource if necessary, i.e., add to the resource
F12	Transfer or dispose of the resource
F13	Evaluate the overall effectiveness or usefulness of the resource
Factor 4: RESOURCE ACQUISITION FUNCTIONALITY (RAF)	
	Impact of the application on the ability of primary users to:
F4	Order or put in a request for the resource
F6	Acquire the resource, i.e., be in physical possession of the resource
F7	Verify that the resource meets specifications, i.e., test the resource for a match with needs
Factor 5: THREAT (THRT)	
T1	Costs which your company would incur if it changed to alternate suppliers
T3	Your company's ability to evaluate various suppliers and choose the most appropriate supplier
T4	Your company's ability to threaten vertical integration, i.e., threaten to perform some of the functions performed currently by its suppliers or customers
T5	Your company's ability to evaluate various customers and choose the most appropriate customers
T6	Cost which customers would incur if they change to alternate suppliers
T7	Customers' cost of locating alternate suppliers
Factor 6: PREEMPTIVENESS (PRMPT)	
P2	The system provides unique access to channels, such as brokers, distributors, or retailers
P4	The system's market positioning is such that competitors are forced to adopt less favorable postures
P5	The system is protected from imitation by institutional barriers such as patents, copyrights, and trade secrets
P6	The system has influenced the development of technical standards and practices in the industry
Factor 7: SYNERGY (SYNRG)	
S1	The system is aligned with your organization's business strategy
S2	The system is aligned with your company's marketing policies and practices
S3	Your firm has technical expertise in the area of the application
S4	Top management is involved in and supports the system
S6	Your firm has the ability to continuously innovate and enhance the application

When ρ_c is greater than 50%, it implies that the variance captured by the trait is more than that by error components (Bagozzi 1981).

Table 6 shows the indices for each of the eleven revised CAPITA dimensions. In all cases, ρ_c is greater than 0.5.

Assessment of Discriminant Validity

Discriminant validity refers to the degree to which measures of different model dimensions are unique. Following Venkatraman (1989), discriminant validity for CAPITA was assessed by testing if correlations between pairs of dimensions are significantly different

Table 6 Assessment of Reliability Indices

Dimension	Number of Indicators	ρ_c
Primary Activity Efficiency	4	0.73
Support Activity Efficiency	3	0.72
Resource Management Functionality	4	0.83
Resource Acquisition Functionality	3	0.80
Threat	6	0.63
Preemptiveness	4	0.58
Synergy	5	0.72

from unity. A model in which this correlation was constrained to one was compared with an unconstrained model. To satisfy the discriminant validity criteria, the fit of the model with the unconstrained correlation should be significantly better than the fit of the constrained model.

Table 7 reports the results of 21 pairwise tests among the seven CAPITA dimensions. The results indicate strong support for the discriminant validity criteria.

Assessment of Predictive Validity

The conceptual meaning of a construct is determined not only by its definition and operationalization (Bagozzi 1981) but also by its relationship to antecedents and

Table 7 Assessment of Discriminant Validity

Description	ML Estimate ϕ	t-value	χ^2 Statistic: Constrained Model (df)	χ^2 Statistic: Unconstrained Model (df)	Difference
Primary Activity Efficiency with:					
Support Activity Efficiency	0.266	2.964	108.94 (14)	33.12 (13)	75.82
Resource Management Functionality	0.319	3.828	183.23 (20)	60.06 (19)	123.17
Resource Acquisition Functionality	0.271	3.11	154.01 (14)	26.36 (13)	127.65
Threat	0.411	4.554	192.19 (34)	52.35 (33)	139.84
Preemptiveness	0.243	2.377	102.97 (20)	46.54 (19)	56.43
Synergy	0.225	2.577	240.32 (27)	93.31 (26)	147.01
Support Activity Efficiency with:					
Resource Management Functionality	0.307	3.684	249.06 (14)	35.51 (13)	213.55
Resource Acquisition Functionality	0.276	3.148	133.69 (09)	48.08 (08)	85.61
Threat	0.172	1.804	131.34 (26)	71.14 (25)	60.2
Preemptiveness	0.052	0.522	141.18 (14)	17.95 (13)	123.23
Synergy	0.316	3.801	102.56 (20)	39.10 (19)	63.46
Resource Management Functionality with:					
Resource Acquisition Functionality	0.727	14.021	78.31 (14)	26.58 (13)	51.73
Threat	0.226	2.452	159.63 (34)	74.59 (33)	85.04
Preemptiveness	0.211	2.139	113.98 (20)	57.74 (19)	56.24
Synergy	0.317	3.900	164.23 (27)	35.06 (26)	129.17
Resource Acquisition Functionality with:					
Threat	0.371	4.254	158.04 (26)	71.98 (25)	86.06
Preemptiveness	0.319	3.303	65.22 (14)	18.19 (13)	47.03
Synergy	0.170	1.942	188.13 (20)	34.26 (19)	153.87
Threat with:					
Preemptiveness	0.358	3.431	113.59 (34)	76.22 (33)	37.37
Synergy	0.262	2.797	165.19 (43)	83.38 (42)	81.81
Preemptiveness with:					
Synergy	0.292	2.971	113.59 (27)	59.68 (26)	53.96

Note: All chi-square differences are significant (for 1 degree of freedom) at the 0.01 level.

consequents (Bagozzi and Fornell 1982). The predictive validity of each CAPITA dimension was assessed by its relationship to *effectiveness* (described in Table 8), a dimension comprising three indicators satisfying the criteria for unidimensionality, convergent validity, and reliability. The structural equation model for this analysis is written as:

$$\eta = \Gamma\xi + \zeta$$

where η is the endogenous theoretical construct (i.e., *effectiveness*), Γ is the matrix of structural coefficients (y) relating the exogenous theoretical construct (i.e., CAPITA dimensions) to η, and ζ is the residuals of η.

Table 9 reports the results of the seven tests carried out to relate each of the CAPITA dimensions to *effectiveness*. The positive y coefficients for all the dimensions provide evidence for predictive validity.

Assessment of the Revised Full CAPITA Model

The full CAPITA model, consisting of the seven dimensions and the 29 measures that satisfied all previous measurement criteria, was reestimated. The results are shown in Table 10. The fit of the model is satisfactory based on the criteria of RMSR, χ^2/df, and the significance of item loadings (shown in Table 11). Also, the revised model surpasses the hypothesized model (Table 4) on all fit criteria; this confirms that the modifications introduced have real meaning. Furthermore, most importantly, the model is tenable from a content and a theoretical standpoint, as highlighted in the ensuing discussion.

Table 8 Measurement of the Effectiveness Dimension

Measures Comprising Effectiveness:
1. Impact of the IT application on sales growth rate
2. Impact of the IT application on profits
3. Overall competitive advantage provided by the IT application

Unidimensionality, Convergent Validity, and Reliability results:

$\chi^2 = 1.82$
df = 1
p-value = 0.178
GFI = 0.992
RMSR = 0.023
$\zeta c = 0.70$

Table 9 Assessment of Predictive Validity with Effectiveness

CAPITA Dimensions	γ	t-value[1]
Primary Activity Efficiency	0.47	4.31***
Support Activity Efficiency	0.25	2.33**
Resource Management Functionality	0.21	2.19**
Resource Acquisition Functionality	0.27	2.79***
Threat	0.26	1.96**
Preemptiveness	0.49	2.72***
Synergy	0.49	4.74***

[1] two-tail test
*** $p \le 0.01$; ** $0.01 < p \le .05$; * $0.05 < p \le 0.10$.

Discussion

CAPITA Dimensions and Their Measures

Factors 1 and 2 in Table 5 show that the *efficiency* dimension of CAPITA is not unidimensional as envisioned, but instead comprises two dimensions: Primary Activity Efficiency and Support Activity Efficiency. These results correspond to those of Lind and Zmud (1991), who found that IT support of value chain activities encompasses two components: impact on primary activities and impact on support activities.

