THE EMERGING DIGITAL ECONOMY

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FIGURES AND TABLES

INTRODUCTION

During the past few years, the United States economy has performed beyond most expectations. A shrinking budget deficit, low interest rates, a stable macroeconomic environment, expanding international trade with fewer barriers, and effective private sector management are all credited with playing a role in this healthy economic performance.

Many observers believe advances in information technology (IT), driven by the growth of the Internet,*[1] have also contributed to creating this healthier-than-expected economy.

In recent testimony to Congress, Federal Reserve Board Chairman Alan Greenspan noted, "...our nation has been experiencing a higher growth rate of productivity—output per hour—worked in recent years. The dramatic improvements in computing power and communication and information technology appear to have been a major force behind this beneficial trend."[1]

Some have even suggested that these advances will create a "long boom"[2] which will take the economy to new heights over the next quarter century.

Other economists remain skeptical about the contribution of the IT industry to overall productivity. As yet, there is limited direct evidence in government data that investments in IT have substantially raised productivity in many non-IT industries.[3]

While the full economic impact of information technology cannot yet be precisely evaluated, its impact is significant. IT industries have been growing at more than double the rate of the overall economy— a trend that is likely to continue. Investments in IT now represent over 45 percent of all business equipment investment. Declining prices for IT products have lowered overall inflation.

This report also begins a discussion about the potential impact on the economy of the Internet and electronic commerce.

Recent rapid growth of the Internet is in part attributable to its strength as a medium of communication, education and entertainment, and, more recently, as a tool for electronic commerce.

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* The Internet is a global matrix of interconnected computer networks using the Internet Protocol (IP) to communicate with each other. For simplicity, the term "Internet" is used throughout this paper to encompass all such data networks and hundreds of applications such as the World Wide Web and e-mail that run on those networks, even though some electronic commerce activities may take place on proprietary or other networks that are not technically part of the Internet.

Businesses in virtually every sector of the economy are beginning to use the Internet to cut the cost of purchasing, manage supplier relationships, streamline logistics and inventory, plan production, and reach new and existing customers more effectively.

Cost savings, increased consumer choice and improved consumer convenience are driving growth in the sale of physical goods and in the digital delivery of goods and services via the Internet.

Because the Internet is new and its uses are developing very rapidly, reliable economy-wide statistics are hard to find. Further research is needed. This report therefore uses industry and company examples to illustrate the rapid pace at which Internet commerce is being deployed and the benefits being realized. Examples showing the growth of the Internet and electronic commerce this past year are numerous:

- Fewer than 40 million people around the world were connected to the Internet during 1996. By the end of 1997, more than 100 million people were using the Internet.[4]

- As of December 1996, about 627,000 Internet domain names had been registered. By the end of 1997, the number of domain names more than doubled to reach 1.5 million.[5]

- Traffic on the Internet has been doubling every 100 days.[6]

- Cisco Systems closed 1996 having booked just over $100 million in sales on the Internet. By the end of 1997, its Internet sales were running at a $3.2 billion annual rate.

- In 1996, Amazon.com, the first Internet bookstore, recorded sales of less than $16 million. In 1997, it sold $148 million worth of books to Internet customers. One of the nation's largest book retailers, Barnes and Noble, launched its own online bookstore in 1997 to compete with Amazon for this rapidly growing online market.

- In January 1997, Dell Computers was selling less than $1 million of computers per day on the Internet. The company reported reaching daily sales of $6 million several times during the December 1997 holiday period.

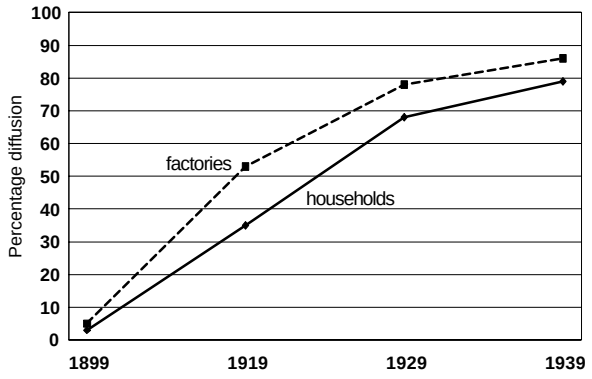
- Auto-by-Tel, a Web-based automotive marketplace, processed a total of 345,000 purchase requests for autos through its Web site in 1996, for $1.8 billion in auto sales. As of the end of November 1997, the Web site was generating $500 million a month in auto sales ($6 billion annualized) and processed over 100,000 purchase requests each month.

If the trends suggested by this preliminary analysis continue, IT and electronic commerce can be expected to drive economic growth for many years to come. To realize this potential, however, the private sector and governments must work together to create a predictable, market-driven legal framework to facilitate electronic commerce; to create non-bureaucratic means that ensure that the Internet is a safe environment; and to create human resource policies that endow students and workers with the skills necessary for jobs in the new digital economy.

CHAPTER ONE:
THE DIGITAL REVOLUTION

The Industrial Revolution was powered by the steam engine, invented in 1712,[7] and electricity, first harnessed in 1831.[8] Harnessing the power of steam meant less labor was needed for manual work; it also meant that factories could locate anywhere, not just in geographical areas with strong wind and water resources.

Figure 1. Diffusion of Electric Power in the U.S., 1899-1939



Factories - primary and secondary electric motor HP's as proportion of total mechanical drive in mfg.
Household - proportion of U.S. dwellings wired for electric lighting.
Source: David, Paul. "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox."

Because it required a network to contain and transmit its power, electricity's potential had to wait until 50 years after it was first harnessed before the first power station was built in 1882.[9] It took another 50 years before electricity powered 80 percent of factories and households across the country (Figure 1).[10]

Early uses of electricity were limited. While factories used generators for lighting, their primary power still came from line shafts and belt drives up to 1907. It was not until factories replaced the old power system for electric motors that fundamental changes in production occurred. Factory structures were streamlined, and key processes, such as materials handling and manufacturing flows, were made more efficient.[11]

The digital revolution is happening much more quickly. The harnessing of light for nearly instantaneous communications and the ability to use microscopic circuits to process and store huge amounts of information are enabling this current economic transformation.

In 1946, the world's first programmable computer, the Electronic Numerical Integrator and Computer (ENIAC), stood 10 feet tall, stretched 150 feet wide, cost millions of dollars, and could execute up to 5,000 operations per second. Twenty-five years later, in 1971, Intel packed 12 times ENIAC's processing power into a 12 mm^2 chip with a $200 price tag.[12] Today's personal computers (PCs) with Pentium processors perform in excess of 400 million instructions per second (MIPS). At the current pace of development, by 2012, PCs will be able to handle 100,000 million instructions per second.[13]

As late as 1980, phone conversations only traveled over copper wires which carried less than one page of information per second. Today, a strand of optical fiber as thin as a human hair can transmit in a single second the equivalent of over 90,000 volumes of an encyclopedia.[14] By 2002, a constellation of several hundred satellites orbiting hundreds of miles above the earth is expected to bring high-bandwidth[15] communications to businesses, schools and individuals everywhere on the planet.

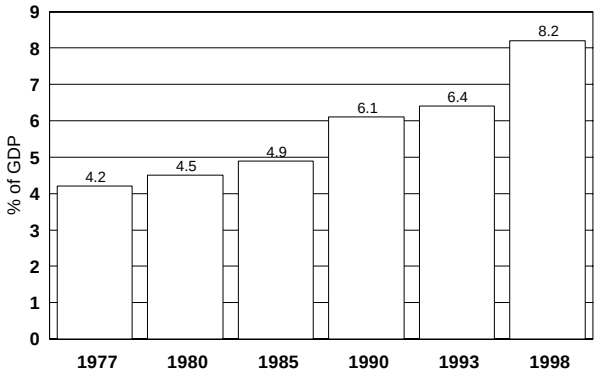
A global digital network using new packet switching technology[16] combines the power of these remarkable innovations in computing and communication. The Internet ties together the computing power on desks, in factories and in offices around the world through a high-speed communications infrastructure. More than 100 million people around the world, most of whom had never heard of the Internet four years ago, now use it to do research, send e-mail to friends, make requests for bids to suppliers, and shop for cars or books.

The Internet's pace of adoption eclipses all other technologies that preceded it. Radio was in existence 38 years before 50 million people tuned in; TV took 13 years to reach that benchmark. Sixteen years after the first PC kit came out, 50 million people were using one.[17] Once it was opened to the general public, the Internet crossed that line in four years.[18]

Growing Economic Importance of the IT Sector:

One of the most notable economic developments in recent years has been the rapid increase in the IT sector's (computing and communications) share of investment activity and of the gross domestic product (GDP). It grew from 4.9 percent of the economy in 1985 to 6.1 percent by 1990 as the PC began to penetrate homes and offices. The next spurt started in 1993, with the burst of commercial activity driven by the Internet. From 1993 to 1998, the IT share of the economy will have risen from 6.4 percent to an estimated 8.2 percent (Figure 2). With such rapid expansion, IT's share of total nominal GDP growth has been running almost double its share of the economy, at close to 15 percent.

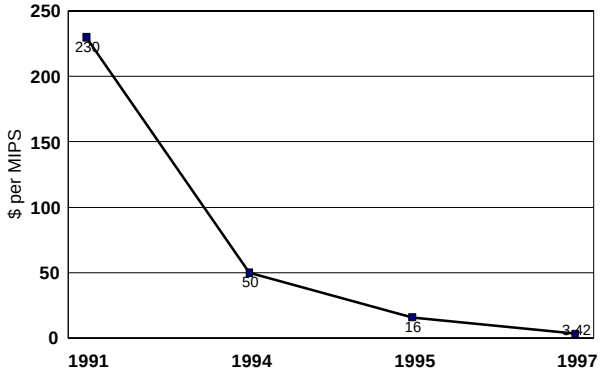
Figure 2. IT's Share of the Economy Grows



Source: U.S. Department of Commerce
Economics and Statistics Administration
Estimates based on Bureau of Economic Analysis and Census data

What makes this rise in IT's nominal share of the economy even more remarkable is the fact that IT prices, adjusted for quality and performance improvements, have been falling while prices in the rest of the economy have been rising.

Figure 3. Microprocessor Prices Plummet from $230 per MIPS to $3.42 per MIPS in 6 years

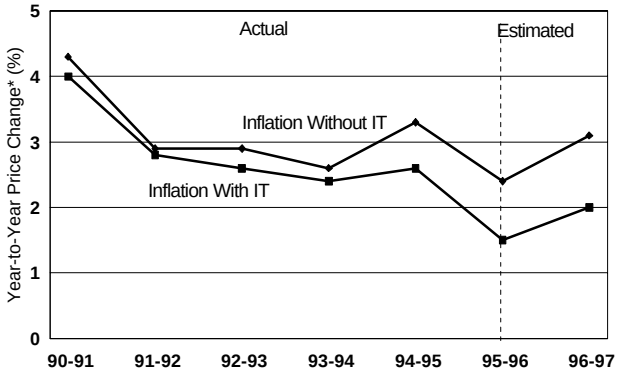


Source: Intel

Computing power has been doubling every 18 months for the past 30 years. At the same time, the average price of a transistor has fallen by six orders of magnitude, due to microprocessor development. In just six years' time, the cost of microprocessor computing power has decreased from $230 to $3.42 per MIPS (Figure 3). No other manufactured item has decreased in cost so far, so fast.[19]

In 1996 and 1997, declining prices in IT industries lowered overall inflation by one full percentage point (Figure 4). Without the contribution of the IT sector, overall inflation, at 2.0 percent, would have been 3.1 percent in 1997.

Figure 4. IT Industries Help to Keep Inflation Down

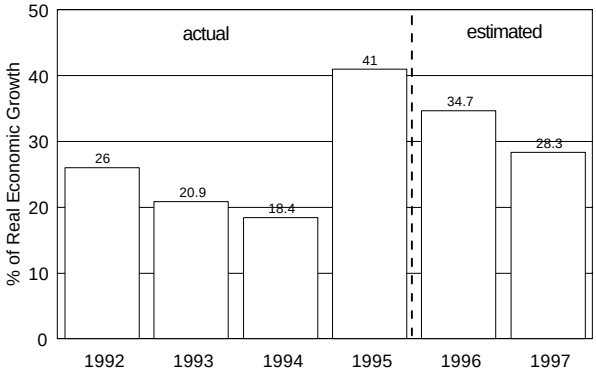


*As measured by the Gross Domestic Income Implicit Price Deflator

Source: U.S. Department of Commerce
Economics and Statistics Administration
Estimates based on Bureau of Economic Analysis and Census data

Thus, in real terms, the expansion of the IT sector accounts for an even larger share of overall economic growth in the mid-to late-1990s. In recent years, IT industries have been responsible for more than one-quarter of real economic growth (Figure 5).[20]

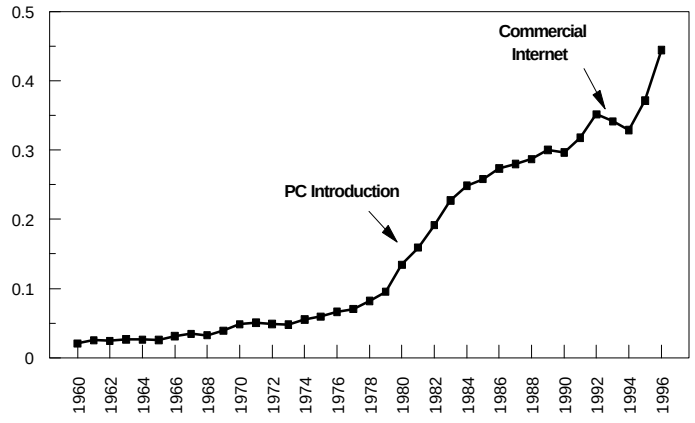
Figure 5. IT Contribution to Real Economic Growth



Source: U.S. Department of Commerce
Economics and Statistics Administration
Estimates based on Bureau of Economic Analysis and Census data

Companies throughout the economy are betting on IT to boost productivity and efficiency. In the 1960s, business spending on IT equipment represented only 3 percent of total business equipment investment. In 1996, IT's share rose to 45 percent (Figure 6). For some industries like communications, insurance and investment brokerages, IT equipment constitutes over three-quarters of all equipment investment.

Figure 6. IT's Share of Business Equipment Investment Grows Rapidly



Source: U.S. Department of Commerce
Bureau of Economic Analysis

* Inflation-adjusted investment in information processing equipment (office, computing, and accounting machinery, communications equipment, instruments, and photocopying equipment) as a share of total private equipment investment.

Information technology supports high-paying jobs. In 1996, 7.4 million people worked in IT industries and in IT-related occupations across the economy. They earned close to $46,000 per year, compared to an average of $28,000 for the private sector.

The impact of IT is also reflected in the capital IT firms currently represent. The collective market capitalizations of five major companies, Microsoft, Intel, Compaq, Dell and Cisco, has grown to over $588 billion in 1997 from under $12 billion in 1987,[21] close to a fifty-fold increase in the space of a decade.

Despite these impressive trends, the digital revolution is just beginning. Growth could accelerate in the coming years not only in the IT sector itself, but across all sectors of the economy as the number of people connected to the Internet multiplies and as its commercial use grows. The growth will be driven by four types of economic activity:

- ***Building out the Internet*:** In 1994, three million people, most of them in the United States, used the Internet.[22] In 1998, 100 million people around the world use the Internet.[23] Some experts believe that one billion people may be connected to the Internet by 2005.[24] This expansion is driving dramatic increases in computer, software, services and communications investments.

- ***Electronic commerce among businesses***: Businesses began using the Internet for commercial transactions with their business partners about two years ago. Early users already report significant productivity improvements from using electronic networks to create, buy, distribute, sell, and service products and services. By 2002, the Internet may be used for more than $300 billion worth of commerce between businesses.[25]

- ***Digital delivery of goods and services***: Software programs, newspapers, and music CDs no longer need to be packaged and delivered to stores, homes or news kiosks. They can be delivered electronically over the Internet. Airline tickets and securities transactions over the Internet already occur in large numbers. Other industries such as consulting services, entertainment, banking and insurance, education and health care face some hurdles but are also beginning to use the Internet to change the way they do business. Over time, the sale and transmission of goods and services electronically is likely to be the largest and most visible driver of the new digital economy.

- ***Retail sale of tangible goods***: The Internet can also be used to order tangible goods and services that are produced, stored and physically delivered. Though Internet sales are less than 1 percent of total retail sales today, sales of certain products such as computers, software, cars, books and flowers are growing rapidly.

CHAPTER TWO:
BUILDING OUT THE INTERNET

Where advances in telecommunications and computing largely occurred side-by-side in the past, today, they converge in the Internet. Soon, virtually all information technology investment will be part of interlinked communications systems, whether internal to a business, between businesses, between individuals and businesses, or individual to individual.

However measured, the Internet is expanding at a very rapid pace.

For instance, the number of Americans using the Internet has grown from fewer than 5 million in 1993 to as many as 62 million by 1997.[26]

UUNET, one of the largest Internet backbone providers, estimates that Internet traffic doubles every 100 days.[27]

The number of names registered in the domain name system grew from 26,000 in July 1993 to 1.3 million in four years. Over the same period, the number of hosts connected to the Internet expanded from under 1.8 million to over 19.5 million (Table 1).

Table 1. Growth of Internet Hosts and Domain Names*
(000s)

	# Hosts	# Domains
July 93	1,776	26
July 94	3,212	46
July 95	6,642	120
July 96	12,881	488
July 97	19,540	1,301

* Internet host refers to a computer that is connected to the Internet that has a unique Internet Protocol (IP) address. A domain name represents a record within the Domain Name System.

Source: Network Wizards http://www.nw.com

In January 1995, just over 27,000 top-level commercial (.com) domain names were assigned. Most businesses used them for little more than posting product and company descriptions, store locations, annual reports and information about how to contact corporate headquarters. Two and a half years later, commercial domain names number 764,000.[28] Static brochures and bulletin boards are giving way to full-fledged businesses offering financial services, news and information, manufactured goods, and travel and entertainment to individuals and businesses.

To meet this increased demand, consumer electronics companies, media giants, phone companies, computer companies, software firms, satellite builders, cell phone businesses, Internet service providers, television cable companies and, in a few cases, electric utilities, are aggressively investing to build out the Internet.

Hundreds of new firms are starting up around the country to help businesses use the World Wide Web effectively. They design Web sites and advertising banners, create Web-based catalogs, build security tools, create and track direct marketing campaigns, provide consulting services, and develop technology to speed the flow of data and information across the network. Venture capitalists gave just under $12 billion to hundreds of information technology start-ups in 1996 and 1997.[29]

Making the Internet Faster and More Accessible

Households typically connect to the Internet through a PC and a telephone line. This method of access means that most households without PCs (just under 60 percent of all U.S. households[30]) do not have Internet access. It also means that most Internet connections from the home are slow.[31] To illustrate the importance of speed, it takes 46 minutes to download a 3.5-minute video using a 28.8 kbps (thousand bits per second) modem, the modem most commonly used by households today (Table 2).

Table 2. Time to Download 3.5-Minute Video Clip Using Different Technologies

	Transfer Time
28.8 Kbps modem	46 minutes
128 Kbps ISDN	10 minutes
4 Mbps cable modem	20 seconds
8 Mbps ADSL	10 seconds
10 Mbps cable modem	8 seconds

Source: FCC, CS Docket No. 96-496, 1997; ADSL from Werbach 1997, p. 75.

