TOWARD A CUMULATIVE TRADITION OF RESEARCH ON INFORMATION TECHNOLOGY AS A STRATEGIC BUSINESS FACTOR

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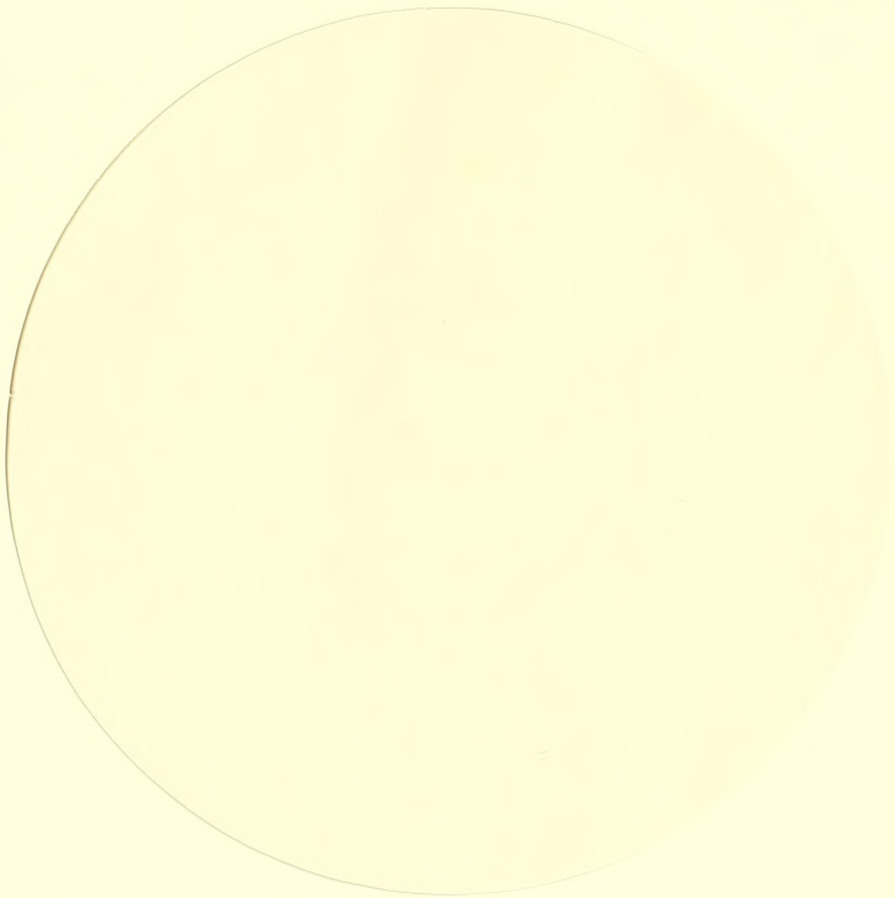

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Toward a Cumulative Tradition of Research on Information Technology as a Strategic Business Factor

by
Michael E. Treacy

1. Introduction

Research on the potential of information technology to improve the competitive position of the firm has grown in volume and quality in a few short years. It has attracted venturesome intellectual capital from all corners of our research community and new research articles appear with regularity in major MIS journals. But, the foundation for a research endeavor that produces theoretical as well as practical achievements, is only beginning to emerge. In this paper, we critically review the methodological basis of the existing literature on information technology (IT) and competitive advantage and identify steps for building more quickly toward what Keen has termed a cumulative tradition of research.[Keen, 1980]

Since 1982, more than seventy articles have been published in this area of information technology as a strategic business factor (ITSBF). The research is of three types. Most numerous are descriptions of particular companies and their strategic use of information systems. The examples at American Hospital Supply Corporation[Fortune, 1982] and Merrill Lynch[Fortune, 1980] appear to have had an important influence on thinking in this area. A second category includes those articles that prescribe how the information systems function should be managed in this new strategic era of information systems. Gerstein and Reisman[1982],

Keen[1981a, 1981b], McFarlan[1984], and McFarlan, McKenny, and Pyburn[1982] all have published articles of this type.

