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# INFORMATION SYSTEMS, TELECOMMUNICATIONS, AND THEIR EFFECTS ON INDUSTRIAL ORGANIZATION

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## ABSTRACT

There is general agreement among academic researchers that information systems can prove strategic if they are well crafted. However, the field currently lacks frameworks that predict which applications might provide lasting benefit and sustainable competitive advantage. Moreover, little has been attempted in analyzing effects on the organization of industry. These effects may, in the long term, prove at least as interesting as effects on individual firms. We present here an initial examination of the effects of information systems and telecommunications on the competitive position of firms. Our intention is to provide guidelines for choosing opportunities that convey sustainable competitive advantage. We present also an initial analysis of predicted changes in the organization of industry. This work draws on field research and on recent work in market economics.

## INTRODUCTION

A growing literature attests to the fact that information systems can be used as competitive weapons within the context of a market economy (Clemons, *et al.*, 1984; Clemons and McFarlan, 1986; Harris, 1985; Ives and Learmonth, 1984; Jonscher, 1983; McFarlan, 1984; Petre, 1984; Porter, 1985; Rackoff, 1985; Wiseman, 1985). This literature largely relies on a common and perhaps overworked collection of examples that plausibly demonstrate use of information systems to gain competitive advantage. Since the authors' tone is generally evangelical, the examples selected are those that can be described as major successes. Unhappily, neither the literature nor the oral tradition goes into much depth; both are largely anecdotal. Little is understood by way of general principles or theory about why certain moves work or are likely to work, or why others fail. Still less is known about the longer-term organizational effects on industry of existing or anticipated information systems technologies. Normative and predictive models, which would be valuable for

assessing options and choosing preferred strategies, seem yet more distant.

There are firms that, through well-timed and well-crafted applications, have achieved reduced costs or enhanced service for their customers, leading to improved margins or increased market share; perhaps they have also gained sustainable competitive advantage. Merrill Lynch Cash Management Accounts, American Hospital Supply and McKesson Drug Company distribution systems, and American Airlines and United Airlines reservation systems are among the most widely-cited examples of such applications. Many others are known. There have also been mistakes, of which very little is written.

For examples of the benefits of successful strategic choices and of the costs of mistakes, we look initially to financial services and banking. Cash Management Accounts (CMAs), introduced by Merrill Lynch in the late '70's during a period of high inflation and high interest rates, successfully drew billions of dollars out of banks and out of savings and loan institutions. Now,

more than six years later, Merrill Lynch still enjoys an enormous market share advantage -- over half the CMA volume, and several times the share of its nearest competitor. Contrast that with automated teller machines (ATMs), offered by virtually all major banks. Most industry observers acknowledge that the universal adoption of ATMs has benefitted the substantial portion of retail customers who use them. However, since ATMs are offered by almost all banks, they have conferred neither margin nor market share advantage. Moreover, they do not appear to have reduced banks' expenses; customers use them frequently, as cash machines, but do not appear to be substantially reducing either papers transactions or their need for interaction with bank personnel. Finally, in the area of electronic home banking, we find banks that have invested millions of dollars in developing and advertising the service. Consumer demand for home banking, however, appears minimal. No bank has successfully exploited the service as a means of increasing share or margins, or of reducing costs.

How can we explain the differences in these applications? CMAs have been widely copied and are generally available, yet the original developer continues not only to benefit, but to dominate. This surely looks like sustainable competitive advantage. ATMs likewise are generally available, yet they appear to have conferred competitive advantage on none of their offering banks; rather, they appear only to have increased costs throughout the industry. And at present, both of these appear successful when compared to electronic home banking, which is largely being ignored by consumers.

Unexplained as these differences are, we do not believe them unexplainable. The main goal of this paper is to put forward several hypotheses on the organizational effects on industry of information systems technology. These hypotheses, we believe, are plausible and supported by what evidence is now available. Within information systems technology, our main emphasis will be on telecommunications technology, although we recognize that no fast distinction can be made between telecommunications and other applications of information systems. For present purposes, what counts as a telecommunications application is one in which the movement of information over a significant distance matters critically in figuring the value of the given application of IS technology.