Telephone companies, satellite companies, cable service providers and others are working to create faster Internet connections and expand the means by which users can access the Internet. New technologies such as ADSL (Asynchronous Digital Subscriber Line) enable copper telephone lines to send data at speeds up to 8 million bits per second (mbps). At this speed, that same 3.5 minute video takes 10 seconds to download.[32]

PC manufacturers and software developers are also taking steps to make home computers cheaper and easier to use.[33] Some PCs can now be purchased for less than $1,000 apiece. New network computers are expected to be introduced at prices of a few hundred dollars apiece. At the same time, new and enhanced software programs (for instance, better graphical user interfaces, search tools, and voice recognition technology) will make the PC and the Internet easier to use and thereby able to reach a broader community of consumers.

Soon, many Americans will be using their televisions to access the Internet. Present in nearly every household, TVs are easy to operate and require little or no maintenance. Digital broadcasting services (high-definition television, or HDTV) will be available in the top ten markets by November 1999, and broadcasters are expected to make the transition to digital

broadcasting by 2006.[34] With digital broadcasting, TV viewers will be able to interact with their televisions and surf the Web, pay bills, plan a weekend trip, or make dinner reservations. Already, satellite dishes and signals carried over cable television lines enable consumers to receive data from the Internet through their TVs and television programming through their personal computers. At speeds of 10 million bits per second, a household connected to the Internet via a cable modem can download a 3.5-minute video in 8 seconds.[35] In most cases today, however, the outgoing communication (the speed at which the Internet receives the commands by the user) is still limited to the fastest modem speeds that copper telephone wires will support.

Two-way cable traffic would be much faster, but only 9 percent of the 103 million cable subscribers in the U.S. and Canada (9 million homes) live in zones where two-way cable connectivity exists. And, only a small number of them—111,000—have actually subscribed to the service. By 2000, analysts estimate that two-way cable connectivity will be available to 34 million households, of which 1.6 million are expected to subscribe to the service.[36] Cable operators are planning to make significant investments in the next few years to upgrade their systems to carry two-way Internet traffic.

The wait for broadband Internet access to households is measured in years, not decades. Within the next five to ten years, the vast majority of Americans should be able to interact with the Internet from their television sets, watch television on their PCs, and make telephone calls from both devices. These combined services will be brought to homes by satellite, wireless, microwave, television cable and telephone lines, all interconnected in one overall system.

People will also access the Internet away from their homes or offices. Cellular telephones and portable digital assistants (PDAs) have become very sophisticated devices capable of sending faxes, receiving e-mail and electronic pages, and now, accessing the Internet. Industry experts predict that users of cellular phones and digital personal communications devices will more than triple from 77 million to 251 million by 1999.[37]

Technology already exists to enable many appliances and consumer electronics devices to transmit and receive data. The first products to link home appliances with PCs should become available this year. Entering a simple message into a computer on a desk will be able to turn off the television or pre-heat the oven for dinner. Automobiles with video monitors will receive data from overhead satellites to warn about traffic jams, give directions to the nearest gas station, and deliver the latest news and information.

The U.S. Government's FY 1999 budget calls for $850 million to be invested in high-performance computing and communications. As part of this effort, the budget provides $110 million for the Next Generation Internet Initiative, which will create a research network that is 100 to 1,000 times faster than today's Internet, and invests in R&D for smarter, faster networks that support new applications, such as telemedicine, distance learning and real-time collaboration.

Table 3. The Race to Build Out the Communications Infrastructure of the Internet

During the 19th and 20th centuries, governments played a key role in helping build or actively regulate much of the country's transportation, communication and energy infrastructure powering the Industrial Revolution. Although the Internet originated in U.S. Defense Department research, private sector investments will largely drive its future expansion.

Telecommunications: Manufacturers and software companies have been developing new technologies to allow higher-bandwidth communications across the existing copper network infrastructure, including DSL technologies, compression and faster electronic switches. Communications carriers around the world are building out fiber optic networks; technological advancements including optical amplification and new photonic switches make these high-speed networks more powerful and more efficient.

Satellite: Satellite, telecommunications, electronics and aerospace companies plan to spend close to $27 billion to build out a global broadband network in the sky between 1998-2002 to reach most of the two billion people that live in areas around the world where phone service is unavailable.

Cable: Thick cable wires pass more than 90 percent of U.S. households, piping in TV programming at speeds much faster than telephone copper carries voice traffic. Four years ago, many cable companies began to prepare the cable network for two-way Internet traffic, investing in fiber optic cable and set-top boxes to decipher voice, video and data sent in digital form.

Wireless: Over time, wireless networks will be integrated with the Internet. Investments in satellites and repeater stations are now being made at a rapid rate to accomplish this. Cellular phones, pagers and hand-held computers will be able to transmit and receive voice, data and Internet traffic.

Electric utilities: A number of utility companies around the country are beginning to lay thousands of miles of new fiber cable for Internet access at speeds ten times faster than today's high-speed phone connections.

As the number of Internet users grows, accessing the Internet becomes faster and easier to do, and as the number of Internet-enabled devices multiplies, the IT industry's share of the economy can be expected to continue to expand rapidly.

CHAPTER THREE:
ELECTRONIC COMMERCE BETWEEN BUSINESSES

Internet commerce is growing fastest among businesses. It is used for coordination between the purchasing operations of a company and its suppliers; the logistics planners in a company and the transportation companies that warehouse and move its products; the sales organizations and the wholesalers or retailers that sell its products; and the customer service and maintenance operations and the company's final customers.

Early computers were used for scientific and military purposes, not for commerce. They first made their way into commercial applications in the 1960s, with ERMA (the Electronic Recording Machine—Accounting). Banks were swamped with the growing volume of checks that needed to be processed (between 1943 and 1952, check use had doubled from 4 billion to 8 billion checks written each year). By automating the function with ERMA, the first bank to use the computer, Bank of America, reported that nine employees could do the job that previously took 50 people.[38]

The commercial use of computers quickly spread as companies in a variety of industries used them to keep accounting ledgers, administer payroll, create management reports, and schedule production.

In the 1970s and 1980s, businesses extended their computing power beyond the company's walls, sending and receiving purchase orders, invoices and shipping notifications electronically via EDI (Electronic Data Interchange). EDI is a standard for compiling and transmitting information between computers, often over private communications networks called value-added networks (VANs). The 1980s also brought the introduction of computer-aided design (CAD), computer-aided engineering (CAE) and computer-aided manufacturing (CAM) systems that enabled engineers, designers and technicians to access and work on design specifications, engineering drawings and technical documentation via internal corporate communications networks.

The cost of installation and maintenance of VANs put electronic communication out of the reach of many small and medium-sized businesses. For the most part, these businesses relied on the fax and telephone for their business communications. Even larger companies that used EDI often did not realize the full potential savings because many of their business partners did not use it.

The Internet makes electronic commerce affordable to even the smallest home office. Companies of all sizes can now communicate with each other electronically, through the public Internet, networks for company-use only (intranets) or for use by a company and its business partners (extranets), and private value-added networks.

Companies are quickly moving to utilize the expanded opportunities created by the Internet. For instance, Cisco Systems, Dell Computers and Boeing's spare parts business report almost

immediate benefits after putting their ordering and customer service operations on the Internet. They are so convinced of its benefit to their own companies and their customers that they believe most of their business will involve the Internet in the next three to five years.[39]

Although still in an embryonic stage, analysts predict businesses will trade as much as $300 billion annually over the Internet in the next five years.[40] Some believe the volume of Internet commerce will be much higher. As statistically valid sampling data are not yet available, determining the actual growth rate is very difficult to do. This report does not attempt to size the current market or predict the size of the future market. Instead, it describes the underlying drivers of growth of business-to-business electronic commerce, using specific company and industry examples as illustrations.

Growth of business-to-business electronic commerce is being driven by lower purchasing costs, reductions in inventories, lower cycle times, more efficient and effective customer service, lower sales and marketing costs and new sales opportunities.

LOWER PURCHASING COSTS

Buying materials or services for a corporation can be a complex, multi-step process. First, purchasers have to find suppliers who make the product and determine whether they meet volume, delivery, quality and price requirements. Once a potential supplier has been chosen, detailed drawings and information are transmitted to the supplier so that the product is built to exact customer specifications. Assuming the product sample has been approved and the supplier's manufacturing lines are ready for production, the buyer then transmits a purchase order (P.O.) for a specific quantity of goods. The buyer, meanwhile, receives notification from the supplier that the P.O. was received and confirmation that the order can be met. When the product ships from the supplier, the buyer again receives notification, along with an invoice for goods delivered. The buyer's accounting department matches the invoice with the P.O. and pays the invoice. When changes to the normal order happen—a frequent occurrence in most companies—the process can be much more complicated.

Companies lower procurement costs by consolidating purchases and developing relationships with key suppliers to benefit from volume discounts and tighter integration in the manufacturing process. They also cast a wide net for lower-cost sources of supply.

Large companies have been using EDI over private networks to reduce labor, printing and mailing costs in the procurement process. Automating routine procurement means the procurement staff has more time to focus on negotiating better prices and building supplier relationships. Analysts estimate that businesses already trade well over $150 billion in goods and services using EDI over VANs.[41] Companies using EDI commonly save 5-10 percent in procurement costs.[42]

The Internet has the potential to further reduce procurement costs. Large companies benefit from lower transmission costs versus private networks. The Internet also opens the door to doing

business electronically with new suppliers and with small and medium-sized suppliers who formerly communicated only via fax or phone. Small companies also benefit. The Internet reduces processing costs and opens up new sales opportunities from potential buyers that post requests for bids on the Internet.

Procurement via the Internet is new enough that projecting economy-wide savings or other benefits is difficult. Specific company examples suggest that its potential is large and growing. For instance, General Electric's lighting division reports significant gains in responsiveness, improved service, and reduced labor and material costs as a result of shifting purchasing from a largely manual system to an electronic one using Internet protocols.

Factories at General Electric's lighting division used to send hundreds of requisitions for quotes (RFQs) to the corporate sourcing department each day for low-value machine parts. For each requisition, the accompanying blueprints had to be requested from storage, retrieved from the vault, transported on site, photocopied, folded, attached to paper requisition forms with quote sheets, stuffed into envelopes and mailed out. The process took at least seven days and was so complex and time-intensive that the sourcing department normally only sent out bid packages to two to three suppliers at a time.

In 1996, GE Lighting piloted the company's first online procurement system, TPN Post, an extranet developed by GE Information Services. Now, the sourcing department receives the requisitions electronically from its internal customers and can send off a bid package to suppliers around the world via the Internet. The system automatically pulls the correct drawings and attaches them to the electronic requisition forms. Within two hours from the time the sourcing department starts the process, suppliers are notified of incoming RFQs by e-mail, fax or EDI. A bid can be evaluated and awarded the same day GE receives it.

Previously, more than one out of four invoices had to be investigated and "reworked" to reconcile them with purchase orders and receipts. With the transaction handled electronically from beginning to end, invoices are now automatically reconciled with purchase orders, reflecting any modifications that happen along the way.

According to GE, the division's labor costs for procurement have declined by 30 percent. Sixty percent of the procurement staff have been redeployed. The sourcing department has at least six to eight additional days a month to concentrate on strategic activities rather than the paperwork, photocopying and envelope stuffing it had to do when the process was manual.

Material costs have declined by up to 20 percent as the ability to reach a wider base of suppliers online created more competition and led to lower prices.

As of October 1997, eight divisions of General Electric use TPN for some of their procurement. The company bought more than $1 billion worth of goods and supplies via the Internet in 1997. By 2000, GE aims to have all 12 of its business units purchasing its non-production and maintenance, repair and operations materials (MRO) via the Internet, for a total of $5 billion. GE

estimates that streamlining these purchases alone could save the company $500-$700 million over the next three years.[43]

Other companies report plans to use the Internet for procurement. One out of four purchasing managers expects to use the Internet for MRO purchases, up from 10 percent who use it for that purpose today.[44]

REDUCED INVENTORY/THE RIGHT PRODUCTS IN STOCK

The longer it takes for production schedules to reach suppliers, the more inventory a company has to hold to account for delays and errors, and the less quickly it can react to changes in demand.

The more inventory a company holds, the higher its operating costs, and the lower its profits. Carrying more inventory does not ensure better customer service, either. Shelves weighed down with size-10 running shoes do not help the customer who wears a size 8. When a customer enters a furniture showroom looking for an armchair with green and white stripes and is told it's on back-order for 12 weeks, he may drive across town to a competitor rather than wait.

Managing inventory properly results in better service for the customer and lower operating costs for the company. Increasing the frequency of inventory "turns" (the number of times inventory in existing warehouse or store space is sold or used for production each year) reduces inventory-related interest, handling and storage costs. Reducing inventory levels also means that existing manufacturing capacity is more efficiently utilized. More efficient production can reduce or eliminate the need for additional investments in plant and equipment.

IBM's Personal Systems Group provides an illustration of how the Internet and private networks are helping companies keep stocks of inventory smaller, yet more targeted on likely consumer needs.

Each month, the group's marketing departments report information on how many PCs they think will be sold. The production planning departments identify manufacturing and materials capacity in each factory. Armed with inputs from across the company on demand and supply, production schedules are assigned to each factory. The procurement staff uses the same information to negotiate with suppliers. As new information comes in each week, the process is repeated and the production schedule fine-tuned.

Electronic communication between factories, marketing and purchasing departments have made this quick response possible. Problems are communicated as they arise and the appropriate adjustments are made. If demand suddenly rises or if one factory cannot meet its production schedule, IBM is aware of it in time to increase production at another factory.

The Personal Systems Group has been phasing in this Advanced Planning System (APS) since 1996 and already reports significant results. During the first year of APS, inventory turns

increased 40 percent over the previous year, and sales volumes increased by 30 percent. The group anticipates another 50 percent increase in turns and a 20 percent increase in sales volume in 1997. By better utilizing its existing manufacturing capacity, IBM has avoided having to make additional investments to meet the increased volume requirements. The lower investment and operating costs due to improved inventory turns have resulted in savings of $500 million.

IBM is not alone in its efforts to use networks to improve communication between the marketing and sales arm of a business and its production units. Manufacturers, wholesalers and retailers are working together to form standards and guidelines for better forecasting and restocking called Collaborative Planning Forecasting Replenishment (CPFR). These standards will allow companies to collaborate in determining future demand for products and to share information about the availability of products in stock.

With CPFR, a retailer and its supplier electronically post their latest sets of forecasts for a list of products. A server tied to the Internet compares the forecasts and flags differences in those that exceed a normal safety margin—say 5 percent. Differences are then reconciled by planners at both the retailer and the supplier. To keep that process from becoming too cumbersome, software companies are working to develop programs that automatically handle exception messages based on rules that apply to that business.[45] The accounting and consulting firm Ernst & Young believes that CPFR could yield an inventory reduction of $250 billion to $350 billion across the economy. By reducing inventory levels, businesses will realize substantial savings in materials handling, warehousing, and general administrative costs.[46]

LOWER CYCLE TIMES

Cycle time is the total time it takes to build a product. There are certain fixed costs associated with building any product that do not vary with the amount of production, but rather are time dependent. These "fixed" costs include depreciation of equipment, most utility and building costs, and most managerial and supervisory time. If the time to build a product can be reduced to seven days instead of ten, then the fixed costs per product are lower since less time was needed. Electronic commerce allows "cycle times" to be shortened, allowing more to be produced for the same or lower costs.

In the 1980s, the lower cycles times realized by Japanese companies presented American companies with a serious competitive challenge. They responded by breaking down organizational barriers that had grown up between design, manufacturing and sales divisions and improving communications with external partners.

Establishing electronic links with their large suppliers and customers enabled companies to transmit and receive purchase orders, invoices and shipping notifications with much shorter lead times than previously. Some also began to share product specifications and drawings over value-added networks to speed product design and development.

The Internet will permit even further reductions by broadening the network of businesses connected electronically and by facilitating collaboration on projects across work teams and geographical locations.

Few industries faced a greater challenge to reduce cycle times than the automotive industry in the early 1980s. While Japanese automakers could take a car from concept to mass production in approximately three years, American companies typically took four to six years.

First, a full-scale clay model was built to see how the vehicle would look in real life. Incorporating changes to the model could take months. Once approved, single- or multiple-prototype vehicles were built by hand to see whether parts fit together correctly and whether the car could be built economically. Engineers worked with the prototype builders to refine the engineering specifications. Once the prototype was ready, the engineers would design the individual components and the tooling needed to make the components. Then, purchasing agents would work with suppliers to produce prototype tooling and parts for assembly of pilot or pre-production vehicles. If everything went smoothly, the manufacturing-engineering team would then assemble the vehicle to discover any assembly problems. Finally, after additional modifications, the vehicle was mass produced.[47]

Today, all parties involved in designing a new platform or vehicle—designers, engineers, suppliers, and manufacturing and assembly personnel—work as part of a team, contributing to the process from beginning to end. As a result of computerization, steps that used to take weeks or months can now be done in a matter of days. Sharing information electronically allows the different members of the group to work on projects together, rather than having to wait for each member to finish his step before the next one can be taken. Through the use of computer-aided design (CAD), computer-aided manufacturing (CAM) and computer-aided engineering (CAE), the whole team can share computer files and use 3-D modeling techniques to design the vehicle and see how parts fit without building prototypes by hand. Changes to the components can be made without building sample tooling and parts.

When the final design is agreed on, CAM data is loaded into machines that build the tooling and prototype parts. The same techniques are being used to reconfigure and retool assembly plants. Working as a team and sharing information electronically has cut the time it takes to develop and build a new vehicle to about 30 months.[48]

Automotive companies now want to shorten the design cycle to less than 24 months by setting up platform teams in different parts of the world and linking them electronically. By using global communication links, engineers in Detroit can assign a problem to engineers on their team in India. With the time zone difference, the engineers in the Far East can work on the problem and get an answer back to their Detroit counterparts by the next business day.[49]

Cycle times are also being shortened for production. Before the use of EDI, automotive companies communicated production requirements and schedules to their suppliers by phone, fax or mail. This meant time-consuming manual data entry, photocopying and information hand-offs

from one supplier to another. It could take several weeks to get the manufacturing schedule and requirements to all component factories and vendors. To minimize the impact of delays and errors caused by miscommunication, the assembly plant kept a large inventory of parts on-hand.

Today, automobile manufacturers and their large suppliers communicate production and scheduling requirements via EDI. The assembly plant electronically sends the supplier an 8- to 12-week forecast or build plan. Daily production requirements detailing the number of parts needed at each plant at specific scheduled times are also communicated electronically. When the parts are ready and loaded in the trailer, the supplier notifies the assembly plant that the parts are on their way. The plant schedules its lines to coincide with the arrival of the trailers. By changing its assembly process to take advantage of the more accurate and timely information they receive electronically, most North American assembly locations turn inventory 130 times per year, up from 7 to 10 times per year in the past.[50]

In January 1994, Chrysler, Ford, GM, Johnson Controls and 12 of their suppliers began working together as part of the Manufacturing Assembly Pilot (MAP) to further improve material flow within a pilot four-tier seat assembly supply chain. At the project's outset, it took four to six weeks for material release information to reach the bottom of the supply chain. Along the way, information was distorted and truncated. The resulting late, inaccurate and untrusted information cost millions of dollars in the form of "just-in-case" inventories, premium freight, unplanned set-ups and changeovers, and other inefficiencies.

By electronically connecting the MAP participants, production schedules reached the bottom of the supply chain in less than two weeks. On-time shipments improved 6 percent. Error rates were reduced by 72 percent. Up to eight hours per week per customer was saved in labor costs.