The third category is made up of articles that develop techniques for identifying strategic systems opportunities. As is characteristic of a new field of study, many of these articles propose frameworks. They try to establish a clear vision of alternatives by employing a categorization scheme built using important dimensions of the problem. Different ones have been proposed by Bakos and Treacy[1985], Barrett and Konsynski[1982], Benjamin, et al[1983], Cash[1984], Cash, McLaughlin, and Howe[1983], Beath and Ives[1986], Ives and Learmonth[1984], Keen[1981a, 1981b], Notowidigdo[1984], Parsons[1983], and Rockart and Scott Morton[1984].

This is the point at which research into strategic uses of IT now finds itself. Through descriptive work we have developed a fair degree of understanding of what the range of systems possibilities and impacts are. It is now time for academic research to contribute explanations of how these systems impact competition and corporate performance. If we are to correctly influence managerial practice, we need to understand such things as the mechanisms by which an inter-organizational system shifts the balance of bargaining power between firms and how internal support systems contribute to business unit performance.

In this paper we discuss five ways to strengthen the theoretical and practical contributions of present research on information technology as a strategic business factor. These recommendations are:

(1) to broaden our view of research topics that are important within this area;

(2) to use more reference theories from corporate strategy and industrial economics to strengthen our work;

(3) to emphasize models that can explain cause and effect relationships rather than frameworks that categorize and stereotype;

(4) to clearly define theoretical concepts and operationalize them in reliable and valid ways;

(5) to test some of the descriptive and prescriptive ideas we have formed in this area through rigorous empirical tests.

In our discussions, published research papers will be used to illustrate some of these recommendations which can hasten our move toward a cumulative tradition of research in this area.

2. Research Topics

The research agenda on ITSBF has narrowly focused on two topics of wide interest to practitioners: (1) identifying and categorizing opportunities to employ IT for strategic advantage and (2) adapting the I/S organization to play a more important role in corporate strategy formulation. By focusing narrowly on these issues, several topics of great potential importance to practitioners may not be given the attention they warrant or may even be missed altogether. For example:

* Interorganizational systems often result in a shift in bargaining power between firm and customers or firm and suppliers. Are customers and suppliers always the losers in these circumstances? What features of the

system and the circumstance determines who wins and who loses in the shifting power balance?

* The flip side to strategic opportunity is strategic response. Countermeasures can and will be taken against strategic systems thrusts. How should a firm try to compete against a competitor with an entrenched strategic interorganizational system?

* If for every strategic system there will be a competitive response, then for the innovator much rests on timing. What can be learned about the effects of development time, implementation time, and gestation time, on the success and value of strategic systems opportunities?

* What can we learn about the organizational adjustments to strategic systems that occur within the innovating firm? Cash and McLeod[1984] have begun to look into this issue. How does the rate and quality of adaptation affect the success of a strategic system?

* What are the major factors that cause success of strategic systems? Is the quality of information systems development a key element of firms that have succeeded with strategic information systems? Can success be engineered or is it largely unexplainable luck?

* Parsons[1983] and Cash and Konsynski[1985] have drawn our attention to industry-level impacts of these systems. Systems that can improve a firm's competitive position within an industry may have a damaging effect on the industry's position relative to other industries. How can industry-level effects be predicted?

The airline industry provides an interesting illustration of several of these research topics. The industry can be analyzed to identify new opportunities for firms to employ information technology to support corporate strategy, but in this industry many strategic systems are already in place. The impact of American and United Airlines' electronic reservation systems on competitors has been well documented.[Vitale, 1984] Less studied is the effect of these systems on the customer relationship. Reservation systems have dramatically lowered the search cost that a customer must incur to find the most suitable flight. With abundant information about alternatives, customers are more able to find flights that optimize schedules and cost. The obvious response of the industry has been to overschedule and underprice. The industry level effects on profitability can be staggering. American Airlines is a stronger competitor today because of its investment in an electronic airline reservation system, but is it a stronger company? Have reservation systems contributed to the shift in bargaining power between airlines and their customers? What has been the real cost to the industry of strategic information systems?

