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ABSTRACT

Information Technology (IT) can support or even cause changes in the structure of industries and the relationships between firms. Yet, at present, we lack the vocabulary and theory to explain or predict these changes. Drawing on recent work in the resource-based theory of the firm, we propose that shifts in resource values are central to economic restructuring. We show how IT can operate to shift resource values through the basic economic drivers of network externalities and economies of scale, scope, and specialization. We use this theory to investigate the situations that will lead to each of the basic structural responses: changes in market consolidation, in diversification, and in vertical integration. We also can make some specific statements about what forms can be employed in the structural responses: ownership, outsourcing, or cooperation.

1. INTRODUCTION

It has been observed that IT can cause or support changes in the structure of industries and the relationships between players. It has even been suggested that these structural changes may be more important to competitive position and survival than being the innovator, since strategic applications of IT are often easily duplicated (Clemons and Row 1987; Vitale 1986).

Although IT's role in economic change is recognized, we lack even good vocabulary to discuss such changes in economic structure, much less any theory for explaining or predicting them. The problem is complicated by the fact that structural changes in a particular market don't happen in a vacuum, but interact with changes in other markets. Many structural changes involve the inter-relationships of a single firm's operations in several markets.

This paper examines economic reorganization and the role IT plays in it. Economic change is viewed in terms of changes in the allocation and integration of strategic resources. This resource-based approach builds on our earlier work (Clemons and Row 1987). In that paper, we suggested that change in competitive position comes from leveraging an advantage or mitigating a disadvantage in critical resources and showed how IT could be used to accomplish this by exploiting structural differences among firms.

Here we show how IT's effect on resource values can operate to change the structure of economic activity. The proposed framework is used to make predictions about what types of structural changes would be expected in specific situations.

2. ECONOMIC RESTRUCTURING: ANTECEDENTS

The issues of *economic organization* and *structure* have been concerns of several areas of study. As a result, there has been some variety in definitions, assumptions and theory. In this section, we examine the evolution of theories of economic structure in economics and strategic management. We seek to give a sense for the relationships between these major areas of academic study and for the evolution of concepts and theories, as a context for the resource-based view presented in the next section. We draw on the concepts of each theory as appropriate. We do not review the literature's empirical support of these theories.

2.1 Traditional Industrial Organization View

Economic structure has a central role in traditional industrial organization (IO) economics (e.g., Scherer 1980). This role is probably best characterized by the *structure-conduct-performance* paradigm. In this model, market structure provides the context for firm behavior, and both together determine performance.[1] Market structure generally includes (Scherer 1980, p. 4):

- The number and distribution of buyers and sellers
- Product differentiation
- Barriers to entry
- Vertical integration
- Diversification

The theory in this field grows out of traditional micro-economics. It is posited that firm profits arise from *monopoly power*, when there is a monopoly seller or a few sellers that can collude to restrict output below the

competitive level. Where there is an oligopoly, monopoly power is viewed as a shared industry resource. Market structure thus plays the critical role of constraining the size of this shared resource or the range of potential profits available to competitors through collusion.

There are several problems with this approach for our purposes. In traditional IO, the unit of analysis is a market or industry, variously defined in terms of substitution of demand, production, or inputs. But in investigating the impact of IT on economic structure, we are often concerned with changes in industry boundaries and relationships between markets.[2] For example, Merrill Lynch's CMA financial product combined banking functions, check, and debit card access to funds with brokerage functions, investment reporting, and margin accounts (including sweeps of available funds into money market funds). This product supported a breakdown in the boundary between the banking industry and the securities industry (Clemons and Row 1988a). IO gives us few tools and concepts to deal with these structural relationships between markets.

Traditional IO also is weak in dealing with firm differences. The microeconomic basis of IO represents firms as production functions and often assumes homogeneous firms. In most industries, firms differ in very fundamental ways. A key difference among firms is often in what markets they compete and what activities they perform in those markets. Another critical difference is the organizational structure of firms. We are concerned with how IT affects relationships between business units in a firm and how these relationships influence competition in each market (Clemons and Row 1987). We view these relationships as an important part of economic structure.

