The Networked Economy: Lessons from the Trenches

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Chapter 1:

Introduction – Does the Net Change Everything?

“Everything that can be invented has been invented.”

Charles H. Duell, Office of Patents, 1899

“We don’t like their sound. Groups of guitars are on their way out.”

Decca executive, 1962, after turning down the Beatles

“Radio has no future. Heavier-than-air flying machines are impossible. X-rays will prove a hoax.”

William Thomson, English scientist, 1899

“Stocks have reached a permanent high plateau.”

Irving Fisher, Professor of Economics, Yale University, 1929

“The Internet changes everything.”

IT and networking pundits

History is full of exaggerated claims and grand assertions of imminent and dramatic change. In hindsight, it is easy to scoff at such shortsighted proclamations, but history notwithstanding, many of the impressive claims for the Internet may, in fact, prove true. An increasing body of research, including the Economic Strategy Institute’s (ESI) ongoing investigation and analysis, suggests that the Internet and associated networking technologies stand to touch nearly every aspect of social, economic, and corporate life.

Networking technologies are having a broad impact because of the importance of information as a vital component in all social and economic interaction. Networking technologies make social and economic exchanges simpler, cheaper, faster and more reliable, while
vesting them with new sources of value, both to firms and consumers alike.

Associated with the diffusion of networking technologies is systemic change among essential American institutions, such as business, education and government. The ESI Networking Technology Project has been examining the changes that networking technologies present to those institutions, in the hope that an understanding of how networking technology is affecting those institutions will elucidate the broader trends sweeping our economy and society.

With a view to investigating the changes specifically affecting corporate America, the ESI research team conducted a series of extensive on-site visits, in 1998 and 1999, with five major American corporations, in order to investigate how they are using, and being affected, by networking technologies.

The companies profiled in Exhibit 1.1 were selected to provide a range of diversity with respect to industry, company size, and the extent of network utilization.
Exhibit 1.1 – Profile of Five Companies Surveyed by ESI

<table>
<thead>
<tr>
<th>Company</th>
<th>Profile</th>
<th>Network Activity</th>
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<tbody>
<tr>
<td>Computer Networking Equipment</td>
<td>15,000 employees; $13 billion in revenues during 1999</td>
<td>Extensive network implementation throughout operations, with substantial benefits</td>
</tr>
<tr>
<td>Worldwide shipping and package</td>
<td>$2 billion in revenues in 1999; market capitalization over $10 billion</td>
<td>Development of new service, handling the inbound and outbound logistics for other firms through its own system</td>
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<tr>
<td>distribution</td>
<td></td>
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<tr>
<td>Automobile manufacturer</td>
<td>Several hundreds of thousands of employees worldwide and more than $60 billion in revenues in 1999</td>
<td>Extensive EDI system of links to first-tier suppliers and satellite links to dealers in place; uneven implementation of newer Internet-based technologies</td>
</tr>
<tr>
<td>Creates business-to-business</td>
<td>Revenues of more than $11 million in 1999</td>
<td>Business entirely online; most of its management and organization is organized through networking</td>
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<tr>
<td>communities for finding sales leads</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automotive parts supplier</td>
<td>Revenues of more than $29 billion in 1999</td>
<td>EDI links to suppliers; has not implemented significant changes in internal networking systems</td>
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During its visits with these companies, the ESI research team documented the changes being implemented by the firms, the impact of those changes, the benefits realized, and the continuing challenges faced. This study focuses on the information gleaned from the visits. Among the main conclusions:

1. Within firms, networking technologies are redefining core competencies and enabling different, and frequently more efficient, organizational structures.

2. All business activities – those within the firms, as well as those linking firms with both their suppliers and customers – are being reengineered, while their associated costs are declining.

3. Products are changing, in order to possess more informational content and to reflect dynamic consumer preferences better and more quickly.

4. Firms need strong leadership and a favorable corporate culture if they are to exploit the opportunities presented by networking technologies.
Chapter 2: Redefining Core Competency and Firm Structure

The vertically integrated corporation triumphed in an earlier era because of its ability to manage and process information efficiently in the context of complex production processes. The structure survived as the efficient organizational solution as long as the fundamental cost mechanisms for managing and processing information did not change.

Networking technologies, however, have revolutionized the economics of managing and processing business information. This revolution, in turn, is forcing firms to refocus on their core competencies and to change their organizational structure.

Redefining Core Competency

Networking technologies eliminate the difference between conducting certain functions internally and paying someone else to do them. The increasing ability to link effectively with other firms throughout a supply chain has meant that, in many cases, it is more efficient for a firm to retain and perform only those functions that it does very well, and to outsource the rest. Moreover, competition requires them to ensure that every step in the value chain is as efficient as possible, whether they perform it internally or outsource it to others.

A good example of this phenomenon comes from one company in the ESI study, a company that has traditionally focused on the design and manufacture of electronic and computer equipment. The company deployed an Extranet to outsource much of its manufacturing and assembly operations to highly efficient subcontractors. In doing so, it created with its suppliers a virtual enterprise, which permits "direct fulfillment" of manufacturing orders.

That system now accounts for 50% of the company’s unit sales, and its products are frequently shipped directly to the customer without
the contracting company ever requiring its own transshipment. Of the firm’s total workforce of 18,000, only five hundred work the factory floor. This change has allowed the company to dedicate a greater share of its resources to its own areas of expertise: the development of new products, customer relations, and consulting for its customers’ equipment needs.

Furthermore, having the firm’s manufacturing process on an Extranet allows for remote testing of products, remote design, and inventory controls, as well as publishing and sharing of forecast data. This permits a measure of immediate and continuous coordination among two hundred different companies, a feat previously unimaginable.

Those changes allow employees to concentrate on work that more directly addresses the company’s core competencies. The dividends are real: revenue-per-employee has increased at a robust rate to $660,000, and the company now leads the industry (compared to $564,000 and $465,000 for its next two closest competitors).

An additional benefit of this system is that the firm believes it can now respond more flexibly to changes in the business cycle. It no longer needs to sustain unduly large overhead or to lay off workers in the event of reduced demand, because its manufacturing capability is distributed. To secure its supply chain further against the vagaries of the business cycle, the company relies only on suppliers for whom its business constitutes less than 20% of turnover. This helps to insulate the firms in its supply chain from any temporary decrease in demand from the company, while helping to ensure that the chain remains intact for the resumption of business activity.