Primary Activity Efficiency: Factor 1 consists of the effect of the IT application on the cost of the following: inbound logistics (receiving, storing, and disseminating inputs to the product), operations (transforming inputs into the final product), outbound logistics (collecting, storing, and distributing the final product to customers), and service (enhancing or maintaining product value). All four are primary value chain activities (Porter 1980),

Table 10 Goodness-of-Fit Indices for the Revised Full CAPITA Model

Number of Latent Variables	7
Total Number of Items	29
Degrees of Freedom (df)	355
χ^2 Statistic	776
p-value	0.00
χ^2/df	2.1
Goodness of Fit Index	0.76
Root Mean Square Residual	0.08

Table 11 The Final CAPITA Model: Standardized Loadings and Standard Errors

	Dimensions							
Items	PAE	SAE	RMF	RAF	THRT	PRMPT	SYNRG	Uniqueness[2]
E2	0.72 (0.074)[1]							0.47 (0.075)
E3	0.78 (0.074)							0.37 (0.076)
E5	0.53 (0.077)							0.71 (0.084)
E6	0.49 (0.078)							0.76 (0.087)
E8		0.55 (0.080)						0.69 (0.086)
E9		0.84 (0.083)						0.29 (0.102)
E10		0.60 (0.080)						0.64 (0.085)
F9			0.83 (0.064)					0.30 (0.050)
F10			0.75 (0.066)					0.42 (0.057)
F12			0.70 (0.068)					0.49 (0.062)
F13			0.67 (0.069)					0.54 (0.066)
F4				0.74 (0.069)				0.45 (0.062)
F6				0.82 (0.066)				0.31 (0.057)
F7				0.69 (0.070)				0.51 (0.066)
T1					0.34 (0.084)			0.88 (0.097)
T3					0.54 (0.082)			0.70 (0.088)
T4					0.78 (0.083)			0.38 (0.096)
T5					0.40 (0.083)			0.83 (0.094)
T6					0.33 (0.084)			0.89 (0.097)
T7					0.35 (0.084)			0.87 (0.097)
P2						0.37 (0.090)		0.85 (0.099)
P4						0.63 (0.092)		0.59 (0.102)
P5						0.44 (0.089)		0.80 (0.097)
P6						0.58 (0.090)		0.66 (0.098)
S1							0.84 (0.072)	0.28 (0.075)
S2							0.54 (0.076)	0.69 (0.082)
S3							0.44 (0.078)	0.79 (0.089)
S4							0.59 (0.075)	0.64 (0.079)
S6							0.46 (0.078)	0.78 (0.088)

[1] Numbers in parentheses are standard errors; all loadings are significant at the 0.01 level.
[2] Theta-Delta Matrix.

thus the label for this factor: Primary Activity Efficiency. In general, primary activities are those which involve the "physical creation of the product and its sale and transfer to the buyer as well as after sale service" (Porter 1985, p. 18). The results suggest that reducing the cost of activities concerned with the physical creation, distribution, and service of the product is an especially powerful source of CA. On the other hand, reducing the cost of marketing and sales, the remaining primary activity, may directly affect the quality of the offering provided to customers, thus compromising any benefits or competitive advantage resulting from reduced costs.

Support Activity Efficiency: Factor 2 is comprised of the impact of the IT application on the cost of the following: human resource management (recruiting, hiring, development, and compensation of personnel), firm infrastructure (general management, planning, finance, accounting, legal, government affairs, and quality management), and coordination of different activities. Since all three pertain to support value chain activities, which help sustain primary activities, this factor is called Support Activity Efficiency.

The relationship of the above items to CA may be attributed to the fact that few firms understand their significance; thus, lowering their costs may provide a cost advantage relative to competitors who are unaware of this potential. This lack of awareness is described by Porter (1985) as follows: "the cumulative costs of human resource management are rarely well understood" (p. 42); "Firm infrastructure is sometimes viewed only as 'overhead' " (p. 43); and linkages within the value chain "are often subtle and go unrecognized" (p. 50). The difficulty in recognizing the costs of support activities seems to make doing so a powerful source of CA.

Factors 3 and 4 indicate that the hypothesized unidimensional *functionality* trait actually consists of two dimensions: Resource Management Functionality and Resource Acquisition Functionality.

Resource Management Functionality: Factor 3 measures how well the IT application assists its primary users in meeting the following needs related to a resource: monitor utilization, upgrade, transfer or dispose, and account for. It is interesting to note that these activities correspond to the end stages of the resource life cycle (Ives and Learmonth 1984). Specifically, they comprise the Stewardship and Retirement stages of the four-stage IBM model (IBM 1981). Since these stages are concerned with the post-acquisition management of the resource, this factor is called Resource Management Functionality. Post-acquisition support is increasingly being emphasized as a notable source of CA. For instance, Ives and Vitale (1988) describe the potential for competitive repositioning by using applications of IT in the maintenance process. Similarly, Culnan (1989) stresses the key role of service in differentiating a firm from competitors. This dimension is a measure of the extent to which the IT application leverages post-acquisition activities for CA.

Resource Acquisition Functionality: Factor 4, called Resource Acquisition Functionality, consists of the IT application's impact on the acquisition phase of the resource life cycle. Specifically, this dimension measures the impact of the IT application on users' ability to order a resource, acquire it, and verify its acceptability. Applications which support these user needs, unlike those for post-acquisition management, are perhaps the best known examples of strategic IT applications, such as American Airlines' and United Airlines' reservation systems, and American Hospital Supply's and McKesson Pharmaceuticals' order-entry systems (*Business Week* 1987, *Forbes* 1985). The popularity and significance of resource acquisition support as a source of CA is reflected by this dimension.

Threat: Factor 5, Threat, consists of the impact of the IT application on the following six items: (1) the firm's ability to evaluate and choose from alternate suppliers (supplier selection) (2) its switching costs (3) its ability to threaten vertical integration (both forward and backward) (4) its ability to evaluate and choose alternate customers (customer selection) (5) customers' cost of locating alternate suppliers (6) customers' switching costs. IT applications which reduce a firm's switching costs and facilitate supplier selection and backward integration reduce the bargaining power of suppliers. Analogously, applications which assist in forward integration and customer selection and which increase customers' search-related and switching costs diminish the bargaining power of customers. These effects enable a firm to retain more of the value it creates rather than competing it to suppliers or buyers (Porter 1985), thus creating CA.

Preemptiveness: Factor 6, *preemptiveness*, consists of four items: the extent to which the IT application provides unique access to channels (brokers, distributors, and retailers), forces competitors to adopt less favorable market postures, influences the development of industry standards and practices, and offers barriers against imitation such as patents, copyrights, and trade secrets. Through providing favorable access to channels and market position, setting industry standards, and erecting institutional barriers, the IT application translates its technological lead into first-mover advantages that persist even if the technology gap closes (Porter 1985). The results also encourage a pursuit of legal mechanisms to protect IT applications even though such barriers can be "invented around" at modest cost, and the legal requirements for upholding their validity or proving their infringement are high (Teece 1986).

Synergy: Factor 7, *synergy*, is a function of the application's alignment with the firm's business strategy, marketing policies and practices, ability to continuously innovate and enhance the application, technical expertise, and top management support for the application. The salience of these items is that while alignment makes it difficult for competitors to benefit from copying the application (Clemons and Row 1987), continual innovation makes copying itself difficult. However, enhancements require technical expertise and, more importantly, top management support to guarantee the commitment of adequate financial and organizational resources for the IT application (*Information Week* 1986). Thus, *synergy* represents an exploitation of the firm's uniqueness by the IT application that competitors cannot benefit from or copy.

Relationships Among the CAPITA Dimensions. The CAPITA dimensions are positively correlated (Table 7) with each other, and except for one case, all coefficients are significant. This implies that IT applications that provide CA accrue multiple benefits to the organization.[9] Conversely, the lack of any negative correlations among the dimensions indicates that a high value on one dimension does not preclude a high value on another dimension. In other words, the dimensions complement each other.