There are some attempts to incorporate observed firm differences in both strategy and profitability into traditional IO through a theory of *strategic groups* (e.g., Caves 1977; Porter 1979) or groups of firms following similar strategies. This work on the structure within an industry retains the idea of monopoly power as a shared resource, but makes the relevant unit of analysis a strategic group. In this theory, barriers to entry may vary by strategic group, creating differences in the profitability of the groups. Further, each group's profitability is influenced by *mobility barriers*, which protect the group from rivalry with other groups. However, this approach still lacks the conceptual tools to discuss the structure of relationships between strategic groups and between business units in a firm.

A final problem with the traditional IO view of economic structure is that its theoretical roots are based in assumptions that are unhelpful in analyzing the structural impact of IT.[3] In particular, equilibrium of optimizing behavior under perfect information seems more than a little restrictive. Understanding the role of IT depends on explicit attention to bounded rationality and imperfect information.

However, the traditional IO field has contributed a vocabulary, extensive theory, and a substantial body of empirical results that can help in understanding the impact of IT on economic structure. This field has been drawn on extensively in the IT literature. IO, as popularized by Porter (1980), has been used frequently (e.g., McFarlan 1984; Parsons 1983). Bakos and Treacy (1986) also view more formal IO analysis, for example game theory, as a promising direction for future work. Unfortunately, the traditional IO approach has not yet yielded a conceptual theory of strategic applications of IT with significant explanatory or predictive capability, largely, we feel, because of the limitations of traditional IO discussed previously in this section.

2.2 The New Institutional Economics View

Several conceptual directions have been taken to cope with the problems presented by traditional IO. These include Williamson's (1975) *transaction cost theory*, the *evolutionary theory* of Nelson and Winter (1982) and what we call the *resource-based theory*.[4] These theoretical directions that form the basis for our work.

Williamson's transaction cost theory attempted to address some shortcomings in traditional IO. He posited that the organization of economic activity was based on balancing production economies, such as scale, against the cost of transacting. With the transaction as the unit of analysis, Williamson united the problems of market structure and organizational structure, by viewing markets and firms as alternative ways of organizing economic activity. Firms were viewed as more efficient than markets in situations of recurring transactions under high uncertainty with significant sunk costs in managing the transaction.

The transaction cost approach appears to be very useful in investigating the relationship between IT and economic structure. First, its definition of structure is sufficiently broad to deal with relationships between markets and between business units in a firm (organizational structure). Second, it provides a link between micro level behavior and the high level features of economic structure. Decision makers characterized by bounded rationality and opportunism operate over time in an uncertain environment.[5] These micro-level assumptions lead to the breakdown of markets in certain technological and environmental situations, determining the boundaries and structure of firms and markets. Moreover, the micro level theory appears well suited to information systems, given the importance of bounded rationality, information, and uncertainty.

But transaction cost theory does not have a well defined theory of profitability[6] or of differences among firms, and therefore of changes in economic structure. Differences in firm profitability are assumed to arise from differences in efficiency in setting firm boundaries, organizational

structure, and employment relationships. This does not give a clear view of what guides reaction when the underlying economics change, particularly when firms differ in strategy and structure. Moreover, transaction cost theory does not provide the tools for analyzing interrelationships among a firm's transactions. For example, a fixed transaction infrastructure that is common to several types of transactions can drastically change the transaction costs for any individual interaction. Similarly, converting data to machine readable form at one point in a value chain decreases the transaction costs in subsequent transactions.

The issue of structural change was addressed extensively by Nelson and Winter (1982). In their evolutionary theory, they proposed that firms be viewed as a collection of routines. Reaction to a change in environment will depend heavily on the nature of a firm's learned routines (i.e., history). Their conceptual approach is intuitively appealing for the study of IT. Again, information and information processing limitations play a central role. IT, in fact, can be viewed as a medium for storage of an organization's routines. While we do not adopt their modeling approach, their philosophy of the change process underlies the resource-based work presented later.

The relevance of transaction cost theory to the issues of IT has been recognized within the IT field (Bakos and Treacy 1986). Malone, Yates and Benjamin (1987) presented the most complete treatment to date of the transaction cost view of the relationship between IT and economic organization. They suggest that IT influences economic organization by reducing transaction costs and reducing the specificity of assets. As a result, IT would tend to favor market-mediated transactions. They identified two forms of electronic mediation: electronic markets and electronic hierarchies. However, relying solely on transaction cost theory, it was not possible to make any statements about the competitive effects of such changes.