The large auto manufacturer ESI surveyed provides another example of how firms can use networking technologies to renew a focus on core competencies. Historically, the company was a fully integrated manufacturer, conducting most of the stages in the value chain itself. In the early 1980s, however, the firm put into place a system of electronic data interchanges (EDIs) that provided direct links to suppliers. In doing so, the company found it more effective to assume a coordination role for the design and manufacturing efforts of other firms.
The company achieved significant efficiencies by using a common computer-aided design-and-engineering system for both its internal engineering staff and its networked suppliers. The practice of "design-in-context" engineering was also adopted, so that a vehicle’s subparts would fit perfectly into larger components. If changes in a subpart were necessary, they were automatically relayed throughout the system so that appropriate adjustments could be made to the larger components. The company can now determine two years in advance if a part will fit a vehicle’s overall design.

The value of this system is frequently seen in the assembly of a new model’s first units. Those units now roll directly off the factory assembly line, whereas previously they were hand-assembled to determine whether the various parts would fit together.

These changes have resulted in an evolution of the company’s focus, allowing it to concentrate more resources and strategic effort on product design, customer relations and marketing. This has strengthened its business. Furthermore, the company is far less vertically integrated than other firms in its industry.

A third company in the ESI study has used networking technologies to develop an entirely new service. Because this firm’s traditional focus has been the physical transportation and delivery of packages, it developed an efficient, networked system for routing, tracking, and verifying the delivery of packages.

The company soon discovered, however, that its in-house system was, in fact, a new product of potentially great value. Although the system was developed specifically to run the firm’s own package-delivery operations more efficiently, it turned out to be of even greater value when viewed as an integrated logistics solution for other firms. While the company continues to operate its traditional package delivery service, it has also discovered new business opportunities in providing fully integrated inbound and outbound logistics support to other firms.

The development of such new services requires careful rethinking of corporate strategy. Managing a critical service in another company’s value chain is very different from providing a simpler product or service. Once two companies have entered into a long-term contract
for an outsourced step of the value chain, the relationship between the buyer and seller changes.

For the seller, the link to the client creates a semi-captive market. Once a client transfers a segment of its value chain to another firm, there arise significant barriers against transferring to a new supplier. From the seller’s perspective, such an arrangement creates a stable market for a high value-added service. However, such an arrangement also increases the supplier’s responsibility to deliver on contractual obligations.

Transferring responsibility for a critical business process to an outside company – and the resultant, deep sharing of information – creates codependency between the buyer and the seller. The relationship is less proximate than that between two departments in a single firm, but at the same time, it is more proximate than that between two totally independent firms. The two companies are no longer arms-length parties to a commercial transaction. Each benefits from the other’s successes, and each is vulnerable to the other’s failures. Disputes that arise cannot be thrown capriciously into court for resolution. Just as different departments of a networked company must work together in a culture of trust to realize a larger goal, the buyer and seller in an outsourced arrangement must also do so.

Moving from Vertical to Horizontal Organizational Structure

In addition to their effect on core competencies, networking technologies are also altering the internal structures of firms, enabling more efficient organizational structures by facilitating coordination among the disparate functions and units of a firm.

The pre-networked world was characterized by important barriers to information flows, even within firms. In such an environment, it was often most efficient to promote strong specialization within vertically integrated departments. Each department built up its own systems and processes, which related to its individual mission. Projects were then passed from one department to another to receive a subsequent unit’s infusion of expertise and value. As previously
discussed, the most competitive companies were those that best succeeded at vertically integrating the different segments of the resulting value chain.

Networking technologies are rapidly reducing the barriers to information flows and, consequently, reducing the costs of information sharing. This has permitted firms to turn to new organizational models. Among the innovations is the establishment of cross-departmental linkages to accomplish goals. As this has occurred, a traditionally vertical model has yielded to a more horizontal model, a change that promotes efficiency, reduces duplicative efforts, allows corporate departments to work more closely in concert, and imbues a new focus on a firm’s overall goal.

An example of this kind of change is provided by a large manufacturing company in ESI’s study that has developed cross-departmental "platform teams." Within the company, elements from several traditional departments simultaneously develop projects together. The platform-team system makes all departments aware of the project’s needs. The procurement process, for instance, is linked to the work of the other departments. As product development advances, other departments respond to the need for component parts. This has reduced the time associated with new product cycles and has improved the overall efficiency of the design process.

This same company demonstrates how platform teams can provide further benefits, because its platform teams have returned budgeted funds on occasion when they proved unnecessary. That was something of a rarity among traditional departments, which have usually guarded their budget allotments jealously.

Furthermore, as different departments increased communication with one another, they were able to identify and address problems in processes at an earlier stage, exploiting other efficiencies. For example, as disparate computer systems have been integrated under the new organizational scheme, the company has succeeded in eliminating millions of lines of software code. As a result, twenty percent of old legacy programs are removed each year because of redundancy. In another instance, different departments previously had employed nine
separate computer programs to process defective materials, but a single, integrated network has successfully replaced those disparate programs.

Companies Born on the Web

Networking technologies are not only transforming existing companies but they are also fueling the explosive growth of firms that are “born on the Web.” Many companies have quickly learned how to exploit the opportunities presented by the Internet, either developing new and more efficient ways of providing existing goods and services or developing entirely new products and services.

While much of the publicity regarding e-commerce has centered on the business-to-consumer (B2C) interface – witness, for example, the selection of Amazon.com’s founder Jeff Bezos as Time magazine’s “Person of the Year” – most of the actual commercial activity on the web has been business-to-business (B2B). Moreover, B2B remains the arena anticipating the most growth in the immediate future. Exhibit 2.1 provides a recent forecast of the growth expected for B2B activity over the next four years.
Exhibit 2.1 – Worldwide B2B Revenue Forecasts

Source: Gartner Group

For that reason, ESI included among its visits a company that was born on the web and is operating in the B2B e-commerce space.

Traditionally, there have been substantial information costs in those industries characterized by large numbers of both small buyers and sellers. Trade shows and trade publications have frequently been the methods for matching buyers and sellers in such industries, but those methods are both expensive and inefficient.

The company ESI visited uses the Internet to create virtual communities of buyers and sellers in industries with inefficient market-making mechanisms. Each industry for which they create a community consists of a large number of buyers (at least 40,000) and a large number of smaller suppliers (about 3,000 to 4,000). The company’s function is to aggregate industry demand by attracting a large number of qualified buyers to the site.

To do so, the company creates industry “yellow pages” for each virtual community, providing a list of industry suppliers, offering opportunities for advertising, and ensuring a steady stream of qualified
buyers to the virtual community. To attract further purchasers to a site, the company adds value by organizing the virtual community around an industry expert who is a source of current information.

In January 1999, the company had thirty-three communities up and running. The sites generated 36,000 leads for companies listed in the communities’ yellow pages that month, with an aggregate sales value worth approximately $350 million. This example illustrates the substantial capacity of networking technologies to organize and create markets.