However, it is possible that the relationships among the dimensions are profoundly different for certain types of IT applications. To examine this issue empirically, within-group correlations[10] were examined for IT applications whose primary users were customers and applications whose primary users were internal company personnel. The results showed that all correlation coefficients in each category are positive, though the strength of the relationships among the seven dimensions varies across the two types of IT applications.

Thus empirical evidence, though limited, leads to the conclusion that the dimensions reinforce each other. However, a caveat is that the degree and strength of the relationships among the CAPITA dimensions are moderated by the nature of the IT application.

A Further Exploration of CAPITA's Structure. While the intent of this study was primarily to demonstrate the existence of CAPITA rather than its precise structure, a supplemental analysis was undertaken to provide some insight about the latter. This analysis explored a second-order factor model for CAPITA. The seven dimensions were modeled as first-order latent variables, determined by three second-order latent variables. Specifically, a second-order variable *efficiency* was posited as influencing Primary Activity and Support Activity Efficiency, *functionality* influencing Resource Management and Resource Acquisition Functionality, and a construct called *sustainability* influencing *threat*, *preemptiveness*, and *synergy*. The bases for the three second-order factors are the models proposed by Porter (1980), Bakos and Treacy (1986), and Bakos (1987).

The path diagram for the second-order factor analysis is shown in Figure 1. The structural equation model is:

$$\eta = \Gamma\xi + \zeta$$

where η is first order factors (i.e., the seven dimensions), Γ is the matrix of second-order factor loadings, ξ is second-order factors, and ζ is the vector of unique variables for η.

The results given in Table 12 show that the loadings of all seven dimensions on their respective second-order factors are positive and significant. Also, correlations among the second-order factors are positive and significant.

However, overall model statistics indicate that the fit of the second-order model is not as good as that of the first-order model (Table 10); in fact, by the chi-square difference test, the latter has a significantly better fit (χ^2(df:12) = 53; significant).

This lack of fit may be attributed to errors in model specification (e.g., failure to model the impact of *synergy*, *threat*, and *preemptiveness* on *efficiency* and *functionality*) or to errors in measurement (i.e., deficiencies in the indicators of the seven first-order dimensions). However, isolating the precise source of error must wait until future studies have validated the measurements of the seven dimensions. Regardless, this analysis raises the possibility of exploring complex factor structures for CAPITA.

Implications, Extensions, and Conclusion

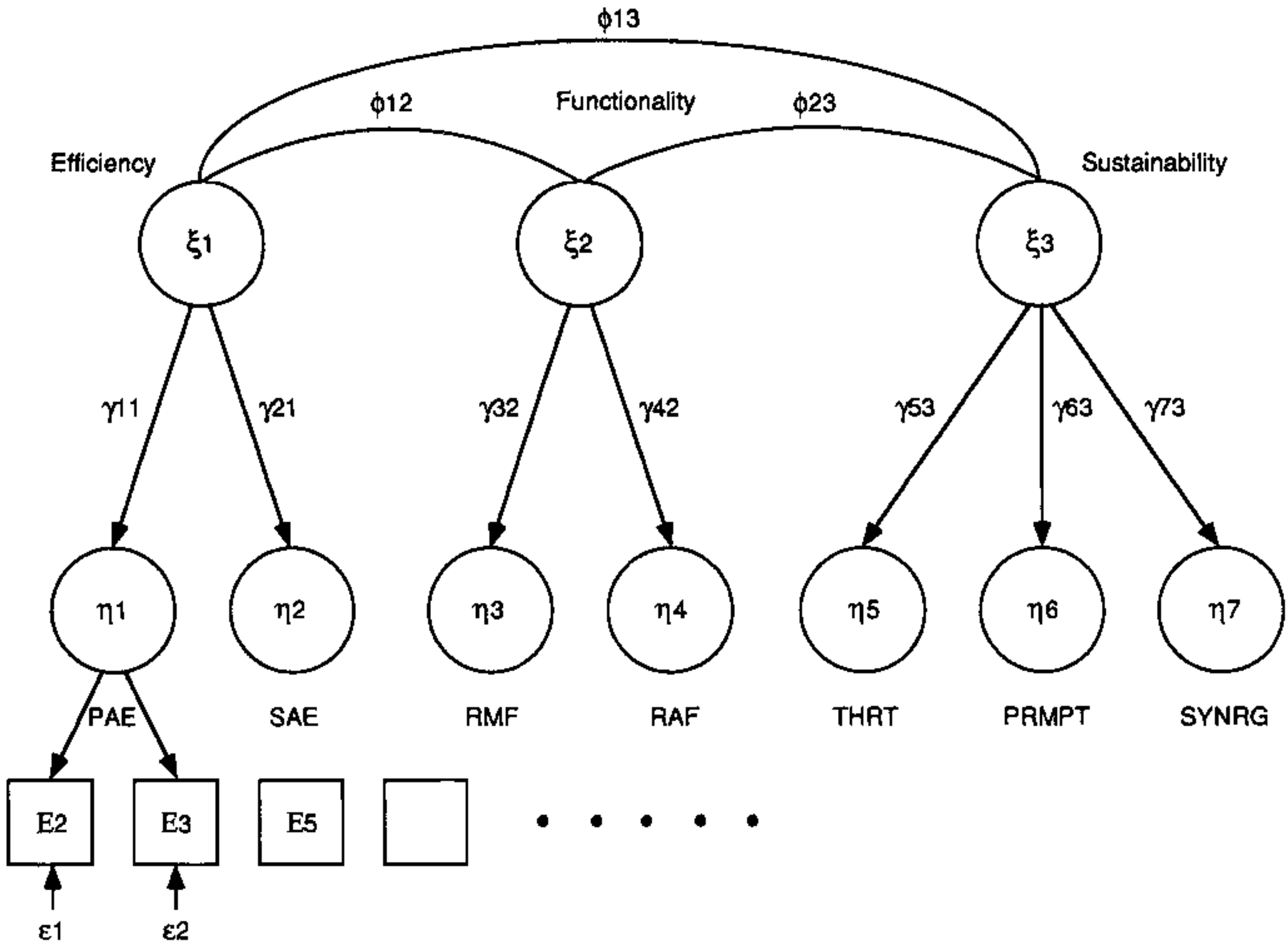
Implications

The seven dimensions of CAPITA can form the basis of a preliminary multidimensional measure or index of CA. Computing an overall grand index of CA is pre-

[9] This is similar to Runge's (1988) results that telecommunications-based IT applications that provide CA frequently exploit multiple sources; each application may support several customer resource life-cycle activities.

[10] Pearson product-moment correlations were computed using factor-based scores for each dimension.

Figure 1 Summary Path Diagram for the Second-order Factor Analysis



mature. There are numerous unresolved theoretical issues, such as whether the dimensions are compensatory in nature (Kerlinger 1964), and methodological issues, such as whether to use linear models[11] (King 1983). On the other hand, it would be reasonable to compute an overall score for each dimension, since they are unidimensional. A simple sum of item scores would be adequate because the results are generally comparable with those obtained by a more rigorous utilization of factor score regressions (Kim and Mueller 1978, Johnson and Wichern 1988). Such an aggregation would have many practical benefits.

A profile along the seven dimensions would be useful to practitioners for demonstrating, or at least elucidating, the benefits of an existing IT application. Such assessments are currently based on "gut feeling" (Parsons 1983), unrealistic assumptions regarding the application's contribution to the company's bottom line, or a disregard for benefits such as reduced overhead, higher switching costs and other barriers to entry, and increased product differentiation (Johnston and Vitale 1988).