## STRATEGIC ADVANTAGE: DISTINCTIONS AND DEFINITIONS

There has been much attention paid to strategic information systems applications in the popular press. Articles are frequently found in the *New York Times*, the *Wall Street Journal*, and *Fortune Magazine*. *Business Week* recently ran a cover story on "Information Power" (Harris, 1985). The treatment in these sources certainly helps to advance general awareness of the possibilities inherent in information systems, and it probably enhances the belief that information systems can be essential components of corporate strategy. And yet we find this treatment, as well as that in the academic literature, in many ways quite deficient. By way of introducing our own framework for analysis, we begin with four basic points:

1. Innovation that results in greater efficiency -- doing something better -- may or may not yield competitive advantage.
2. What is essential for doing business may or may not be strategically important.
3. What is strategically important may or may not yield competitive advantage.
4. Competitive advantage may or may not be lasting.

### Better Operations May Not be Strategic

First, we distinguish between doing something better and gaining competitive advantage. Surely, if you gain competitive advantage you likely are doing something better, but doing something better need not confer competitive advantage. If there is something to be done better (e.g., faster, cheaper) and everyone can do it easily, then everyone will, and the competitive scene will remain unaltered. To take an IS example, consider automating payroll. It is clearly cheaper to do so than to rely on a manual system, but the means to do so are available to all. Consequently, all firms of a reasonable size have automated their payrolls and none has altered its competitive position.

The distinction between doing things better and gaining competitive advantage is often lost or blurred in the IS literature. Porter notes that, "A technology is important for competition if it significantly affects a firm's competitive advantage or industry structure" (Porter, 1985). Much of the literature, however, is concerned with showing that firms have projects of strategic importance to them and that these projects often depend on IS. For example, "Information technology can be used to support or shape the firm's competitive strategy by supporting or shaping strategic thrusts. Strategic thrusts, therefore, constitute the mechanisms for connecting business strategy and information technology" (Rackoff, 1985). Given the pervasiveness of information systems, it would be very surprising if they did not often figure as components in so-called strategic thrusts; so do labor and raw materials.

### Even Essential Systems May Not Be Strategic

With regard to our second point, there is no doubt that information systems are becoming ever more pervasive in business. The computer and communications industry continues to draw an increasing share of the GNP at the same time that it consistently improves price/performance indices. None of this, however, necessarily implies that either computing or communications is strategically important to anyone who uses them.<sup>1</sup> Our second distinction, then, is between what is *strategically important* and what is *essential for doing business*. Information systems are, without question, essential for doing business; so is air. But usually all industry participants have full and equal access to air.

Something is strategic if it significantly affects either the competitive position of a firm or the structure of its industry (see Porter, 1980, 1985; Ives and Learmonth, 1984). For an IS application to be strategically important, it is not enough that it be essential to doing business; firms must also differ in their ability to develop or to exploit this application. These differences among firms can have many origins; difference in technical skills, available financial resources, or technical infrastructures are possible.

<sup>1</sup>Of course, they must be strategically important to the sellers of these products, but that's a different matter.

Clearly, information systems will continue to be useful, even essential. Will they continue to be strategic? How, and to what extent, will communications-based applications yield opportunities for firms to gain advantage or to radically alter the structure of an industry?<sup>2</sup>

### Strategic Importance Need Not Confer Advantage

This takes us to our third distinction, that between what is *strategically important* and what confers *competitive advantage*. A firm has competitive advantage if it is able to obtain returns on its investments (in a given industry) that are better than normal.<sup>3</sup> Clearly, anything that gives good promise of yielding competitive advantage is strategically important. But something that threatens the competitive position of a firm (and hence alters industry structure significantly) is also strategically important. Something may be strategically important not because it confers advantage, but because failing to attend to it results in strategic disadvantage. Actions may need to be taken out of strategic necessity, a point we reexamine later.

### Advantage May Not Be Sustainable

Our fourth and final distinction is between *temporary* and *lasting (or sustainable)* competitive advantage. Projects that, for example, reduce costs and thereby permit realization of better than normal returns on investments may loosely be said to confer competitive advantage. But if competitors can duplicate the effect quickly, whatever advantage was achieved is only temporary. Projects of this sort are nice to find, but should be analyzed much as any other capital budgeting investment. It is misleading to speak of them as being strategically important. Our practice will be to speak of an IS investment as yielding competitive advantage only if

<sup>2</sup>For present purposes we can use Porter's model of industry structure as consisting of five factors: suppliers, buyers, new entrants, industry competitors, and substitutes. Industry structure changes when the power relationships among these factors changes significantly.

