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From Hierarchies to Network Firms

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Over the past quarter-century, organizations' growing reliance upon networking technologies has brought about a deep transformation of economic activities. Information networks, once considered merely a utility like water or natural gas systems, moved centre stage during that period to become strategic infrastructures. From a technological standpoint, digital convergence was the fundamental enabler of this transition. Telecommunications and computing became more alike: networks were built upon digital technologies and increasingly served to interconnect computers, while computers relied ever more upon networks to support their basic operations. Software, at the heart of the resulting digital networks, made it possible to create new communication applications for individuals or organizations to collaborate and compete. Software also came to define network configuration – the set of rules determining who can communicate with whom, to do what and under which conditions – so that ownership of the underlying hardware alone no longer guaranteed control of the network's uses. The result was a fast-evolving, software-defined, indispensable, and increasingly capable information infrastructure: the 'new media' of much economic activity, our focus in this chapter.

While the information networks born of digital convergence spread through all economic sectors in developed countries, their deployment and implementation have taken many forms. A range of factors, such as the nature of pre-existing economic arrangements, the state of the national communication infrastructure, or national telecom policy, have influenced and shaped the deployment of intra- and inter-organizational networks. As a result, while the new media share a common technological lineage, they have been put to a variety of uses in organizations, with diverse consequences. For example, digital networks have been used at times to reinforce central coordination and at others to enable decentralized power; to buttress existing organizations or to invent new ones; to strengthen long-term, stable economic partnerships or to support fluid, fast-changing virtual teams.

At the individual level, new media networks permit new work arrangements overcoming time and space constraints (Morton, 1991; Sproull and Kiesler, 1991; Wigand, 1997), allowing firms to cut costs associated with coordinating dispersed geographical facilities. These network-enabled work arrangements are said to result in increased job satisfaction and empowerment (Sproull and Kiesler, 1991; Malone, 2004), and provide access to a wider pool of potential employees, unlimited by geographical constraints (Cash et al., 1994).

At the firm level, new media networks make multiple kinds of reorganization possible.

They are said to yield faster response time to market changes (Lucas, 1996), better maintenance and access to organizational memory (Morton, 1991), improved leverage of organizational knowledge (Carayannis, 1998; Finholt, Sproull and Kiesler, 2002), speedier and more efficient information flows, better coordination of group communication, greater employee participation, rapid scheduling, efficient task assignment and reporting, enhanced communication across hierarchical levels, and enhanced coordination of communication within dispersed groups (Sproull and Kiesler, 1991). They also help improve dispersed employees' organizational commitment by acting as a 'window on the corporation' and enabling better socialization of new organizational members.

In addition to improving existing organizations, the new media networks are said to permit entirely new organizational forms. First among such IT-enabled organizational forms is the networked organization where all participants are linked (Rockart and Short, 1991) and the organization flexibly reorganizes itself around each new task (Baker, 1992). Networks also play a crucial role in the establishment and maintenance of internal and external linkages, transforming hierarchies and markets. The network organization thus extends beyond the boundaries of individual firms to form a wider network of multiple organizations (Malone and Laubacher, 1998), increasing interdependence within industries (Rockart and Short, 1991). This state of increased communication between suppliers, distributors and business partners (Cash et al., 1994; Lucas, 1996) supports improved interorganizational arrangements such as strategic networks and the Japanese *keiretsu*, and timely cooperation forms such as joint ventures and consortia (Wigand, 1997). At the extreme, the network model leads to virtual organizations (Davidow and Malone, 1992; Malone, 2004), composed of a set of loosely coupled, self-organizing networked individuals in geographically dispersed locations. New media would thus usher in an 'e-lance' economy (Malone and Lanbacher, 1998; Malone, 2004), where individuals or autonomous groups come together around specific projects.

The present survey of the new media impact on industrial organization is structured in three sections. It begins with a review of the economic hopes that were pinned on the technology, in particular on its potential to increase productivity. It then examines how the impact of new media on industrial organization has been analysed, through their impact on two organizational archetypes – markets and hierarchies – and their enabling of an alternative, the network organization. The final section looks at how this analysis fits with the facts in a few emblematic case studies.