Clemons and Kimbrough (1986) focus more on the competitive effect of reducing transaction costs. They argued that "competitive advantage" could result when the transaction costs in dealing with some competitors were reduced more than for others. The situations and types of applications that would lead to this result were not fully developed.

The resource-based theory, presented in the next section, appears, at least conceptually, to resolve the problems of transaction cost theory, while explicitly taking into account the evolution of economic structure. Moreover, this approach has the capability of making predictive statements and discriminating among possible outcomes.

3. IT AND ECONOMIC RESTRUCTURING: A RESOURCE-BASED VIEW

In this section we describe the resource-based view of economic organization. We maintain that this approach addresses many of the conceptual problems in alternative theories, particularly industrial organization economics and transaction cost economics, which we identified in the previous section. More importantly, we view this approach as being extremely useful in analyzing IT's impact on economic structure.

Penrose (1959) first proposed that firms be viewed as collections of resources. Her interest was primarily in explaining the growth of firms, which was, in her view, driven by a desire to utilize slack resources. Rubin (1973) further clarified and formalized the concept of a resource as a "fixed input which enables a firm to perform a particular task" (p. 937). He modeled firm expansion as being driven by *firm-specific* resources, those resources that were difficult to transfer via the market mechanism.

The role of resources in firm growth and diversification has been further developed by Teece (1980, 1982) and Rumelt (1982). Wernerfelt (1984) related the resource perspective to several issues in IO. He showed that focusing on *resource barriers*, the resources that underlie the entry barriers of traditional IO, was very useful in planning diversification strategies. The importance of strategic factor markets was developed in detail by Barney (1986), who showed that the timing of resource acquisition on the strategic factor markets greatly influences the cost of implementing various strategies for different firms. This work is very useful in understanding the emergence and evolution of firm differences.

Abernathy and Clark (1985) as well as Teece (1986, 1987) have shown how innovation can influence the value of a firm's resources and how these resources can influence who retains the economic benefits of the innovation. The impacts of an innovation will generally differ according to the resource positions of the various participants.

In the rest of this section, we explicate the relationship between resources and economic structure and describe how resources influence the evolution of structure over time. We then introduce the role of IT in this process.

3.1 Resources and Structure

In the resource-based approach, the concern is with the allocation of resources to activities. Firms are viewed as resource bundles under common managerial control. A firm's profitability is closely linked to the terms under which it can access these resources in the *strategic* factor markets. Firms and markets evolve to maximize profits, given the distribution of resources, which will usually differ due to history and chance (Barney 1986).

Within this context, *economic structure* can be viewed as the distribution of resources to activities and the interactions among these activities. As with the transaction cost approach, we are concerned with the question of how the

interactions are managed. The form of organization for the interaction is subject to the tradeoff between production economies and transaction costs.

There are two sets of interactions that are of importance. The first are what we call *vertical* interactions: the flow of goods and services along a single value chain. In vertical interactions, the output of one activity is an input to the other activity. There are also *horizontal* interactions: the coordination of similar or complementary resources among multiple markets or industries. Both of these types of interactions can be either intra-organizational or inter-organizational.

Changes in economic structure thus amount to changes in the allocation of resources to activities or changes in the interactions between activities. The mechanism of this change process is discussed next.

3.2. Evolution of Economic Structure

The evolutionary[7] view of industry restructuring that we propose treats resources as fundamental drivers of the structural change process. Industry restructuring is the result of changes in the value of these resources.

The restructuring process begins with some shift. This may be external to the firm or be driven by innovation within the firm. The shift may be radical or may result from gradual evolution of the firm's environment, including changes to product supply and demand conditions, technology, and institutional support.

The shift alters the economic value of some resource. For example, an innovation that doubles the yield of a machine changes the productive value of that machine. But a change in the productive value of a resource doesn't necessarily translate into a change in economic value, which also depends on the supply and demand conditions for that resource on the strategic factor market.

If the resource is available in competitive supply, all producers will be able to acquire the resource at the same cost, using the increased productivity to expand output, driving down the product price, with the result that much of the economic benefit of the increased productive value of the resource will be competed away to customers.