Connecting all levels of suppliers through the entire industry via EDI could save nearly $1.1 billion annually—a cost savings of $71 or more per car—and decrease information lead-time to just one day between each tier of the supply chain.[51]

The automotive industry is now investing in a new venture, the Automotive Network Exchange (ANX), a managed "virtual private network" that runs over the Internet and links manufacturers and suppliers worldwide. ANX will electronically link those suppliers who still communicate to the automotive manufacturers by fax, phone and mail. And, it will replace the thousands of direct dial connections with a single network, considerably lowering the transmission costs borne by the manufacturers and the suppliers. Scheduled to be fully implemented by 2000, the network will electronically route product shipment schedules, CAD files for product designs, purchase orders, payments and other business information. Participating automobile manufacturers believe that ANX has the potential to reduce the product development and manufacturing cycles even further, as well as improve many other key business processes.

The results achieved by the auto industry through EDI can be, and are being, replicated in many other industries. Because of its low cost and ease of use, the Internet will help accelerate the pace at which businesses communicate with each other electronically and the benefits they can realize.

MORE EFFICIENT AND EFFECTIVE CUSTOMER SERVICE

Companies are beginning to use the Internet for customer service. Having product descriptions, technical support and order status information online not only saves money by freeing up a company's own customer service staff to handle more complicated questions and manage customer relations, it can also lead to more satisfied customers.

Companies have long gathered and stored information about customers and products in databases that only certain authorized employees can access. Innovative businesses are finding ways to tap the potential of that information, making it available to those who need it most—whether it's a customer service representative answering a phone call or a customer looking for account information or technical support online.

Few things are more frustrating to a customer than uncertainty about when an important purchase will arrive. Too often, phone calls to a supplier result in a series of transfers from one department to another and an eventual promise to check on the status of the order and to call the customer back. This pattern consumes time and money for the customer and the seller.

Delivery companies are helping their business partners solve this problem via the Internet. A customer can go to the company's Web site, enter his order number, and find out that the product is already on a FedEx or a UPS truck and is expected to arrive the next morning. This information can be retrieved from the company's Web site in less than a minute.

In addition to improved customer satisfaction, companies using the Internet for customer service report savings from putting order tracking, software downloads and technical support information online. For instance, Cisco reports that its customer service productivity has increased by 200 to 300 percent, resulting in savings of $125 million in customer service costs. Dell estimates that it saves several million dollars a year by having basic customer service and technical support functions available on the Internet.

LOWER SALES AND MARKETING COSTS

An individual sales person can support as many customer accounts as he can physically visit or contact by telephone. Therefore, as the number of accounts increases, so does the size of the sales force. Even direct marketing companies increase staffing as telephone order volume increases. By contrast, a Web business can add new customers with little or no additional cost. Because its sales function is housed in a computer server rather than physical store locations or sales people, its reach is bounded only by the capacity of the servers to respond to inquiries and orders.

The Internet can also make traditional sales organizations, layered distribution channels, catalog sales and advertising more efficient. With automated ordering capabilities, sales representatives no longer have to prepare time-consuming manual orders. Instead, they can spend time building

and maintaining customer relationships. Electronic catalogs present far more information and options than their paper counterparts. Direct marketing online can shorten repurchase cycles and increase the ability to sell additional items.

Some recent business examples suggest the potential of the Internet as an efficient sales tool.

Boeing's spare parts business debuted its PART Page on the Internet in November 1996, allowing its airline customers around the world to check parts availability and pricing, order parts, and track the status of their orders. Less than a year later, about 50 percent of Boeing's customers use the Internet for 9 percent of all parts orders and a much larger percentage of customer service inquiries. The Boeing spare parts business processes about 20 percent more shipments per month in 1997 than it did in 1996 with the same number of data entry people. And, because customers can satisfy many service requests online, as many as 600 phone calls to customer service representatives are avoided each day.

Cisco builds virtually all its products (routers, switches and other network interconnect devices) to order, so there are very few off-the-shelf products. Before the company established an Internet sales capability, ordering a product could be complicated. Generally, an engineer at the customer site knew what type of product was needed and how it should be configured. The engineer communicated this information to his procurement department who then created the purchase order and sent it to Cisco via fax, phone or e-mail. A Cisco customer service administrator entered the order into Cisco's system. If the order went through "clean", it would be booked and production scheduled within 24 hours. Nearly one out of four orders didn't get a "clean" bill of health, however. Instead, when Cisco's system tried to validate the order, it discovered an error in how the product was configured. The "dirty" order would be rejected, the customer contacted and the procurement cycle would begin again.

In July 1996, Cisco rolled out its Web-based ordering and configuring system. Today, that same engineer can sit down at a PC, configure the product online, know immediately if there are any errors, and route the order to the procurement department. Because the customer's pricing structure is already programmed into the Cisco site, the authorized purchaser can complete the order with a few keystrokes. And, rather than calling Cisco to find out the status of the order, invoice or account information, a customer with the proper authorization can access the information directly on the Web site. With the online pricing and configuration tools, about 98 percent of the orders go through the system the first time, saving time both at Cisco and the customer's site. Lead times have dropped two to three days, and customers' productivity has increased an average of 20 percent per order.

NEW SALES OPPORTUNITIES

The Internet operates around the clock and around the world. As a result, businesses on the Web can reach new markets they could not reach effectively with an in-person sales force or advertising campaigns.

For instance, a plastics commodity specialist at a large manufacturer can sit down at his PC, click on a Web browser and search for suppliers selling industrial plastics online. A small supplier with a limited sales force can now reach that buyer, getting its first introduction online. Similarly, a vendor's sales force may not be able to reach the millions of home offices and small offices around the country. By having an online presence and creating customized services for the small business market, that vendor may develop a new, lucrative market, both within the U.S. and globally.

Companies using the Internet to sell products find that they attract new customers. For example, eighty percent of the consumers and half of the small businesses who purchased from Dell's Web site had never purchased from Dell before. One out of four say that if not for the Web site, they would not have made the purchase. And, their average purchase value is higher than Dell's typical customer.

W.W. Grainger, the leading distributor of MRO supplies in North America, describes similar results. The company launched its Web business in the spring of 1995. Today, more than 30 percent of the company's online sales are to new customers or incremental sales to existing customers. Because the virtual store is open seven days a week, 24 hours a day, customers who wouldn't otherwise be able to order from a Grainger store are now able to do so. In fact, more than 50 percent of all orders are placed after 5 PM and before 7 AM when the local store is closed.

THE FUTURE

Businesses that use the Internet to buy, sell, distribute and maintain products and services are realizing significant cost savings and increased sales opportunities. And, the benefits only increase as the network of businesses conducting electronic commerce grows.

Investments are already taking place to realize the $300 billion in business-to-business Internet commerce analysts predict by 2002.[52] Three of the companies discussed in this chapter—Cisco, Dell and General Electric—were responsible for about $3 billion in Internet commerce in 1997. If their current projections prove accurate, these three companies alone will conduct more than $17 billion in Internet commerce within three to five years.[53] The experiences of these and other companies are quickly spreading through the rest of U.S. industry through conferences and consulting firms who assist companies to design and implement Internet-based business solutions. Even at $300 billion, Internet commerce will only represent 3 percent of total GDP.[54] This means that the greater efficiencies companies are experiencing from electronic commerce are likely to continue to diffuse through the U.S. economy for decades to come.

Meeting legal and technical hurdles

Businesses have raised three potential inhibitors to the widespread adoption of Internet commerce: the lack of a predictable legal environment, concerns that governments will overtax the Internet, and uncertainty about the Internet's performance, reliability and security.

For a business to feel comfortable about using the Internet in communications with its suppliers and customers, it needs to be sure of the identity of the party at the other end of the transaction and that any agreement made electronically is binding.

Today, a business verifies identities with passwords, electronic signatures and Internet Protocol (IP) addresses. Initiatives are currently underway to develop a more effective system of digital certification and authentication. The U.S. Government is promoting the development of an international convention to legally recognize digital authentication.

The U.S. government also supports the development of both a domestic and global uniform commercial legal framework that will recognize, facilitate and enforce electronic transactions worldwide. Internationally, the U.S. government is working with the United Nations Commission on International Trade Law (UNCITRAL) which has completed work on a model law that supports the commercial use of international contracts in electronic commerce. The government is also encouraging the work of the International Chamber of Commerce which has issued model commercial code guidelines.

Companies are also concerned about the potential for excessive taxation of the Internet. The U.S. Government believes that no new discriminatory taxes should be imposed on Internet commerce. It also believes that no customs duties should be imposed on electronic transmissions. The application of existing taxation on commerce conducted over the Internet should be consistent with the established principles of international taxation, should be neutral with respect to other forms of commerce, should avoid inconsistent national tax jurisdictions and double taxation, and should be simple to administer and easy to understand.

Some companies express concern about the Internet's current technical limitations. Those who conduct EDI transactions over VANs have the confidence and experience that important information will arrive at its destination, on schedule, intact. If any problems do arise, a single network service provider is accountable and responsible for resolving them.

Companies expecting this level of service worry that the Internet offers no such guarantees. Because it is a public network that connects many smaller, interconnected networks and service providers, there is no single entity responsible for ensuring that a message leaves one point and arrives, intact, at another. And, because companies have a need to transmit confidential information, they want assurance that it remains secure.

Companies are taking different approaches to address the current technical limitations. Some use the Internet to purchase lower-value, indirect materials while keeping their higher-value, direct material purchases over VANs. Some rely on extranets, or "virtual private networks," that limit access to a certain pre-qualified set of businesses and their partners.

Sophisticated encryption products and firewalls are being used by some companies to protect privacy and ensure the security of Internet transactions. Many others await a resolution of current export limitations on encryption software before they plan to increase their Internet business.

The automotive industry's ANX is an example of an extranet that will provide automotive trading partners with a single, secure network for electronic commerce and data transfer. The industry has created a management structure and business rules to ensure that the network meets the performance, reliability and security requirements the industry has put forward. The ANX Overseer, Bellcore, has direct operations and management responsibilities over the network. Participating Internet Service Providers and Network Exchange Points have been certified and will operate according to the terms of the ANX. A common set of business practices, including "acceptable use" policies and common network level security methods are additional conditions of participation in the ANX.

Businesses will pursue alternatives most suitable for their immediate business requirements. For some, standard off-the-shelf solutions running over the public Internet are satisfactory. For others, customized solutions—along with explicit rules and operating procedures—may be the answer.

As the Internet's performance and reliability improves over time, and as predictable legal frameworks emerge, the growth of business-to-business electronic commerce will accelerate.

CHAPTER FOUR:
DIGITAL DELIVERY OF GOODS AND SERVICES

Software, CDs, magazine articles, news broadcasts, stocks, airline tickets and insurance policies are all intangible goods whose value does not rely on a physical form. Much of today's intellectual property is produced, packaged, stored somewhere and then physically delivered to its final destination. The technology exists (or soon will exist) to transfer the content of these products in digital form over the Internet.

CONTENT

News from around the world is now available on the Internet, usually free of charge. More than 2,700 newspapers have online businesses, of which over 60 percent are U.S.-based.[55] All but three of the top 50 magazines in the country (as defined by paid circulation) had a Web presence as of January 1998.[56] More than 800 TV stations across the U.S. have Web sites.[57] UltimateTV.com lists 151 U.S. cable channels including CNN, fX, HBO, MTV, the Weather Channel and a host of others.[58] AudioNet calls itself the leader in Internet broadcasting, with live continuous broadcasts of over 175 radio and television stations, play-by-play of thousands of college and professional sporting events, live music, on-demand music from the CD Jukebox (over 1,600 full-length CDs), live and on-demand shows and Internet-only Webcasts and live and on-demand corporate and special events.

The rapid emergence of information services on the Internet is being driven by consumer demand, more effective distribution, and an expected shift in advertising revenues away from traditional media to the Internet.

Consumer Demand

Nearly 90 percent of Web users go online to get news and information.[59] There, they can find obscure or limited circulation journals online as well as the top sellers. Articles limited to text and perhaps a picture in a print edition may be supplemented in the online version with video or audio clips, maps or in-depth background research.

Still somewhat difficult to navigate, the Internet's wide selection of content sites save individuals time when conducting research, and yield much more complete and up-to-date information than offline alternatives. As technology advances and search tools become easier to use, individuals can be expected to increasingly turn to the Internet's content sites to do research, to learn about the day's news, and to be entertained.

How quickly individuals change their behavior in favor of the Internet, and away from other media, is difficult to determine. Recent studies indicate that as use of the Internet increases, television viewing declines.[60] However, some of today's Web businesses point out that circulation for their existing newspapers and magazines has not dropped, even while their Web audiences increase. They state that some in the online audience are also found among their most loyal print readers, but look to each medium to satisfy different purposes. For instance, *Business Week* reports that visitors to its Web site read the front page article and then use the site to research the magazine's archives and special report sections, features they do not have in the print version.

It may take a number of years before the impact is felt. For instance, McGraw-Hill's financial information services division began to distribute its products electronically over ten years ago. Up until three years ago, print revenues made up 85 percent of the division's sales. Today, digital products account for more than 50 percent of sales.

Lower Capital and Distribution Costs

The New York Times invested $350 million in its new printing press. Readers can now see front-page photos in color instead of black and white. Readers accessing the *New York Times* on the Web not only see color photos from the print version's front page, they get radio clips, color spreads on special feature sections for the Web only, and the chance to interact with other *New York Times* readers interested in the day's or week's hot topics.

Web content businesses require a much lower capital investment than their print counterparts, lowering the barrier to entry in this online industry. With the Internet, the content of a newspaper or a magazine does not have to be printed and delivered to news stands or doorsteps across the city in order to be consumed—steps that add 30 to 40 percent to the cost of the product.

Instead, content delivered via the Internet can be entered directly into a computer, stored digitally on a server and appear directly on a reader's computer screen with a few simple commands the reader enters on the Web site. The consumer can then read the information on the screen or print it out. The publisher's distribution costs include paying off the investment in the Web servers and other technology that ensures that when someone enters the site, it responds quickly. Unlike newspaper or magazine content that gets used once, digitally-stored content offers the potential for repeated repackaging and reuse. Once the content has been created and stored, there is little or no extra cost to send it to one reader or 1,000 readers. That increases the efficiency of the newspaper and magazine businesses dramatically.

However, simply establishing a presence on the Internet does not guarantee that a business will succeed. Building brand awareness through advertising and marketing is critical to success in a new and rapidly evolving market, particularly on the Internet where consumers have the choice of spending their time and money at thousands of different sites. If the Internet evolves in such a way that a limited number of sites become the "funnel" that guides a viewer through its vast content, businesses looking to appeal to mass audiences may have to pay large fees to secure "shelf space" on those sites. Or, they may be excluded altogether. In this scenario, advertising

and marketing costs may become too expensive for some to bear. If, on the other hand, technology and consumer preference evolves so that consumers access and navigate the Internet using a variety of devices and tools (perhaps personal software "agents"), then high rents might be avoided.

Statistics on Web traffic indicate that the "funnel" model is winning out today. Over time, as people begin to access the Web via their TVs, telephones and personal digital assistants, and as the Web becomes easier to navigate, this may change and lower advertising and marketing costs may result.

Shift of revenue sources to the Internet

Even with their lower costs of operation, content businesses on the Web do not yet generate adequate revenues. Unlike newspapers and magazines that rely on subscriptions for some of their revenue, most Web businesses currently shy away from charging subscriptions in favor of building an audience and attracting advertising and direct marketing/transactions revenues. Though growing, these revenue sources are still small.

At this early stage of development, it is unclear how quickly Internet content businesses will draw readers or viewers away from traditional media sources such as newspapers, magazines and television. As it happens, advertising and subscription revenues flowing to the Internet are likely to increase. Even if the total audience for a newspaper or a TV sitcom does not decline, advertisers may shift spending to the Internet if they feel that it provides a more effective means to reach their audiences.

Current trends in classified and local advertising spending indicate a shift already taking place. Newspapers have been watching their share of classified advertising dollars shrink as real estate agents, car dealers and owners, and businesses looking to hire employees increase their advertising in niche publications, direct mail and online services. A 1996 Newspaper Association of America study points out that newspaper publishers could lose as much as 50 percent of their classified ad dollars in the next five years if current trends continue. If that happens, the average newspaper's operating margin, now 14 percent, would drop to 3 percent.[61] To maintain revenues from classifieds and to attract local advertising dollars, newspapers have been quick to establish Web sites featuring classified ads and city guides.

Other industries are also seeking a share of classified and local advertising revenues. Software companies, telephone companies, Internet service providers, television networks and newspapers are gearing up to compete for a share of this potentially large market. A New York-based research firm, Find/SVP, reported that more than 60 corporations ranging from Warner Brothers and PacTel to NBC and U.S. West have launched, or are in the process of organizing, Web sites with a strong emphasis on local content.[62]

Software companies and search engines feature city guides listing movies and restaurants, arts and music, current events, places to go, local sports, weather and news. Some broadcast and cable networks combine coverage of national news and entertainment with local news from affiliates and searchable databases of online classified ads. Directory listings and mapping services partner with newspapers, software companies and others to offer their own city guides. Telephone companies have their own directory listings and mapping services and are partnering with others for real estate listings, restaurant guides, and other local information and services.

Analysts project significant growth in revenues available for online content businesses. Forrester Research predicts that revenues from advertising, subscriptions and transactions fees will grow to $8.5 billion within five years,[63] or almost 5 percent of the $175 billion advertisers spent in newspapers, TV, radio, direct mail, billboards, and other traditional media in 1996.[64]

TRAVEL

Vacationers and business travelers can now find information on the Internet about cities they plan to visit, from driving directions and recommended itineraries to weather patterns and business telephone numbers and addresses. Many hotels have detailed property descriptions, along with photos of the property's grounds, public rooms and bedrooms. Rental cars can be reserved online. Top travel magazines offer online suggestions for the best week-end getaways.

The largest initial online travel business is the sale of airline tickets. Web-based travel services offer the reservations engines that airline customer service representatives and travel agents use directly to leisure and business travelers. Customers enter point-to-point destinations, desired travel times and dates, preferred airlines, and other preferences into the reservation system. The system processes the information and delivers a choice of options, along with a secure transactions environment for customers who wish to purchase the ticket online.

In 1996, Web users booked $276 million worth of travel this way. For 1997, online travel sales are estimated to have reached $816 million. By the year 2000, online travel sales could reach $5 billion,[65] or close to 7 percent of U.S. airlines' revenues for passenger air travel.[66]

According to a survey released in November 1997 by the Travel Industry Association of America, 13.8 million Americans used the Internet to plan their trips and 6.3 million made reservations on the Internet. And, consumer acceptance is growing. In 1996, 10 percent of Internet users used the Internet to make travel plans and purchases. When polled in 1997, nearly 70 percent of Internet users said they planned to use the Internet for travel in the upcoming year. Acceptance is high among the general population, as well. Thirty-eight percent of all adults said they would consider using the Internet for their travel in 1998.

Lower sales and marketing costs, and increased consumer choice and convenience are driving the Internet's increased use in travel planning and reservations.

Lower sales and marketing costs

It is cheaper for an airline to process a ticket sale online than to use a travel agent or a reservations center. Not only are transaction fees reduced, but savings are also realized when cheaper electronic tickets can be substituted for more expensive paper tickets. Through the use of the Internet and other information technology, airlines expect to be able to significantly cut distribution costs.

At $12 billion, distribution—travel agent commissions, marketing and advertising expenses, labor and other expenses for airline central reservations services—is the airline industry's second largest operating expense.[67]

Figure 7. Cost to Process Airline Tickets

$8.00: Travel agent books, using computer reservation system
$6.00: Travel agent books direct with airline
$1.00: Customer books "electronic ticket" direct with airline

Source: Air Transport Association of America, 11/20/97

How a ticket is sold, through an agent or by the airline directly, and whether the ticket is paper or electronic, can mean the difference between paying $8.00 or $1.00 to process a ticket (Figure 7).[68]

Airlines are pursuing various strategies to drive their distribution costs down: lowering travel agent commissions, selling through the Internet and promoting electronic ticketing.