NEW MEDIA AND ECONOMIC PROMISES

The convergence of computing and telecommunications into new communication media became clear in the mid 1970s. Observers coined new terms to describe this emerging information infrastructure, such as the French *télématique* (Nora and Minc, 1978) or its less euphonic English cousin 'compunications' (Oettinger and Weinhaus, 1979). The new networks promised to create a foundation for the emerging information economy (Porat and Rubin, 1977), an economic system that would rely increasingly on information-based processes as part of production and exchange activities. In this 'post-industrial' society (Bell, 1973), agriculture and manufacturing would no longer be the basis for economic power. Instead, knowledge workers would make the greater contribution to value creation. As a result, the new media network infrastructure would become the essential backbone of economic activity and control (Beniger, 1986). It would thus usher in new ways to organize economic and social life, leading to the emergence of the information economy (Porat and Rubin, 1977) and the network society (Castells, 1998).

One crucial expectation in these formative years was that reorganizing the economy around information technology and networks would yield tremendous productivity increases, which would more than justify the investments required. Yet, throughout the early years of

technology deployment, productivity gains proved elusive, prompting economist Robert Solow's (1987) quip that 'You can see the computer age everywhere but in the productivity statistics', the so-called *productivity paradox* (Brynjolfsson, 1993; David, 1990). In part, the sweeping claims inspired by information technology resulted from a propensity 'to suffer from a kind of "telescopic vision": the possible future appears both closer at hand and more vivid than the necessary intervening, temporally more proximate events on the path leading to that destination' (David, 1989: 5). Three broad categories of explanations have been offered to explain that situation: mismeasurement of real output growth, poor understanding of the true benefits of computers, and underestimation of the learning and adaptation required (David, 2000).

Brynjolfsson (1993) points out prevalent measurement errors in the formulation of the paradox. Productivity statistics do not account for the type of productivity gains that result from information technology deployment, such as increased quality, speed and responsiveness, and increased business scope. Increased scope in particular is problematic because it reduces economies of scale and often appears as a decrease in productivity despite the business's increased value to customers. Hitt and Brynjolfsson (1996) suggest that three questions should be asked: whether IT has increased productivity, whether it has improved business profitability, and whether it has created value for consumers. When separating these questions, they find that IT investment increased production output, failed to increase profitability, and significantly increased consumer value. Increased productivity leads to increased competition, which in turn leads to lower profitability. Productivity gains can also be achieved through Furthermore, some of the benefits of computing that may impact firm growth are intangible, such as employee satisfaction and increased consumer and investor confidence (Brynjolfsson, Hitt and Yang, 2002). In more recent research, the authors find that the long-term benefits of computerization are much greater than the short-term impact on productivity (Brynjolfsson and Hitt, 2003).

Further, information technology alone doesn't guarantee productivity gains. Indeed, organizations can worsen their productivity if they simply deploy computer networks to automate old processes (Brown and Hagel, 2003; Brynjolfsson and Hitt, 1998; David, 1990). Once new organizational processes and skilled labour are combined with IT, productivity gains become apparent (Bresnahan, Brynjolfsson and Hitt, 2002). A more realistic view of IT's benefits is to recognize that technology is just one element, not a single determinant, of the thorough business transformation required to improve productivity (Brynjolfsson and Hitt, 1998). In addition, the new media constitute a complex interrelated system. Benefits in one part of that system often require compatibility and standardization with deployments in other parts of the system as well as previous systems deployments, and the overall infrastructure is highly dependent on network externalities (David, 1990). New media systems also require the presence of complementary assets, such as trained users, to be used effectively. As a result, 'the emergence of a new techno-economic regime based on computer and communications innovations will be a protracted and historically contingent affair' (1990: 356).