Conclusion

Networking technologies allow firms to refocus strategically and to make internal management and organization more efficient, changes that not only generate significant cost savings but also allow companies to provide greater value to customers, thus enhancing shareholder value and expanding markets.
Chapter 3: Transformed Business Processes

Networking systems enable the reengineering of virtually all business activities, including activities conducted within the firm, those associated with suppliers, and those associated with customers. Their impact is manifest most clearly in compressed operating cycles, reduced cost structures, and increased customer satisfaction.

First, the improved flow of information associated with networking technologies reduces the time required to develop and introduce new products, place and fill customer orders, and complete internal tasks (e.g., closing the books at the end of a reporting period).

Second, firms are increasingly becoming price takers, because they no longer enjoy the price-setting power they formerly wielded. Their inability to raise prices motivates them to find alternative ways to sustain and improve margins, and they frequently achieve those goals by increasing productivity or by cutting costs. From a process perspective, this means developing new business methods that reduce labor costs or, for growing businesses, methods that support their growth without recourse to an increased corporate head count (i.e., scaleable solutions).

Third, as the Internet diminishes the advantages previously enjoyed by large companies, especially those related to location and access to privileged market information, a company’s relationship with its customers becomes more and more important. As Dr. W. Edwards Deming observed, it is ten times more expensive to acquire a new customer than to hold on to an existing one, and in most industries, the Internet is proving to be the Great Leveler as firms seek to attract, satisfy and retain customers. A company, therefore, that establishes an interface that appeals to customers is more likely to generate repeat business. To the extent that such interfaces employ convenient and easy-to-use web-based solutions, the companies stand to gain both from reduced costs and improved customer satisfaction.

On balance, firms aggressively deploying network-based business processes are significantly improving their competitiveness.
They receive market signals more quickly, respond to the market more quickly, operate more efficiently, and increase customer satisfaction.

In order to take maximum advantage of all those benefits, however, businesses are increasingly calling for access to increased bandwidth. Not surprisingly, as Exhibit 3.1 suggests, the coming years will likely see a major transition toward faster connectivity (i.e., local multipoint distribution service, satellite, cable and various digital-subscriber-line “flavors”). This chapter documents some successful, current efforts at network reengineering and also suggests what businesses may be able to accomplish in the future with faster connectivity.


Source: Pioneer Consulting, LLC

New Product Development
Of the companies studied by ESI, those that have used networking technologies to develop new products have enjoyed a significant reduction in both costs and time. Moreover, in those industries subject to changing consumer preferences, the compression of development cycles enables a company to move its product to market with greater confidence that it will match consumer preference.

An automobile company studied by ESI provides an example of how this works. The company used networking technology to introduce a new platform-based design process that permits teams from various departments – as well as the company’s suppliers – to work simultaneously on both a product’s development and its manufacture. The initial effort reduced the time required for new vehicle development from 48 to 39 months, and additional reductions were achieved with subsequent designs. The timesaving was also accompanied by significant cost savings. The company estimates that, compared to two decades ago, the cost of designing and launching a new automobile has been reduced by more than fifty percent after accounting for inflation.

The computer equipment manufacturer visited by the ESI researchers has seen similar savings. Its “virtual enterprise” has reduced by three months the time required to bring new products to market. Further, the time required to bring to market a redesign of an existing product has been reduced by one month. Those gains represent a reduction in new product cycles of between ten and twelve percent.

Customer Fulfillment

One high-tech company ESI visited has succeeded in moving eighty percent of customer purchasing onto the Internet, and fifteen hundred of its customers now rely entirely on the Internet as their sole purchasing channel. This web-based solution is fully automated, so that orders are processed without any human intervention, which significantly reduces the time a customer requires to place an order, the time the company requires to fill an order, and the head count devoted to taking orders. The company estimates its move to the Web has eliminated the need for seven hundred employees in order-processing, representing a
savings in direct labor costs of approximately $50 million a year. An additional benefit is greater customer satisfaction.

Given the nature of that particular company’s production process, the web-based solution was especially significant. All of the company’s end products are built-to-order from an available pool of more than 1,000 different parts and components. A key challenge faced in the ordering process is that not all parts and components are compatible with one another when assembled into a final product. Therefore, a high level of expertise is required to design a functional product for the customer.

When the process relied on order-processing staff using facsimile machines to communicate with customers, the completion of an order frequently required several weeks. Because of the incompatibility of some parts, initial orders suffered chronic error rates, frequently approaching 40%. In such cases, a series of faxes would travel back and forth between the company and the customer, until the product was finally configured in a way that ensured it would work as intended.

The company replaced that system with a web-based ordering system that features an artificial-intelligence (AI) program. By providing customers with real-time feedback on component incompatibilities, the AI feature prevents customers from placing orders for products with incompatible components. Guided by AI, the customer can change the order immediately, so that only those orders with compatible parts are forwarded ahead for assembly. This feature has permitted the company to reduce the costs associated with order processing, while at the same time accelerating order placement. Consequently, the staff devoted to taking phone and fax orders has been reduced to a skeleton crew, errors in the ordering process have approached zero, and along with substantial cost-savings, the scores on periodic customer satisfaction surveys have risen steadily.

In yet another example of the impact of networking technologies, the package shipper in ESI’s sample is working with a customer whose indirect distribution system represented 18% of its cost of sales. The shipping company, by adapting its efficient, network-based, logistics management system, provided its client an e-commerce direct
distribution solution. The net result was a reduction in the client’s distribution costs to only 6.2% of sales.

Financial Management

Networking technologies have brought highly visible efficiency gains to financial management at the companies ESI visited. The computer equipment manufacturer, for example, has standardized its internal accounting procedures, and network linkage has enabled the company to close its books within two days after the end of a reporting period. It expects that figure to shrink to one day. Thereafter, the goal will be to permit a “virtual closing” at any point in time, in order to support improved decision-making.

The package shipping company has moved the bulk of its invoicing to an automated, network-based system. Seventy-one percent of packages are now shipped using automated labeling and invoicing. That has liberated a large number of the fifteen hundred employees previously required to operate the old invoicing system.

For the auto manufacturer, volume in accounts payable has tripled in the past ten years, while staff has shrunk from 150 to 50. The company has grown in the past decade, but the cost of operating the financial function has shrunk to less than 0.5% of corporate revenues.
Employee Management

Companies are also discovering that networking technologies can have very useful applications in human resource (HR) functions, in employee recruitment and training, and in travel management.

For example, few firms of meaningful size can operate without a human resources office, but HR offices do not directly add value to the corporate bottom line. Internal business processes such as HR, therefore, are attractive targets for network-based reengineering, which can reduce the necessary costs of operating the business.