<sup>3</sup>Whether normal should be defined in terms of the industry as a whole or in terms of investments as a whole is an issue we leave open at present.

the advantage is sufficiently long-lived to be considered as altering industry structure. The distinction is genuine, even if imprecise.

## SOURCES OF ADVANTAGE

With these distinctions and definitions before us, it is perhaps less obvious that telecommunications-based applications are strategically important to their users. And if this is obvious, it is certainly not obvious how telecommunications can confer strategic advantage. On technology in general, Porter (1985) identifies four factors that may allow a technological change to yield sustainable competitive advantage.

1. The technological change itself lowers cost of enhanced differentiation and the firm's technological lead is sustainable.
2. The technological change shifts cost or uniqueness drivers in favor of a firm.
3. Pioneering the technological change translates into first-mover advantages besides those inherent in the technology itself.
4. The technological change improves overall industry structure (pp. 171-176).

What, then, can be said about the strategic importance of telecommunications? The current trends in technology and in pricing are producing a movement away from private networks and towards measured service via regulated or unregulated common carriers. Communications services will be available to all, and at competitive prices. Communications alone, therefore, cannot be the basis of sustainable advantage. For example, telemarketing has proven to be a tremendously effective marketing tool, but anyone can hire people to make telephone calls. It would surely seem then, that it will be the application systems rather than the telecommunications network that conveys advantage.

Porter's second condition is perhaps more promising in the case of telecommunications.

As Porter notes:

Even if the technological change is imitated, therefore, it will lead to a competitive advantage for a firm if it skews drivers in the firm's favor. For example, a new assembly process that is more scale-sensitive than the previous process will benefit a large-share firm that pioneers it even if competitors eventually adopt the technology (p. 172).

While it is far from obvious what particular effects telecommunications-based applications will have in this regard, it is likely that scale effects will be significant only for massively complex and costly implementations.

First-mover advantages, the third factor above, will figure importantly in what follows. Important questions have to do with how extensive these opportunities are. It may be that the well known success stories of strategic use of telecommunications rely on such first-mover effects and that opportunities of this sort are rare.

Finally, there is the case of improved industry structure. In fact, in one of the examples cited above, airline reservations, it can be argued that the publicized strategic applications actually harmed industry structure by reducing profits of all participants.

## INFORMATION SYSTEMS CAN BE STRATEGIC

McKesson Drug Company is a widely publicized innovator in the use of interorganizational information systems (Corey, 1985; Kleinfeld, 1984) for support of customers. McKesson's systems' most obvious effect is in support of customers' order entry; in fact, the system helps the customers in all aspects of running their pharmacies.

To place an order the store clerk walks through the retail store, waving a wand bar-code reader at any item in limited supply; the product is recorded on a small cassette recorder. When a circuit of the store is finished, the clerk can dial (or auto-dial) McKesson's computer, which reads the cassette and creates an order, reorder-

ing each item requested in the customer's standard reorder quantity. Order entry couldn't be much easier.

Items are shipped to pharmacies already marked with the individual pharmacy's current prices, which are stored on McKesson's computer. Additionally, McKesson has the floor plan of each retail operation with which it deals and items are placed in boxes in reverse order of that in which they will be needed; that is, the items encountered on the first shelves will be on the top of the shipment. The customer thus restocks by making one circuit through the store, removing prepriced items and placing them on shelves. Like order entry, restocking could not be much easier.

McKesson provides rapid and reliable restocking; combined with easy and inexpensive reordering, this leads the customer to reorder only when supply is needed rather than batching orders and maintaining safety stock. McKesson also provides additional services to their customers, including a billing service to support house charge accounts and a database of drug interactions and counter-indications.

This really does appear to be a pretty piece of work. Assessing benefits to McKesson's customers is far easier and far more direct than assessing benefits to McKesson. It is problematic to determine if McKesson enjoys margins greater than average for its industry or if it has substantially increased market share. The principle result of this system may have been limited to change in industry structure, the driving out of small local distributors. However, the principle factor of this system — ease of use and reduced (nonfinancial) transaction costs for customers — warrants more formal analysis. We turn to this in the following section.