Southwest Airlines was the first major U.S. airline to let passengers buy tickets directly on their Internet site in 1996, bypassing the agent and the commission. New Web travel services quickly emerged: online travel sites sponsored by airlines themselves, "virtual" travel agents like Microsoft's Expedia.com and The SABRE Group's Travelocity.com, and travel agents' own sites. Whether customers purchase tickets on an airline's site or through online travel agents, the airlines save money since their own travel reservations centers do not have to be involved in the purchase. In addition, the commissions they pay to online agents are about half what they pay to traditional agents.[69]

While the airlines' ability to move customers away from paper tickets to lower-cost electronic tickets does not depend on the Internet, it is proving to be a useful vehicle for accelerating the shift. Some airlines encourage their Internet customers to use electronic tickets by offering frequent flyer miles for travel booked online with an electronic ticket. Because Internet customers reserve their tickets, select seats and give credit card information online, getting an electronic ticket rather than a paper one seems natural.

Airlines also use the Web to generate additional revenues. No matter how precise an airline's forecasting, seats still go unsold on some flights. Auctioning airline seats to the highest bidder and offering special "cyberfares" for leisure travel are two techniques made possible by the Internet.

Every Monday or Tuesday, American Airlines looks at its yield management results and picks out low-performing markets. Midweek, more than one million "NetSAAver" subscribers receive an e-mail from American Airlines listing special discounted fares for travel in selected markets during the upcoming weekend. The NetSAAver program has generated tens of millions of incremental dollars for the airline since its launch in March 1996.

RETAIL BANKING

Internet banking is still in its infancy. Although most of the top 100 banks in the U.S. have a Web site, the Online Banking Report classifies 24 of them as "True Internet Banks"—banks that let their customers review balances, transfer funds and pay bills on their Web sites. Smaller banks also have Web presences. In Online Banking's list of 133 "True Internet Banks," 109 do not make the list of the top 100 U.S. banks ranked by assets.[70]

Before the decade is out, customers are likely to be able to do most of their banking transactions on the Web. According to a 1996 Booz-Allen & Hamilton survey of North American financial institutions with Web sites, 80 percent of respondents planned to allow their customers to conduct most traditional banking transactions over the Internet within three years.[71]

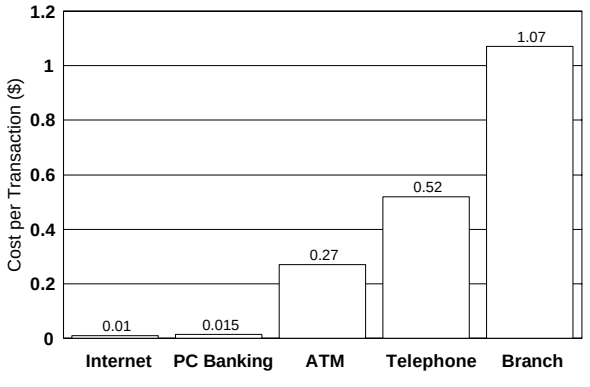
Online retail banking is being driven by lower operating costs, the ability to offer new services, and the ability to do one-to-one marketing.

Lower operating costs

Online banking services are less expensive to offer to customers than other forms of banking. Checking an account balance or transferring funds from a checking account to a savings account can be done in person at a branch bank, over the telephone, with an Automatic Teller Machine (ATM), at home using a PC, or, in some cases, on a bank's Web site.

A branch bank can serve as many customers as it has staff to handle. Once the investment is made to create a fully functioning Internet site (for a

Figure 8. Internet Banking is Cheaper for Banks



Source: Booz-Allen & Hamilton

large bank, the initial investment could be millions of dollars; a more limited solution for a small bank might cost tens of thousands of dollars), the bank's Web site can handle one customer inquiry or tens of thousands a day.

Booz-Allen & Hamilton estimates that it costs about a penny to conduct a banking transaction using the Internet and more than one dollar if handled by a teller at a branch bank (Figure 8).[72]

New Services

Today's online banking allows customers to check account balances, transfer funds, and update customer information—transactions that can already be performed through traditional banking channels. For some customers, the convenience of banking from home or the office is preferable to calling the bank's automated phone service or going to a branch bank. Others do not find the services offered online today reason enough to change their banking habits.

In the future, analysts expect that Internet banking will be enhanced with new services that make online banking easier and more convenient than banking by ATM, by phone, or visiting the branch bank. Paying bills electronically is one such example.

Checks are the preferred method of bill payment in the United States.[73] For a business, preparing and sending paper bills can be costly. For a consumer, paying bills by check can take a great deal of time. Billers print out and mail the bills to a consumer's home. The consumer writes a check, records the check number and amount paid, balances the checkbook, finds a stamp and mails the check back to the biller. The biller receives the check, updates his accounts and sends the check to the bank to credit to his account. Handling paper bills and checks can cost a biller between $1.65 and $2.70 each time he sends out a bill.[74] It costs the customer time and the price of a stamp to pay each bill.

Today's Internet-based bill payment services take some of the paperwork out of the process. Rather than writing a paper check and mailing it to the vendor, a customer authorizes his bank to pay bills on his behalf. This saves the customer some time, and may save the vendor some money, if all steps are completed electronically. However, vendors still incur the costs of mailing the bill to the customer. And, smaller vendors without an electronic connection still have a series of manual and paper-based steps to complete.

Some banks believe that future Web-based bill payment services can make the entire process paperless. The vendor will send an electronic image of the bill to the customer's bank. The customer will electronically authorize the bank to pay the bill, the bank will debit the customer's account, and the vendor will receive payment electronically. The vendor's printing and mailing costs are eliminated, and processing costs are greatly reduced. The customer enjoys the convenience of paying bills without having to keep stamps and envelopes on hand. With services that automatically update account balances, the customer also saves time he formerly spent balancing his checkbook.

One-to-one Marketing

Today, most banks are still equipping their Web sites with basic transactions processing and do little with tailored or one-to-one marketing. However, some now realize that through the Internet, a bank can get to know a customer's banking priorities and preferences even better than it could when banking was done in small neighborhood branches.

Bank of America's "Build Your Own Bank" provides an example of how one-to-one marketing could work. Internet customers using this service provide the bank with basic information about their place of residence, occupation, age, income and gender, whether they own or rent a home, and what types of accounts they have with the bank. They then indicate their financial interests and priorities—whether saving and investing, home buying/improvement, building a business, retirement, economic and financial markets, electronic commerce, or simply better financial organization and budgeting. Based on these inputs, the bank responds with Money Tips and news items geared to the customer's interests, and special offers for the services the customer has prioritized.

These and similar mechanisms give banks the opportunity to cross-sell products and services. Ideally, the customer benefits from these tailored offerings, as well. At a minimum, he should benefit from greater convenience. Because his account profile automatically gets called up when the customer logs into a personalized site, he wastes no time entering account information. Having up-to-date information about balances in each account gives the customer a snapshot of his holdings with the bank without having to do the math himself. The personalized tips and special offers may help the customer to make important financial decisions.

The Future

Over the next few years, a growing number of American households are expected to do their banking online—whether through a dial-up connection to their bank or through the Internet. Roughly 4.5 million households were banking online in 1997. By the year 2000, as many as 16 million households are expected to bank online.[75]

INSURANCE

Insurance carriers' Web sites typically provide customers with basic corporate and policy information, but refer customers to offline agents or customer service phone representatives in order to make a purchase. A more limited number of carriers' sites, and other sites, including banks, securities brokerages, real estate companies and automobile marketplaces, allow Internet customers to purchase term life, automobile and homeowners' insurance online.

Table 4. Internet Sales of Personal Insurance Projected to Grow

	1997	2001
Auto	$21 M	$850 M
Term life	$17 M	$108 M
Homeowner	$1.1 M	$152 M
Total	$39.1 M	$1.1 B

Source: Forrester Research

By 2001, analysts project that more than $1 billion in premiums will be generated via the Internet (Table 4).[76] The rapid increase in sales will be driven by cost savings, increased competition and growing consumer acceptance.

Cost savings

Distribution costs for life and property and casualty policies can be as high as 33 percent or more of the product's price.[77]

Selling policies and providing customer service over the Internet is much less expensive than via an agent or a telephone representative—as much as 58-71 percent lower over the lifetime of a customer.[78] In a direct online sale by the carrier, the agent commission is avoided. If the sale is completed by an online agent such as Quicken InsureMarket, it can be more than cut in half. Even if a traditional agent completes the transaction started on the Internet, the transaction is less expensive. The Internet prequalifies the customer for the agent, saving sales time and expense. The Internet can also be used for electronic communication between agents and carriers, reducing time spent on routine tasks such as applications processing, updating customer account information, and reporting on the status of claims.

In addition to saving money, the Internet can generate new sales opportunities. Carriers that traditionally sell through agents may pick up new customers on the Internet that agents cannot effectively reach. Because of the time needed to acquire a new customer, agents tend to focus on clients they believe will buy larger policies. One insurer, Lincoln Benefit Life, reports differences in the face value of the policies it sells via the Internet and through independent agents. The majority of policies sold by an agent have face values of $500,000 or greater. Online, Lincoln reaches customers who wish to purchase policies with face values of $500,000 and under.

Increased competition

Banks and securities brokerages have begun to sell insurance in their aim to be the one-stop shop for consumers' financial services needs. Whether through alliances with insurers or in direct competition with them, these new entrants will affect how insurers go to market. At the moment, both banks and securities brokerages are embracing the Internet more rapidly than insurers.

Growing consumer demand

Surveys indicate that people would like to be able to get quotes, pay premiums and update their policies online—functions that are not yet provided on most insurance carriers' sites today.

Insurance executives believe that within five years, their customers will prefer to purchase and receive auto and term life policies online to purchasing from an agent. They will use the Web to get product information and quotes, pay premiums, compare prices, access their claims status, access and update their policy information, and get advice from financial service experts.[79]

THE FUTURE

Most industry watchers predict that the market for the digital delivery of products and services will evolve quickly. The rate varies considerably by industry, however.

Selling travel online appears to have the fewest constraints, perhaps because computer reservations systems have been in place for years. Analysts predict rapid growth in travel services, from less than $1 billion in 1997 to close to $8 billion within three to five years.[80]

Similarly, the financial services area is poised for quick growth. Nearly 5 million people actively trade stocks online and pay $8 - $30 per trade (traditional brokerages charge an average of $80 per trade).[81] Investment bank Piper Jaffrey estimates that $614 million in broker commissions were generated online in 1997. This represents more than 4 percent of total retail brokerage commissions and 29 percent of the $2.1 billion in commissions attributable to the discount brokerage sector.[82] Analysts predict that 10-16 million households will bank online by 2000, more than double the number in 1997.[83] Internet-generated premiums for insurance are expected to grow from $39 million in 1997 to $1.1 billion by 2001.[84]

Other digital products and services have significant growth potential, but their long-term success is tied to solutions for protecting copyrights and to improvements in the Internet infrastructure. Intellectual property holders—software developers, recording artists and record companies, movie studios, authors and publishers—worry that digital copies sold or transmitted over the Internet may be prone to copyright infringement and piracy. The Internet is a natural, low-cost distribution channel for these digital products, but the uncertainty of whether their products can be protected impedes growth. Companies are working with technological solutions such as "watermarks" and "digital object identifiers" so that they can keep track of their products online. In December 1996, governments negotiated treaties at the World Intellectual Property Organization (WIPO) to address the question of how copyright should be recognized and protected in global Internet commerce. The U.S. government is working to have these treaties ratified in the U.S. and around the world.

For the multimedia industry, the question of bandwidth is crucial. Until Web users can download a video in a matter or seconds, Web sites will not create many video products to sell online and Web users will prefer to read text, watch television or use their VCR.

Increased bandwidth will also benefit education and health care services. Educational services will be able to use more video programming to supplement other online resources. The Web can also be a very useful tool in medical education and for the delivery of health care diagnostic services. Today's Web users can access some information from their health plans and physicians about medical conditions, symptoms and suggested treatments. Increasingly, they will be able to schedule appointments, pay bills, and check the status of their claims online. As new equipment is developed for remote diagnosis, doctors will be able to diagnose some medical conditions and recommend treatments to patients via the Internet (state laws and regulations regarding telemedicine and licensure may limit how widely remote diagnosis is used). However, because some medical diagnostics require very high-quality images (poor resolution could give the impression of a tumor or a fracture where none exists, for instance), improvements in bandwidth, image quality and reliability will need to occur before telemedicine and remote medical diagnostics emerge as viable industries on the Internet.

CHAPTER FIVE:
RETAIL SALE OF TANGIBLE GOODS

In addition to goods and services that can be delivered electronically, the Internet is also used to sell physical goods. Increasing demands on leisure time and the improvement of overnight and second-day delivery services that spurred the growth of catalog shopping in the 1980s and 1990s are now leading people to shop over the Internet.

A fall/winter 1997 CommerceNet/Nielsen study found that 10 million Web users in the U.S. and Canada (about 16 percent of all Internet users in North America) have actually purchased something on the Web, up from 7.4 million six months earlier. A much larger number use the Web to shop, but they still close the transaction over the telephone or at a store.[85]

Internet consumers report that they shop on the Web because of convenience, ease of research and good prices.[86] Where most Internet shoppers bought computer software and hardware a year ago, today's shoppers buy more mainstream items. America Online (AOL), the largest Internet Service Provider with 11 million customers, reported a shift in online buying patterns during the 1997 holiday season. Apparel climbed to the top spot, and books, to third place this year. Also popular were food, flowers, music and toys.[87]

Internet retailers pursue a variety of strategies to attract customers. Just as one would find in traditional retailing, specialty retailers, large discounters and malls/marketplaces have their places online. Internet consumers may also visit online auction houses or use a "personal agent" to help with their shopping.

Most Internet stores try to make online shopping as familiar and as easy as possible. Physical products arranged on store shelves are replaced with electronic catalogs that include photographs, detailed product descriptions, pricing and size information. Third-party reviews may be available to assist the buyer in choosing between different brands or models. When ready to make a purchase, the customer clicks on the product and puts it into a virtual "shopping cart," and may continue shopping or proceed directly to check out. First-time customers enter basic name and address information, along with a credit card, hit the enter key on the computer, and the transaction is completed. Recognizing that customers may want to speak with a company representative directly in some instances, many Internet retail sites offer toll-free customer service numbers.

Just as traditional bookstores feature tables of bestsellers and gift books, and organize racks of books by subject area, Internet bookstores also provide guides through their vast virtual selection. For those who know the title or the author of the book, a keyword search scans the entire inventory in a matter of moments, retrieves the title, along with a brief description and review of the book, and a button to add it to the customer's shopping cart. Visitors may also browse for a

book according to topic. The topic can be as broadly defined as “history” or as narrowly defined as “Civil War.”

At the same time they borrow from concepts familiar to traditional retail, Internet merchants do not think that merely duplicating what can be found offline is enough to convince customers to shop online. Early pioneers of Internet retail talk about attracting customers with additional value, selection and entertainment.

The Cendant Corporation, a $5.3 billion consumer goods and services company, sells over one million products and services on its Web site, from cars to electronics and cameras, books, appliances, luggage, perfume, flowers and gifts, computer hardware and software, video games and a variety of other goods and services. For an annual membership fee of $69, Cendant claims that its netMarket Web site satisfies 20 percent of the average family’s shopping needs. Because the company’s business model relies almost entirely on membership fees, Cendant reports that it sells products to retail customers at, or near, wholesale prices. In 1997, Cendant facilitated the sale of more than $1.2 billion worth of products and services over the Internet. Before the decade comes to a close, the company plans to offer a product selection which will cover 95 percent of the products a typical household would buy.

Internet Shopping Network’s First Auction site aims to attract Internet users looking for adventure, entertainment, and seeking a bargain. People from all over the country bid against each other in real-time to “win” products. First Auction starts many of its bids at $1.00, well below a product’s cost. Bidders quickly bid up the price, competing with each other to take possession of golf clubs, CD players, television sets, jewelry and a range of other items. Launched in July 1997, First Auction’s membership roster approached 100,000 people by the end of 1997, and 30,00 people visited the site each day.

An Internet shopper need not go to a “store” in order to buy something. In fact, the concept of retail is blurring. Some media sites, online service providers and search engines prominently feature retailers and provide direct links to their sites. Some give customers the ability to buy goods directly from their own sites. Time Warner, the media and entertainment company, has a marketplace on its Web site featuring retailers selling books, music, travel, computers and electronics, vitamins and more. Visitors using Yahoo!’s search engine can buy products from The Visa Shopping Guide by Yahoo!. A shopper who wants to buy a pair of ladies’ shoes, but does not want to go from Web store to Web store to shop, can use the “one search” option and a software agent scans the offerings of participating retailers for selection and price information in one trip. An interested buyer can click on the “buy” button and be transported to the Web page featuring a picture and a more detailed description of the shoes at the retailer’s site to finish the transaction.

Even buying a car, more of an investment than a typical retail purchase, is possible to do through a number of auto marketplaces, online classified sites, and manufacturers’ own sites. JD Power & Associates, a marketing information firm specializing in the automotive industry, estimates that roughly 16 percent of all new car and truck buyers used the Internet as part of their shopping

process in 1997, up from 10 percent in 1996. By 2000, they project that the Internet will be used in at least 21 percent of all new car and truck purchases.[88]

As in other areas, the growth of online retailing is being driven by cost savings, the ability to customize marketing, and increased consumer convenience.

Virtual stores report lower operating costs than their physical counterparts. Costs of supporting a store infrastructure—rent and depreciation, labor, utilities and other expenses - - are almost entirely avoided online. 1-800-FLOWERS sells flowers through its own flower shops, affiliated flower shops in major cities across the country, by telephone sales and online. Although its online business generates only 10 percent of its total revenues, its profit contribution to the overall business is nearly that of its store-based business which generates 20 percent of total revenues.[89]

Direct marketing in traditional retail is already quite sophisticated: retailers can access and manipulate extensive databases made up of warranty information for cars, appliances and consumer electronics. Retailers can use this information to attract new customers by sending mailings to consumers living in certain zip codes that fit given demographic or other specialized profiles. Databases of existing customers may be even more detailed, allowing retailers to send more targeted offers. In either case, these direct mailings often take time and significant expense to compile, mail and then review their effectiveness.

Though not really in practice yet, the Internet offers the opportunity to take direct marketing to the next level: to market directly to narrow bands of customers—even to individuals—and to do so profitably. When a customer visits a site, for example, the site may say "hello" and state the visitor's name. It knows who is there because of a technology that records the Internet address of the visitor and matches it to a name if the visitor has already registered or purchased something at the site.

Web businesses also keep track of what an individual customer purchases. Increasingly, Web businesses will send a message to the buyer of a 28.8 kbps modem that the company now offers the latest 56 kbps modem; the person who buys a certain style and size of pants and sweaters will receive notices of new merchandise in that style or size, along with suggestions for accessories to match; the adventure traveler whose last trip was to Nepal at the height of trekking season may receive information about the newest hiking boots and multi-day packs to hit the market or an invitation to join a team traveling to Patagonia. Right now, many consumers are wary of this type of marketing, fearing a loss of personal privacy. If Web users become convinced that they can protect their privacy online at the same time they make these offers, targeted marketing will likely become commonplace.