But many strategic resources are not available in competitive supply, due to imperfections in the strategic factor markets. Some resources are unique, or essentially nonduplicable, such as market share[8] in a mature industry. Some resources are so highly specialized that the transaction costs of acquiring them are prohibitive.[9]
Thus, changes in the economic value of key resources will not affect all firms equally, but will depend on the initial distribution of the resources. Firms often differ in resource endowments for historical reasons (Barney 1986). Firms with an initial comparative advantage in the resource will realize the increased value as superior profitability (i.e., return on investment). Firms that must acquire the resource must do so at a price that reflects the economic change; the increase in economic value is capitalized. That means that the costs and benefits of the same strategic adjustment may be radically different for different players in the same industry.

Differences in profitability lead to changes in industry structure as firms try to exploit a resource advantage or minimize the effects of a resource disadvantage. There is rarely only one solution.

3.3 Role of IT in Restructuring

IT enters this picture in two ways. First, innovations in IT or innovative applications of IT can be a source of changes in resource values. This can be the case where the application is itself a key strategic resource or where IT directly influences the economics of production or transaction activities. For example, in drug distribution IT has become a significant resource in itself as well as enabling economies from the rationalization of purchasing and distribution (Clemons and Row 1988b).

Second, IT can be used as a mechanism for implementing strategies for adjusting to changing values of other, non-IT resources. For example, Merrill Lynch's CMA account was primarily an effort to take advantage of economic and regulatory changes that enabled Merrill to offer banking-like services, while still being protected from retaliation by banks; this discontinuity increased the value of Merrill's distribution network, money market funds, and other resources by opening up a new source of demand (Clemons and Row 1988a).

Similarly, the use of systems for quality improvement in the automobile industry was driven by an increase in the value of quality, itself driven by the quality of Japanese imports, and a sharp increase in the cost of consumer credit (e.g., Eisenstein 1988).

4. TYPES OF RESTRUCTURING

Economic restructuring can be viewed as changes in the allocation and integration of resources. We can therefore begin to classify changes in economic structure by looking at the basic ways firms can alter or redeploy their resource bundles.

- **Size**: Firms can expand or contract within a particular market, relative to the total market size.
- **Diversification**: Firms can expand into, or withdraw from, different markets and industries.

- **Vertical Integration**: Firms can expand into, or withdraw from, activities that are vertically related within a single value chain.

Each of these can be generalized in terms of changes in *integration* between resources. An increase in firm size implies an increase in the integration of resources horizontally within the market, i.e., more resources are under the common control of a single firm.[10] An increase in diversification means an increase in the integration of resources horizontally between markets. An increase in vertical integration implies, of course, increased integration of resources vertically along a single value chain. Corresponding statements can be made for decreasing integration. It is important to keep in mind that we are dealing with *relative* terms, rather than absolute measures of structure.

By viewing the underlying concept as integration, rather than simply firm boundaries, we can recognize that restructuring may be *virtual*, in that many of the economic effects of restructuring can be realized without changes in ownership. For example, McKesson's Economist can be viewed as virtual forward integration: the strategic network of McKesson and its customers achieve many of the benefits of the large chains, but without ownership (Clemons and Row 1988b).

In fact, the *form* of integration can be by ownership, outsourcing, or cooperation. The first two are the traditional hierarchies and markets of transaction cost economics fame (Williamson 1975). Cooperation is meant to include what Malone, Yates and Benjamin (1987) call "electronic hierarchy" and what has been called "strategic network" (Thorelli 1986). These forms are slightly different for horizontal, as opposed to vertical, interactions.

The form of resource integration (ownership, outsourcing, or cooperation) depends in part on the initial resource positions. Small players that are severely disadvantaged in certain key resources may be acquired or forced into bankruptcy; alternatively, they may be forced into virtual consolidation in the form of consortia or reliance upon vendors. For example, the members of the NYCE ATM network formed a joint venture to generate the scale and geographic coverage necessary to compete with Citibank. Likewise small brokerages and banks find it advantageous to purchase back office processing from larger banks and other third parties, since internal development and operation would be prohibitively expensive, given their lack of scale. Clearly, multiple modes of integration can co-exist within an industry.

It is important to realize that any change in a firm's structure is usually accompanied by related changes in other firms. Economic restructuring must be viewed in this holistic way. For example, if a firm increases in size relative to the market (i.e., increases its market share), some other firms are contracting relative to the market, or exiting. Similarly, if a firm gets wider, for example, by offering a service to several industries, then either existing companies offering that service are getting smaller, or existing companies that consume that service and had performed it internally are now getting narrower.