## Transaction Costs

The McKesson example plausibly shows, at the very least, that telecommunications can be used to affect industry structure. McKesson may or may not have gained competitive advantage with its automated ordering system, but an overall effect has certainly been to reduce the number of players in the industry. Telecommunications, in this example, is strategically important, and the application resulted in something—inventory reordering—being done better. What

generalizing hypotheses are suggested here? We begin to answer the question by making a small appeal to theory.

It would be surprising if it were possible to have a solid theory of the strategic uses of telecommunications without linking that theory to current thinking in the field of industry organization. If telecommunications is used for competitive advantage, then industry structure will change, and one would expect that such specific cases would exemplify more general principles. In fact, we believe that at least part of the literature in industry organization is quite pertinent to gaining an understanding of the strategic effects of telecommunications.

In a series of widely cited works, Oliver Williamson has developed what he calls the transaction cost approach to the study of industrial organization (1979, 1981, 1985). This approach proceeds:

...by making the transaction—rather than commodities—the basic unit of analysis and by assessing governance structures, of which firms and markets are the leading alternatives, in terms of their capacities to economize on transaction costs (Williamson, 1980. p. 549).

Williamson believes that much of industrial organization, especially organizational boundaries, can be explained by appealing to firms's attempts to lower their transaction costs. Williamson's central idea is a simple one and can be stated as follows. Economic exchanges themselves have costs. Certain types of exchanges are more costly than others. In attempting to economize on such transaction costs, firms have various organizational options, principally the option of acquiring the goods in the marketplace or producing the goods within the firm. That is, transaction costs affect the make-vs.-buy decision and Williamson holds this decision to be very significant in determining much of industrial organization.

To illustrate, buying light bulbs is a transaction inherently less costly than buying, say, legal advice. Contracting for light bulbs is straightforward for both supplier and purchaser. Light bulbs are standard, known quantities, about which there is little ambiguity. Moreover, the supplier does not make any large transaction-specific investment. If the supplier loses a cus-

tomer, the investment in infrastructure to produce the bulbs can be recovered by selling the light bulbs elsewhere.

The case of legal advice is different in at least two ways. First, it is very difficult to specify unambiguously what the purchaser is buying; thus, argues Williamson, the purchaser must expend effort to monitor the contract for services, lest when interests diverge the lawyers extract extra benefits at the expense of the client. Second, it is often the case that much of what an attorney would learn in providing services is firm-specific. The investment made to acquire such knowledge is not transferable to other clients. The former condition gives the supplier power over the purchaser, while the second condition confers power to the purchaser. The net result of this, in Williamson's view, is much haggling about what is to be done and consequent loss of resources. The main recourse for a purchasing firm in such a case is to develop the capacity in-house to provide the needed service. And we note that few firms make their own light bulbs, but many have their own legal departments.

Williamson offers no precise definition of transaction costs, as opposed to other costs. For our purposes, the transaction costs of an economic exchange can be characterized as the costs of making the exchange happen satisfactorily. These are to be distinguished from the costs of actually producing the goods exchanged. Thus, for example, in purchasing a car the costs of the transaction include shopping around for the car, negotiating a price, arranging for financing, and waiting for delivery. If the dealer must be prodded to meet the full terms of the agreement of sale, then both the cost of the prodding and the cost of the monitoring to determine that prodding is needed are part of the transaction cost.

The transaction cost approach to the study of industrial organization is more complex and subtle than portrayed here. Moreover, the approach is controversial and is surely not the final word on industry organization. The approach, however, is very intriguing for the purpose of suggesting hypotheses regarding the strategic importance and effects of telecommunications systems and information systems generally. In the case of McKesson, it is pretty obvious that monitoring inventory and reordering stock is a transaction, the cost of which was dramatically lowered by the information system in question. We believe that lowering of trans-

action costs, as opposed to pure production costs, may be the rule rather than the exception for strategically important telecommunications systems.

## HYPOTHESES

### Conditions Necessary for Sustainable Competitive Advantage

Our working hypothesis is that interorganizational information systems that convey sustainable competitive advantage will possess all of the following characteristics:

1. They will reduce costs or add value for customers and users. The most attractive way to reduce costs is to reduce transaction costs, making systems easier for customers to use without reducing vendor prices.
2. They will entail substantial switching costs (also called idiosyncratic investment) on the part of the customer or user.
3. There will be a small window of opportunity. Alternatively, and more formally, we can state this by saying that the ratio of customer adoption time to competitor copy time is quite small.