Amazon.com has taken some first steps in this direction. It greets site visitors by name, informs customers by e-mail when a particular book has arrived or sends them reviews of "best new books" in areas where the customer has indicated an interest. An "instant recommendations" feature proposes books to customers based on purchases they have made at Amazon. Customers can also get an accounting of their purchases at Amazon or see the status of their orders.

THE FUTURE

Analysts believe that Internet retailing (where sales are actually completed on the Internet) will grow quickly, but they vary widely on just how quickly. On the conservative end, it is expected to reach $7 billion by the year 2000.[90] If mail order sales are used to determine the potential for Web retail sales, as some suggest, the figure could reach $115 billion in five to eight years.[91] If online shopping provides customers with a larger assortment, better prices, and greater choice than mail order companies, the figure may even exceed that projection.

To make the most of the potential of the Internet, retailers will have to overcome a number of challenges. Among others, they will need to increase consumer confidence in relying on computer images and information to determine the quality and fit of a product, and simplify the process of returning defective or unwanted merchandise. They will also need to address the question of credit card security and consumer privacy.

Making Virtual Purchases More "Real"

How can virtual images on the Internet replicate the sensation of picking up a product, feeling the material and its texture or sturdiness, trying it on (in the case of clothing) or sitting down on it (in the case of a sofa) before making the decision to buy?

As described earlier, Internet retailers offer very detailed product descriptions online. Many provide toll-free numbers for customers who prefer to speak with a sales representative before making a purchase. As video and voice become more widely used, some Internet sites can be expected to give customers the choice to click on a button and speak directly with a customer service or sales representative via the Internet. As bandwidth increases, three-dimensional images that show the product from a variety of angles will supplement or replace the flat photos on most sites today. Customers visiting Internet furniture stores will be able to furnish their own homes and apartments by "dragging and dropping" furniture and accessory icons into rooms the customer has made to resemble those in his home. This feature will enable customers to gauge how well different pieces of furniture fit into a room of a given size, and which furniture styles or colors work best together.

How well will Internet retailers satisfy demands, particularly in the U.S., for immediate gratification, no-fuss returns, and a strong customer service policy?

Customers are generally interested in speed of delivery and ease of return. The emergence of extensive overnight shipping in many parts of the world already allows retailers—including those on the Internet—to provide quick, reliable service. As Web retailing increases, overnight delivery and "drop shipping" services from manufacturers to the customer's home are likely to grow as well. Customers who worry that they will have to make an extra trip to the post office or parcel delivery company if a product they order via the Internet is not what they had in mind may be surprised to learn that some companies will actually send packaging overnight, free of charge,

to a customer's home, along with instructions to return the product, free of charge, to the company.

Making transactions secure

Most Internet purchases are currently made by entering credit card and delivery information on a computerized form and transmitting it electronically to the retailer. Even though consumers are accustomed to giving credit card information over the telephone, many are reluctant to give it online for fear that it will be stolen or misused. This reluctance is often cited as the largest barrier to the growth of retail sales on the Internet.

Web retailers believe that concerns about credit card security will lessen, particularly as more people shop online, have trouble-free experiences, and tell their friends and relatives about them. In fact, some already detect greater comfort among their consumers this year as compared to one year ago. (1-800-FLOWERS recently reported that fewer than one-third of its customers worry about credit card security, compared to almost 75 percent in 1996.[92]) Word of mouth, combined with technology and standards for safeguarding sensitive information, should help to alleviate these concerns.

Smart cards and digital cash will also be used for electronic commerce. Instead of reentering name, address and credit card information each time a purchase is made at a different Web site, information already stored on the smart card will be transmitted to the merchant electronically, saving steps for the consumer and reducing fraud by automatically validating the consumer's identity. For those consumers who wish to purchase goods or services anonymously, digital cash and stored value cards (cards worth a set amount of money) will also be available at banks and other companies for use over the network.

Ensuring Privacy of Personal Information

Consumers worry about protecting the privacy of their personal information, as well. A majority of respondents to a recent *Business Week/Harris* poll mentioned privacy as the main reason they do not use the Internet. More than three-quarters of current users say they would use the Web more if privacy were guaranteed.[93]

Some sites request that new visitors volunteer personal information upon entering the site. In exchange for that information, they may offer "membership" services such as birthday reminder e-mails, new product announcements or newsletters. A purchase may trigger the gathering and creation of a customer profile, as Internet retailers need basic personal information in order to deliver a physical good to a customer. Or, an Internet user may leave an electronic "footprint" of visits to different Web sites and purchases he has made and not even be aware of doing so.

Often today, consumers are not given the opportunity to block the gathering of information or, when they freely give it, to indicate how they would like that information to be used (for instance, whether the company should restrict its use to internal purposes, whether it can be disseminated to external companies if specific conditions are met, or whether it can be widely disseminated). Some realize that their information has been sold without their knowledge or consent when they receive unwanted e-mail. Some may see the positive side to data collection and direct marketing the next time they go to buy a book and are presented with suggestions of new releases in keeping with their interests and past purchases. Nevertheless, they want some control over when and how their data are collected and used.

In order to empower consumers to have control of their own personal information, the U.S. government is encouraging the private sector to establish codes of conduct and self-regulation. To be meaningful, the government believes that self-regulation must do more than articulate broad policies or guidelines. Effective self-regulation involves substantive rules, as well as the means to ensure that consumers know the rules, that companies comply with them, and that consumers have appropriate recourse when there is noncompliance. Consumers need to know the identity of the collector of their personal information, the intended uses of the information, and the means by which they may limit its disclosure. They should be given the opportunity to exercise choice with respect to whether and how their personal information is used. Companies creating, maintaining, using or disseminating records of identifiable personal information must take reasonable measures to assure its reliability for its intended use and must take reasonable precautions to protect it from loss, misuse, alteration, or destruction. In addition, consumers should have the opportunity for reasonable, appropriate access to information about them that a company holds, and be able to correct or amend that information when necessary.

Consumer retail on the Internet is already showing signs of rapid growth. As retailers address the challenges outlined above and as consumers become more familiar and comfortable with buying goods online, the Internet could emerge as an important retail channel.

CHAPTER SIX:
CONSUMERS IN THE DIGITAL AGE

Businesses invest in information technology and electronic commerce to increase productivity, cut costs and enhance customer service. Consumers shop on the Internet because they find their choices dramatically increased. They have access to much more information when making purchasing decisions. Busy consumers can save time and find shopping more convenient as merchants serve their needs individually. Better information and greater selection, combined with lower operating costs for many Internet business may, in turn, drive reductions in prices or improvements in quality.

CHOICE

The sheer number of stores that can be "visited" online far exceeds even the most densely populated retail areas in the country. No longer do customers find their shopping limited to the stores within a reasonable driving or walking distance or to the catalogues they receive in the mail. Online, customers can shop at stores in other states, in other countries, and at stores that do not exist in traditional formats.

News and newspapers provide a vivid example. Residents of large cities already benefit by being able to buy a number of different national and regional newspapers from coin-operated machines and specialty news outlets. Outside large cities, however, the selection is much more limited. Online, readers can access news from thousands of newspapers around the world. An online reader interested in news about the 1998 winter Olympics in Nagano can access coverage in Japan's Asahi Shimbun as well as turning to coverage in the American media.

The vast selection is not limited to products and services that can be delivered digitally. Web sites selling consumer electronics, gardening supplies, office supplies and other hard goods also offer larger selections than do their counterparts in traditional retail.

The largest chain bookstores carry about 150,000 different books. On the Web, readers can choose from 2.5 million titles under one roof, covering both in-print and out-of-print books. In addition to general purpose bookstores, specialty stores carry books on antiques, books written in foreign languages, rare editions, and other books that would require extensive phone calls and physical trips to obtain. On the Web, readers can enter the keywords identifying the types of books they want, choose some promising sites, search their inventories, and often have the book delivered within a few days or a week.

CONVENIENCE

Consumers cite convenience as the number one reason for making a purchase online. Shopping on the Internet can save time. A consumer does not have to travel to a store site or adjust his schedule around the store's hours. No longer does a consumer have to wait on hold for a customer service representative to answer the phone. Recognizing that customers may want products delivered as soon as possible, many sites offer next day or second-day delivery. Online support tools—order status, product availability and pricing, technical support and troubleshooting tips—are generally supplemented with toll-free numbers that customers may call for further information.

The example of Garden Escape, an Internet-based gardening company, shows how combining products and services in a virtual "store" can save consumers a great deal of time and effort. The founders of Garden Escape wanted to create a one-stop shop for gardening needs. They began by taking an inventory of all the resources a gardener uses today: nurseries and seed catalogs for plants and tools, other retailers for specialty outdoor products; books and magazines for tips on the plants and flowers that flourish or perish in certain soil and climate conditions; gardening clubs where hobbyist gardeners share suggestions with other enthusiasts; and the extensive array of catalogs, books and CD-ROMs that help gardeners in designing a garden.

By offering a virtual, rather than real, inventory, Garden Escape offers a selection of products that even the largest nursery could not possibly stock—a selection of 10,000 seeds, perennials, roses, bulbs, greenhouses, tools and other gardening products from around the world. Serious gardeners can use online software tools to design their ideal garden. For suggestions and tips, there's an online magazine, a chat room and new daily tips from the magazine's editors. A consumer with a question about a horticultural term can check out the glossary, or call Garden Escape's toll-free number.

BETTER AND MORE COMPLETE INFORMATION

Web consumers are often better informed than their offline counterparts. Two examples—shopping for a car and shopping for an insurance policy—illustrate the differences between purchasing via the Internet and purchasing through traditional means.

Shopping for a car can be a very complex process. It involves choosing a particular make and model of car, outfitting it with different accessories and performance options, choosing financing options (whether to lease or buy and how to obtain the best rates), purchasing or updating an auto insurance policy, and negotiating a fair price. Prior to the Internet, gathering that information could take a lot of time, and many consumers went to dealer showrooms ill-prepared. The Web changes the dynamic.

Web shoppers can view pictures of different car models and read extensive information on the car's features and performance. Financing and insurance options are also available online.

At Auto-by-Tel, a leading Web-based auto marketplace, shoppers can access model and pricing information, including dealer invoice pricing and manufacturer rebate information on all new and used cars from 2,700 accredited dealers from across the country. Along with a picture of the car and brief descriptions, the customer can access new-car and used-car pricing from third party sources like AutoSite, Edmund's, CarCenter and the Kelley Blue Book.

After deciding which car to buy, the customer enters the zip code where he or she lives and the make and model of the car desired. A screen pops up requesting that the customer indicate what color exterior and interior he wants, the type of transmission, the number of cylinders, and when they prefer a 2-door or 4-door model. Then the customer completes a new car purchase request, selecting the manufacturer options to include on the car (radio, power windows, anti-lock brakes, sunroof, etc.) After making these selections and providing contact information, the customer's request is transmitted to the Auto-by-Tel dealer closest to the customer's home. Within 24 hours, the dealer contacts the customer with a firm price.

Internet businesses selling life insurance products arm consumers with software tools that help them determine what types of insurance they might need, as well as information to enable them make educated choices between one insurer's policy and another's. Quicken InsureMarket, an Internet-based insurance marketplace, provides one illustration. Visitors maneuver through the InsureMarket site, accessing only the information they want; for example, an explanation of a term they do not understand, information about the carrier's rating, or how much and which type of insurance is suitable for them, given their family's financial profile. A consumer can comparison shop for term life policies by clicking on a button and answering some basic questions about residence, age, health, income, family situation, and the amount of insurance desired. In a matter of moments, the customer receives personalized quotes from up to seven carriers and up to four agent contact options. The system randomly generates the order of the insurance carriers providing quotes and referrals the visitor sees so as not to give an advantage to any single carrier. At a glance, the customer can compare the policies and the prices of several different carriers. Another few clicks of the mouse, and the customer has more information about each carrier and policy to determine whether a price difference between apparently similar policies is really justified.

LOWER PRICES

Commerce, and therefore competition, on the Internet is still undeveloped. A good deal of Internet retail is being driven by convenience, the search for a broader selection, or the opportunity to find items not readily available in ordinary retail outlets.

Despite its infancy, some Internet retailers offer discounts from traditional channels. For instance, online booksellers discount some books by 40 percent over typical bookstore prices.[94] (Depending on the cost of delivery, the total cost of an item may be higher on the Internet than at a store.) Consumers buying and selling stocks through the Internet commonly pay $8- $30 per trade, while traditional brokerages charge approximately $80 per trade on average.[95] Internet users can access most online news and information free of charge.

This pattern of lower prices is not universal. Some retailers have determined that their current Internet customers buy products from them primarily because of convenience, selection or quality. In the short term, they do not feel that lowering prices would lead to additional sales. Some traditional store-based retailers set their prices for products they sell through the Internet at the level found in their stores in order not to adversely impact their store-based business.

If retailing continues to grow on the Internet, competition and the favorable economics of the Internet are likely to translate into lower prices for the average consumer.

CUSTOMIZATION

The Internet offers the potential for increased customization**.** Some Web businesses, particularly media businesses, already customize the product to an audience of one. Readers can select only the news they want to read, and it gets "delivered" to their personalized Web page on the site, to an e-mail box, or as a service that the computer defaults to when at rest.

Music and computers are other products where the combination of innovation and economics is encouraging increased customization. Customers at online music stores have the choice of purchasing CDs available at record stores. Or, if they desire, they can create their own CDs from a growing number of digital recordings. Buying a laptop computer is no longer limited to what a store or a manufacturer has in stock. Instead, consumers can choose from a variety of base models, and purchase the standard configuration or customize the machine according to price and performance requirements. (For instance, the customer can decide whether to pay extra for a speedy 266MHz processor or save some money with a somewhat slower 166MHz processor. Similarly, the base model may have 48 MB of memory (RAM), but additional memory is available for those who need it. Different modems, network adaptors, extra batteries and software packages can be installed by the factory at the customer's request. Even the service package can be tailored to the customer's needs. Traditional retail and mail order outlets, in addition to Web businesses, offer customers the opportunity to customize their computers; the Internet and private networks speed the flow of information and thereby improve the economics of customization.

Web-based clothing stores may soon incorporate technology that allows customers to "try on" clothing. Deciding between a Large or Extra-Large sweater may be as simple using the computer mouse to "drag" the virtual sweater over a 3-D image of oneself to see whether it is too snug or a perfect fit. For retailers and manufacturers who continue to produce standard sizes for their customers, this technology will simulate the physical act of trying on clothing in a store's dressing room. Other businesses may decide to build a business around tailored clothing, using the 3-D image to customize the size and fit of the sweater to that individual customer.

The Internet and other new technologies may encourage businesses to explore the feasibility of mass customization; whether and how extensively retailers and manufacturers start to customize clothing, furniture, and other products based on individual customer specifications will ultimately depend on market demand.

THE FUTURE

Today's Web consumers benefit from a selection of products and services unparalleled in traditional channels. Without leaving home or an office, consumers can access thousands of Web sites to become informed about breaking news and events, research products, and purchase everything from groceries to books to insurance policies.

Whether they complete the transaction online or make the purchase at a store after using the Web to help narrow the search for a particular product, the Web arms the consumer with much more knowledge about choices and prices available to them.

Despite these advantages, many consumers today still remain wary of the Internet. They are concerned about protecting their privacy and the security of their credit card information. Many do not have computers, or find them too difficult to use. Or, they prefer the experience of shopping and selecting products they can see, feel, or try on in person. For these reasons, shopping in stores will likely be the main way that consumers purchase goods for many years to come.

However, the barriers to Internet shopping are likely to be lower for younger consumers. Children today are growing up with the Internet. Over the next decade, as today's children become adults, shopping on the Internet will be easy and natural to them.

The growth in the numbers of individuals using the Internet provides strong evidence that consumers perceive its benefits. As more individuals come online, as the Internet becomes easier to access, as Internet commerce increases, and as today's children become adults, the combined effect will be to further enhance the already-present benefits the Internet has to offer.

CHAPTER SEVEN:
WORKERS IN THE DIGITAL AGE

The rapid growth of the computing and telecommunications industries has already created a large and growing demand for programmers, systems analysts, computer scientists and engineers. If electronic commerce begins to substitute for more conventional sales and services, it will shift employment from traditional occupations to those requiring IT skills and, in many instances, other higher-level cognitive reasoning abilities. Electronic commerce is very much part of a broader national trend that requires more skills in the work place and an improved basic education in mathematics and science.

The digital age will also create greater opportunities for telecommuting, and already strong trends towards globalization will accelerate.

CHANGING SKILL REQUIREMENTS

Demand for workers in IT industries and workers with occupations focused on the design, programming, maintenance and repair of the computing and communications infrastructure will continue to grow. In 1996, more than 7 million people worked in these jobs and they earned an average annual wage of just under $46,000. Over the next ten years, the Bureau of Labor Statistics (BLS) projects that an additional 2 million workers will be needed to fill these jobs. Companies already report difficulties in filling these positions today.

Workers with information technology skills are needed across the economy. An analysis of IT occupations shows that the demand for workers to fill higher-skilled IT jobs (computer engineers, scientists, and systems analysts) is expected to grow from 874,000 in 1996 to 1.8 million by 2006.[96] These positions typically require a four-year undergraduate degree, often in a field of science, mathematics or engineering, and in many cases, advanced training or a graduate degree. Employment in lesser-skilled jobs like computer operators and duplicating machine operators is expected to decline from 481,000 in 1996 to 342,000 by 2006.

As electronic commerce becomes more widespread, it, too, will likely drive changes in the labor market. In most cases, the share of sales generated by a company's Web business is still only a small fraction of the company's total business. As it increases, however, the composition of the workforce required to produce and deliver a product or service may shift.

For instance, if online delivery of news services replaces some portion of the conventionally delivered news, workers may gradually shift away from the printing or delivery of newspapers to the creation of content or managing of computers. Workers manning printing presses, driving trucks, and staffing news stands have no role in online news distribution. Their function is

performed by new workers responsible for programming, operating and maintaining the computer servers that "distribute" the news to Web readers.

The same could be true for retail as online sales begin to substitute for in-store sales. Today, a super store might be staffed by a few hundred employees. Warehouse personnel receive new merchandise into the store and keep the shelves and bins filled. Salespeople advise customers on product features, check availability of merchandise not found on the shop floor, and book special orders. Cashiers ring up the sale and bag the goods. Back-office staff keep track of inventory and sales patterns, pay vendors and payroll, deposit sales receipts, and manage the day-to-day store operations. Other workers keep the store and its grounds clean and well-maintained.

A retail sale via the Internet does not require the presence of a physical store or the same intensity of staff in order to generate the sale. Virtual retailers will hire people with IT skills to develop and program software, and operate and maintain computer servers and networks. They will also need marketing staff, accounting departments, customer service representatives and people skilled in graphic design to keep their Web site, or "storefront," attractive and user friendly.

Whether a retailer handles the physical distribution of its own products or contracts with another company to perform that function, warehouse and distribution personnel will continue to be necessary to transport products from the manufacturer's site to the customer's home. Retailers with an existing store infrastructure are likely to position the online business as complementary to their traditional store business, at least in the near term. Until online sales are of a size to warrant a dedicated distribution strategy, traditional retailers may choose to deliver goods to Web customers from the nearest store location, adding to the workload of existing warehouse personnel. Other retailers may choose to have manufacturers package and mail or "drop ship" goods directly to customers without going through any intermediate steps. Or, they may outsource the entire logistics process for the online business to a third party. In any of these scenarios, few store personnel would be involved in an online sale.