Another use would be an evaluation of competitors' IT applications. An assessment of a competing system

[11] Some ways in which these assumptions can be statistically verified are detailed in Sethi and King (1991). That demonstration of how to compute an overall index and assess its measurement properties, however, should not undermine the important fact that until the construct measures are replicated, any index that is computed has little meaning of significance.

Table 12 Second-Order Factor Analysis: Parameter Estimates and Goodness-of-Fit Indices

γ (Matrix of Second-Order Factor Loadings[1])

	Second-Order Factors		
	Efficiency	Functionality	Sustainability
Primary Activity Efficiency	0.58		
Support Activity Efficiency	0.47		
Resource Management Functionality		0.89	
Resource Acquisition Functionality		0.82	
Threat			0.55
Preemptiveness			0.51
Synergy			0.53

ϕ (Correlations Between the Second-Order Factors[1])

	Efficiency	Functionality	Sustainability
Efficiency			
Functionality	0.67		
Sustainability	0.86	0.58	

Overall Model Fit Indices
$\chi^2_{367} = 829$
p-value = 0.00
$\chi^2/df = 2.25$
GFI = 0.75
RMSR = 0.09

[1] All loadings and correlations are significant at the 0.01 level.

based on the seven dimensions could reveal the reasons for its success. The results can form the basis for new IT products or enhancements to old systems.

The measures of CAPITA dimensions may also constitute the dependent variables in empirical studies concerning CA. While this effort will not eliminate the lack of consensus in the field regarding the appropriate dependent variable and how to measure it (Bakos 1987), it is a constructive move in that direction.

Extensions

The CAPITA measures are a "first-cut" at operationalizing the competitive impact of an IT application and must therefore be replicated and refined.

Alternative measures of CAPITA must be formulated and compared with the results of this study to clarify the theoretical foundations of the construct. Also, the latent-structure model developed here requires validation on another data set. This is particularly critical because the model was developed as well as tested using the same data set. Additionally, given the perceptual nature of the data used to reflect the theoretical construct, it is important to recognize the problems associated with the "key informant" approach (Phillips 1981, Huber and Power 1985). Thus, a logical extension would be to use multiple informants to verify perceptions regarding the features and impact of the IT application.

The exact structure of CAPITA must also be explored in detail. In addition to first-order structures, higher-order models must be examined. An explicit consideration of causal relationships among the first-order latent variables may be necessary, as illustrated in Venkatraman and Ramanujam (1987).

Conclusion

Often in the search for substantive relationships, an emerging field tends to overlook methodological issues such as measurement (Venkatraman and Grant 1986). The field of information systems has started to pay greater attention to such issues in the last decade. However, most often such consideration has resulted from a realization, prompted by a retrospective look at previous research, that substantive results have been rendered inconsequential by weak measures. This study is a first attempt to preclude such a situation in the area of IT use for CA. Its primary objective is to provide the measures and underpinnings for a program of research on IT impact assessment. CAPITA is the cornerstone of accomplishing that goal.

Appendix 1. Assessment of Unidimensionality (& Convergent Validity) of the CAPITA Dimensions: Description and Rationale of the Procedure

Items	Fit Indices				
EFFICIENCY					
Hypothesized Model	E1 · · · E12	$\chi^2_{54} = 305.3$	$p = 0.00$	GFI = 0.74	RMSR = 0.120
Iteration 1	(E2 · · · E6) (E1, E7 · · · E12)	$\chi^2_{53} = 249.8$	$p = 0.00$	GFI = 0.78	RMSR = 0.10
	To improve the fit of the hypothesized model, the items were respecified to comprise two dimensions: (E2, E3, E4, E5, E6) and (E1, E7, E8, E9, E10, E11, E12, as originally proposed by Porter (1980). The presence of two underlying latent variables was also manifested by the pattern of intercorrelations—the items constituting each dimension had higher correlations among themselves than with those of the second dimension. The results testify to the validity of the respecification: the fit of the two-dimensional model is significantly better than the original model, as indicated by the chi-square difference test χ^2 (df:1) = 55.3 (significant).				
Iteration 2	(E2 · · · E6)(E1, E8 · · · E12)	$\chi^2_{43} = 191.9$	$p = 0.00$	GFI = 0.80	RMSR = 0.09
	E7 was deleted in this iteration because its loading pattern did not display a simple structure; it was showing a tendency to load on both dimensions. Also, there seemed to be little justification for its significant error correlation with another item E6. Thus, in the interest of simplicity as illustrated in Anderson (1987), this item was dropped.				
Iteration 3	(E2 · · · E6)(E8 · · · E12)	$\chi^2_{34} = 125.4$	$p = 0.00$	GFI = 0.85	RMSR = 0.08
	E1 was dropped because it had significantly large error correlations with five other items, thus suggesting only a weak relationship with the construct.				
Iterations 4, 5, 6	(E2 E3 E5 E6)(E8 · · · E10)	$\chi^2_{13} = 27.0$	$p = 0.01$	GFI = 0.95	RMSR = 0.05
	E11, E12, and E4 were successively deleted in iterations 4, 5, and 6 because either their errors exhibited covariation or they were found to be associated with both dimensions. Further modifications were terminated because they could not be justified statistically and substantively. The results show the final model.				
FUNCTIONALITY					
Hypothesized Model	F1 · · · F13	$\chi^2_{65} = 434.5$	$p = 0.00$	GFI = 0.72	RMSR = 0.096
Iteration 1	F2 · · · F13	$\chi^2_{54} = 314.8$	$p = 0.00$	GFI = 0.75	RMSR = 0.089
	The items F1 and F2 were highly correlated (correlation = 0.711). Not surprisingly, their error correlations showed significance also. In the interest of parsimony, F1 was dropped because its loading was lower than F2's.				
Iteration 2	F2 F3 F4 F6 · · · F13	$\chi^2_{44} = 208.8$	$p = 0.00$	GFI = 0.79	RMSR = 0.08
	F5 was dropped because, unexpectedly, it had significantly large error correlations with four other items, thus suggesting only a weak relationship with the construct.				
Iteration 3	(F2 F3 F4 F6 F7)(F8 · · · F13)	$\chi^2_{43} = 158$	$p = 0.0$	GFI = 0.85	RMSR = 0.07
	The items were respecified to comprise two dimensions because the intercorrelations among items F8 · · · F18 were much higher relative to the remaining items. The chi-square difference test affirmed that the respecification has real meaning χ^2(df:1) = 50.8 (significant).				
Iterations 4, 5, 6, 7	(F4 F6 F7) (F9 F10 F12 F13)	$\chi^2_{13} = 21.6$	$p = 0.06$	GFI = 0.96	RMSR = 0.04
	F3, F8, F2, and F11 were successively deleted in iterations 4, 5, 6, and 7, respectively, because either their errors exhibited covariation or their loadings did not display a simple structure. The results show the final model.				
THREAT					
Hypothesized Model	T1 T2 · · · T7 T8				
Iteration 1	T1 T3 · · · T7 T8	$\chi^2_{14} = 53.3$	$p = 0.00$	GFI = 0.89	RMSR = 0.095
	T2 was deleted because it showed an extreme departure from normality, as mentioned on page 15.				
Iteration 2	T1 T3 · · · T6 T7	$\chi^2_{9} = 40.5$	$p = 0.00$	GFI = 0.90	RMSR = 0.086
	T8 was deleted because its loading was not significant, as indicated by its *t*-value.				
Iteration 3	T1 T3 · · · T6 T7	$\chi^2_{8} = 8.2$	$p = 0.41$	GFI = 0.98	RMSR = 0.038
	The error terms of items T6 and T7 were allowed to correlate because (1) their modification index (37.99) was highly significant and (2) items T6 and T7 relate closely to the same underlying aspect of *threat* (customer's switching cost), and therefore it was felt that an overlap is inevitable. As argued by Venkatraman and Ramanujam (1987), overlaps can exist even among parsimonious indicators.				