It is the problems of practicing managers that give this research area life and urgency, but practical needs cannot establish the entire research agenda. There are also methodology-driven needs. These include the creation of research tools, such as measurement instruments, that are specific to this area and the pursuit of topics that are important, but without direct, tangible payback to practice. In this craft of research, the tools of the trade need constant adaptation to the job at hand. For example, we will discuss the need for adapting theories from other areas, the need for measures of information technology and its impact, and for using those measures in empirical testing. We need to begin to establish the methodological agenda for research on ITSBF.

3. Reference Disciplines

Is this field any different if we call it "information technology as a strategic business factor" or "corporate strategic uses of information technology"? Hopefully not. Both titles convey that the field sits squarely at the intersection of two major disciplines. Yet, the topic has been approached almost exclusively from the information systems perspective and only passing respects have been paid to theories of corporate strategy. It is not surprising that the topic has been approached primarily by information systems researchers. Strategic information systems may require major revisions of many old ideas that are central to the MIS field, but they affect only marginally theories of corporate strategy.

What is surprising is that much of this work, which refers dramatically to "strategic tools" and "competitive weapons", makes little or no use of bodies of theory related to either strategy or competition. For example, Ives and Learmonth[1984] base their analysis of opportunities for strategic use of systems on a thirteen stage "resource life cycle" model without any reference to other literature on strategy or competition. Benjamin, et al[1983] and Keen[1981a] each propose four categories of competitive systems, but again, without any references to related disciplines. Similar limitations exist with Rockart and Scott Morton[1984], Barrett and Konsynski[1982], and Notowidigdo[1984].

Two related fields of study, corporate strategy and industrial economics, have much to tell us about strategy and competition. They are the obvious places to look for foundational theory for studying strategic or competitive information systems and they provide a set of methodologies and standards of research which could serve us well in our own studies. As Keen[1980] has observed, good research in MIS

usually requires a strong reference discipline to provide three things: theories, methodologies, and standards of quality.

Theory provides a lens with which to view the MIS problem under investigation. It highlights relevant variables, gives an initial understanding of relationships between those variables, and places the MIS research in a broader context of knowledge so that nomological validity can be assessed [Bagozzi, 1979, 1980] and a cumulative tradition supported.[Keen, 1980] Good MIS research can also contribute to the reference discipline by modifying the foundational theory in one of three ways. In some cases, the research results in specialization of the theory to the particular information systems context under consideration. In other cases, the general theory is extended to include new facets not previously enveloped. In the most extreme case, MIS research results in reconsideration of the theory. Thus, foundational theory from a reference discipline can be more than just a starting point. MIS research can also contribute to the reference discipline.

The valuable role of reference discipline theory is well illustrated by the recent research that has emanated from the Harvard Business School. In a series of articles, Parsons[1983], Cash[1984], and others have developed typologies and methodologies for identifying opportunities to support and extend the strategy of the firm through information technology. Their ideas are built upon Porter's influential work in corporate strategy.[1980, 1985] By beginning with theory drawn from an appropriate reference discipline, they have avoided developing an idiosyncratic, private theory of the strategic use of information systems. Their assertions and conclusions are plausibly argued from an accepted point of origin and are seen as part of the larger fabric of corporate strategy. The overall result is a contribution to both fields of information systems and corporate strategy.

Although Porter's work on industry structure is immensely popular with practitioners, it is only one tributary off the mainstream of research on corporate strategy. Other tributaries address issues such as corporate diversification, economies of scale and scope, efficiency of markets, and industry boundaries. Among researchers on corporate strategy, much of Porter's work remains controversial because of its qualitative nature and many untested assertions. Thus, it may provide only a narrow theoretical foundation for studying the strategic uses of information technology. One needs to complement Porter's work with other strategic planning literature drawn from either an organizational or economic perspective.