Jobs characterized by a transfer of information from one party to another—travel agents, insurance agents, stock brokers, customer service representatives—will likely see routine tasks like order taking disappear, and more complicated tasks replacing them. For instance, a leisure traveler making plans to go home for the holidays usually knows all the carriers flying that route and simply needs to make the reservation and pay for the flight. That would be a case of order taking, a function as easily performed online as by calling the airline or a travel agent. On the other hand, a couple planning a trip to South Africa might seek the advice of someone who has been to the region, who can recommend hotels in the wine country near Cape Town and safaris in Kruger. Similarly, someone purchasing a term life policy with a face value of $400,000 may feel comfortable enough researching and purchasing that policy online. To help make the decision of whether to buy a whole or variable life insurance policy or put the money into an Individual Retirement Account or other investment vehicle, however, he might prefer to consult an expert in person.

WORKFORCE FLEXIBILITY

Workforce flexibility refers to a company's ability to produce products and services with less rigid organizational structures. It also refers to a worker's ability to work without being tied to a desk or an office. The growth in information technology has played an important role in both driving the need for a new work force and in enabling greater flexibility in the work place.

In the old model of industrial organization, production workers performed tasks by rote, over and over again throughout a shift. A car frame rolled down an assembly line, a worker attached a part, it proceeded to the next worker who performed the next process, and on it continued until a completed car emerged at the other end. A bank teller opened accounts, accepted deposits and provided account balance information. Someone else handled transactions involving Certificates of Deposit, Money Market Accounts and safety deposit boxes.

Bureaucratic work organizations are giving way to flexible "cells" and teams that cross the once-rigid lines of job description, management reporting structures, and business units. This transformation often results from a corporate objective to implement total quality management (TQM) and Six Sigma (a benchmark of nearly zero defects) systems throughout their organizations. Reducing errors and return rates, lowering cycle times and reducing costs means getting it done right the first time. People on the "front lines" - - the factory floor, the sales department, the customer service organization - - need to have the education and information to make decisions and solve problems. Companies with successful TQM and Six Sigma initiatives invest heavily in training and education. They also give employees the tools they need: clearly-stated objectives and real-time feedback on how well those objectives are being met. A robust computer network with online training and support tools can reinforce (or substitute for) in-classroom training sessions. It also keeps workers up-to-date with the latest forecasts, the current day's production or sales requirements, materials shortages, and other information in order to better perform the day's tasks and anticipate future needs.

As more companies move to this method of work organization, the need to share information and knowledge across the enterprise will increase. Internal corporate networks and the Internet will play an important role in enabling this transition.

Thanks to personal computers, fax machines, modems and cellular phones, as many as seven million workers in the United States work at home in "virtual offices."[97] The Department of Transportation estimates that up to 15 million workers may be telecommuting in the next decade.

Organizations with telecommuting programs report an increase in productivity, faster completion of assignments, fewer sick or absent days, better time management and increased morale and commitment to the company. They also benefit from reduced office space needs and associated costs, an enhanced ability to attract and retain quality employees, and improved customer service.[98]

Telecommuting benefits employees, as well. For those who need to balance work commitments with family commitments, telecommuting provides the means for working and communicating with coworkers and clients from home. Employees working part-time can manage their time more effectively, spending less time driving to one or more offices, and instead focusing on completing work assignments.

GLOBALIZATION

Information technology has opened up new opportunities for global commerce. The signals transmitted over the Internet do not recognize national borders. Work on the same project can be done in several places or several countries without workers having to physically relocate.

Organizations can now deploy resources and operations around the world. Information about new product introductions, corporate earnings, forecasted sales patterns, and materials requirements can be shared almost instantaneously via corporate e-mail systems and value-added networks, and now, over the Internet.

Developing software, designing a car, providing consulting services to a client, can be done collaboratively by teams of employees from different parts of the world. For instance, an engineer in California can send an e-mail at the close of her business day to a colleague in Singapore, asking him to look over the attached design specifications for a new product. By the time she arrives for work the next morning, a reply could be sitting in her "in-box" with a marked-up set of specifications.

With the opportunities come serious challenges. Countries that have an insufficient supply of skilled workers will see high-skilled, high-paying jobs migrate to countries that can supply the needed talent. Those that have a surplus will find job opportunities opening for their workers in overseas organizations. Even though the United States has led the world into the digital age, we face these same realities. Without a concerted effort to develop students and workers to meet the new challenges of the digital economy, the United States could face a migration of high-skilled, high-wage jobs to other countries.

CHAPTER EIGHT:
CHALLENGES AHEAD

This report has focused on the emergence of the digital economy—the promise it contains and some of the challenges it poses. Some of the challenges are technical, others involve the development of standards, and still others require significant capital investments.

The digital revolution is also changing the respective roles of government and the private sector. In the 19th and for much of the 20th centuries, governments played a key role in helping build or actively regulate much of the country's infrastructure. The federal government made extensive land grants to encourage private capital to expand the nation's rail network. Government subsidies were used to stimulate the development of an airline industry. Federal and state dollars combined to build and maintain the interstate highway system. In communications, the government granted a virtual monopoly to a single company and regulated the industry after its breakup. Most power companies have been regulated monopolies at the state or federal level.

The federal government funded and developed early versions of the Internet for national security and research purposes. It will continue to provide funding for research and development on future Internet and high-performance computing technologies. However, most of the capital to build the computing and telecommunications infrastructure is being provided by the private sector.

The pace of technological development and the borderless environment created by the Internet drives a new paradigm for government and private sector responsibilities. Creating the optimal conditions for the new digital economy to flourish requires a new, much less restrictive approach to the setting of rules.

- Governments must allow electronic commerce to grow up in an environment driven by markets, not burdened with extensive regulation, taxation or censorship. While government actions will not stop the growth of electronic commerce, if they are too intrusive, progress can be substantially impeded.

- Where possible, rules for the Internet and electronic commerce should result from private collection action, not government regulation.

- Governments do have a role to play in supporting the creation of a predictable legal environment globally for doing business on the Internet, but must exercise this role in a non-bureaucratic fashion.

- Greater competition in telecommunications and broadcast industries should be encouraged so that high-bandwidth services are brought to homes and offices around the world and so

that the new converged market place of broadcast, telephony and the Internet operate based on laws of competition and consumer choice rather than those of government regulation.

- There should be no discriminatory taxation against Internet commerce.

- The Internet should function as a seamless global marketplace with no artificial barriers erected by governments.

As with any major societal transformation, the digital economy will foster change and some upheaval. The Industrial Revolution brought great economic and social benefit, but it also brought about massive dislocations of people, increased industrial pollution, unhealthy child labor and unsafe work environments. Societies were often slow in responding to these negative side effects.

Similarly, the digital economy may bring potential invasions of privacy, easier access by children to pornographic and violent materials and hate speech, more sophisticated and far-reaching criminal activity and a host of other as-yet unknown problems.

The private sector and government, working together, must address these problems in ways that make the Internet a safe environment while not impeding its commercial development.

The U.S. Government's "Global Framework for Electronic Commerce," posted on the Internet at http://www.ecommerce.gov, describes a market-driven framework that will stimulate the growth of the digital economy while offering flexible, industry-driven solutions that will effectively address problems that may arise. Steps are now being taken in the United States and around the world to meet these public policy goals.

Perhaps the greatest challenge the U.S. faces, however, is to put in place the human resource policies necessary for the digital economy. If the trends described in this study continue, millions of jobs will likely be created, while millions of others will be lost.

The good news is that the net economic growth anticipated by this digital revolution will likely create more jobs than those that are lost. Further, the jobs created are likely to be higher-skilled and higher-paying than those that will be displaced. However, it is clear that we will face great challenges in preparing the current workforce and future workers to fill the new jobs that will be created. If we do not have a sufficient number of well-educated and trained people to fill these jobs, then the good news can turn to bad.

If these public policy issues can be resolved, and electronic commerce is allowed to flourish, the digital economy could accelerate world economic growth well into the next century.

ENDNOTES

1. "Monetary Policy Testimony and Report to the Congress." Testimony of Alan Greenspan, Chairman, Federal Reserve Board. February 24, 1998. Http://www.bog.frb.fed.us/boarddocs/HH/

2. Schwartz, Peter and Leyden, Peter. "The Long Boom: A History of the Future, 1980-2020." *Wired*. Issue 5.07. July 1997. Http://www.wired.com/wired/5.07/longboom.html

3. There is an ongoing debate on IT's contribution to productivity. Some believe that IT has had a positive impact on productivity, yet it does not show up in government data because of inadequate measurement techniques. Others believe that IT has not had a measurable impact on productivity because businesses have not yet reorganized their operations in order to take advantage of information technology. They note that the lag between investments and their full payoff generally takes many years.

4. NUA Internet Surveys estimate that there were between 23-33 million Internet users in the U.S. in 1996, representing 83 percent of all Internet users. Using that calculation, between 28-40 million people around the world were using the Internet in 1996. By the end of 1997, NUA estimates that 101 million people were using the Internet. Http://www.nua.ie/surveys

5. Network Solutions, Inc. Private communication received February 1998.

6. Inktomi Corporation White Paper. 1997. Paper cites data from UUNET, one of the largest Internet backbone providers. Traffic is measured as the total amount of information - - bits - - going across the network. http://www.inktomi.com/Tech/EconOfLargeScaleCache.html

7. Gordon, John Steele. "What has Watt wrought?" *Forbes*. July 7, 1997. pp.144-171. Thomas Newcomen developed the first practical steam engine in 1712, used primarily for pumping water out of mines. This engine was only practical near a source of wood or coals. James Watt's steam engine of 1769 added a separate condenser which increased the fuel efficiency by a factor of four. Due to this addition, a steam engine could be put anywhere and the fuel hauled to it. In 1782, Watt modified the engine by introducing a rotary motion that could turn a shaft.

8. Michael Faraday first harnessed electricity in 1831 by means of motion in a magnetic field. Forty years later, Thomas Edison and Joseph Swan invented the incandescent filament lamp.

9. Thomas Edison's Pearl Street Station in New York City began generating electricity on September 4, 1882. Smithsonian Institution, National Museum of American History.

10. David, Paul, "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox." *The American Economic Review*. Vol. 80, No. 2, 1990. pp. 355-361.

11. Ibid.

12. Gwennap, Linley. "Birth of a Chip." *BYTE*. December 1996.

13. Moore, Gordon. "The Continuing Silicon Technology Evolution inside the PC Platform." Intel archives. http://developer.intel.com/solutions/archive/issue2/feature.htm

14. Lucent Technologies. http://www.lucent.com/netsys

15. Bandwidth determines the speed at which data can flow through computer and communications systems without interference. In the early days of the Internet, most messages were simple text that did not require large amounts of bandwidth. Bandwidth requirements have increased as people began to send images, sound, software, video and voice over the Internet.

16. In a packet-switched system, a message is broken into chunks and each chunk or "packet" is individually addressed and individually routed across the network to its destination. At the destination, the message is reassembled. Packets that do not arrive at the destination are retransmitted. As Vint Cerf, one of the inventors of the Internet, describes it: Packet switching is conceptually similar to the way the postal service works. That is, each letter or postcard is individually addressed and moves geographically from point-to-point as it travels towards its destination. Two postcards mailed from a post office in San Francisco may take different routes to New York, but once they arrive at the New York City post office, they are assembled with the other mail going to the destination address and delivered. Each "packet" is like a postcard and network routers are like the mail stops along the way.

17. Meeker, Mary and Pearson, Sharon. *Morgan Stanley U.S. Investment Research: Internet Retail.* Morgan Stanley. May 28, 1997. pp.2-2, 2-6. Notes: Data for TV and other media are U.S. figures. PC figures reflect worldwide users. Morgan Stanley uses the launch of HBO in 1976 as their estimate for the beginning of cable. "Though cable technology was developed in the late 1940's, its initial use was primarily for the improvement of reception in remote areas. It was not until HBO began to distribute its pay-TV movie service via satellite in 1976 that the medium became a distinct content and advertising alternative to broadcast television."

18. In 1989, the World Wide Web (WWW) protocols for transferring hypertext via the Internet were first used in experimental form at the European Center for Particle Research

(CERN) in Switzerland. In 1991, the National Science Foundation lifted the restrictions on the commercial use of the Internet. That same year, the World Wide Web (WWW) was released by CERN. In 1993, the alpha version of Mosaic, the graphical user interface to the WWW, was released, giving non-technical users the ability to navigate the Internet. This report uses 1993 as the date when the Internet became truly open to the public. See: Cerf, Vint. "The Internet Phenomenon." National Science Foundation Web page. Http://www.cise.nsf.gov/general/compsci/net/cerf.html

No exact figures exist on Internet usage worldwide, but different sources point to 1997 as the year when Internet usage approaches/crosses the 50 million mark. For instance, NUA, an Internet consultancy and developer, compiles figures from different research analysts and finds the following ranges of Internet usage: 1995: 8-30 million, 1996: 28-40 million, 1997: >100 million. (Note: some research groups report U.S. figures only. Global figures for 1995 and 1996 were derived from NUA estimates on U.S. Internet usage as a percent of global Internet usage.) http://www.nua.com/surveys/how_many_online/index.html

19. Intel. "Moore's Law: Changing the PC Platform for another 20 years." http://developer.intel.com/solutions/archive/issue2/focus.htm

20. Making adjustments for price and performance, the IT sector contributed 28 percent of real GDP growth between 1996 and 1997. Measured in nominal terms, the IT sector contributes 15.7 percent of GDP growth over the same time period. (See IT chapter for more detailed explanation and charts.)

21. Parekh, Michael et al. *Goldman Sachs U.S. Research: Cyber Commerce: Internet Tsunami*. Goldman Sachs. August 4, 1997.

22. Meeker, Mary and Pearson, Sharon. *Morgan Stanley U.S. Investment Research: Internet Retail.* Morgan Stanley. May 28, 1997.

23. Ibid.

24. Nicholas Negroponte, founder and director of the MIT Media Lab, estimates that 1 billion people will use the Internet as early as 2000. See: "The Third Shall Be First: The Net leverages latecomers in the developing world." *Wired.* January 1998. In his book, *Digital Economy*, Don Tapscott cites the New Paradigm Learning Corporation when he estimates that there should be well over 1 billion Internet users by 2000. Others feel that 2000 may be too optimistic, as much of the developing world does not even have a basic telecommunications infrastructure. As new investments in fiber, satellite, wireless and cable are made, more of the world will be connected to the Internet. One billion people on the Internet by 2005 could therefore be possible.

25. Forrester Research, numerous business executives.

26. Morgan Stanley estimates 46 million U.S. Internet users in 1997. See: Meeker, Mary and Pearson, Sharon. *Morgan Stanley U.S. Investment Research: Internet Retail.* Morgan Stanley, May 1997.

    CommerceNet Nielsen estimates 62.8 million Web users in the United States and Canada for the six months ending September 1997. Statistics provided by CommerceNet/Nielsen representatives.

    IntelliQuest estimates 62 million online in the United States in the 4th quarter 1997. See: IntelliQuest. "Latest IntelliQuest Survey Reports 62 Million American Adults Access the Internet/Online Services." IntelliQuest Press Release. February 4, 1998. http://www.intelliquest.com/about/release41.htm

27. Inktomi Corporation White Paper. 1997. http://www.inktomi.com/Tech/EconOfLargeScaleCache.html

28. Network Wizards. "Internet Domain Survey." http://www.nw.com/

29. Price Waterhouse LLP. "Price Waterhouse National Venture Capital Survey: National Edition Top Line Results." Full Years 1995, 1996, Quarterly Results 1997. For purposes of this report, "IT startups" include communications, computers and peripherals, electronics and instrumentation, semiconductors, and software and information firms. http://www.pw.com/vc

30. Consumer Electronics Manufacturers Association (CEMA). "U.S. Consumer Electronics Industry Today." June 1997. pp. 50-52. CEMA reports that 40 percent of U.S. households own PCs. A more recent analysis by IDC/Link estimates that the penetration rate has now reached 43 percent.

31. While high-speed optical fiber lines are used for long-distance communications, most U.S. homes connect to these lines via lower-bandwidth copper wire. Integrated Services Digital Network (ISDN) connections have become widely available to households and businesses, but a very small percentage of Internet subscribers use them.

32. Federal Communications Commission (FCC). "Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming." CS Docket No. 96-496. January 2, 1997. pp.58-59. Http://www.fcc.gov/Bureaus/Cable/Reports/fcc97423.html

33. From January 1997 to January 1998, the average selling price of a home PC dropped 30 percent, to $1,169. By Christmas 1998, analysts expect top PC makers to offer $600 machines. At this price, analysts predict that PCs could find their way into 60 percent of U.S. homes by 2002. Source: Burrows, Peter et al. "Cheap PC's." *Business Week*, March 23, 1998.

34. Shankar, Bhawani. “Digital TV on home run.” *Telecommunications*. December 1997.

35. FCC, CS Docket No. 96-496, 1997, p.58. Because access to the cable network is shared, speeds may be overstated.

36. Estimates provided by Michael Harris, President of Kinetic Strategies, Inc., February 1998. Figures represent latest available projections for year-end 1997 and the year 2000 as of February 1998.

37. Bellcore, Mobile Solutions. http://www.bellcore.com/BC.dynjava?MobileSolutionsCCGeneralCustomerCenter

38. Allison, David. “Using the Computer: Episodes across 50 Years.” Smithsonian Institution. February 14, 1996. http://www.si.edu/resource/tours/comphist/eniac.pdf

39. Boeing currently receives 50 percent of its orders via EDI over the private airline network. Boeing believes that the Internet could automate up to 60 percent of the spare parts orders that come to them via phone, fax and mail by 2000. Between the private network and the Internet, 80- 90 percent of their orders will be transmitted electronically.

40. Forrester Research estimates that U.S. businesses will buy and sell $327 billion worth of goods over the Internet by 2002. Source: Erwin, Blane et al. “Sizing Intercompany Commerce.” Forrester Research. July 1997.
The International Data Corporation (IDC) predicts that it will be $208.5 billion by 2002. Source: Phone conversation with IDC, February 1998. U.S. business-to-business figures were drawn from IDC’s global Internet Commerce Market Model.

41. Input, a firm specializing in electronic business market research and consulting services, estimates that the worldwide value of goods and services traded between businesses via EDI over private networks was $162 billion in 1997. Torrey Byles, President of Granada Research, an electronic commerce research and consulting firm, estimates that U.S. businesses traded $500 billion via EDI in 1996. Input’s figure counts only those transactions where the entire transaction from purchase order to payment, was completed electronically. Byles’ figure includes transactions that are initially electronically. Payments may have been received via other means.

42. Lundstrom, Scott. “Internet Enabled Indirect Procurement: A Low Risk/High Return Project?” *The Report on Supply Chain Management*. Advanced Manufacturing Research, Inc. July 1997.

43. “Sales are Clicking on Manufacturing’s Internet Mart.” GE Information Services. Excerpts from *Fortune*. July 7, 1997. http://www.tpn.geis.com

44. 1997 survey of purchasing managers by Porter Novelli for W.W. Grainger.

45. Verity, John. “Vision Quest.” *Computer World*. December 15, 1997.

46. Phone conversations with Chuck Harrison and Bill Antoskiewicz, Ernst & Young. January 1998. According to Ernst & Young, CPFR could lead to reductions of 25-35 percent in finished goods inventory across the supply chain.

47. Pittman, Lee. “Electronic Commerce in Manufacturing: A Vision of the Future.” *EDI Forum*. The EDI Group. Vol. 10, No. 1. Lee Pittman is Vice President of Industry Relations for Future Three Software, a company specializing in EDI and other software for automotive suppliers and a member of the AIAG faculty for EDI.

48. Ibid.

49. Ibid.

50. Ibid.

51. Hoy, Tom and Margolin, David. “Charting the Course.” *ActionLine*. September 1996**.** Tom Hoy is a loaned executive to the Automotive Industry Action Group, a consortium of OEMs (original equipment manufacturers) and 1,300 suppliers. David Margolin is formerly of Wizdom Systems, a software and consulting company specializing in business process reengineering solutions.