Items	Fit Indices				
PREEMPTIVENESS					
Hypothesized Model	P1 P2 P3 P4 P5 P6	$\chi_9^2 = 22.4$	$p = 0.00$	GFI = 0.95	RMSR = 0.062
Iterations 1, 2	P2 P4 P5 P6	$\chi_2^2 = 4.9$	$p = 0.08$	GFI = 0.98	RMSR = 0.045
	P3 and P1 were deleted in successive iterations because each had significant error correlations with two other items.				
SYNERGY					
Hypothesized Model	S1 S2 S3 S4 S5 S6	$\chi_9^2 = 9.53$	$p = 0.39$	GFI = 0.97	RMSR = 0.043
Iteration 1	S1 S2 S3 S4 S6	$\chi_5^2 = 4.85$	$p = 0.43$	GFI = 0.98	RMSR = 0.033
	S5 was deleted because its loading was only 0.196; the next smallest loading was 0.437.				

Appendix 2. How Does Information Technology Provide Competitive Advantage?

INSTRUCTIONS

Many companies are using information technology applications to gain an advantage over competitors. For instance, in the clinical laboratory industry, one company installed computer terminals in doctors' offices so that the doctors could directly access the results of specimen analysis. This improved customer service since the physicians received test results as soon as they were completed.

Has your company developed information systems that were intended to make a significant contribution to your organization's competitive position?

____ Yes ____ No

If Yes, please answer the questions in this survey with regard to the single information system which was intended to make the most significant contribution to your firm's competitive position.

If No, please describe the single information system which you feel currently makes the most significant contribution to your firm's competitive position.

THANK YOU FOR YOUR HELP

BACKGROUND INFORMATION REGARDING THE INFORMATION SYSTEM

The idea for the system came from (check the most important source):

_____ sources internal to the organization (specify which):
- _____ top management of the company
- _____ information systems department
- _____ other _____________

_____ sources external to the organization (specify which):
- _____ customers
- _____ suppliers
- _____ observation of competitors
- _____ other _____________

To what extent was the idea for the system generated as part of a formal process of identifying strategic applications?

1	1	1	1	1
no extent	some extent	moderate extent	great extent	very great extent

The impetus for the system was (check the most important reason):

_____ a preemptive strike (to preempt competitors and to be the first to develop an information system)

_____ a defensive move aimed at countering a threat

_____ other _____________

Users of the system refers to those who actually use the system and for whom the system was intended. Please indicate who are the primary users of the system.

_____ Customers _____ Suppliers

_____ Personnel internal to your company

_____ Other _____________

How long has your company been using the system? _____ months

How long did it take from the time your company implemented the system to the time competitors responded to the system?

_____ months _____ No competitor response yet

_____ Other _____________

Which of the following generic technologies are most important for obtaining benefits from the system (indicate the top three by checking 1 next to the most important, 2 next to the second most important, and 3 next to the third most important technology):

_____ Information input technologies
_____ Computer hardware
_____ Systems control software and utility software
_____ Expert systems
_____ Applications software other than expert systems
_____ Storage technologies related to hardware
_____ Database management systems
_____ Local area networks
_____ Long distance networks
_____ Output technologies
_____ Other _____________

What has been the impact of the system on your company's sales growth rate?

1	1	1	1	1	1	1
greatly decreased	moderately decreased	somewhat decreased	no impact	somewhat increased	moderately increased	greatly increased

What has been the impact of the system on your company's profits?

1	1	1	1	1	1	1
greatly decreased	moderately decreased	somewhat decreased	no impact	somewhat increased	moderately increased	greatly increased

Overall, the competitive advantage provided by the system is (if the system was a defensive move aimed at countering a threat, the overall success of the system has been):

1	1	1	1	1	1	1
very low	moderately low	somewhat low	neither low/high	somewhat high	moderately high	very high

Briefly describe the information system including its importance to your company.

____

____

____

____

____

1. FEATURES OF THE INFORMATION SYSTEM

The following statements describe potential features of an information system. For the system under consideration, please indicate the extent to which you disagree or agree with the following statements by circling the appropriate response.

1 strongly disagree (SD)
2 moderately disagree
3 somewhat disagree
4 neutral (N)
5 somewhat agree
6 moderately agree
7 strongly agree (SA)

	SD			N			SA
The system is aligned with your organization's business strategy.	1	2	3	4	5	6	7
The system is aligned with your company's marketing policies and practices.	1	2	3	4	5	6	7
Your firm has technical expertise in the area of the system.	1	2	3	4	5	6	7
Top management is involved in, and supports the system.	1	2	3	4	5	6	7
The system exploits unique resources (unavailable to competitors) possessed by your firm.	1	2	3	4	5	6	7
Your firm has unique know-how regarding the system.	1	2	3	4	5	6	7
The system provides unique access to channels such as brokers, distributors, or retailers.	1	2	3	4	5	6	7
The system provides unique access to resources.	1	2	3	4	5	6	7
The system's market positioning is such that competitors are forced to adopt less favorable postures.	1	2	3	4	5	6	7
The system is protected from imitation by institutional barriers such as patents, copyrights, and trade secrets.	1	2	3	4	5	6	7
The system has influenced the development of technical standards and practices in the industry.	1	2	3	4	5	6	7
Your firm has the capability to continuously innovate and enhance the system.	1	2	3	4	5	6	7
The system was an improvement over existing ideas and practices in the industry.	1	2	3	4	5	6	7
The system can be easily replaced by information systems developed by competitors or by other technology.	1	2	3	4	5	6	7
The development of the system requires personnel with specialized skills.	1	2	3	4	5	6	7
The system was developed in response to a specific problem.	1	2	3	4	5	6	7
It was difficult for competitors to detect that the system was in use.	1	2	3	4	5	6	7
The system was perceived by competitors as having a high potential, i.e. competitors believed that the application would significantly change the strategic position of its developer.	1	2	3	4	5	6	7
Competitors perceived the system as attacking a strategic thrust of a major competitor.	1	2	3	4	5	6	7
The benefits from the system are readily observable by competitors.	1	2	3	4	5	6	7
The system uses state-of-the-art technology.	1	2	3	4	5	6	7
The system offers high quality of service, i.e. small response time and high reliability.	1	2	3	4	5	6	7
The system is highly flexible, i.e. it can handle growth and changes.	1	2	3	4	5	6	7
The system provides a broad range of services to users.	1	2	3	4	5	6	7
Users' cost of acquiring the system is low.	1	2	3	4	5	6	7
The system is easy to use.	1	2	3	4	5	6	7
Users can experiment with the system on a limited basis, i.e. they can adopt the system on a trial basis.	1	2	3	4	5	6	7
The system requires high investment on the part of users in complementary assets (resources which are used in conjunction with the system).	1	2	3	4	5	6	7
The complementary assets which are required to be used in conjunction with the system can be readily used for other purposes by users if they were to divest the system.	1	2	3	4	5	6	7
Your company provided training to users.	1	2	3	4	5	6	7
Your company made significant efforts to market and publicize the system to users.	1	2	3	4	5	6	7
The size of the systems is large relative to other systems in the industry.	1	2	3	4	5	6	7

The system's development time was long relative to other systems in the industry.	1	2	3	4	5	6	7
The system's development cost was high relative to other systems in the industry.	1	2	3	4	5	6	7
Your company can use the system as a substitute for labor.	1	2	3	4	5	6	7
The technological risk (that the system would not work as planned) of the system was high.	1	2	3	4	5	6	7
The financial risk (that the system may involve unpredictable and substantial costs) of the system was high.	1	2	3	4	5	6	7
The organizational risk (that is may not be possible to handle the system with existing management and technical teams) of the system was high.	1	2	3	4	5	6	7
The business risk (that users may not accept the system and that it may not be profitable) of the system was high.	1	2	3	4	5	6	7

2. IMPACT OF THE INFORMATION SYSTEM ON THE COMPANY

Organizations perform numerous activities such as buying inputs, choosing suppliers, converting inputs into outputs, selling, and advertising. Please describe the impact of the system on your company by specifying the extent to which the system was increased or decreased the following:

1 greatly increased (GI)
2 moderately increased
3 somewhat increased
4 no change (N)
5 somewhat decreased
6 moderately decreased
7 greatly decreased (GD)

	GI			N			GD
Cost of activities associated with purchasing the inputs (raw materials) required by your company.	1	2	3	4	5	6	7
Cost of receiving, storing, and disseminating inputs to the product, e.g. material handling, warehousing.	1	2	3	4	5	6	7
Cost of transforming inputs into the final product, e.g. machining, assembly.	1	2	3	4	5	6	7
Cost of marketing the company's final product, e.g. advertising, promotion.	1	2	3	4	5	6	7
Cost of collecting, storing, and distributing the final product to customers e.g. order processing, scheduling.	1	2	3	4	5	6	7
Cost of providing service to maintain or enhance the value of the product, e.g. installation, training, repair.	1	2	3	4	5	6	7
Cost of improving the company's products and processes, e.g. R&D.	1	2	3	4	5	6	7
Cost of recruiting, hiring, training, development, and compensation of personnel.	1	2	3	4	5	6	7
Cost of general management activities, e.g. planning, finance, accounting, legal, and government affairs.	1	2	3	4	5	6	7
Cost of coordinating different activities described above, such as purchasing, processing, marketing, sales, etc.	1	2	3	4	5	6	7
Cost of interacting and coordinating activities with suppliers.	1	2	3	4	5	6	7
Cost of interacting and coordinating activities with customers.	1	2	3	4	5	6	7
Costs your company would incur if it changed to alternate suppliers.	1	2	3	4	5	6	7
Your company's cost of locating alternate suppliers.	1	2	3	4	5	6	7
Your company's ability to evaluate various suppliers and choose the most appropriate supplier.	1	2	3	4	5	6	7
Your company's ability to threaten vertical integration, i.e. threaten to perform some of the functions performed currently by its suppliers or customers.	1	2	3	4	5	6	7
Your company's ability to evaluate various customers and choose the most appropriate customer.	1	2	3	4	5	6	7
Costs which customers would incur if they change to alternate suppliers.	1	2	3	4	5	6	7
Customers' cost of locating alternate suppliers.	1	2	3	4	5	6	7
The level of financial investment which companies in your industry need to compete.	1	2	3	4	5	6	7
The growth rate of your industry.	1	2	3	4	5	6	7
Your company's ability to achieve new economies of scale.	1	2	3	4	5	6	7

3. IMPACT OF THE INFORMATION SYSTEM ON USERS

Information systems help users to perform their tasks. These tasks include determining what resources users need, and where and how to obtain resources. For instance, customer order entry systems help their primary users, external customers, to locate suppliers and to place orders. On the other hand, the primary users of quality monitoring systems are personnel internal to the company who use the system to verify that products meet specifications. Please describe how the system under consideration has decreased or increased the ability of its primary users to perform the following tasks:

1 greatly decreased (GD)
2 moderately decreased
3 somewhat decreased
4 no change (N)
5 somewhat increased
6 moderately increased
7 greatly increased (GI)

	GD			N			GI
Determine how much resources they need, i.e. establish their requirements.	1	2	3	4	5	6	7
Determine the attributes of the desired resources, i.e. specify the nature of desired resources.	1	2	3	4	5	6	7
Locate an appropriate source for buying or obtaining the resource.	1	2	3	4	5	6	7
Order or put in a request for the resource.	1	2	3	4	5	6	7
Pay for the resource or obtain authority for obtaining the resource.	1	2	3	4	5	6	7
Acquire the resource, i.e. be in physical possession of the resource.	1	2	3	4	5	6	7
Verify that the resource meets specifications, i.e. test the resource for a match with needs.	1	2	3	4	5	6	7
Add the resource to existing inventory, i.e. integrate the new resource with other resources.	1	2	3	4	5	6	7
Monitor the use of the resource, i.e. keep track of the utilization of the resource.	1	2	3	4	5	6	7
Upgrade the resource if necessary, i.e. add to the resource.	1	2	3	4	5	6	7
Repair the resource and keep it in good working condition.	1	2	3	4	5	6	7
Transfer or dispose of the resource.	1	2	3	4	5	6	7
Evaluate the overall effectiveness or usefulness of the resource.	1	2	3	4	5	6	7

BACKGROUND INFORMATION REGARDING THE RESPONDENT

How many years have you worked in the company? ______ years

What is your job title? ________________________

What is the approximate annual gross revenue of your company?

____

Approximately how many employees work in your company?

____

Indicate your company's sophistication in long-range business planning.
______ There is no formal long-range business planning.
______ Long-range planning is more tactical than strategic.
______ Long-range planning is clearly strategic in nature.

Indicate your company's sophistication in managing information resources.
______ not at all ______ moderate ______ very great
______ somewhat ______ great

To what extent does the data processing department participate in the company's long-range business planning?
______ no extent ______ moderate extent ______ very great extent
______ some extent ______ great extent

To whom does the top data processing executive report?
______ An administrative vice president
______ A controller or financial vice president
______ A president or general manager
______ Other ________________________

Check the primary business activity of the company.
___ agriculture
___ banking
___ communication
___ construction
___ education
___ finance
___ government
___ health, medical
___ insurance
___ investment
___ legal
___ manufacturing
___ mining
___ real estate
___ retail
___ transportation
___ utilities
___ wholesale
___ other ______

Please provide your name and address or attach your business card if you would like a copy of the survey results.

____

____

____

May we call in case we need to discuss your responses to any of these questions?
__ Yes   __ No   Phone Number (_____) __________

Please return this survey in the enclosed postpaid envelope or mail to:

William R. King, University Professor of Business Administration
Joseph M. Katz Graduate School of Business
University of Pittsburgh, Pittsburgh, PA 15260

If you have any questions, please call us at (412)-648-1588

References

Ahituv, N., M. C. Munro, and Y. Wand, "The Value of Information in Information Analysis," *Information and Management*, 4 (1981), 143–150.

Anderson, J. C., "An Approach for Confirmatory Measurement and Structural Equation Modeling of Organizational Properties," *Management Sci.*, 33(4) (1987), 525–541.

—— and D. W. Gerbing, "Some Methods for Respecifying Measurement Models to Obtain Unidimensional Construct Measurement," *J. Marketing Research*, 19 (1982), 453–460.

——, ——, and J. E. Hunter, "On the Assessment of Unidimensional Measurement: Internal and External Consistency, and Overall Consistency Criteria," *J. Marketing Research*, 24 (1987), 432–437.

Angleitner, A., O. P. John, and F. J. Lahr, "It's What You Ask and How You Ask It: An Intemmetric Analysis of Personality Questionnaires," in A. Angleitner and J. S. Wiggins (Eds.), *Personality Assessment via Questionnaires*, Springer-Verlag, Berlin, Germany, 1986, 61–108.

Bagozzi, R. P., *Causal Models in Marketing*, John Wiley & Sons, New York, NY, 1980.

——, "An Examination of the Validity of Two Models of Attitude," *Multivariate Behavioral Research*, 16 (1981), 323–359.

Bagozzi, R. P., "The Role of Measurement in Theory Construction and Hypothesis Testing: Towards a Holistic Model," in C. Fornell (Ed.), *A Second Generation of Multivariate Analysis*, Volume 2, Praeger 1982, 5–23.

Bagozzi, R. P. and C. Fornell, "Theoretical Concepts, Measurements, and Meaning," in C. Fornell (Ed.), *A Second Generation of Multivariate Analysis*, 2, Praeger, 1982, 24–38.

Bailey, J. E. and S. W. Pearson, "Development of a Tool for Measuring and Analyzing Computer User Satisfaction," *Management Sci.*, 29(5) (1983).