Companies must typically gather and process significant amounts of HR-relevant information (e.g., health benefits, pension benefits, labor rules) and then expend additional resources to print and distribute the information to their employees, usually in hard-copy form. Intranets are becoming more and more widely used, because they provide a simple and cost-effective method for distributing such information to employees in electronic form.

The companies ESI visited, for example, are adopting Intranets and enjoying modest savings in the form of reduced paper, printing, and distribution costs. One company, in particular, deployed its Intranet to great effect by developing an interactive HR interface that gave individual employees greater responsibility for maintaining their own personnel data (e.g., family status, address, benefits selected). Previously, employees who needed to update such data completed a form and submitted it to the HR department, where an HR employee would then enter the information into the company’s database.

Today, instead of spending the time to fill out a form, each employee uses that time to enter the information directly into the company’s personnel database via the Intranet. Such a change requires privacy protection features and passwords for each employee, but those are little different from those used for voice-mailboxes. This approach has permitted one company with only seven HR employees to handle benefit services for an employee base of more than 15,000.
Employee recruiting presents another area of opportunity for the application of networking technologies. One fast-growing company ESI visited has typically hired 1,200 to 1,500 employees every quarter. Eschewing newspapers, the company instead advertises job openings on those websites that tend to attract people possessing attributes the company seeks. To reduce the number of its recruitment staff, the company also arranged to have its initial contacts with potential employees take place on the Web. Prospective employees complete an applicant profile and input their personal information directly into the company’s database via the Internet. The information is then sorted, based on the company’s requirements.

As a result, their Web interface has eliminated the need for company employees to conduct the normally labor-intensive introductory meetings with prospective applicants. As a result, the company has reduced its staffing level in the hiring department by twenty-seven and has reduced the fees it formerly paid to a placement agency. The company also employs an Intranet to help orient its new employees – a link provides them with necessary orientation information and serves as a convenient reference for frequently asked questions.

The training of employees has traditionally represented yet another high-cost, labor-intensive endeavor. Among the costs are the time spent by students and instructors alike, the development of training content, and the use of training facilities.

Aside from the costs, however, another issue is that classroom training is not necessarily the most effective training medium. According to one estimate, students remember ten percent of what they read, twenty percent of what they hear, and eighty percent of what they do.

Consequently, multisensory, interactive, network-distributed simulations promise both reduced training costs and increased retention of training information. Using such an approach, training can be tailored for individualized scheduling, while lesson plans can be tailored according to an individual’s need. Artificial-intelligence systems, much like those described above, can adapt a training course according to an employee’s mastery of material, as determined by integrated testing.
Finally, having employees train at their desks conserves on instructor and facility costs.

While some American firms are known to be experimenting with these alternatives, none of the companies in the ESI study has done so yet. One of the companies visited, however, is making active plans to move employee training to its Intranet.

Travel management is another internal business process that networking technologies can improve. One company has fully automated its travel system, so that employees make their own travel arrangements using the company’s Intranet, cut their own travel orders, and travel without paper-based approvals. When the employee returns, the web-based travel system produces an “e-voucher” reflecting the travel order and any charges placed on the employee’s corporate credit card. The system automatically reviews charges to assure they are within spending limits, approves the e-voucher if they are within limit, and electronically deposits a reimbursement directly into the employee’s bank account.

That system reduced the company’s travel reimbursement cycle from six weeks to two days, while reducing its processing costs to just $5.00 per voucher, as compared to an industry average estimated at $50.00 per voucher. The company’s managers emphasized that the value of any forgone interest that could have been earned on the float from a longer reimbursement cycle pales in comparison to that generated by a corporate culture devoted to innovation and cycle-compressing at all stages of its business.
Post-Sale Customer Support

One high-technology company previously had a large staff of software engineers to answer calls on a customer help line. Most of the software engineers’ time was spent fielding fairly routine questions. By contrast, only a small percentage of time was spent responding to complex problems that challenged and drew upon the staff’s expertise.

To address the problem, the company developed a website employing an artificial-intelligence query system. Among the advantages of that web-based system is its availability to customers twenty-four hours a day. It provides assistance to virtually all of its customers’ routine questions, and only those queries that are too complex for the AI system are routed to an actual software engineer.

Management notes that the website, maintained by a staff of only twenty persons, now handles 81% of the company’s customer support. A staff of 900 is still needed for the remaining 19% of technical support queries that require contact with a software engineer, but that figure suggests that the AI system has already generated significant cost savings for the company. In addition, feedback has been positive, as customers laud the benefits of a system that is always available and easy to access. It has also improved employee morale, because highly trained software engineers now spend their time working on more interesting and challenging problems.

Many high-technology products also demand considerable training of customers in proper product use and maintenance. Such training, like other services requiring a human interface, tends to be a relatively high-cost service, in terms of both the trainer’s and the student’s time. Bringing customers to the corporate headquarters for customer training programs can involve significant time, travel expense, and inconvenience.

One of the companies ESI visited has moved much of its customer training to the Internet, where its customers have access to a
range of online training available on demand. For the company, therefore, Internet-distributed training offers a scaleable solution for what had previously been a labor-intensive service. The customers benefit because travel costs are avoided, customers can schedule training sessions to meet their individual needs, training resources are readily available if a customer requires a refresher course, and the multisensory training available on the network is frequently more effective than that offered by traditional classroom instruction.

In another example of post-sale customer support, the package shipping company in ESI’s study has found remarkable value on the Internet by substituting a web-based package-tracking system for its previous system, which used telephone banks for customer support. Customers can now easily track the progress of their packages via the shipping company’s website, where tracking information is continuously updated and immediately available to customers. The web-based solution scaled so well that the company estimates it avoided having to build fifteen additional call centers, each of which would have been staffed by two thousand employees.

**Employees Adding Greater Value**

As described above, networking technologies have facilitated the automation of certain routine business operations, decreasing the number of employees required to handle given areas of responsibility. Typically, the remaining tasks are more challenging for employees and add more value to the firm. The result, therefore, should be understood not so much as “down-sizing,” as “up-skilling.”

One of the companies ESI visited, like many others throughout the United States, has moved from paper-based communication and documents to e-mail and electronic files, dramatically reducing the need for support staff and changing the types of work performed by the remaining support staff. E-mail is their predominant form of internal and external communication, so secretaries are less frequently needed to type supervisors’ letters and memos, and because documents are maintained on a networked server, there is no longer a need for someone to file them. As a result, the ratio of support staff to professional staff has been reduced to 1-to-40, and the administrative support staff that remain are
doing higher value-added work. As an example, one assistant interviewed by ESI said that she now spends most of her time doing research for her supervisor on the Internet and maintaining her supervisor’s website.