52. Erwin, Blane, et al. “Sizing Intercompany Commerce.” Forrester Research. July 1997. Forrester Research predicts that business-to-business electronic commerce will reach $327 billion by 2002.

53. A conservative estimate for the combined online transactions for Cisco, Dell and GE in 1997 would be $3 billion. During the first 10 months of 1997, Cisco booked more than $1 billion in sales via the Internet. Although Dell did not report its 1997 sales via the Internet, a rough estimate would place them between $750 million - $1 billion for the year. GE reports having purchased over $1 billion online in 1997.

    In three to five years’ time, Internet commerce for the three companies will, by their own estimates, reach or exceed $17 billion. Cisco expects online sales to grow to 60 percent of total volume over the next year. If analyst projections for Cisco to grow to a $10.5 billion company by July of 1999 are correct, Cisco’s online sales will reach $5-6 billion by then. Dell expects to conduct half its total business online shortly after the year 2000. Even taking 50 percent of its current volume ($12 billion in 1997 and growing rapidly) would lead to $6 billion in online sales shortly after the year 2000. By 2000, GE aims to have all 12 of its business units purchasing via the Internet, for a total of $5 billion.

54. Forrester estimates that business-to-business electronic commerce will reach $327 billion by 2002. By 2002, the U.S. economy is projected to reach $9.993 trillion.

55. Number of Online Newspapers on the World Wide Web as of March 17, 1998. http://www.mediainfo.com/ephome/npaper/nphtm/stats.htm

56. "Top magazines by paid circulation: six month averages ended June 30, 1997." Advertising Age. Figures compiled by the Audit Bureau of Circulations and BPA International figures. http://www.adage.com/dataplace/archivers/dp169.html The three magazines that could not be located on the Web were: the Cable Guide, Home & Away and American Rifleman (although they may exist under a different name).

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60. Hu, Jim. "Study: Net use eclipsing TV." news.com. March 30, 1998. http://www.news.com/News/Item/0%2C4%2C20597%2c00.html?dd.ne.tx.wr

61. "Classified in Crisis." Newspaper Association of America. Newspaper Association of America Market & Business Analysis estimates; Presentation to NAA's Classified Advertising Project Team. "The Classified Imperative." Booz-Allen & Hamilton. January 19, 1996.

62. Noack, David. "The City Guide Wars: Free For-All Over Local Advertising." mediainfo.com. September 1997. http://www.mediainfo.com/ephome/news/newshtm/minfocom/0997c.htm

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64. Total advertising spending figures from McCann-Erickson.

65. Jupiter Communications Press Release. "Top End of Online Travel Market Closing as Bottom Tier Opens to New Players - - Online Travel Sites Must Differentiate or Die." April 16, 1997.

66. According to the Air Transport Association of America, domestic and international passenger revenues for U.S. Scheduled airlines in 1996 was $75 billion.

67. DOT Form 41 data, "Total Operating Revenues and Total Operating Expenses by Objective and Functional Groupings for U.S. Airlines with Annual Operating Revenues over $100 Million." U.S. Department of Transportation.

68. Phone conversation with Dave Swierenga, Air Transport Association of America. November 20, 1997.

69. Airlines pay commissions of 8 percent to traditional travel agents for each domestic ticket, with a cap of $25 for one-way travel and $50 for round-trip travel. Though there is no industry standard for commissions or fees paid to online travel agents, the major airlines pay significantly less for travel booked this way: American Airlines pays $15/ticket, United pays $10/ticket, Continental and Northwest pay 5 percent with a maximum of $25 for domestic trips.

70. "True Internet Banks." *Online Banking Report*. Last update April 7, 1998. See: http://www.onlinebankingreport.com/top100banks2.shtml and http://www.onlinebankingreport.com/fullserv2.shtml

71. "Internet Banking: A Survey of Current and Future Development." Booz-Allen & Hamilton, Inc. February 1996. Survey was limited to North American banks who currently had a Web site, among which were 34 commercial banks, 19 credit unions and 3 thrifts/FSBs.

72. Ibid.

73. "Lessons from the Payments War: The Battle Banks Must Win." Booz-Allen & Hamilton. November 1997. The check is the preferred method of payment 70 percent of the time for paying monthly bills in the U.S.

74. IBM Analysis

75. Jupiter Communications estimates that 4.5 million households were banking online in 1997, growing to 13.1 million by the year 2000. See: "1997 Home Banking Report." Jupiter Communications. Faulkner & Gray expects that 10 million households will be banking online by 2000. Source: Faulkner & Gray's *1998 Directory of Home Banking & Online Financial Services*. Booz-Allen & Hamilton projects that by 2000, more than 16 million households will do their banking using the Internet. See: "Internet Banking: Letting Customers Have It Their Way." *Financial Services ONLINE*. November 1997. pp. S3-S8. Find/SVP projects that upwards of 16 million households will bank online by the year 2001, "provided banks do a better job of marketing." See: "Online Banking: User Profiles, Market Segments and Forecasts." Find/SVP. March 1997.

76. Forrester Research

77. "The Long Uphill Climb." *Insurance Executive*. Winter 96/97. Ernst & Young.

78. "Internet Insurance: A Study of Current Use and Future Trends." Booz-Allen & Hamilton, Inc. February 1997. p. V-4.

79. "Global Insurance to the 21st Century." Economist Intelligence Unit Ltd. and IBM. 1996. Survey of insurance executives.

80. Jupiter Communications predicts that online travel will reach $8.5 billion by 2002, Forrester Research anticipates it will reach $7.4 billion by 2001.

81. Lipton, Beth. "Online trading up 150 percent." News.com. January 14, 1998. http://www.news.com/News/Item/Textonly/0,25,18101,00.html?pfv

82. "Ramping up for volume sales." *U.S. Banker*. New York. November 1997. According to the article, retail brokerage commissions across all channels should total $13.9 billion in 1997, of which $2.9 billion is attributable to the discount brokerage sector.

83. Jupiter Communications, Faulkner & Gray, Booz,Allen & Hamilton, and Find/SVP all predict that at least 10 million households will do their banking online by 2000. The most conservative estimate given is 10 million; the most optimistic is 16 million.

84. Forrester Research.

85. CommerceNet/Nielsen. *Internet Demographic Study*. CommerceNet/Nielsen. Vol. 1 & 2. Spring 1997. The Fall 1997 statistics were provided by CommerceNet/Nielsen representatives. See also: CommerceNet. "Electronic Commerce on the Rise According to CommerceNet/Nielsen Media Research Survey" Press Release. December 11, 1997. http://www.commerce.net/news/press/121197.html

86. Forrester Research.

87. Clark, Tim, "Xmas sales up for Net merchants," news.com, December 31, 1997.

88. Armstrong, Larry and Kerwin, Kathleen. "Downloading their Dream Cars." *Business Week*. March 9, 1998. Year 2000 projection is based on December 1997 phone interview with John Osborn, JD Power and Associates.

89. Goth, Nikki C. "Sweet Smell of Success." *H!TS supplement*. Red Herring online. Spring 1997. http://www.herring.com/hits/03/800.html

90. Forrester Research and Robertson Stephens 1997 estimates. Note: for purposes of this report, retail does not include travel or auto.

91. Meeker, Mary and Pearson, Sharon. *Morgan Stanley U.S. Investment Research: Internet Retail*. Morgan Stanley. May 28, 1997. pp.4-2+. The report estimates that mail order spending in the U.S. ranged from $71 - $155 B in 1996. It posits that Internet retailing's growth may occur three to five times faster than mail order did, given the growth in the

number of Internet users and the ease and efficiency of ordering from the Internet. Based on these assumptions, Morgan Stanley estimates that Internet retailing could reach $115 billion in five to eight years.

92. "1-800-FLOWERS announces key findings in on-line purchase habits..." 1-800-FLOWERS. Press Release. December 23, 1997.

93. Green, Heather. "A Little Net Privacy, Please." *Business Week*. March 16, 1998.

94. Discounts typically do not include the cost of delivery. When added to the cost of a single item, delivery charges may result in a higher price than can be found in some stores. Combining multiple items in a single delivery lowers the total cost and consumers may save money versus store prices.

95. Lipton, Beth. "Online trading up 150 percent." News.com. January 14, 1998. http://www.news.com/News/Item/Textonly/0,25,18101,00.html?pfv

96. These numbers represent wage and salary employment only, not self-employed and unpaid family workers. Total employment figures which include wage and salary, self-employed, and unpaid family workers are slightly higher.

97. The U.S. Department of Transportation reports that 2-7 million people telecommute. See: "Successful Telecommuting Programs in the Public and Private Sectors: A Report to Congress." U.S. Department of Transportation, August 1997, pp.3-5.

    A recent survey of 2,000 U.S. households by Find/SVP suggests that the figure might even be higher. Their results find that the number of telecommuters in the U.S. jumped to 11.1 million in 1997, up from 9.7 million in 1996. Three out of four telecommuters owned home computers and 43 percent have multiple phone lines. Thirty-five percent of today's telecommuters use the Internet and e-mail. Http://etrg.findsvp.com:80/prls/pr97/telecomm.html

98. "Successful Telecommuting Programs in the Public and Private Sectors: A Report to Congress." U.S. Department of Transportation, August 1997, pp.3-5.

APPENDIX 1

INFORMATION TECHNOLOGY INDUSTRIES–

OF GROWING IMPORTANCE TO THE ECONOMY AND JOBS

APPENDIX 1

INFORMATION TECHNOLOGY INDUSTRIES- OF GROWING IMPORTANCE TO THE ECONOMY AND JOBS

FIGURES

TABLES

INFORMATION TECHNOLOGY INDUSTRIES- OF GROWING IMPORTANCE TO THE ECONOMY AND JOBS

In the 1990s, information technology (IT) has altered the way businesses and consumers interact. Domestic and worldwide use of computer hardware and software products and communications equipment and services is converging into a single market. This market supports the global information infrastructure (GII), which is dominated by the Internet. Although IT is used by all industries to some degree, industries that support the GII are, for the purpose of this report, considered to be IT industries (Table 1). The criteria for the selection of IT industries and the methodology used to derive the charts below are described in the "Data and Methodology" section.

IT industries enable electronic commerce (e-commerce), thus their health and/or performance give some indication of the potential size and likely growth of e-commerce. This analysis presents an estimate of the size and growth of IT industries and their importance to overall U.S. economic and employment growth. Growth of IT industries provides us with some idea of the past and probable future success of e-commerce, but should not be interpreted as a direct measure of it.

IT Industries and Recent Economic Performance

The economy has been performing well lately, in terms of growth, employment, inflation, and productivity. Between 1996 and 1997, the economy grew 3.8 percent in inflation adjusted or real dollars, about 3 million new civilian employees were added, inflation remained low, 2.3 percent,[1] and business productivity increased by 1.9 percent. Some analysts believe that growth of the IT sector helps account for a large part of this good performance and the findings in this paper lend support to their assessments. In recent testimony to Congress, Federal Reserve Board Chairman, Alan Greenspan noted that

> "... our nation has been experiencing a higher growth rate of productivity -- output per hour worked -- in recent years. The dramatic improvements in computing power and communication and information technology appear to have been a major force behind this beneficial trend."[2]

Other analysts believe, however, that other factors may account for recent good performance and that the data do not yet confirm whether the recent burst of activity in the IT sector has had large positive effects on the rest of the economy. Because of the lags between bursts of investment and their economic effects taking hold, we are not yet able to assess the full economic effects of the recent dramatic growth in IT investment.

One of the most notable developments in recent years has been the rapid increase in the IT sector's (computing and communications) share of investment activity and the overall economy. IT grew from 4.9 percent of the economy in 1985 to 6.1 percent in 1990. In 1990, the IT share of the economy was proportional to its contribution to overall economic growth. Beginning in 1994, however, the IT sectors contributed twice its share of the economy to overall nominal economic growth.

In 1996, IT industries accounted for an estimated 7.5 percent share of the economy[3] and an estimated 15.8 percent of the rise in Gross Domestic Product (GDP), in current dollar terms as measured by its earned income. By 1997, IT industries accounted for an estimated 7.8 percent of GDP and 12.4 percent of its nominal growth, while in 1998, IT industries may account for as much as 8.2 percent of the economy and an estimated 14.7 percent of its nominal growth.

What makes this rise in IT's nominal share of the economy even more remarkable is the fact that IT prices, adjusted for quality improvements, have been falling while prices in the rest of the economy have been rising. In 1996 and 1997, declining prices in IT industries (as measured by their overall implicit deflator) lowered the annual change in prices in the overall economy by an estimated one full percentage point. Thus, the estimated real contribution of this sector to economic expansion was greater than what the nominal shares indicate. In recent years, an average of over one-quarter of total real economic growth can be attributed to IT industries.

In 1996, the IT workforce, as defined by employment in IT industries (Table 1) and employees with IT-related occupations (Table 2), across the economy, was 7.4 million workers (6.2 percent

Table 1. Information Technology Industries

SIC	Industry	SIC	Industry
Hardware		**Software and Services**	
3571,2,5,7	Computers and equipment	7371	Computer programming services
5045 pt.	Wholesale trade of computers and equipment	7372	Prepackaged software
5734 pt.	Retail trade of computers and equipment 5045 pt.		Wholesale trade of software
3578,9	Calculating and office machines, nec	5734 pt.	Retail trade of software
3695	Magnetic and optical recording media	7373	Computer integrated systems design
3671	Electron tubes	7374	Computer processing, data preparation
3672	Printed circuit boards	7375	Information retrieval services
3674	Semiconductors	7376	Computer services management
3675-9	Passive electronic components	7377	Computer rental and leasing
3823	Industrial instruments for measurement	7378	Computer maintenance and repair
3825	Instruments for measuring electricity	7379	Computer related services, nec
3826	Laboratory analytical instruments		
Communications Equipment		**Communications Services**	
3651	Household audio and video equipment	481, 22, 99	Telephone and telegraph Communications
3661	Telephone and telegraph equipment		
3663	Radio and TV and communications equipment	4832	Radio broadcasting
		4833	Television broadcasting
		4841	Cable and other pay TV services

of total employment) with an average annual wage of $45,737,[4] compared with a total employment of 119.6 million and an annual average wage of $28,000 (for all private employees). The Bureau of Labor Statistics (BLS) projects that the demand for these workers will increase to 9.5 million by 2006.

The fastest growing segment of IT workers is in the software and services industries. Between 1985 and 1996, employment in these industries more than doubled from just over one-half million workers to 1.2 million with an average annual wage of about $56,000. By 2006, BLS projects the demand for these workers to double again to 2.5 million.

The debate over the relation of IT industries to the health of the economy will continue for some time. Although the results of this paper suggest a healthy relationship, more data and analysis, especially in the area of IT-generated productivity improvements throughout the economy and the contribution to non-inflationary growth, are needed.

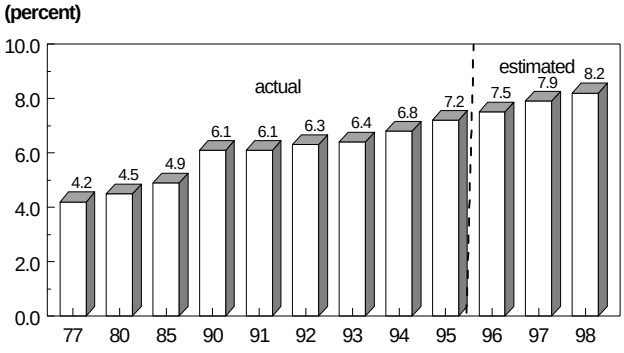
IMPACT ON ECONOMIC GROWTH, INFLATION, AND BUSINESS INVESTMENT

Share of the Economy and Contribution to Growth

The IT share of the economy, in current dollars, hovered between 4- and 5-percent from the late 1970s through the mid-1980s (Figure 1). Then, as the personal computer became more common in business and in the home, the IT share of the economy jumped by 1.2 percentage points between 1985 and 1990 to reach 6.1 percent. With the commercialization of the Internet, it started its upward climb again, growing from 6.4 percent in 1993 to an expected 8.2 percent by 1998.

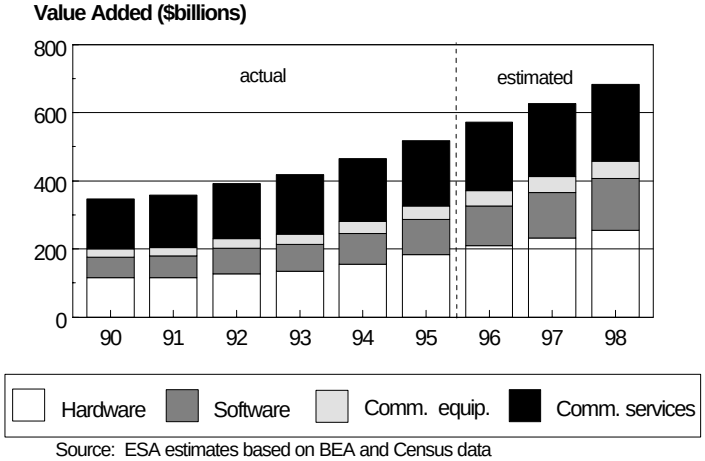
Between 1990 and 1998, value added of IT industries are expected to roughly double, growing from $347 billion to $680 billion (Figure 2). Hardware sales, comprised of computer hardware, electronic components, and some instruments, are expected to grow from $116 billion in 1990 to $254 billion by 1998—more than doubling over the period. Software sales are expected to increase by two and one-half times from $60 billion to $152 billion. Value added of the communications industries, by comparison, is expected to increase by about 60 percent, from $171.2 billion in 1990 to $276.5 billion in 1998.

Figure 1. Information Technology Industries: Share of the Economy Rises Slowly in the 1980s, Accelerates in the 1990s



Source: DOC's Economics and Statistics Administration (ESA) estimates based on Bureau of Economic Analysis (BEA) and Census data

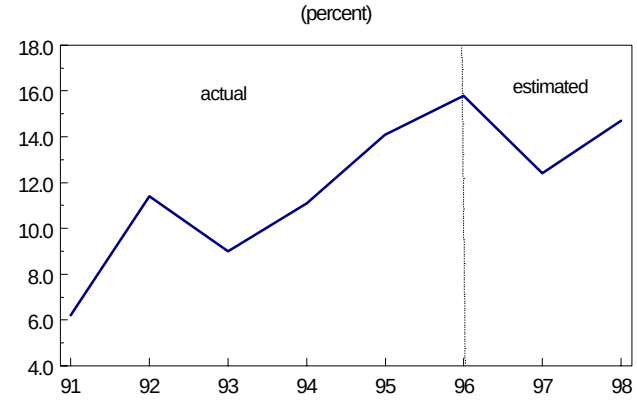
Figure 2. While Communications Revenues Increase By Half Computer Hardware and Software Sales More Than Double



Source: ESA estimates based on BEA and Census data

IT industries contributed a proportional share to the nominal growth of GDP in the early 1990s. For instance, in 1991, IT industries accounted for 6.1 percent of the economy and 6.2 percent of overall economic growth (Figure 3A). Since the commercialization of the Internet in the mid-1990s, IT's contribution to nominal GDP growth has expanded rapidly. Between 1994 and 1998, IT is responsible for 11-16 percent of overall economic growth, while its share of the economy ranges between 6.8-8.2 percent.