In the following sections we will discuss the major types of restructuring and the primary economic drivers of these types in the context of IT.

4.1 Horizontal Integration of Resources within a Market

Changes in the horizontal integration of resources within a market is perhaps the most straightforward of the basic forms of restructuring. The primary economic driver of concentration within a market is the desire for *scale economies*. Scale economies increase when the productivity of a fixed factor of production is increased. In general, IT contributes to increasing scale economies both as a resource itself and as a mechanism for coordinating other resources. IT is, therefore, a pressure for increasing concentration in most markets.

As a strategic resource, IT exhibits large inherent scale economies in both development and operation. This may seem obvious, but it is of critical importance. Software, like information, is a public good, in that use does not reduce the value of the resource. The marginal software development cost of installing a branch automation system in an additional branch is close to zero. Similarly, the marginal cost of processing an additional transaction in a data center also approaches zero.

Due to these scale economies, there should be pressure for increased concentration of the IT resource. The amount of pressure should be related to the importance of IT to the business and its cost relative to other costs. There are three forms this concentration could take: *ownership consolidation*, *outsourcing*, and *cooperative supply*. The modes chosen depend on the potential economies of integration, the initial resource positions, and transaction costs in transferring the services of the resource. All of these modes can exist at once in any given industry.

We would expect that resource integration through *ownership consolidation* would increase with the importance of the IT applications to the core business, with the potential of IT economies of scale, and with the initial resource position (e.g., market share or other measure of relative scale). In other words, the larger the company (relative to competitors) and the more critical the IT resource, the more we would expect to see an aggressive ownership consolidation strategy. The observed ownership consolidation occurring in IT intensive industries, such as banking, securities and other financial services, is consistent with this statement. This was particularly acute in securities firms following the 1975 deregulation of commission

rates. Small competitors, without the resources to develop and operate the applications efficiently, are under pressure to either be acquired or merge (Clemons and Row 1988b).

Where the transaction costs of accessing the resources are low relative to the savings from scale economies in the resource, and the risks of dependence are low also, other options are available. Smaller competitors may *outsource*, that is, acquire the services of the resources from third parties. These third party vendors may be larger players from within the industry or from industries with significant overlap in the key resources (see the discussion on diversification below). Again, the financial services industry is a good example. Many large players, such as Merrill Lynch and PNC Financial, provide IT support to smaller players in their industry.

Smaller competitors may also form *consortia* or other *cooperative ventures* to compensate for a resource disadvantage. Cooperative ventures are most frequently observed when there are substantial benefits to resource concentration, but no player has the resources required by themselves, and when there are factors that argue against outsourcing. This occurs when there are substantial risks that the vendor will be in a position to exploit the firm's dependence at some point in the future (see, for example, Klein, Crawford and Alchian 1978). Cooperative ventures are most common as a defense against dominant players. New York's NYCE ATM network is an example. NYCE was formed largely as a response to the dominant position Citibank had in ATMs.

Another very strong pressure for concentration of IT resources can come from *network externalities*. Network externalities exist when the value of a system is dependent on the number of participants in the system. Systems that handle interactions between customers and suppliers may exhibit such economies, since the value of the system to the customer may depend on the range of products or suppliers participating. The key example here is the airline reservations systems. The network externalities are so significant that all systems feel they must list all major airlines, even competitors. Bank ATM networks also exhibit significant network externalities, since the value of the network to users increases with the number of banks participating.

Where network externalities and scale economies are significant, it is unlikely that the industry will support many competing systems. At the same time, such a monopoly or oligopoly situation is extremely threatening to most players in the industry. In these situations cooperative ventures appear to be a stable solution. Airline reservations systems and ATMs are again excellent examples. One of the two dominant airline reservations systems in the US (Covia, formerly United Apollo) is now co-owned by multiple airlines. Attempts by the second system to open ownership up to other airlines were recently derailed by the Justice Department. Amadeus and Galileo, in Europe, and Abacus and Fantasia, in Asia, are all joint ventures between multiple airlines. Similarly, in most major markets, ATMs have consolidated into one or two cooperative multiple-owner networks. A seeming exception to this is the MAC network in Philadelphia, a monopoly network that is wholly owned by Philadelphia National Bank. The single owner form of MAC can largely be explained by timing. MAC was an early shared ATM network, initiated years before NYCE, and before many of its participants realized the strategic importance of ATM service to their retail operations. They were therefore willing to accept the risks associated with outsourcing from a competitor (Clemons 1989). Also, closer examination reveals that there is now a governing board made up of MAC's member banks. Additionally, the network resources are still owned and operated by the member banks, constituting a viable threat of defection and thus constraining MAC's ability to exploit its monopoly position.