As the new media networks emerged, the traditional Fordist firm and the interorganization coordination mechanisms that went along with it began reaching their limits (Cohen and Zysman, 1987). Organizations required greater flexibility, both static and dynamic, to adjust to new competitive environments (Coriat, 1994). This prompted the emergence of new organizational forms, made possible by network technologies (Piore and Sabel, 1984; Antonelli, 1992). Overall, however, the emergence of the network society is not simply driven by the deployment of a new media infrastructure. Rather, it represents a broader transformation, made possible by the development of new ways to organize production and exchange activities. In this reorganization, the new media are a critically important element, but only one element. They support change as they enable the design and implementation of new organizational forms and permit a rearticulation of production processes. They also suggest further change, as

the digital network's increasing flexibility lets end users experiment directly with diverse communication configurations and the organizational arrangements they imply (Bar, 1990). In the end, the key to overcoming the productivity paradox resides in the ability to reorganize around the new media. The other chapters in this part explore this reorganization process within work groups and firms. We focus here on the broader reorganization of interactions between these entities and its implications for industrial organization.

UNDERSTANDING THE IMPACT OF NEW MEDIA ON INDUSTRIAL ORGANIZATION

An understanding of the impact of new media on the organization of economic activity starts with the fundamental theory that explores the reasons behind specific patterns of economic organization: transaction cost economics (TCE). Oliver Williamson (1975) formulated transaction cost theory, building on the work of Coase (1937), to identify the most efficient governance structure according to the varying nature of transactions between firms. He identified two extreme forms of organizations: markets and hierarchies. Markets provide a decentralized, self-governing structure within which firms can find partners and negotiate specific transactions, allowing for fluid changes in patterns of economic interaction. Hierarchies, by contrast, represent rigid, centrally governed structures within which economic actors interact in a stable and predictable fashion. According to transaction cost economics, the relative costs of setting up transactions between actors within these two extreme organizational structures leads to the choice of one over the other. Because digital networks increasingly support these interactions, they can affect the relative cost of market and hierarchical transactions, thereby resulting in changes in previous industrial organization.

Transaction cost theory is based on two key assumptions: bounded rationality and opportunism (Williamson, 1996). Actors engaged in transactions are rationally bounded and are therefore unable to process large amounts of information and consider all the alternative choices, leading to satisficing behaviour, or opting for a 'good enough' action (Simon, 1957). Applied to TCE, this means that 'all complex contracts are unavoidably incomplete' (Williamson, 1996: 37), with the risk that extra transaction costs can occur down the road because of missing information. Thus, a major purpose of organizing is the attempt to compensate for bounded rationality and to reduce opportunistic behaviour among the involved actors, establishing the relative stability necessary for long-term planning.

Hierarchies offer lower transaction costs, reduce opportunistic behaviour and mitigate the downsides of bounded rationality through a higher degree of administrative control (Williamson, 1975). Indeed, it is easier to resolve disputes internally and therefore transactions contracts can be left more incomplete than in the case of markets (Williamson, 1996). Markets by contrast, organized around spot contracts, reduce transaction costs in the case of products of a low degree of specificity, whereas hierarchies are appropriate for highly specific products (Williamson, 1975; 1996). When complexity, uncertainty and specificity increase, more information processing is needed. Hierarchies and centralized communication structures are more suited to the processing of such complex information.

Obviously, most of these transaction costs result from the acquisition, processing and transmission of information about products, production and work processes, or about the qualifications of economic partners. Therefore, because new media precisely aim at transforming information activities, they can be expected to have significant effects on these costs. Thus, transaction cost economics has been applied to understand the impacts of new media on economic organization. But if digital networks clearly have the potential to improve the functioning of both hierarchies and markets, their ultimate impact on economic organization is more controversial: will the new media result in more hierarchies, more markets, or new organizational forms?