Similarly, the company that moved its customer ordering onto the Internet has reduced by two-thirds the number of employees devoted to sales support and has also changed their job duties. The remaining employees have become customer relationship managers. They have been retrained, their job responsibilities have been coded two grades higher, and they earn 25 to 30 percent more.

Another company reduced staffing by two thousand employees when it shifted to electronic storage, transfer and editing of files. That same company is in the process of moving more of its sales to a web-based system and, as a result, is contemplating a dramatic reduction in the size, and a shift in the use of, its sales force, which currently consists of 4,000 representatives. Whereas their sales force used to sell product, they are now being trained to advise customers on problem-solving solutions, a far more difficult and challenging job.

As businesses increasingly shift toward the faster connectivity afforded by digital subscriber lines (DSL), local multipoint distribution service (LMDS), and satellites, additional opportunities will surely present themselves. Real-time video conferencing with suppliers and branch offices stands to become commonplace. Regular video conferencing among participants in a virtual production chain could prevent distributed systems from developing weak links. Higher streaming capacity will also make telecommuting more practical, and when married with wireless technology, will permit employees access to greater data from anywhere on the planet.
Chapter 4:
The Evolving Product in a Networked World

ESI’s research and site visits revealed that networking technologies are not only changing business processes but are also changing products and services, either by replacing or complementing them. First, networking technologies provide another channel for introducing new products and services, as well as a better medium for transmitting some existing products and services. Second, networking technologies facilitate the addition of a variety of services to existing products, both complementing and replacing current functions and services. Third, mass customization, made possible by networking technology, enables firms to deliver distinct products and services tailored to individual customer preferences.

A New Medium for Selling Goods and Services

While new products and services are being introduced online via networking technologies, some companies are employing networks to compete with firms that deliver existing products and services through more conventional channels.

An example from the ESI study is the company that hosts virtual B2B communities. In a business-to-business advertising market estimated at $310 billion per year, the company is able to facilitate electronic market intermediation at lower cost than is possible through traditional media. The company’s estimates are impressive: to acquire the equivalent number of direct leads available through the company’s virtual communities, a seller would have to attend some forty-four trade shows, at approximately 117 times the cost, excluding travel and personnel expenses. Granted that a seller could also choose to rely on direct mailing and marketing, but those are usually even less cost effective than the trade show alternative.
Entertainment products provide another example of the promise inherent in networking technologies. Such products have traditionally been sold as physical objects (e.g., audio compact discs, audio tapes, VHS cassettes). With the increasing penetration of broadband, such products can be distributed more conveniently via the Internet. After all, digital content requires minimal inventory, exhibits substantial economies of scale, and can be easily tailored to satisfy individual preference. The success of digital-audio MP3 files is indicative. Likewise, the merger of AOL, the largest American Internet service provider, and Time Warner, a leading multimedia “content provider,” hints strongly at the strategies firms will be pursuing in tomorrow’s entertainment and information markets.

Adding Characteristics to Products and Enhancing Functionality

Products constitute bundles of characteristics. Networking technologies, however, permit sellers to alter products by adding information components to those characteristics, a strategic move that can help differentiate a product in the marketplace. After-sales support and upgrades, for example, can be viewed as characteristics of a product.

One of the companies studied by ESI sells an integrated hardware and software product, which can be upgraded over time with new software. The company enhances the value of that product by providing free software upgrades to customers who access them over the Internet. This approach is mutually beneficial, providing added-value to the customer while imposing only marginal distribution costs on the company.

In general, more and more products are being loaded with networked service options. For example, one automaker is testing vehicles equipped with systems that detect problems before they become apparent and automatically alert the repair shop about needed repairs. Variations on that system have almost boundless potential for many other products, including common household appliances. Another auto manufacturer already offers an active safety monitoring system that combines sensors, a cell phone, and a Global Positioning System (GPS).
If sensors determine that the car’s airbags have deployed, the system automatically uses the cell phone and the GPS to report the probability of an accident, along with the car’s location, to authorities. That accelerates the arrival of medical assistance at the scene.

**Mass Customization – Precision Responses to Customer Preferences**

The Internet allows consumers to interact with manufacturers and service providers, to access product data, and to communicate preferences directly. This provides for more robust data exchange, automatic transmission throughout a production chain, and substantial efficiency gains. Networking technologies, therefore, will increasingly allow for “mass customization,” the manufacture of products tailored specifically for end-users through direct consumer interfaces.

Mass customization via networking permits a company to exploit the scales from large-quantity manufacturing while avoiding the traditionally high costs of customization. The end results are greater levels of customer satisfaction, reduced churn, and increased revenue per customer.

Heretofore, many manufacturers have been producing goods based on forecasting models that may have been conducted months or even years before a new product is brought to market. Consequently, the forecasts can lack precision. Executives from the auto manufacturer explained to ESI researchers just how that problem affects their industry. When auto manufacturers traditionally had to rely on regional sales projections to decide which cars to send to dealers, the dealers wound up with some cars that customers desired and other cars that customers did not want to buy.

Networking technologies, however, make it affordable to assess in real time the specific preferences of consumers and to respond directly and promptly to such demand. According to the executives interviewed, automobile companies are moving increasingly to a demand-pull
inventory model, in which the quantity, model, color, and specific features of their cars are determined by specific consumer demand.

The particular auto manufacturer surveyed by ESI reported that 50% of its model year’s vehicles already built or committed were based on such customer information. They have not yet achieved total flexibility, because commitments to suppliers mean they cannot instantaneously change the production of certain products, and so they still need six-to-twelve weeks for adjustments. That lag time, however, is steadily decreasing.

Meanwhile, the computer manufacturer visited by ESI has integrated its Internet-based ordering system with its supplier network, in order to communicate orders directly. The company is able, therefore, to provide its suppliers with up-to-the-day demand figures, and production can be adjusted accordingly.

It seems clear that firms have only begun to exploit the advantages of mass customization. As networking solutions diffuse, increasing numbers of producers will likely be offering highly customized products to a broad customer base.
Chapter 5: Network Deployment: Overcoming the Challenges

ESI’s visits and interviews revealed a set of challenges that companies face when seeking to deploy networking technologies, as well as some suggestions for how companies can overcome the challenges. The study identified several elements that appear vital for successful deployment. It also discovered that, even when companies are struggling to overcome a set of challenges, they may still achieve significant benefits in the process, because the challenges involve obstacles to maximizing the benefits rather than obstacles that prevent any benefit whatsoever.