So far we have focused on IT as a resource subject to scale economies, but IT can also exploit scale economies in other strategic resources. Potential scale economies may exist in some key resources, but not be exploited due to transaction costs in transferring the services of the resources. IT may reduce these transaction costs, enabling potential scale economies to become realized. For example, Hewlett Packard, the electronics giant, utilizes a very decentralized structure. Operating units are very focused and autonomous. However, there is a significant overlap in components and other inputs among these diverse businesses. HP has implemented a purchasing system that allows central purchasing of these common components, while not compromising the autonomy and flexibility of the operating units. The system also tracks component quality across divisions to aid in supplier negotiations and integrates component demand schedules to improve coordination with supplier's production schedules. This system exploits economies of scale, scope and specialization in purchasing as well as more fully utilizing HP's tremendous purchasing power.[11]

Frequently the potential scale advantages that can be exploited through IT stem from load leveling of fixed resources and increased predictability afforded by scale. Otis Elevator Company operated its elevator maintenance activities decentralized by geographical region. By using IT to centralize customer service via their Otisline system, Otis Elevator was able to greatly improve the productivity and utilization of customer service personnel. Moreover, the system enabled better planning and allocation of maintenance resources and information useful in marketing and product planning. The result was lower costs and greatly enhanced customer service (Stoddard 1987). Similarly, McKesson used the data captured by their Economist system to rationalize warehouse and delivery operations with dramatic results (Clemons and Row 1988b).

Again, these economies will create pressure for resource consolidation. In these cases, alternatives to ownership consolidation are more difficult. This is primarily due to higher transaction costs in transferring the services of non-IT resources. However, examples do exist. Abbot Laboratories and 3M have formed an alliance for joint ordering and distribution of their products (Muller 1988). This cooperative venture shares not only the systems, but physical distribution resources.

Will IT ever lead to fragmentation of a market? We argue that it would be rare for IT to lead to fragmentation, although IT may allow a fragmented market to remain so. From time to time the argument is made that a new technology will lead to a populist "fragmentation" -- see, for example, early literature on CATV and cellular radio. Often, other reasons and other factors, such as economies of scale in marketing, lead to the opposite result.

Note that by outsourcing or forming cooperative ventures, two related structural changes are occurring. First, the resource is becoming more concentrated in the market. Second, the firms outsourcing have shortened their value chains, i.e., reduced the activities in the value chain which they perform. In other words, a scale-intensive resource can consolidate without affecting the fragmentation of other activities. An example is ATMs in the banking industry. ATM services have consolidated in most markets,[12] but the networks have not exploited this concentration to earn extraordinary profits. Access to these services is affordable even to most small banks. As a result, ATMs do not create significant pressure for bank consolidation.[13]

This phenomenon of outsourcing may be more common where the resource is IT, due to the low transaction costs involved in IT services. When data are already in machine readable form, it is easy to outsource. In fact, we have seen examples where firms may outsource discontinuous portions of a single value chain. Maybe the best documented example of this is in guaranteeing student loans, where some steps are performed by the originator, and some performed by the guarantor; the outsourced steps are not, in general, contiguous steps in the loan servicing process (Kimbrough 1989). When the resources being integrated are tangible, such as warehouses and trucks, it may be more difficult to outsource. We will return to the issue of such "outsourcing" when we talk of vertical disintegration.

4.2 Horizontal Integration of Resources between Markets

The horizontal integration of resources is not limited to a single market. Where similar resources are employed in several markets or industries, it may be possible to utilize IT to integrate these resources, realizing considerable economic benefits. These economic benefits may be creating scale advantages in resources that are similar in multiple markets, reducing average units costs. However, diversification can also create scope economies where the value of the integration is greater than the parts independently.