Better Hierarchies

One effect of digital network technology on economic organization has been to promote the creation of 'electronic hierarchies' (Malone et al., 1987). Digital networks allow tighter coordination between organizations within the same value chain, leading to greater vertical integration (Clemons and Kleindorfer, 1992). This integration may be virtual (realized simply through tight interorganizational information networks), or formalized through corporate structures or cross-ownership. In either case, this leads to hierarchies where buyers work with stable, predetermined suppliers (Malone et al., 1987). Some analysts have described the electronic hierarchy as an 'electronic monopoly', reflecting the exclusive buying relationship established with a supplier (Chodhury, 1997). For example, Clemons and Row (1992) report the quasi-vertical integration enabled by network technology between Procter & Gamble and Wal-Mart. In this electronic hierarchy, P&G has electronic access to all sales data, and is able to deliver inventory to Wal-Mart as needed, enabling Wal-Mart to avoid the cost of holding inventory and order processing.

This is an example of what Malone et al. call the 'electronic integration effect' of the new media, where companies articulate tightly coupled processes around information networks. The electronic integration effect is most typically produced in electronic hierarchies (Malone et al., 1987). Indeed, it permits a level of integration that is not possible with other interorganizational networks, enabling the optimization of the integration of the total value chain (Chodhury, 1997). The supplier, through this exclusive relationship, is able to collect a significant amount of information about the buyer's needs and integrate its processes to those of the buyer to better meet those needs. However, the buyer loses the potential advantage of being able to scan the market for the better offer, which is characteristic of the market form of network governance (Chodhury, 1997).

More Perfect Markets

The same digital networks can also serve to build electronic markets. These 'e-markets' are also said to lead to the elimination of intermediaries, acting as electronic brokers that put buyers in direct communication with sellers (Malone et al., 1987). The resulting disintermediation, combined with more intense, 'friction-free' price competition, could lead to more perfect markets (Bakos, 1996). However, as some analysts have speculated, while existing intermediaries may be eliminated or forced to adapt, new types of electronic intermediaries will emerge. Bakos (1998) foresees the emergence of intermediaries that will match buyers and sellers, provide product and customer information to interested parties, and manage physical delivery and payment functions.

Indeed, network technology has the potential to lead to an economy organized around constantly emerging electronic markets (Benjamin and Wigand, 1995; Keen, 1981; Malone et al., 1987). Malone et al. have formulated the 'electronic markets hypothesis', arguing that in addition to reducing production costs, IT will reduce coordination costs usually associated with markets. In that view, an electronic market is a multilateral interorganizational information system that, because of the scalability of the new media, can link a potentially unlimited number of buyers and suppliers (Choudhury et al., 1998). Hence, the digital network serves the function of market (Benjamin and Wigand, 1995). The network itself becomes the marketplace (Bar, 2001). This form offers price competition advantages, while offering little opportunity for electronic integration between buyer and supplier, since they engage in constantly reconfigured spot transactions rather than long-term relationships (Chodhury, 1997).

A firm will set up or join an electronic market if it assumes that the profits to be realized from a large volume of potential buyers are greater than the potential loss caused by lowering prices due to increased competition (Benjamin and Wigand, 1995). Malone et al. (1987) suggest that digital networks lead to an 'electronic brokerage effect', where electronic markets can act as brokers, resulting in an increase of possible quality alternative suppliers and buyers and a decrease in the cost of the

selection process (Bakos, 1998; Benjamin and Wigand, 1995; Malone et al., 1987). This will potentially have the effect of eliminating intermediaries between the manufacturer and the buyer (disintermediation), as the information superhighway will enable direct market contact between manufacturer and consumers (Benjamin and Wigand, 1995). Besides the reduction of coordination costs, the emergence of markets will result from IT's ability to simplify complex product descriptions for highly complex products that were usually traded through hierarchies.

While traditional intermediaries between manufacturers and sellers are disappearing, there is a significant cost to consumers in the electronic marketplace of acquiring all the information necessary to identify sellers and compare prices. Hence, new intermediaries are emerging. The number of firms that have positioned themselves as the intermediaries of electronic markets have grown substantially in recent years. Auction giant EBay, Amazon.com, Yahoo!, and Shopping.com are such firms positioning themselves as intermediaries where individual sellers and buyers meet and exchange goods. These intermediaries enable sellers of all sizes to access immense pools of consumers. These firms have found that profit-making in the electronic marketplace is more readily achieved by acting as the meeting place of a community of sellers and buyers rather than holding inventory themselves (Leschly, Roberts, Sahlman and Thedinga, 2002; Yin, 2004).