4. Theories of Strategy and Competition

Information technology can create competitive advantage. An explanation of this rather bald statement is the primary goal of research on ITSBF. What is "competitive advantage" and what is "information technology"? These questions are an essential point of departure for a program of research in this area. What we need to do is decompose the concept of competitive advantage into sufficient detail and define information technology at a sufficiently abstract level, so that the two concepts can meet and be joined. The bodies of literature within the reference discipline that we draw upon should provide the decomposition of the concept of competitive advantage and suggest how IT should be appropriately characterized.

If we had an operational rather than a strategic view of corporate performance, then our focus would be on profits, composed of revenues and costs. In a rough sense, strategic performance is concerned with long-term profits and competitive advantage is an important means for achieving superior, long-term profit performance, either through superior revenues or superior cost performance. The useful aspect of partitioning strategic performance into these two components, long-

term revenue performance and long-term cost performance, is that a body of literature within industrial economics and within corporate strategy relates to each. The industrial economic theory of market power, better known as monopolization theory, provides a basis for understanding the effects of information technology on prices, market share, and revenues. Williamson's studies of markets and hierarchies [1975, 1983] can help to explain the industry-level impact of information technology through changes in production and transaction cost structures. We will briefly review each of these areas to highlight their potential application for research on ITSBF.

A firm can achieve an advantage relative to its competition by increasing its bargaining power over customers and suppliers. If its control is complete, it is a monopolist to customers and a monopsonist to suppliers. Monopoly power is enhanced through attractive product differentiation and by reducing the amount of searching for suppliers performed by customers. Information technology can affect both these variables. For example, product differentiation can be achieved in at least two ways: (1) information and IT-based services can be bundled with existing products to differentiate them from competition, and (2) even more radical are innovative, IT-based products which are uniquely positioned in a marketplace. The size of a customer's search for suppliers can be affected with direct order entry systems and other forms of vertical information integration.

The case of monopsony power is similar. A firm's monopsony power can be enhanced by avoiding unique, differentiated products and by searching widely for competing suppliers. The economics of searching, which directly affect the size of search set, are often radically altered with information technology. In fact, electronic marketplaces, much like a stock exchange, can reduce the cost of searching for the most economical supplier nearly to zero. This facilitates finding

the best product at the best price and reduces any price premium that the supplier might otherwise have extracted from the firm.

The market power literature provides one interpretation of "competitive advantage". The theory gives us guidance about which variables are relevant to an analysis of the impact of information systems on competitive advantage and it provides a basic understanding of the relationship between those variables. It is one starting point that industrial economics can provide to this area of research. There are many others.

Williamson[1975] provides another body of literature that can be employed as a foundation for developing specific theories about the effect of IT on industry boundaries.[Ciborra, 1985] Starting from a perspective that encompassed both economics and organizational theory, Williamson developed the theory that boundaries between industries arise at those points where a market's advantage of production efficiencies outweigh the transaction cost superiority of internal organization. Simply put, separate and specialized industries exist because at some points it is cheaper to buy a product or service than to make it. Williamson's model has been used to study the degree of vertical integration in the automobile manufacturing industry [Monteverde and Teece, 1982; Walker and Weber, 1984] and the decision to forward integrate with a direct sales force versus using manufacturers' representatives.[Anderson, 1982]

Information technology has the potential to radically alter cost structures and transform the structure of industry boundaries. In some cases, functions that were once integrated into the organization may be eliminated and alternatives may be purchased in a market. In other cases, products and services that were once purchased now may be created by functions within the organization. IT can have this

impact on industry structure by altering the relative production efficiencies and transaction costs of market and organization mechanisms, and the specificity of assets that create products.

An example of these shifts in industry boundaries, which can be studied from Williamson's theoretical perspective, is the decline of the timesharing industry. It can also can be employed to predict the success or failure of "value-adding" to existing products with information-based services. It is only through a powerful theoretical lens that important problems such as these can be analyzed. Williamson's theories are innovative and well grounded. They let us leverage our own research efforts and begin our analysis on a much higher plane. We do not have to develop an idiosyncratic lens, a "framework", for viewing the problem. We can use one that has been used before, for other problems in other arenas.