Bakos, Y. J., "Dependent Variables for the Study of Firm and Industry-Level Impacts of Information Technology," *Proceedings of the Eighth International Conference on Information Systems*, December 1987, Pittsburgh, PA, 10–23.

—— and M. E. Treacy, "Information Technology and Corporate Strategy: A Research Perspective," *MIS Quarterly*, June 1986, 107–119.

Ball, L. and R. Harris, "SMIS Member: A Membership Analysis," *MIS Quarterly*, 6(1) (1982), 19–38.

Banker, R. D. and R. J. Kauffman, "Strategic Contributions of Information Technology: An Empirical Study of ATM Networks," *Proceedings of the Ninth International Conference on Information Systems*, Minneapolis, MN, 1988.

Benjamin, R., J. F. Rockart, M. S. Scott Morton, and J. Wyman, "Information Technology: A Strategic Opportunity," *Sloan Management Review*, Spring 1984, 3–9.

Berger, P., J. G. Kobelius, and D. E. Sutherland (Eds.), *Measuring Business Value of Information Technologies*, ICIT Press, Washington, DC, 1988.

Bollen, K. A., *Structural Equations with Latent Variables*, Wiley, New York, 1989.

Brancheau, J. C. and J. C. Wetherbe, "Key Issues in Information Systems Management," *MIS Quarterly*, March 1987, 23–45.

Brooke, P. P., D. W. Russell, and J. L. Price, "Discriminant Validation of Measures of Job Satisfaction, Job Involvement, and Organizational Commitment," *J. Applied Psychology*, 73(2) (1988), 139–145.

Bryan, E. F., "Information Systems Investment Strategies," *J. Information Systems Management*, Fall 1990, 27–35.

Burnkrant, R. E. and T. J. Page, Jr., "The Examination of the Convergent, Discriminant, and Predictive Validity of Fishbein's Behavioral Intention Model," *J. Marketing Research*, 19 (1982), 550–561.

Business Week, "The Information Business," August 25, 1986, 82–90.

——, "A Shoving Match in the Travel Agency," June 22, 1987.

Cameron, K. S., "Effectiveness as Paradox: Consensus and Conflict in Conceptions of Organizational Effectiveness," *Management Sci.*, 32(5) (1986), 539–553.

Carmines, E. G. and J. P. McIver, "Analyzing Models with Unobserved Variables: Analysis of Covariance Structures," in G. W. Bornstedt and E. F. Borgatta (Eds.), *Social Measurement: Current Issues*, Sage Publications, Beverly Hills, CA, 65–116, 1981.

Cash, J. I., Jr. and B. R. Konsynski, "IS Redraws Competitive Boundaries," *Harvard Business Review*, March–April, 1985, 134–142.

Chervany, N. L. and G. W. Dickson, "An Experimental Evaluation of Information Overload in a Production Environment," *Management Sci.*, 20(10) (1974), 1335–1343.

Churchill, G. A., Jr., "A Paradigm for Developing Better Measures of Marketing Constructs," *J. Marketing Research*, 16 (1979), 64–73.

Clemons, E. K., "Information Systems and Business Strategy: Mini-Track on Current Research," *Proceedings of the 1989 Hawaii International Conference on System Sciences*, 1989, 181–183.

——, "Information Systems for Sustainable Competitive Advantage," *Information and Management*, 11(3) (1986), 131–136.

—— and S. O. Kimbrough, "Information Systems, Telecommunications and Their Effects on Industrial Organizations," *Seventh Annual International Conference on Information Systems*, December 1986, San Diego, CA, 99–108.

—— and M. Knez, "Competition and Cooperation in Information Systems Innovation," *Information and Management*, 15 (1988), 25–35.

—— and M. Row, "Structural Differences Among Firms: A Potential Source of Competitive Advantage in the Application of Information Technology," *Eighth Annual International Conference on Information Systems*, December 1987, Pittsburgh, PA, 1–9.

Computerworld, "The Premier 100: The Most Effective Users of Information Systems," September 11, 1989.

Cron, W. L. and M. G. Sobol, "The Relationship Between Computerization and Performance: A Strategy for Maximizing the Economic Benefits of Computerization," *Information and Management*, 1983, 171–181.

Crowston, K. and M. E. Treacy, "Assessing the Impact of Information Technology on Enterprise Level Performance," *Seventh Annual International Conference on Information Systems*, December 1986, San Diego, CA, 299–310.

Culnan, M. J., "Designing Information Systems to Support Customer Feedback: An Organizational Message System Perspective," *Proceedings of the Tenth International Conference on Information Systems*, December 1989, Boston, MA, pp. 305–314.

Dickson, G. W., R. L. Leitheiser, J. C. Wetherbe, and M. Nechis, "Key Information Systems Issues for the 1980's," *MIS Quarterly*, 8(3) (1984), 135–159.

Feeney, D. F. and B. Ives, "In Search of Sustainability: Reaping Long-Term Advantage from Investments in Information Technology," *J. Management Information Systems*, 7(1) (1990), 27–46.

Forbes, "Linking Business Communications to Business Strategy," September 23, 1985.

Geise, P. E., "Using Information Technology to Capture Strategic Position," *Management Review*, September 1984, 8.

Ghemawat, P., "Sustainable Advantage," *Harvard Business Review*, 64(5) (1986), 53–58.

Gongla, P., G. Sakamoto, A. Back-Hock, P. Goldweic, L. Ramos, R. C. Sprowls, and C. K. Kim, "S*P*A*R*K: A Knowledge-based System for Identifying Competitive Uses of Information Technology," *IBM Systems Journal*, 28(4) (1989), 628–645.

Hamilton, S. and N. L. Chervany, "Evaluating Information System Effectiveness—Part I: Comparing Evaluation Approaches," *MIS Quarterly*, September 1981, 55–69.

Huber, G. P. and D. J. Power, "Retrospective Reports of Strategic-Level Managers: Guidelines for Increasing their Accuracy," *Strategic Management Journal*, 6(2) (1985), 171–180.

Ian, M., "Computing Matters: Making it Work to Best Effect," *Management Today*, January 1989, 109–110.

IBM Corporation, *Business Systems Planning: Information Systems Planning Guide*, White Plains, NY, IBM Document GE20-0527-3, July, 1981.

Idaszak, J. R., W. P. Bottom, and F. Drasgow, "A Test of the Measurement Equivalence of the Revised Job Diagnostic Survey: Past Problems and Current Solutions," *J. Applied Psychology*, 73(4) (1988), 647–656.

Information Week, "The Strategic Use of Information: Seizing the Competitive Edge," May 26, 1986, 26–62.

——, "Quicksand: What Kills Strategic Systems," May 11, 1987, 24–28.

Ives, B. and G. P. Learmonth, "The Information Systems as a Competitive Weapon," *Communications of the ACM*, 27(12) (1984), 1193–1201.

——, M. H. Olson, and J. J. Baroudi, "The Measurement of User Information Satisfaction," *Communications of the ACM*, 26(10) (1983).

—— and M. R. Vitale, "After the Sale: Leveraging Maintenance with Information Technology," *MIS Quarterly*, 12(1) (1988), 7–22.

Johnson, R. A. and D. W. Wichern, *Applied Multivariate Statistical Analysis*, Prentice-Hall, Inc., 1988.

Johnston, R. H. and M. R. Vitale, "Creating Competitive Advantage with Interorganizational Systems," *MIS Quarterly*, June 1988, 152–165.

Joreskog, K. G. and D. Sorbom, *Analysis of Linear Structural Relationships by Method of Maximum Likelihood*, National Educational Resources, Chicago, IL, 1978.

—— and ——, *LISREL 7: A Guide to the Program and Applications*, Second Edition, SPSS, Inc., Chicago, IL, 1989.

—— and ——, *PRELIS: A Program for Multivariate Data Screening and Data Summarization. A Preprocessor for LISREL.*, Scientific Software, Inc., Mooresville, IN, 1986.