Beyond Hierarchies and Markets: Network Organizations

As new media transform traditional markets and hierarchies, pure examples of these two forms become more elusive. Indeed, hierarchical organizations increasingly rely on network-based, market-like processes to coordinate the work of their employees and work groups, or to conduct business with the clients, suppliers and subcontractors that constitute their extended hierarchy. Likewise, many network-based markets depend on features traditionally associated with hierarchical organizations, combining the market's arm's-length dealings with tighter longer-term relationships among market partners, including for example the pre-qualification of buyers and sellers who become part of the market's inner circle, or the establishment of a hierarchy of markets for the governance of subtasks. Confronted with such evolution, transaction cost economics tends to view these new organizational forms as hybrids of market and hierarchy.

However, others argue that we are witnessing not simply the combination of traditional markets and hierarchies, but the emergence of a distinctly new form of economic governance, the network organization (Antonelli, 1992; Jarillo, 1988). Because networks allow a distinct form of economic governance, transaction cost economics and its focus on dyadic relationships (Williamson, 1996) is ill-suited to the study of network organizations (Powell, 1990). The main distinction they identify between the new network form and the traditional markets and hierarchies is the nature of relationships between actors. In a network, independent actors cooperate on a long-term basis, and the relationship is based on trust and goodwill. In a hierarchy, relations can be long term, but a specific authority is identified as having the ability to resolve arising disputes. In a market, relationships are episodic, and last only for the duration of a specific transaction (Poldony and Page, 1998).

Network organizations existed before the emergence of the new media (such as, for example, in northern Italy's textile industry: Piore and Sabel, 1984). Digital networks however have proven essential to the more widespread adoption of new network forms of organizations. Castells suggests that digital networks favour a distinct form of organization, the network enterprise, which he defines as 'that specific form of enterprise whose system of means is constituted by the intersection of segments of autonomous systems of goals' (1998: 171). This organizational form is characterized by long-term exchange relations, but with the absence of an ultimate authority to arbitrate possible disputes (Poldony and Page, 1998). By reducing transaction costs (Ciborra, 1983; Jarillo, 1988), and more specifically coordination costs, digital

networks 'can facilitate the development of stable, tightly coupled relationships among firms' (Clemons and Kleindorfer, 1992: 10). Involved in a network relationship based on long-term trust, a firm does not have to worry about opportunistic behaviour on the part of other firms in its network. The use of network technology to support the network form can further reduce transaction costs through a fast and tight coupling of the participating firm's processes.

Various strands of the literature analysing new media's impact on industrial organization tend to adopt a deterministic approach. Extrapolating from the characteristics of the new media technology they investigate, they predict corresponding characteristics of the organizations that use them. Individually, when looking at particular economic sectors or at specific organizational arrangements, these studies have assessed how the new communication technologies affect the prior balance between market and hierarchy, or promote the development of new network forms of organizations. They diverge in their assessments, some concluding that new media result in better hierarchies, some finding that new media lead to greater reliance on market processes, others showing that new media bring about entirely new organizational forms. Taken together, however, they offer a different picture. They show that new media technologies do not determine organizational form, but can in fact support a variety of different approaches to reorganization. They suggest that the resulting organizational form will be determined less by new media technology than by other characteristics of the firm's internal processes and external competitive environment. In fact, in several industries, similar communications technologies have supported different organizational outcomes in different periods, as in the cases explored below.

CASE STUDIES

This section reviews some of the classic case studies of the establishment of new media networks between economic entities and their effect on the resulting economic organization. We review some of the literature on electronic data interchange (EDI), airline computerized reservation systems, and strategic information systems. These show how similar new media systems and technologies, deployed in various circumstances or at different times, entail different organizational implications. The important variables include the competitive environment within which they are deployed, and the relative positions of the actors engaged in network-mediated interaction.