We address each of these in turn. We apologize if these appear obvious after explanation; a review of the literature and of recently attempted information systems reveals that they are not yet common knowledge among academic researchers, systems architects, or strategic planners.

The first point claims that systems cannot be strategic unless they fill some need, either by reducing costs or providing improved service to users. The current failure of home banking and videotex services demonstrates the need to fill some customer need and the penalty of failing to do so. The success of American Hospital Supply and McKesson Drug Company illustrates the benefit to be gained by reducing either hard financial costs or perceived transaction costs, or

by providing improved and differentiated service.

Systems that fill a need and provide real benefit, and do so at reasonable cost, will create demand. They will, in some cases, increase the innovator's market share, and in other cases will grow the product or service market or create a new market for an entirely new product or service. This is unlikely to yield sustainable advantage unless the innovator's gains can be protected against incursions from competitors. As such protection for distribution systems and other services is rarely available through patents--neither services nor processes are eligible for patent protection--the innovator will usually retain its gains only if the customer can be persuaded not to move to a new supplier.

Several mechanisms exist for protecting the customer base, ranging from constant improvement by the original offerer to sanctions against potential defectors.<sup>4</sup> The most effective mechanism to date has been customers' switching costs. A customer who changes suppliers of an electronic service-- a travel agent, an industrial purchasing agent, a user of a cash management account--forfeits a large, and largely unrecoverable, idiosyncratic investment. This investment may include any or all of the following: procurement of special purpose hardware; development of software interfaces to connect the customer's computer application systems to those of the service provider; entering customer data such as inventory on hand and prices, or current portfolio; and training of order entry clerks or other personnel. Only if there is some significant switching cost or other means of holding early users can the initial developer expect to receive lasting benefit from inter-organizational information systems.

Finally, the ability of innovators to defend their gains counts for nought if there are no gains to defend. Thus, not only do we require the ability of innovators to defend (and retain) their early adopters if a system is to provide competitive ad-

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<sup>4</sup>Travel agents who use Apollo or Sabre benefit from the halo effect, the benefits that United and American provide only to agents using their systems. An agency that replaces its Apollo system with a competitor's offering would lose, for example, the ability to book important business flights at the last minute, such as Monday morning and Friday evening United flights between Chicago and New York. This is an effective sanction discouraging defection to TWA's PARS system.

vantage, we require that the body of early adopters be large. This, in turn, requires that the rate of adoption of the system be rapid when compared to the rate at which competitors can copy it. If adoption is rapid, and competitors respond only slowly, then there will be, at least initially, a first mover effect providing real benefit to early developers. If, in addition, the gains from early adopters can be defended, there exists the possibility of sustained profit due to sustainable competitive advantage. Only systems offering sustainable above-market profits can be said to yield sustainable competitive advantage.

The commonly cited examples of strategic information systems can all be readily seen to satisfy all three of our criteria. Merrill Lynch's Cash Management Account provided interest rates approximately three times that of a passbook savings account and thus offered real value to customers. Once a customer's portfolio was entered as a Merrill Lynch CMA, it required significant effort by the customer to transfer to another company, and no real advantage, as Merrill Lynch continuously improved their original offering. Finally, adoption was very rapid as large sums flowed into Merrill Lynch CMAs within days of introduction, while competitors required nine to eighteen months to respond. The effects of this combination is readily apparent: Merrill Lynch provided a valuable service and acquired an enormous and valuable customer base rapidly before competitors could respond. Six years later Merrill Lynch has retained much of this customer base. The CMA has turned out to be a strategic, and sustainable, competitive advantage.

## Changes Expected in Industry Organization

We provide the following additional hypotheses concerning the role of communications-based information systems:

1. Competitive advantage is more rare than strategic necessity.
2. The result of innovation may be change in the structure of the industry rather than change in the



competitive position of an individual firm. Even for the innovator, change in industry structure may be more significant than change in the firm's position within the industry.

3. The role of industry-wide standards will be quite significant.
4. Even short-term profitability for the first mover may be significant as it may enable the innovator to drive out or acquire smaller players.
5. Strategic advantage due to benefits resulting from reduced production or distribution costs should be extremely rare.

These are preliminary hypotheses based on limited observation and, more heavily, on intuition. We treat each in turn, supporting with specific cases where possible.