5. Frameworks versus Models

A good deal of the work in our field of management information systems is devoted to building frameworks for looking at new problems. Because rapidly changing technology creates a steady stream of new research issues, we are often searching for structures with which to view them. This is one of the important contributions of frameworks. They serve to: (1) highlight important dimensions or features of the problem area; (2) suggest which dimensions and features are unimportant; and (3) categorize and classify by indicating salient differences and similarities between the elements under study. The best frameworks are powerful lenses for viewing a problem and they provide a language with which to talk about key issues.

Research in information technology and corporate strategy has developed its share of frameworks, though, surprisingly, there has not been a framework

describing the entire area and laying out the major research topics within this area. Several of the papers we have cited attempt to provide better ways of looking at the problem of opportunity identification. They are typically constructed by choosing two salient dimensions of strategic systems and combining them to form a matrix of cells, each one of which represents a different opportunity for strategic systems.

As descriptive structures, these categorization schemes are useful and valuable. As a basis for making decisions about opportunities for new systems, they are badly flawed. Description does not beget prescription. Categories do not equate to opportunities. Only if one assumes that the salient dimensions used to differentiate systems are also the critical features for explaining systems success, can one make that leap in logic. Yet, such simple facts are often overlooked and many researchers have come to believe that the work is complete when a satisfactory framework has been developed. Instead, it is just the beginning.

The importance of reference disciplines becomes apparent when one moves beyond frameworks and tries to build explanatory models of phenomena. It is difficult work, made much easier if one borrows and builds upon existing theory. It might take many iterations and several years to develop a good model of how specific characteristics of inter-organizational systems cause different types of impacts. These models tend to be built one insight at a time, with each iteration building on previous findings. A strong reference discipline provides a continuity of perspective that facilitates the accumulation and integration of new insights.

6. Definitions and Measures

In all of the work on information technology as a strategic business factor, there are few useful characterizations of IT. The five levels of interorganizational systems defined by Barrett and Konsynski[1982] is one of the only notable examples.

A parsimonious characterization of IT would serve to answer many questions. What do we mean by IT, beyond electronic computing and communicating technologies? What are the salient features of IT? How can one efficiently characterize diverse types of IT? Can we compare and contrast two different systems in terms that will have currency ten years from now? If not, we are in some difficulty.

This is an area where we do need a framework, to provide a compact language for describing IT in terms that are relevant to our research problems. Without that language, it is difficult to build explanatory models, because it is difficult to identify and represent salient features of systems and to logically connect them to theories of corporate strategy and industrial economics. A starting point for an IT framework is to identify the different types of functions that IT performs and the different characteristics that are common to them.

By way of illustration, consider the simple IT framework proposed by Bakos[1985] and Bakos and Treacy[1986]. It includes the two basic functions of processing and communicating and three characteristics that are common to each, capacity, quality, and unit cost. Even this simple framework provides a language with which we can begin to link with greater clarity IT and strategic performance. The framework begs to be improved by refining the types of functions and extending the list of salient characteristics. The vocabulary of IT description can be extended within this basic framework as research demands.

Information technology is not the only term for which we have a poor descriptive language. Several other terms, such as "competitive advantage" and "corporate strategy", are widely used, but little understood. Without a rich working vocabulary about the types and qualities of competitive advantage or corporate strategy, it is very difficult to develop insights that are neither unlikely conjecture

nor plainly obvious. As was discussed earlier, the path to a richer understanding of these terms leads directly through established bodies of research.