Better Hierarchies? Electronic Data Interchange

Electronic data interchange (EDI) systems were one of the earliest new media technologies aimed at enhancing interorganization interactions. First deployed in the mid 1970s, their main purpose was to facilitate the exchange of formatted information between firms (rather than free-form communication). EDI technology has diffused in certain industries and its adoption is no longer limited to large companies (Jackson and Sloane, 2003; Lee, Lee and Kang, 2005). Once two business partners agree to use a common EDI standard, they can electronically exchange highly specified messages such as parts orders, invoices or payments. The EDI standards define precise formats for data fields containing codified information including parts numbers, prices, quantities, delivery locations, shipment times or account numbers. EDI systems have made possible the automation and standardization of interorganizational communication networks (Brousseau, 1994).

The initial development of EDI standards was a laborious process, requiring painstaking definition of the information required for many diverse transactions. As a result, EDI was initially aimed at improving existing bilateral or multilateral business relationships between buyers and sellers engaged in sustained, long-term relationships. Sets of EDI standards emerged in individual industries, most notably manufacturing (principally automotive), retail and distribution (including transportation), and

banking. The high specificity of interactions between members of the related value chains made them good candidates for that technology. Early EDI deployments thus aimed to rationalize existing supply chains and impose on them a coherent governance. In so doing, EDI implementations were not meant to stop at the strict automation of individual economic relationships, but intended to reorganize broad cross-firm production and exchange processes within existing supply chains. Their goal was to create an extended hierarchy that reached beyond individual firms to include their long-term business partners. A variety of EDI standards emerged in different industry sectors, each associated with the articulation of a particular electronic hierarchy.

Over time, however, a different analysis of EDI networks would emerge. EDI systems, like all communication technologies, are associated with strong network externalities (Katz and Shapiro, 1985). Therefore, companies within one industry have economic incentives to adopt common standards in order to be able to do business with each other electronically. As a result, one would expect the different EDI standards to merge, at least within industries, creating conditions for the support of a more fluid organizational structure. Common EDI standards would enable the rapid establishment of bilateral electronic dyads or their swift dissolution, where a buyer or seller uses EDI technology to sustain links with a selected number of sellers or buyers (Chodhury, 1997). Rather than supporting extended hierarchies, EDI would then enable network forms of economic organization and could even, in extreme cases, support electronic markets.

In reality, a variety of configurations emerged in different industries, in different countries and at different times. For example in the North American automotive manufacturing industry, EDI standardization was driven primarily by the large auto-makers. Industry-wide standardization efforts were limited as each promoted a distinct EDI implementation, partly for strategic reasons (to better control their respective supply chains) and partly for lack of traditions or policies encouraging coordination. While each auto-maker was able to force its preferred system on its parts suppliers, individual suppliers who sold to multiple auto-makers had to support multiple EDI standards and incur the related costs. The result was a series of Balkanized electronic hierarchies (Bar, 1990; 1995). By contrast in the European auto industry, a combination of policy incentives for coordination, stronger industry institutions and the greater relative strength of parts suppliers led to much greater industry-wide standardization, supporting an arrangement closer to the network form of organization (Brousseau, 1996).

These examples show how one technology, EDI, can be implemented in very different ways and lead to remarkably different organizational results. Brousseau (1994) further points out that organizational stability will also play an important role in the implementation of such technologies. In particular, EDI is unlikely to be successfully implemented in highly certain environments (because it would then be obsolete) or highly uncertain environments (because EDI implementation assumes some knowledge of what future communication needs will be) (1994: 337). In industries where the environment is uncertain and the business relationships must remain flexible, highly standardized EDI implementation could become detrimental by reducing network flexibility. In a case study of EDI implementation in Singapore, Teo et al. (1997) have shown that network technology can lead to a transformation of organizational structure, business networks, business scope and competitiveness. Hence, the real benefits of EDI systems reside not in the technology itself but in the restructuring of business processes and the establishment of new network partnerships (Gottardi and Bolisani, 1996). It remains to be seen whether EDI will eventually be uprooted by Internet-based interorganizational systems (Soliman and Janz, 2004).