The resource being leveraged between markets may be IT itself. In this case, the benefits may come from scale economies in the IT. McKesson has leveraged its drug distribution systems and expertise in other industries, such as office supplies distribution. Here, scale economies in IT development are obtained through *technology transfer* between markets or industries. It is also possible to realize scale economies in IT *operations* by integrating IT resources between markets. McKesson is attempting this with its efforts to create super-distribution centers, combining operations for multiple distribution businesses (Clemons and Row 1988b).

This integration between markets can take on any of the forms that integration within a market can: ownership consolidation, outsourcing, or cooperative agreements. Again, IT can reduce the transaction costs sufficiently to allow potential economies of scale in other, non-IT resources to be realized. The discussion in the previous section is also relevant here.

The cooperative agreements in the airline industry, such as the recent agreements between SAS and Texas Air (Ott 1988) or British Air and United (Banks 1988), are good examples of cooperative arrangements between markets. While these airlines do not compete directly,[14] they can share airport facilities and marketing efforts, reducing costs. Moreover, shared facilities and shared flight codes allow each airline to funnel customers to the other in a reciprocal fashion: SAS is a feeder for Continental and vice versa. This type of arrangement is becoming increasingly popular in the industry. IT plays a critical role in implementing this integration.

Provident National Bank in Philadelphia performs back office processing for small brokerage firms. Similarly, State Street Bank in Boston has a major position in securities custodial services. Such outsourcing between markets appears very common in financial services due to the high overlap in the resources required in the different markets. Even firms outside the industry, such as ADP and McGraw-Hill, perform services for small players in financial services. We expect outsourcing and cooperation between markets actually to be more common than within market, since there is less likely to be anti-trust limitations or competitive concerns.

In the above discussion, similar resources are being integrated between markets and industries. These economies are scale economies made possible by the firm's scope. IT can support such economies either by increasing the scale benefits of the resource or by decreasing the transaction cost of coordinating resource utilization between markets.

In some cases, integrating dissimilar resources between markets can provide an alternative form of economies of scope, where the integration results in a product or service whose value is greater than the combined value of the constituent parts separately. Merrill Lynch's CMA is a classic example of this, where banking and brokerage services were integrated in a single delivery system (Clemons and Row 1988a). The airline CRS also appears to have a "super-additive" value function with the addition of hotel and rental car reservations. The value of this combination is more than just combining reservations for these different functions: it is a platform for integrated trip management services. Exploiting this source of scope economies was central to the ill-fated Allegis strategy, leading to Ferris's ouster and the spinning off of Allegis's non-airline businesses. Although Wall Street frowned upon this strategy, other firms have not. In particular, SAS is pursuing services that integrate the handling of baggage, reservations, ground transportation and boarding cards. It recently acquired a 40 percent interest in the Intercontinental Hotel chain. SAS is also consistently the top ranked airline in terms of customer satisfaction.

The effect of IT on the form and mode of resource integration between markets is more difficult to generalize and predict than that within a market. The great variety of possible resources makes between-market forms of structural change much more context-specific than those within a market. This is particularly true of increase in value from integrating dissimilar resources.

4.3 Vertical Integration of Resources

Vertical resource integration refers to the transfer of goods and services along a single value chain. Vertical integration is driven by the balancing of production economies and transaction costs, as in the horizontal case. But in the vertical situation, decreased transaction costs or increased production economies leads more to resource *disintegration*.

Malone, Yates and Benjamin (1987) first pointed out that if IT reduced transaction costs then IT should lead to more market-mediated transactions, i.e., reduced vertical integration. They also pointed out that where there is some benefit to close vertical coordination, there is likely to be an electronically implemented sole supplier relationship, which they call an "electronic hierarchy." Our work here is consistent with their views.

As we discussed above, IT can lead to vertical disintegration (outsourcing) in access to strategic resources when a firm is at a scale disadvantage in operating those resources (compared to larger competitors or other vendors) and it is prohibitive to acquire the resources necessary to be competitive.