Empirical testing creates another reason for why it is important to develop rich, but precise descriptions of important constructs. Measurement, the foundation of empirical testing, is critically dependent on precise definitions. Without agreement on "what", it is impossible to assess "how much". Thus, descriptions of important constructs are an important link between theory and empirical analysis. They provide a vocabulary for constructing theory and a definition of that which should be measured for empirical analysis. Construct definitions occupy a central place in the emerging philosophy of organizational research which advocates simultaneous testing of theory and measurement instruments.[Bagozzi and Phillips, 1984]

7. Empirical Testing

Sometimes it is worth refreshing our memories about some of the basic principles of the logico-deductive method of scientific inquiry[Popper, 1959]:

* Theory that is untested in the plane of observation is purely conjecture.

* A theory is never proven with empirical evidence; it is only not disconfirmed.

* Data used to synthesize a theory does not provide an independent test of the validity of the theory. Only an independent sample can provide that.

The first principle defines the essential role that empirical testing plays in scientific inquiry. The second principle reminds us that a theory is only true until a better theory comes along. It also illustrates the importance of competing theories for rapidly advancing the frontiers of knowledge. The last principle asserts that

inductive logic is not self validating. A theory inferred from a few examples is only a theory about a few examples until it is submitted to independent verification.

It should not be assumed that the lack of independent empirical testing of theories in this area is due to researches' rejection of the logico-deductive method. Rather, it is a paucity of theories and difficulties in conducting empirical studies that are to blame. We have already discussed the predominance of frameworks over explanatory models in this area. Frameworks, as languages for structuring problems, are not subject to verification. A framework is not used because it is "true"; it is used because it is more powerful than competing language systems for describing elements of the research.

When a large and complex strategic information system provides only a single data point for empirical analysis, we know that verification of theory is a large and difficult job. Almost every aspect of empirical testing is difficult in this area. Key variables are not adequately defined, valid measures of them have not been developed, treatments cannot be controlled, controlling other confounding effects is very difficult, and sampling in general is a problem. But, we should not give in to these difficulties, for if we do, we confine ourselves to conjecture. Instead, the practical problems of testing should be allowed to influence the design of our research, the types of models we develop, and ultimately, the topics we choose to study.

This may appear to be a large price to pay for empirical testing. If we have constructed our theories carefully, why is testing so important? There are at least two answers to this question. First, testing the validity of conceptual assertions is an essential differentiating feature of good research. Discipline and rigor are fundamental to our role as academics and these qualities are only ensured through

empirical testing. The second response is that theories are rarely constructed carefully. Few of our ideas are based on accepted theories from a reference discipline. Different people interpret events differently and the resulting theories usually reflect the biases of their makers. Good theory is developed through an iterative process of construction, testing, and modification, starting from an established base of work.

8. Conclusions

We are at a crucial point in the development of research on information technology as a strategic business factor. The literature is developing a common language and some practical insights. The discipline and rigor that is a differentiating feature of academic research is developing more slowly. We suffer in this, as in other areas of MIS research, from having an important problem that is quickly evolving. We are still in a pre-theoretical stage because the phenomenon under study is new and changing. The research agenda is dominated by pressing practical concerns which crowd out methodological issues.

We have identified five recommendations for ways in which research on information technology as a strategic business factor can be improved. Our prescriptions are that: (1) a broader range of topics need to be addressed, beyond opportunity identification; (2) the reference disciplines of industrial economics and corporate strategy should be employed to provide initial theories, methodologies, and standards of quality; (3) we must aspire to build models that explain, in addition to frameworks that categorize; (4) we must clearly define important terms and provide measures for them; and (5) empirical testing is the sine qua non of quality research. Taken together, these five points lead us toward a methodological agenda for research on information technology as a strategic business factor.

The fundamental problem is to create a research agenda that includes work to develop and test explanatory models based on related reference disciplines and to develop the necessary research tools. To some, this suggestion combines many of the worst features of "academic" research, avoiding the practical and pressing concerns of a wider public for the precise and parochial interests of academic researchers. Another opinion, implicit in this paper, is that practical and theoretical approaches to research are complementary and can successfully coexist. The discipline and rigor of theoretical research provides a skeptical jury for experiential insights. These insights also provide important guidance about important, real world problems. Both approaches will be needed to advance our understanding of the real effects of information technology on corporate strategic performance.

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