Better Markets? Airline Computerized Reservation Systems

The airline industry provides another interesting illustration of the new media's consequences

for the organization of economic activity. Successive waves of digital network deployment have led the organization of airline reservations from hierarchy, to biased market, to less biased market, to a network organization around Internet-based systems and disintermediation. With the deployment of the first computerized reservation systems (CRSs), American Airlines' SABRE in particular, airlines controlled an electronic hierarchy that extended to travel agencies. In time, that system became more open to competing airlines and other travel service providers and came to resemble more closely an electronic market, within which travel agents could access offers from all suppliers on an equal footing. The Internet pushed the industry closer to a perfect market, where travellers are in direct contact with airlines, negotiating for prices and conditions within a more perfect market.

A closer look at airline reservation systems shows that network technology didn't drive that transition alone. Airlines encouraged the shift from hierarchy to market, hoping for greater profits by ensuring that their reservation system offered tickets from all airlines, thus making it more attractive to the customer (Dang-Nguyen, 1996). However, research suggests that even organizations which possess significant market share can suffer profit losses when joining an electronic market. Indeed, the price reductions forced on them by competitive markets reduce their profit margins, such as has been the case for the airline carriers who joined SABRE and APOLLO (American and United's respective CRSs). Here as in other cases, however, the critical mass of other joiners leaves little choice to an organization but to join the electronic market. Even dominant players such as United and American reportedly suffered a loss as a result of having to share SABRE and APOLLO with other suppliers (Benjamin and Wigand, 1995).

Competitive incentives and the pursuit of critical mass did not alone result in the creation of a (more) open market for airline reservations. Government policy provided additional inducement, when the Department of Justice's antitrust department showed that the hierarchical airline reservation systems such as the first-generation SABRE were biased toward their owner airline company (Dang-Nguyen, 1996). Overall, this evolution suggests that networking technology, while it creates opportunities for reorganization, doesn't alone determine the economic organization of a particular activity: depending on the strategic priorities of the dominant participants, and on external factors such as antitrust policy, the application of new media can lead to tighter hierarchy as well as a more perfect market as it did in the airlines case.

American Airlines generated revenues by selling their system and know-how to other companies spanning numerous industries, while still hoping to be the best at using the information strategically (Hopper, 1990). This is consistent with the proposition that in an electronic market, the profits of the market-maker and network designer will remain higher than those of other companies participating in the market (Benjamin and Wigand, 1995); the network maker benefits from 'co-specialized assets' giving it the ability to appropriate more benefits from the electronic market (Duliba, Kauffman and Lucas, 2001). Sabre became an 'electronic travel supermarket', a 'computerized middleman' (Hopper, 1990), linking suppliers and buyers of the travel and tourism industry through network technology. Benjamin and Wigand (1995) argue that policy-makers must set guidelines to regulate electronic organizations to ensure that a market-maker refrains from creating network bias in favour of a specific supplier (as was the case with SABRE).

SABRE and APOLLO have been replaced by the Internet as the electronic marketplace. The Internet has led to further disintermediation in the airline industry and a more perfect market, eliminating the role of the travel agent as airlines sell directly to consumers on websites. While some intermediaries have disappeared, new ones have emerged as new companies position themselves in the marketplace for a wider array of services. Hence, while users can buy airline tickets directly from the airlines' websites, they also enjoy the benefits of lower search costs associated with centralizing their travel purchases within a single intermediary.

Travelocity.com, Expedia.com and other sites that offer not only airline reservations but also hotel, car and other services, have emerged as the new middle-men of the travel industry.

Strategic Use of Information Technology

An important aspect of the story becomes apparent through these various examples. When companies deploy new media infrastructure and applications, they will strive to enhance their own strategic position. In some cases, this may motivate them to sponsor a sweeping rearticulation of their supply chain or a reorganization of the marketplaces they participate in. In other cases, they may encourage the formation of alliances to foster the deployment of standardized systems. Or they may choose instead to pursue isolated, proprietary technologies precisely because such lack of interoperability creates entry barriers for their competitors. In the end, their strategic response to the particular competitive challenges they face, more than intrinsic characteristics of the new media technologies they choose to deploy, will determine the organizational consequences.