Kauffman, R. J. and P. Weill, "An Evaluative Framework for Research on the Performance Effects of Information Technology Investments," *Proceedings of the Tenth International Conference on Information Systems*, Boston, MA, December 4–6, 1989, 377–388.

Keen, P. G. W., *Competing in Time: Using Telecommunications for Competitive Advantage*, Ballinger, 1986.

Kerlinger, F. N., *Foundations of Behavioral Research*, Holt, Reinhart and Winston, Inc., 1964.

Kim, J. and C. W. Mueller, *Introduction to Factor Analysis*, Sage Publications, Beverly Hills, CA, 1978.

King, R. C., *Innovative Use of Information Technology and Organizational Context*, Ph.D. dissertation, University of Texas, Austin, TX, 1987.

King, W. R., "On Measurement, Valuewise Independence, and Linear Models," *OMEGA: The International Journal of Management Sci.*, 11(3) (1983), 227.

—— and B. J. Epstein, "Assessing Information System Value: An Experimental Study," *Decision Sci.*, 14 (1983), 34–45.

——, V. Grover, and E. Hufnagel, "Seeking Competitive Advantage Using Information-intensive Strategies: Facilitators and Inhibitors," *The 1986 NYU Symposium on Strategic Uses of Information Technology*, May 21–23, New York, 1986.

Lawley, D. N. and A. E. Maxwell, *Factor Analysis as a Statistical Method*, Butterworth, London, 1971.

Lind, M. R. and R. W. Zmud, "The Influence of a Convergence in Understanding Between Technology Providers and Users on Information Technology Innovativeness," *Organization Sci.*, 2(2) (1991), 195–217.

Loevinger, J., "Objectives Tests as Instruments of Psychological Theory," in D. N. Jackson and S. Messick (Eds.), *Problems in Human Assessment*, MacGraw-Hill, New York, 1967, 78–123.

MacMillan, I. C., "Preemptive Strategies," *J. Business Strategy*, Fall 1983, 16–26.

Marsh, H. W. and D. Hocevar, "Application of Confirmatory Factor Analysis to the Study of Self-Concept: First and Higher Order Factor Models and their Invariance Across Groups," *Psychological Bulletin*, 97 (1985), 562–582.

McFarlan, F., "Information Technology Changes the Way You Compete," *Harvard Business Review*, 62(3) (1984), 98–103.

Meyer, J. P. and I. R. Gellatly, "Perceived Performance Norm as a Mediator in the Effect of Assigned Goal on Personal Goal and Task Performance," *J. Applied Psychology*, 73(3) (1988), 410–420.

Mulaik, S. A., L. R. James, J. V. Alstine, N. Bennett, S. Lind, and C. D. Stilwel, "Evaluation of Goodness-of-Fit Indices for Structural Equation Models," *Psychological Bulletin*, 105(3) (1989), 430–445.

Parsons, G. L., "Information Technology: A New Competitive Weapon," *Sloan Management Review*, Fall 1983, 3–14.

Pedersen, M. K., "Strategic Information Systems in Manufacturing Industries," *Proceedings of the Eleventh International Conference on Information Systems*, Copenhagen, Denmark, December 16–19 1990, 193–204.

Peter, P. J., "Construct Validity: A Review of Basic Issues and Marketing Practices," *J. Marketing Research*, 18 (1981), 133–145.

Phillips, L. W., "Assessing Measurement Error in Key Informant Reports: A Methodological Note on Organizational Analysis in Marketing," *J. Marketing Research*, 18(4) (1981), 395–415.

Porter, M., *Competitive Strategy*, Free Press, New York, NY, 1980.

——, *Competitive Advantage*, Free Press, 1985.

—— and V. E. Millar, "How Information Gives You Competitive Advantage," *Harvard Business Review*, July–August 1985, 149–160.

Rackoff, N., C. Wiseman, and W. A. Ullrich, "Information Systems for Competitive Advantage: Implementation of a Planning Process," *MIS Quarterly*, December 1985.

Rifkin, G., "CEOs Give Credit for Today but Expect More for Tomorrow," *Computerworld*, 239160 (April 17, 1989), 75–82.

Rock, D. A., R. E. Bennett, and T. Jirele, "Factor Structure of the Graduate Record Examinations General Test in Handicapped and Nonhandicapped Groups," *J. Applied Psychology*, 73(3) (1988), 383–392.

Rockart, J. F. and A. D. Crescenzi, "Engaging Top Management in Information Technology," *Sloan Management Review*, November 1984, 3–16.

Runge, D., *Winning with Telecommunications*, ICIT Press, Washington, DC, 1988.

Schwab, D. P., "Construct Measurement in Organizational Behavior," in B. M. Staw and L. L. Cummings (Eds.), *Research in Organizational Behavior*, 11, JAI Press, Greenwich, CT, 1980.

Sethi, V. and W. R. King, "Construct Measurement in Information Systems Research," *Decision Sciences*, 22(3), Jul–Aug 1991, 455–472.

Souder, W. E., *Managing New Product Innovations*, D. C. Heath and Company, 1987.

Srinivasan, A., "Alternative Measures of System Effectiveness: Associations and Implications," *MIS Quarterly*, 9(3) (1985), 243–253.

Strassman, P. A., "Management Productivity as an IT Measure," in P. Berger, J. G. Kobelius, and D. E. Sutherland (Eds.), *Measuring Business Value of Information Technologies*, ICIT Press, Washington, DC, 1988.

Sullivan-Trainor, M., "Building Competitive Advantage by Extending Information Systems," *Computerworld*, 23(41) (1989), SR/19.

Synnott, W. R., *The Information Weapon*, John Wiley and Sons, 1987.

Tavakolian, H., "Linking the Information Technology Structure with Organizational Competitive Advantage: A Survey," *MIS Quarterly*, 13(3) (1989).

Teece, D. J., "Profiting From Technological Innovations: Implications for Integration, Collaboration, Licensing, and Public Policy," *Research Policy*, 1986, 285–305.

Tetrick, L. E. and J. M. LaRocco, "Understanding, Prediction, and Control as Moderators of the Relationships between Perceived Stress, Satisfaction, and Psychological Well-Being," *J. Applied Psychology*, 72(4) (1987), 538–543.

Venkatraman, N., "Strategic Orientation of Business Enterprise: The Construct, Dimensionality, and Measurement," *Management Sci.*, 35(8) (1989).

—— and J. H. Grant, "Construct Measurement in Organizational Strategy Research: A Critique and a Proposal," *Academy of Management Review*, 11(1) (1986), 71–87.

—— and V. Ramanujam, "Planning System Success: A Conceptualization and an Operational Model," *Management Sci.*, 33(6) (1987), 687–705.

Vitale, M. R., "The Growing Risks of Information Systems Success," *MIS Quarterly*, December 1986, 326–334.

——, B. Ives, and C. Beath, "Identifying Strategic Information Systems: Finding a Process or Building an Organization," *Proceedings of the Seventh International Conference on Information Systems*, San Diego, California, December 1986.

Weill, P. and M. H. Olson, "Managing Investment in Information Technology: Mini Case Examples and Implications," *MIS Quarterly*, 13(1) (1989), 3–18.

Werts, C. E., R. L. Linn, and K. G. Joreskog, "Interclass Reliability Estimates: Testing Structural Assumptions," *Educational and Psychological Measurement*, 34 (1974), 25–33.

Wiseman, C., *Strategic Information Systems*, Dow Jones Irwin, Homewood, IL, 1988.

—— and I. MacMillan, "Creating Competitive Weapons from Information Systems," *J. Business Strategy*, 5(2) (1984), 42–49.

Zmud, R. W., A. C. Boynton, and G. C. Jacobs, "An Examination of Managerial Strategies for Increasing Information Technology Penetration in Organizations," *Proceedings of the Eighth International Conference on Information Systems*, Pittsburgh, PA, December 1987.

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References

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