### Competitive advantage vs. strategic necessity

All major banks today offer ATM services to customers and, as these services are merged through inter-bank consortia, they cease to provide differentiation. They clearly do not offer competitive advantage. They are, however, a strategic necessity, an urban bank without an ATM network would be at a significant competitive disadvantage. Other examples exist, and their number is increasing.

### Change in industry structure

Strategic necessity, combined with large development costs, may drive small players out of some industries completely. Alternatively, they may form consortia--where regulation permits--in order to share development costs and thus survive. As communications systems enable large participants to respond rapidly, small companies that survived only as flexible local middlemen may no longer be cost-effective and may vanish. Electronic distribution systems, by providing a "perfect" market, may

depress or eliminate an industry's profits.<sup>5</sup>

### The role of industry standards

The role of industry-wide standards for inter-organizational information systems is quite complex. No doubt, if Johnson & Johnson had foreseen the erosion of their hospital sales and profits due to incursions from American Hospital Supply, made possible by the latter's electronic order entry system, J&J would have taken defensive action. The most likely form of defensive action would have been an industry standard for remote order entry, agreed upon by J&J and major hospital chains' purchasing agents. Such standards might have resulted in a cure almost as bad as the problem it was intended to address. Experience in other industrial settings implies that such standard systems result in more perfect markets and shift power towards large purchasers. Both phenomena shave margins and depress profits. However, it is at least plausible that the presence of industry standards and the understanding that remote order entry systems could thus provide no sustainable competitive advantage would serve to restrain introduction of such systems. Relationships between industry standards and industry organization are quite complex and remain an intriguing topic for further research.

### Role of short-term benefits

Even short-term benefits, which cannot be sustained indefinitely, may be strategic if they provide other advantages. In particular, the initial innovator may use early above-market profits to acquire small players that recognize their inability to compete in the new marketplace.

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<sup>5</sup>Airline reservation systems have without question increased the relative strength of early developers, American and United Airlines. There is, however, widespread belief that by making competitive shopping so easy these systems have depressed profits for the entire airline industry. Although American and United are very profitable relative to the average for their industry, it is an open and probably unanswerable question whether they are more profitable than they would have been in the absence of such systems.

## Competitive advantage due to production improvements are rare

If our earlier hypothesis concerning necessary preconditions for sustainable advantage proves valid, then opportunities to introduce strategic systems for production will be quite rare. This does not mean that systems can never be strategic in manufacturing organizations. Moreover, even systems that do not convey competitive advantage may be quite valuable, even essential, in this environment.

Application systems for production of operations are generally for internal use, and thus will preclude the relevance of customer switching costs and related first-mover effects. A competitor that is late to introduce systems that reduce costs may still have to match the innovator's lower prices, initially depressing profits; eventually, though, it too will have its system in place. The net effect, then, will probably be reduced producer costs and thus lower prices for customers.

There will, however, still be opportunities made possible by other aspects of a firm's position. A competitor with a network already in place may be able to piggyback new applications that would be prohibitively expensive without the network. American Airlines' reservation system may provide the infrastructure for its real-time control of operations. This would be prohibitively expensive for a competitor without an existing network. A firm like General Motors could absorb development costs that would be infeasible for smaller players like American Motors or Chrysler.

There is some preliminary evidence that theory does not adequately explain firms' current use of information systems internally, for production, distribution, or control. Firms differ not only in their physical resources, but in their human resources, culture, and traditions. This results in differing abilities and willingness to exploit information technology. These yield real effects, although the causes are difficult to quantify in economic terms.

## CONCLUSIONS

We suspect that difficulty in locating opportunities for strategic and competitive uses of information systems may in large part be because such opportunities are rare. We do not conclude from this that the recent attention given to such systems or the priority placed on finding opportunities is overstressed. In most cases, the benefits of these systems will accrue most heavily only to the first one or two innovators.

We believe--and the evidence supports this belief--that strategic uses of information technology share three characteristics: such systems provide real benefit to users; users incur significant switching costs when changing to systems offered by a competitor; and adoption time is short relative to the time a competitor needs to copy the system, providing early developers with an opportunity to develop their initial base of users. Absence of any one of these three characteristics probably precludes sustainable advantage.

The additional hypotheses presented are plausible, but more preliminary. They are being investigated as part of an ongoing Wharton research project in information systems, telecommunications, and business strategy. This project is directed by Clemons and involves a cooperative effort among industrial sponsors and the Reginald H. Jones Center for Management Policy, Strategy, and Organization.

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