Where IT is the resource, or where IT is the mechanism for delivering the services of the resource, the mode of the disintegration is likely to be a stable cooperative contractual relationship (electronic hierarchy), rather than a competitive one (electronic market). We can think of no examples of IT leading to fully competitive disintegration for access to resources. There is a reasonable argument supporting this result. Contractual sourcing will be preferred over competitive sourcing when the economies of an assured relationship outweigh the improved price (less search costs) that could be obtained from competitive search. Where the product in question is access to a fixed resource, it appears rare that competitive sourcing will be preferred. Imagine a bank bidding for an ATM network daily,[15] or deciding who will perform back office processing on a transaction by transaction basis. For resource access, the sophistication of the interface, the need for record keeping, the expense of training, and the value of a relationship over time argue for long term contractual relationships, even for commodity resources.

IT can also lead to vertical integration of resources. What is required for this to happen is a decrease in production economies of scale relative to transaction costs. An excellent example of this is desktop publishing and other graphics services that are increasingly being brought in-house.

5. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

Changes in industry structure are usually very complex. It is difficult to classify these changes at a level high enough to allow reasonable generalizations, yet detailed enough to permit explanatory or predictive analyses. We think the discussion above fits these criteria.

The basic message is that, in many cases, resource positions may be more relevant to long-term survival and profitability than being leading edge in IT. Where a firm is at a resource disadvantage with respect to information systems, it should look very carefully at development projects to see whether outsourcing or cooperative development and operation may be more appropriate. This will usually be the case where

- the system is, or is likely to become, a commodity service (i.e., a strategic necessity);
- the system is subject to considerable scale economies in development or operation;
- there is a low transaction cost in acquiring the service.

In particular, when a vendor exists that is not a direct competitor, now or potentially in the future, and the application is not critical to a core business, outsourcing is more likely than cooperative agreements.

When a firm is at a disadvantage in terms of tangible resources, systems may still play a crucial role in addressing this disadvantage. Systems can be used to mitigate a resource disadvantage by coordinating resources with other business units within the firm or with other companies with needed resources. For example, the cooperative agreement between SAS and Texas Air provides each with needed feeder routes.

A key implication of this discussion is that it may become increasingly difficult to ignore inter-relationships between markets and between business units within firms. As competitors continue to exploit potential economies in resource integration, particularly between industries, a much more holistic approach towards planning and strategy may be required.

The approach does not tell what specific resources can be integrated to provide the economies discussed. The variety of resources and products in the economy is much too vast for that level of detail. However, we think that this approach does provide guidance in the search for opportunities as well as in evaluating potential ideas.

Clearly we have not rigorously established the external validity of our approach. Instead, we have used examples to demonstrate the plausibility of the theory. More rigorous empirical investigation is required.

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7. ENDNOTES

1. Of course, there are various feedback loops. For example, firms can invest to increase entry barriers, so conduct can influence structure. These complications are not relevant to the present discussion.

2. It is for this reason that we use the term *economic structure* rather than the more familiar *market structure*.

3. A classic critique of the assumptions of traditional IO is by Nelson and Winter (1982). We will return to their proposed solution below, when we discuss the new institutional economics.

4. This term was first used by Wernerfelt (1984), but the theoretical roots of this view stretch back to Penrose (1959), who first suggested that firms should be viewed as a collection of resources.

5. Contrast this with the traditional micro-economic assumptions of optimizing agents with perfect information in a single period equilibrium.

6. Grossman and Hart (1986) explicitly include profitability in their formal model of vertical and lateral integration. However, their work is specialized and does not attempt to be a generalized extension of transaction cost economics to handle firm profitability.

7. This view is evolutionary in the sense of Nelson and Winter (1982): current actions depend on the history of the process to date, which is completely represented as the stock of resources possessed.

8. Market share is not a resource, per se. However, we use the term to denote the customer relationships, market presence, and physical facilities necessary to obtain and maintain that share.

9. A resource is specialized in the sense of Williamson (1975) when it involves significant non-reversible investment. Transaction costs are high because of the risk and difficulty the party making the sunk investment assumes and must insure against for successful contracting. In such cases, it may be more efficient to acquire a more general resource and specialize it internally.

10. This assumes market size is constant.

11. This example is based on unpublished studies conducted in 1987 and 1988.

12. For example, MAC in Philadelphia, NYCE and Citibank in New York, Baybanks and Yankee 24 in Boston.

13. Of course, there are other pressures for consolidation.

14. That is, they are not competing in the same markets.

15. Experience indicates that, in regions where competing ATM networks exist, it is extremely rare for a bank *ever* to switch networks.