ESI believes that the reader will be well served by a review of the successes and failures experienced by the companies in ESI’s study. Admittedly, this analysis is not exhaustive, nor is it meant to reflect the sum of challenges faced. Moreover, it is evident that no two companies will face identical challenges and, consequently, no single best-practices model will apply to all firms. The examples below are instructive, however, and they provide a good starting point for further analysis of possible problems and solutions.

To Network or Not to Network: Don’t Let the Bean Counters Decide

It is extremely difficult to evaluate an investment in networking technology using traditional ROI analysis. The benefits of a vast network possessing a variety of applications, delivering qualitative and quantitative benefits throughout an organization, are not easily measured.

In this context, it is useful to note that executives interviewed by ESI are increasingly coming to view networking technologies as a fixed
cost of doing business. They view the network as a “necessity,” or as one CFO observed:

A network is as essential to doing business as a telephone…. Just as we don’t do an ROI for the telephone network, we don’t do ROI for this network. However, ROI analysis becomes important when evaluating the applications that will be put on the network, but not the network itself.

ESI’s study suggested that leadership from the top is sometimes essential to the spread of that perspective. One CIO said specifically that her CEO “provided the Network vision that did not rely on ROI analysis.” When the CFO complained about the lack of such analysis, the CEO intervened and personally endorsed the project.

Throughout its survey, ESI heard from CFOs, CIOs, and CTOs who, when describing their motives for adopting networking technologies, used terminology not generally familiar in a finance class. Among the sentiments expressed were: “this is about survival,” “faith,” “go with the gut,” and “leap of faith.”

By contrast, ESI discovered that those firms that regarded ROI as the essential benchmark for making their decision were less advanced in networking technology and application deployment. At one company, for example, ESI was told that a significant benefit from networking technologies has been “better decision making from more accurate and timely information.” While that is an important benefit, it cannot be easily measured using ROI, so that company is moving more timidly than others.

Eventually, of course, a better sense of the financial impact of networks will develop, as more and more companies implement them and analysts wrestle with their consequences, but ROI analysis of qualitative changes such as greater customer care will remain elusive, leaving companies that rely solely on ROI analyses lagging behind.

**Leadership from the Top is Essential**
A common theme from those companies successfully exploiting networking technologies is the key role that senior executives have played in promoting implementation, experimentation and usage. Among companies in which network utilization appeared the most highly developed, ESI heard a consistent refrain: “The Chairman provided the network vision that did not rely on ROI analysis, and we went out and did it.” When a company’s CEO is committed to networking technology, both broadly and with regard to specific efforts, the company’s efforts are more successful, implementation times are shortened, and benefits are more robust.

Many applications – such as supply chain management systems, for example – require cooperation among various divisions, which have to work with one another and also to learn new business methods. Without leadership from the top, it is more difficult to get the various units in a company to work together as a team. Function managers can spend more time vying for control of information than helping to fulfill the broader corporate vision. So, if senior executives are not invested in a project, e-strategies run the risk of becoming isolated ventures, and inadequate cooperation among disparate business units will diminish results and inhibit future efforts at network adoption. It’s the peril of a vicious cycle.

**The Importance of Corporate Culture**

Throughout ESI’s research, companies frequently emphasized corporate culture as a contributing factor in determining the level of benefits a company realizes from networking technology. While admittedly a broad concept, “corporate culture” will be used here to mean the body of values that are articulated, promoted and rewarded in an organization. It includes the relative openness of an organization (including the willingness to share information), the integrity of the business processes, the extent to which individual employees are empowered, the level of trust in an organization, and the approach to teamwork.
For example, with regard to networking technology and associated applications, companies might employ either a culture of command-and-control or a more decentralized approach that empowers individual workers with greater decision-making authority. ESI visited one company that had established an Intranet council to “think-up” and “implement” applications for its network. That body was created because of a perception that all applications and postings on the Intranet should be “authenticated” and “broad-based, not parochial.” All decisions, therefore, would have to be approved by the council, which was comprised of representatives from only three of the company’s functional units. Not surprisingly, those three units expressed the greatest interest in using the Intranet, and other units were slow to employ the system.

In contrast, another company gives each of its business units the responsibility to devise their own networking technology solutions and, in particular, to develop methods for reducing the labor intensity of their work. Each unit develops its own initiatives and then presents them to the CIO, who evaluates and revises projects to meet a unit’s stated objective. Business units pay for projects out of their own budgets and are accountable for the success or failure of such projects.

That company’s approach has allowed it to meet successfully its corporate objective of growing the business without proportionally increasing the corporate head count. In particular, it has been able to shrink staffing levels in administrative functions while sustaining rapid rates of growth.

Clearly, networking technology can empower employees with greater responsibility, because it allows broader access to project information and to the contributions of others on a project. Significant cost savings can be gained, but achieving them requires a great deal of organizational trust. In one experimental program, a company is permitting individual employees to purchase supplies over the web without preapproval. Another company allows its employees to book flights and travel without preapproval and to submit expense claims without obligatory review. This has allowed their technicians to travel when key customers needed them, without the imposition of administrative delay. Again, however, such systems only work in a corporate environment of trust.
Creating “extended enterprises” and “virtual enterprises” with suppliers also requires significant trust. Networking between a manufacturer and its suppliers sometimes involves the sharing of sensitive information, and in some instances, such suppliers can also be working closely with a firm’s competitors. ESI spoke with executives from several companies who have seen sensitive materials leaked to competitors. Naturally, those firms expressed greater trepidation about integrating more fully with suppliers.

**All Levels of the Organization Must Be Fully Invested**

All levels of an organization – including management, workers, suppliers and unions – must be fully invested if networking technology solutions are to be implemented effectively. For senior management, the design, implementation, and usage of the network must be a key management objective. Business managers who are given incentive to implement networking technologies that solve problems and meet goals are more likely to bring changes to significant business processes. In some cases, however, this may require changing the pay scales, bonus structures, and promotion schedules.

ESI visited one company where the human resources department had not changed the basis of its pay scale for managers, so that managers’ salaries continued to reflect the number of employees reporting to them. In circumstances such as that, managers who succeed in using networking technologies to reduce staff could be diminishing their own management position and salary. Unless incentive structures are adapted to the changing technology, those managers will be understandably reluctant to deploy networking solutions.

In addition, function managers also must assign a high priority to project implementation. One company was experiencing a failure rate of 2-3 percent per year in its attempts to implement applications, and ESI learned that the failures were related to three issues:
• No one was directly accountable for a project’s success.
• The implementation task was assigned to lower-level employees burdened with other responsibilities.
• A business unit was being overly reliant on the network office to take control of the project and “do it for them.”