There are many examples of these strategic uses of information technologies. Companies have used information systems strategically to gain information from markets and gain a competitive advantage over other firms in the market, shifting the competitive position of organizations within industries. Cash and Konsynski (1985) give the example of an automotive manufacturer who uses network technology to scan the market for the lowest possible bid for a product, thus increasing the market position of the manufacturer by driving down prices. Clemons et al. (1996) provide several cases of dominant firms losing their most profitable customers to aggressive new entrants relying on IT. Indeed, flexible new entrants rely on IT to get information from the market, to identify and target the most profitable customers of an industry.

By providing lower costs and more effective distribution channels to customers through the use of IT, these new entrants are 'cream-skimming', attracting the most profitable customers away from established firms (Clemons et al., 1996). For example, Clemons and Weber (1994) cite the example of new entrants in the airline industry who threaten the market shares of American Airlines and United Airlines, by gathering information from the marketplace, identifying the most profitable customers, and offering them lower-cost, specific point-to-point services on the most travelled routes. Indeed, digital networks dramatically reduce the cost of capturing, storing and analysing information from the marketplace. Hence, using interorganizational networks, the Inter-Continental Hotel chain is able to target its most profitable customers by capturing very detailed information on their needs and wants and sharing it within network hotels. The Inter-Continental profitable customer will therefore obtain highly catered service, whether staying in New York or London (Clemons and Weber, 1994). Similarly, following the deregulation of the London Stock Exchange, Barclays de Zoete Wedd securities firm reacted to increased competitive pressure by using an information system named Beatrice which enabled it to identify, rank and project the growth potential of its most profitable customers. The firm was then able to target the most profitable customers and offer them new tailored services, while dropping less profitable customers (Clemons and Weber, 1990; 1994). Another possible strategy is price-discrimination, in which different customers are charged different prices (Bakos, 1998). Hence, an organization can ask more from the less profitable customer, while lowering prices for the most desirable customer, and increasing profits.

This process is not necessarily at the expense of the customer since it enables organizations to serve customers that would otherwise be priced out of the market (Bakos, 1998). This is another example of digital networks being used for competitive advantage, moving from a 'one size fits all' strategy to a tailored, market segmentation strategy (Clemons and Weber, 1994). With digital networks becoming increasingly ubiquitous, organizations are becoming

less system builders than system architects, trying to gain competitive advantage from existing network structures rather than building one anew. The goal for organizations then becomes to outsmart each other in using the information network strategically (Hopper, 1990).

CONCLUSION

Our overview of the new media's impact on industrial organization shows that a diversity of outcomes can be expected. The application of digital networking technologies to economic processes of production and exchange, under different circumstances, has served to support and improve hierarchies, markets or new network forms of organization. In the effort to understand the mechanisms at work, one characteristic of new media networks is fundamental. Because the new media are built upon digital technologies, their architecture and the applications they support are defined in software. Control over their configuration is therefore flexibly separable from ownership of the underlying network infrastructure. This creates opportunities for the many actors using these networks to shape them in ways that further their competitive goals.

For the organizations involved, this ultimately boils down to an essential challenge: their ability to create relative advantage through the combination of economies of scale and economies of scope, reconciling standardized processes with rapidly changing, differentiated products and services. The resulting economic regime, which some have called 'mass variety' (Coriat, 1993), combines the search for static flexibility through adaptation to short-term market variations with the more enduring benefits stemming from dynamic flexibility. Meeting this challenge requires smart choices of technologies and work organization methods. The production systems developed around new media play an essential role in promoting better production and exchange processes, the only way to improve overall productivity, and greater flexibility in programming and reprogramming these processes.

However, new media do not dictate the outcome, nor is their implementation preordained by the technology's characteristics. Rather, they serve to suggest, supplement and support a sweeping organizational transformation of production and exchange activities, from product and service design to production methods, from marketing techniques to exchange mechanisms. For the organizations involved, this is precisely what makes the new media 'strategic'.

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