Perhaps the quintessential example comes from one company’s attempts to implement a universal sales and marketing application. The sales managers drove the idea for the application, but failed to see it through because there was no financial incentive.

That company’s sales force, like most, is compensated with bonuses tied to sales performance. Because members of the sales force assign significant opportunity costs to tasks that detract from selling, they did not devote focused attention and resources to the project. Three separate efforts to implement the system failed. Each attempt increased, slightly, the interest and input of top sales managers, but without “full and dedicated commitment,” the project repeatedly stumbled.

The company is now discussing ways of making the implementation of network applications a component of bonus and pay within the sales department. The lesson is that incentive structures cannot be ignored.

As the ultimate users of an application, employees also need to be on board with the changes wrought by networking technologies. They need security and incentives to change their way of working. For starters, few persons will willingly work themselves out of a job, so workers need to be secure in the knowledge that they will not be fired if they eliminate the need for their current positions.

In addition, changes must be thoroughly communicated to all levels in order to avoid a backlash. For example, one company in the ESI study, hoping to optimize efficiency over its entire production process, employed a horizontal platform model and instituted changes that shifted the roles and tasks of some employees. In implementing that process, however, some departments shouldered additional work, which meant less work for people further downstream. The reasons for those changes were not communicated effectively to the group that was tasked with
more work and, as a result, that group resisted the changes, temporarily derailing the entire optimization project.

Union support is also important when seeking to reap the opportunities offered by network technology solutions. For example, in one company, a union benefits representative is assigned to each factory for the purpose of fielding employee questions. The union official, whom the company pays, responds to employees’ questions by calling a toll-free number to get the answers, which he then relays to the employees.

Networking technologies that give employees direct access to personnel information make such intermediation unnecessary, but the company is reluctant to raise the issue because of union opposition to any reductions in benefits realized at the negotiating table. At this time, the company feels that the costs of confronting the union on the matter outweigh the financial benefits of deploying a more efficient network solution on the factory floor.

Training and Retention of Workers

Another benefit provided by networking technologies is that they allow firms to move workers to higher-value-added activities. The networking technologies automate rote tasks, leaving only the more complex, less routine tasks, which provides opportunities for workers to take on new skills and responsibilities. However, an investment in training is often required to prepare the employees for higher-value-added work.

At one company, an automated website replaced the product-ordering process, freeing workers from the routine task of inputting orders into the system. Those employees were retrained as account managers, working specifically on customer relations with large- and medium-sized customers. That combination of changes led to higher levels of customer satisfaction with both the product ordering process and the after-sales support.
In another company, as networking freed executive assistants from filing, scheduling, typing memos, making phone calls, and performing other traditional administrative support work, they were trained to do higher-value-added activities, such as programming in HTML or conducting online research. Again, such changes require dedication to continuous worker training and education.

At the same time, while the benefit of moving workers to more value-added activities is attractive, companies are also realizing that some workers are not up to the task. One company took its “best and brightest” sales people through a training program to focus them on selling new service “solutions,” as opposed to selling its traditional products. At the end of the program, management concluded that only a third of the group was “trainable.”

Another company had to replace its entire IT staff when it determined that the staff did not have the right problem-solving approach for business. Other companies with aging workforces or uneducated workers face significant challenges in adopting networking technologies. One company, for example, has refrained from putting the daily corporate newsletter online and discontinuing the paper copy, fearing that workers will be upset by the loss of a communication channel with which they are comfortable. That decision was made despite the prospective cost savings that could have been realized.

Lately, worker retention has emerged as an important issue for companies in an economy with robust growth and a short supply of trained IT workers. Firms need to retain their workers through the course of a project, but workers with IT training currently enjoy significant employment opportunities, and companies feel they must be cautious about training workers to use new technologies. One traditional manufacturer trained an army of IT employees and then found itself back at square one when all its new trainees quickly fled to jobs elsewhere.

Meanwhile, a Silicon Valley company decided to adopt a local school and train one of its teachers in the skills necessary to set up and maintain the school’s network. Four months later, the teacher was hired away from the school to become a company’s network manager, at a significantly higher salary. The Silicon Valley company reconsidered its approach to assisting the school and opted to train students to maintain
the school’s network, on the theory that they could be expected to stay around at least through graduation – maybe.

**Challenges beyond the Firm: Why Government Policy Matters**

In addition to the internal challenges firms face, there are also regulatory issues that threaten to stymie the benefits of networking technologies. Every firm ESI interviewed identified legal restrictions on data sharing, data mining, and encryption exports as serious barriers to the optimum utilization of networks. Taxation, customs, and privacy are regulatory issues that stand to have an important effect on the evolution of e-commerce and e-business, and consequently, on the benefits that firms might realize when deploying networking technologies.

Additionally, constraints on bandwidth, as well as its continuing high cost, also circumscribe the deployment of networks and their applications. Regulatory barriers contribute to a lack of affordable bandwidth across most of the country, making it prohibitively expensive to adopt solutions throughout the extended value chain. Industry leaders and lawmakers must find solutions to these problems if American companies are to exploit the benefits of networking technologies.
Chapter 6: Networking Technologies and the Macroeconomy

The impact of information technology on the performance of the U.S. economy has been debated for several years, with some analysts arguing that, despite a very large and sustained investment in information technology, there has been no measurable benefit in terms of U.S. economic performance.

Flying in the face of that so-called “productivity paradox,” some intriguing data suggest something new has been occurring in the U.S. economy lately. For example, national income and product account data show a significant increase in manufacturing productivity throughout the 1990s, as compared to the 1970s and 1980s. As Exhibit 6.1 illustrates, the annual growth in manufacturing productivity during the 1990s is a full percentage point higher than in the previous two decades.

Exhibit 6.1 – U.S. Productivity Increases in the Manufacturing Sector

![Bar chart showing productivity increases in the manufacturing sector]

Source: Federal Reserve Bank of St. Louis
The story told by the economy-wide productivity figures is less clear. Those data, however, are a less reliable indicator because of recognized problems in measuring productivity in the service sector, which constitutes approximately two-thirds of the U.S. economy.

In this regard, it is instructive to note that the macroeconomic data on manufacturing productivity is certainly consistent with the information reported to ESI about increased value-added by workers and about compressed development and production cycles.

The other indicator of something new in the economy lies in the macroeconomic data on inflation, corporate profits, and the economy-wide inventory-to-sales ratio. The data indicate that the United States is enjoying its lowest rates of inflation in four decades. As Exhibit 6.2 shows, inflation has been far lower during the last two years of the current expansion than it was during the comparable period of every other economic expansion in the past forty years.
Given that the United States has achieved the longest economic expansion in its history, it is unprecedented to find such low inflation accompanied by such strong and sustained economic growth. Despite strong consumer demand, prices are not rising. Furthermore, the low level of inflation is not a statistical artifact: informed students of the Consumer Price Index (CPI) consider it to suffer an upward bias, so that any errors in the index tend to overstate, not understate, the true level.

Low inflation could be the result of a more efficient and productive economy, or it could be the result of inability by businesses to pass cost increases along to consumers. If the latter explanation were correct, businesses would have to absorb any cost increases in the form of reduced margins and lower profits, which, in turn, would make them reluctant to invest.
However, the U.S. economy has been experiencing robust investment during the 1990s and, as illustrated in Exhibit 6.3, corporate profits have been rising. From 1991 to 1997, corporate profits were a steadily rising share of GDP, and they have remained relatively stable since that time. Rising profits and stable prices can only coexist amid rising productivity and falling costs.

**Exhibit 6.3 – Ratio of Corporate Profits to GDP, and Approximate Dates of Four Recessions, 1973-1999**

Source: Federal Reserve Bank of St. Louis

One last set of data strongly indicates the source of some of the cost savings, a source that is further confirmed by ESI’s site visits to American companies – namely, networking technologies are enabling companies to substitute information for inventories.

Data from the macro level tell a similar story. Exhibit 6.4 compares the inventory-to-sales ratios over the economic expansions of the past four decades. The data for the economic expansion of the 1990s is singular: through the entire expansion there has been a decline in the
inventory level. Lower inventories reduce the cost of business by diminishing the need for working capital and by reducing the physical infrastructure needed to warehouse and maintain inventory.

**Exhibit 6.4 – Inventory/Sales Ratios for Past and Current Business Cycle Expansions**

<table>
<thead>
<tr>
<th>Year of Expansion</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/61-12/69</td>
<td>1.3</td>
</tr>
<tr>
<td>12/70-11/73</td>
<td>1.35</td>
</tr>
<tr>
<td>4/75-1/80</td>
<td>1.4</td>
</tr>
<tr>
<td>12/82-7/90</td>
<td>1.45</td>
</tr>
<tr>
<td>4/91-9/99</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Source: Federal Reserve Bank of St. Louis

Cumulatively, these data portray an economy with lower costs, higher productivity, lower inflation, and higher profits. While the data do not present conclusive evidence for the macroeconomic benefits of networking technologies, they are very suggestive. They also indicate where future research may prove fruitful.
Chapter 7:
Conclusion – Virtuous vs. Vicious Cycles

It is apparent that networking technologies create a broad variety of opportunities. All the firms ESI visited have displayed some degree of network development, ranging from the rudimentary to the highly sophisticated, and all have gained in some tangible way from the changes that networking technologies bring.

The very best among them enjoy virtuous cycles, characterized by lower costs for SG&A, lower inventory costs, lower working capital costs, lower-cost product development, more efficient inbound and outbound logistics, higher productivity among workers, more satisfied customers, and identification of profitable new core competencies. All of this translates into bottom line results for the companies. Revenue is higher and costs are lower, creating better margins, higher profits, and greater capital market valuation. The capital market’s higher valuation for the firms lowers their cost of capital, giving them access to the capital needed to support even greater and faster growth.

Networking technologies also allow firms to concentrate resources on their most valuable core competencies. Thus far, the firms have generally limited deployment of networking technologies to certain strategic areas, but it is clear that networking stands to improve nearly every business process, both internal and external to the firms. The size and distribution of those benefits will vary according to the nature of the applications, the culture of the firm, and the particular industry.

The benefits of networking technologies will only be realized, however, in conjunction with other changes. As one executive told ESI, “You can’t adopt a network solution without adopting a network culture.” Networking technologies force significant change within organizations, challenging management structures, corporate cultures, and essential business processes. ESI’s research shows that firms must adapt to those changes in order to realize the full benefit of networks.
In contrast to such virtuous cycles stands the peril of a vicious cycle, which can follow from a firm’s failed efforts to deploy network solutions. When changes to individual, management, or departmental incentives do not precede deployment of network solutions, or when the process of change is not thoroughly communicated to all personnel, the company may encounter employee reluctance to accommodate the new technology. Such hurdles can emerge from the simple self-interest of employees whose livelihood appears directly or indirectly threatened by network technologies.

In such situations, firms may discover that they have made a substantial capital investment but are not enjoying the expected efficiency gains. Furthermore, the labor costs associated with failed attempts to deploy a network can be substantial. Such failed attempts may discourage a firm from considering network technologies at later stages, resulting in a vicious cycle.

This analysis, if correct, suggests strongly that there will be two types of firms in the short term. One will suffer the vicious cycle associated with failed attempts to deploy network technologies. The other will enjoy the virtuous cycles associated with the successful deployment of network technologies. Over the medium term, however, in all probability, only the latter will remain.

Finally, ESI’s initial analysis reveals strong indications that networking technologies hold vast potential for America’s economic and social well-being, but government policies on privacy, security, encryption, and broadband access also need to remain apace of change if American firms are to leverage networking technologies to their fullest.
Appendix: Description of Companies Sampled

ESI’s site visits focused on five companies, deliberately chosen to include a variety of sectors, sizes, and stages of networking technology implementation. Accordingly, those companies capture many of the disparate effects that networking technology is having on industry and the broader economy.

The five companies are briefly described below. References to their exact identity are withheld to protect proprietary information.

**Company A**

A manufacturer of computer and networking equipment, which employs more than 15,000 personnel and enjoyed revenues close to $13 billion in 1999. Its market capitalization is one of the largest in the industry. The company has extensively implemented networking throughout its operations, and has achieved substantial benefits from doing so.

**Company B**

A company that specializes in worldwide shipping and distribution of packages. In 1999, the firm had more than $2 billion in revenues and a market capitalization over $10 billion. It has used networking to develop a new service – handling the inbound and outbound logistics for other firms through its own system.

**Company C**

A manufacturer of automobiles, which employs several hundred thousand workers throughout its organization and enjoyed more than $60 billion in revenues in 1999. For several years, this firm has had in place an extensive EDI system of links to first-tier suppliers, as well as satellite
links to dealers, but has experienced uneven implementation of newer Internet-based technologies.

**Company D**

Born on the Web, this company creates business-to-business communities aimed at finding sales leads. It enjoyed revenues of more than $11 million in 1999. The company conducts its business entirely online, and also conducts most of its management and organization through networking as well.

**Company E**

A supplier of automotive parts, with 1999 revenue of greater than $29 billion, this company has EDI links to suppliers but has not implemented significant changes in internal networking systems.