Figure 3A. IT Industries: Contribution to Economic Growth Rises from 6% in 1991 to Around 14% between 1995 and 1998

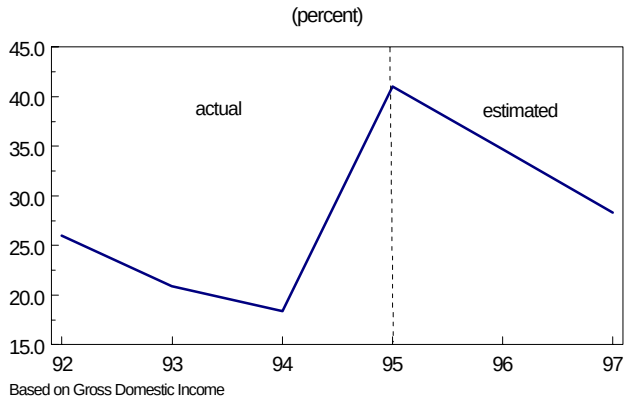


Source: ESA estimates based on BEA and Census data

The contribution of IT industries to nominal growth in the economy understates its full impact. The difference between the nominal and real contributions to growth results from significant productivity growth in some of these industries. Large gains in the quality of IT products, particularly computers and semiconductors, have been achieved without comparable increases in costs.[5]

Between 1992 and 1997, IT industries contributed over one-quarter of the real growth in the economy.[6] (Figure 3B) The IT contribution to real economic growth fluctuates considerably from year to year. From 1992 to 1994, IT growth was only slightly higher than overall economic growth.[7] In 1995, a spurt of investment in IT products in combination with a rather lackluster economy resulted in a dramatic increase in the IT contribution to real economic growth. By 1997, the IT contribution to real economic growth dropped back down to just over one-quarter, primarily

Figure 3B. IT Industries Average Over One-Quarter of Total Real Economic Growth, 1992-1997



Source: ESA estimates based on BEA and Census data

because the rest of the economy was doing well.

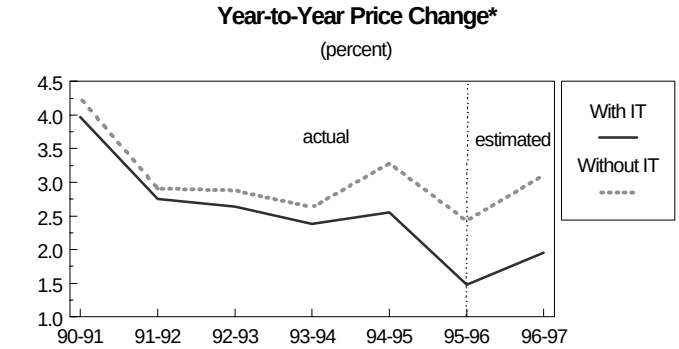
The inflation adjusted measure of the IT sector may overstate its practical contribution to overall economic growth, as businesses may not yet taking full advantage of the quality improvements in the IT products.

Inflation and IT Industries

Since 1996, the Bureau of Economic Analysis (BEA) has adopted quality-adjusted price indexes for computers and semiconductors for use in their real GDP calculations. The need to incorporate quality-adjusted deflators (sometimes called hedonic deflators) arose because of the increasing performance and declining prices of these products. Since the 1960s, the performance of microprocessors has followed Moore's Law--transistor (or microprocessor) density doubling about every 18 months. And during this time of phenomenal growth in performance, the average price of the transistor has fallen by an unprecedented six orders of magnitude. A doubling of microprocessor performance every 18 months is projected to continue for the next 20 years.[8]

With prices of computers and semiconductors falling, overall prices within IT industries have helped keep overall inflation down (Figure 4). Inflation in 1997, as measured by average prices in the overall economy,[9] was 2.0 percent. Without IT industries keeping prices down, inflation would have been 3.1 percent. In 1996, overall price inflation would have been 0.9 percentage points higher without declining prices in IT industries.

Figure 4. IT Industries Helped to Keep Overall Inflation Down



*As measured by the Gross Domestic Income implicit price deflator

Source: ESA estimates based on BEA and Census data

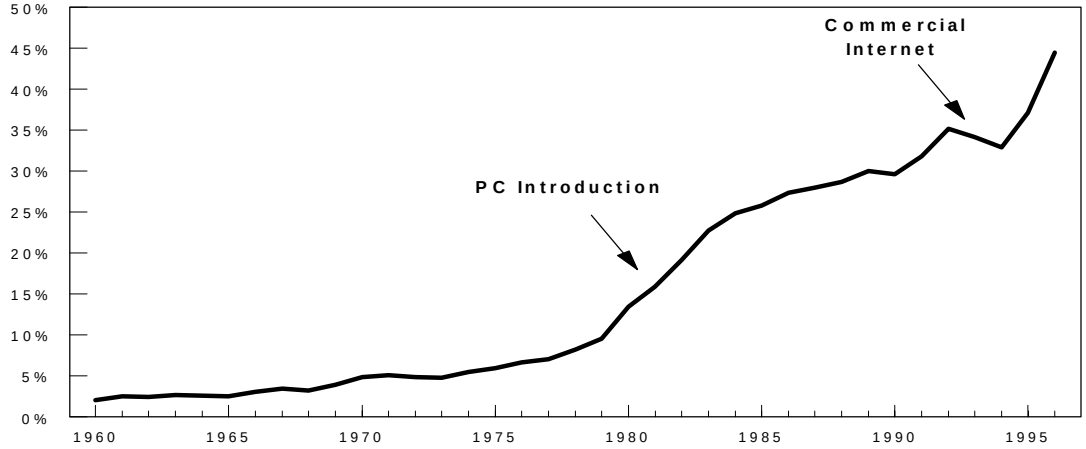
Industry Use of IT Equipment

IT industries not only directly have more than proportional impact on the growth of the economy, but the use of IT products has been an important and growing part of capital investments across all industries. In 1994, of the 53 aggregate industry sectors (across the economy), 40 percent or more of the total capital stock of 15 industries was comprised of IT equipment, 13 between 25 and 39 percent, 20 between 10 to 24 percent, and only 5 had a less than 10 percent share. IT spending, in inflation adjusted dollars,[10] as a share of total business equipment spending, grew

from negligible to 45 percent in a little over 30 years (Figure 5). In 1965, business spending for IT equipment was less than 5 percent of total business spending. By the early 1980s, IT spending jumped to about 15 percent. In the early 1990s, IT spending represented about one-third of all business equipment spending, and by 1996, almost half. The slope of the curve suggests that by 2000, business spending for IT equipment should exceed half of all spending on capital equipment.

A parallel can be drawn between the proliferation of computers (and other IT equipment) in the last three decades and the spread of electricity in the mid 1800s and early 1900s.[11] First harnessed

Figure 5. Information Technology Spending as a Share of Business Equipment Spending



Source: Bureau of Economic Analysis

* Inflation-adjusted investment in information processing equipment (office, computing, and accounting machinery, communications equipment, instruments, and photocopying equipment) as a share of total private equipment investment.

in 1831, electricity's potential had to wait 50 years until the first power station was built in 1882.[12] Industry then began a 50-year transition from using mechanical power to using power generated by electricity. In 1899, less than 5 percent of the power used by industry was from electric power generation. Fifty years later, electricity powered 80 percent of factories and households across the country.

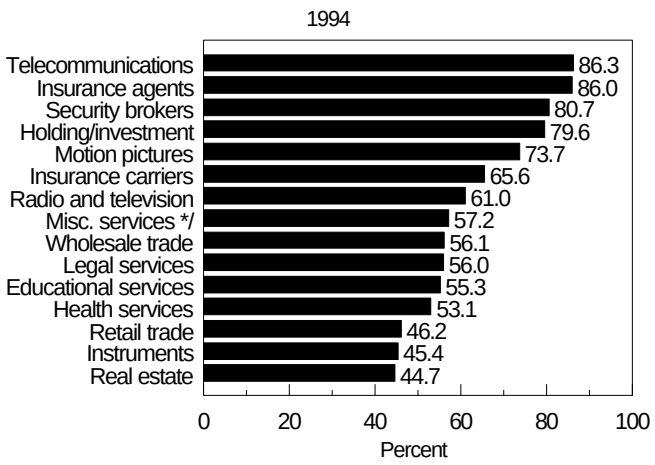
The increase in the share of IT-related capital by industries corresponds to a decline in the share of the other categories of business equipment and can be viewed as evidence of basic structural change among and within industries. Between 1977 and 1996, the share of business spending for the major categories of capital equipment (with the exception of IT) declined—the share of business spending for industrial equipment such as engines and machinery dropped by 5 percentage points over this period (year-end estimates); transportation equipment, such as trucks and autos, dropped by 2 percentage points; and other capital equipment, such as office furniture,

dropped 3 percentage points. At the same time, the share of business spending for IT-related equipment increased by 10 percentage points.

In some industries such as telecommunications, insurance, and securities brokerages, IT equipment constitutes over eighty percent of all the equipment used (Figure 6).

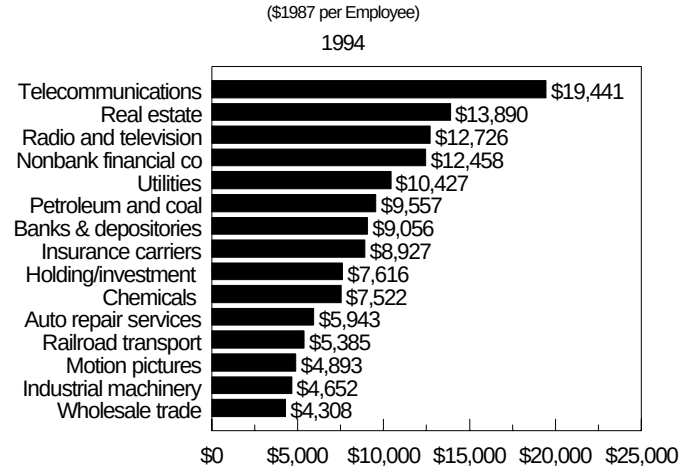
IT equipment used per employee is another measure of IT intensity (Figure 7). The top 15 industries, ranked by this criterion, include telecommunications, real estate, radio and television, nonbank financial companies and utilities. They spend over $10,000 (1987 dollars) per employee compared with an economy-wide average of $2,500. By this measure, while telecommunications remains at the top, other industries such as banks, petroleum, chemicals, and railroad transportation make it to the top tiers as major users of IT equipment.

Figure 6. IT Net Capital Stock - Top 15 Industries



Source: Bureau of Economic Analysis
*/ Includes social, management, engineering, and services n.e.c.

Figure 7. IT Capital Investment Intensity - Top 15 Industries



Source: Bureau of Economic Analysis

Industries that are major users of IT equipment, as shown in Figures 6 and 7, constitute about half of the economy and employ about half the workforce.

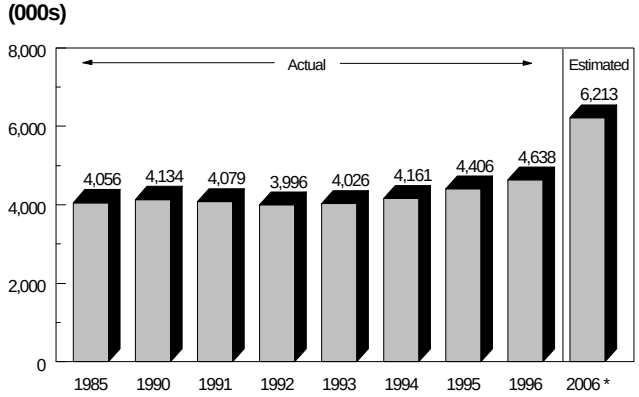
THE IT WORKFORCE

Total employment in IT-related jobs is defined as all employees in IT industries and all employees in IT-related occupations in non-IT industries.[13] In 1996, 7.4 million people worked in the IT workforce. Approximately two-thirds of these jobs were in IT industries, the other one-third were spread across the rest of the economy. The sections that follow include a separate analysis of employment in IT industries followed by a discussion of employment in IT-related occupations. Note that workers in IT industries and workers with IT-related occupations are not additive since approximately one-third of the workers with IT-related occupations are in IT industries.

Employment in IT Industries

Employment in IT industries has remained relatively stable even as its share of the economy has grown (Figure 8). From 1985 to 1990, employment in IT industries grew at only 0.4 percent annually, much slower than the 2.4 percent annual rate of growth for all private industries.

Figure 8. Information Technology Industries: Employment Accelerates after Remaining Flat for Several Years



Source: Bureau of Labor Statistics

* ESA projections of employment demand based on BLS projections.

IT industries have made a small but positive contribution to overall private employment growth, especially since 1993. IT industries contributed very little to the decline in employment from 1990 to 1991, with a loss of only 56,000 of the 1.2 million jobs lost. They supplied over 230,000 of the 2.2 million increase in jobs from 1995 to 1996, or 10.5 percent (Figure 9).

Employment in IT industries is projected to increase 3.0 percent annually from 1996 to 2006, more than twice as fast as the U.S. average of 1.4 percent.

Although historical employment data suggest little change in aggregate IT employment, there has been a fundamental shift in employment among industries. IT industries that produce computer

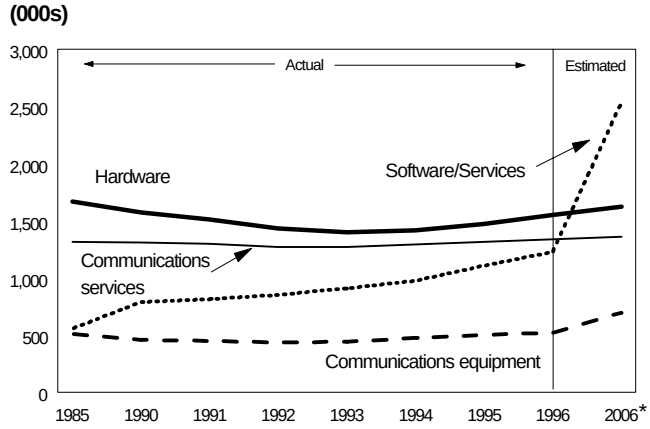
hardware and communications equipment have lost jobs as technological changes have made some processes routine, thus eliminating jobs or reducing the need for in-house staff to perform some jobs.[14] Increased outsourcing is reflected in increased employment in IT industries that provide maintenance and other support services. Also, more computer assembly is being done at the wholesale level.

Among the four IT industry groups, providers of software and services have experienced the most rapid employment growth. From 1985 to 1996, employment in these industries more than doubled from 557,000 to 1.2 million workers, with the fastest growth occurring in the computer programming and prepackaged software industries (Figure 10). By 2006, software and services employment will more than double again to 2.5 million workers, still driven by computer programming and prepackaged software industries. Communications equipment and communications services have seen slow employment growth, despite above average growth in sub-industries such as household audio and video equipment retail stores and cable television. In 1996 there were 116,000 fewer workers in industries that produce computer and related hardware than in 1985. However, employment in several sub-industries such as computer retail sellers and manufacturers of laboratory analytical instruments has grown faster than average.

Figure 9. Information Technology Industries: Contribution to Private Employment Growth is Small but Growing

Source: ESA estimates based on Bureau of Labor Statistics data.

Figure 10. Software/Services Industries Lead IT Industries in Employment Growth

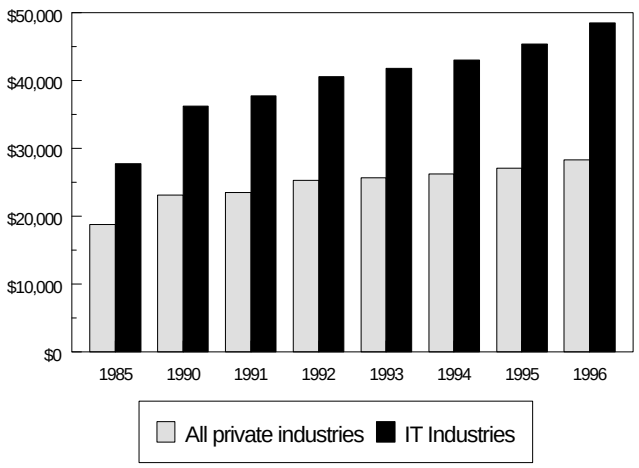


Source: Bureau of Labor Statistics

* ESA projections of employment demand based on BLS projections.

Earnings of Workers in IT Industries

Figure 11. IT Industries Pay Above Average Wages

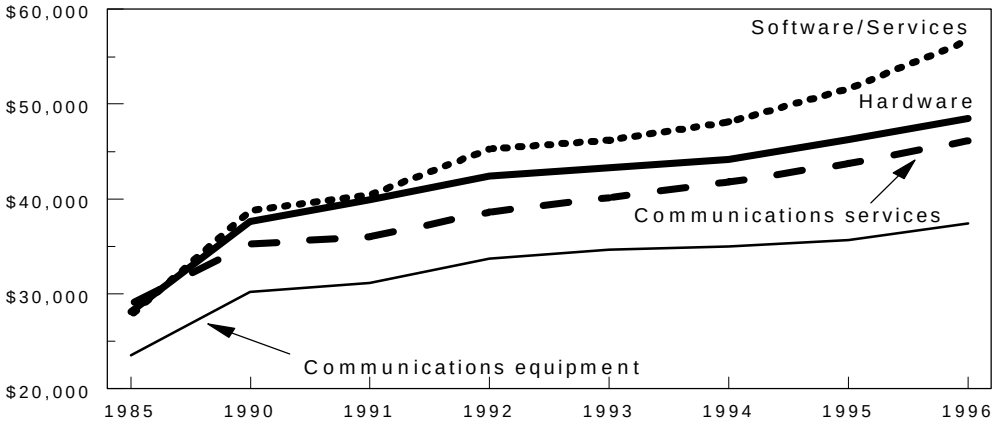


Source: ESA estimates based on Bureau of Labor Statistics data.

IT industries represent a small, but growing share of the total annual wage bill, accounting for 7.9 percent of all wages paid in 1996 compared with 7.4 percent in 1985. Strong growth in value added of the IT industries in the 1990s and rapid growth in productivity (as measured by value added per employee) resulted in a corresponding increase in wages (Figure 11). Wages of IT workers have been growing at 5.2 percent annually since 1985 compared with 3.8 percent for all private workers. In 1996, the average annual wages paid to workers in IT industries was almost $48,000 compared with $28,000 for all private employees.

Among the IT industries, workers in the software and services industries earned the highest annual wages, almost $56,000 in 1996 (Figure 12). This group also had the fastest increase in annual wages)growing at 6.6 percent annually since 1985. Average earnings of workers in the

Figure 12. Workers in the Software/Services Industries Have Seen Fastest Wage Growth



Source: ESA estimates based on Bureau of Labor Statistics data.

hardware-related and communications services industries were similar at around $46,000 to $48,000 per year. Communications equipment workers earned about $37,000 annually.

Employment in IT Occupations

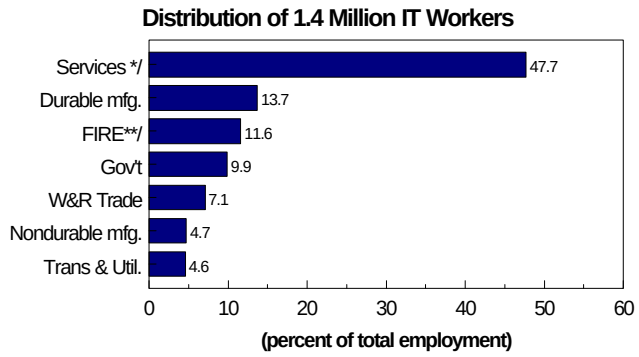
In addition to the IT industries themselves, IT workers are needed across the economy to install, operate, program, repair, maintain, design and develop IT equipment and services (Table 2).

Table 2. IT-Related Occupations

Engineering, science, and computer systems managers	Computer engineers, scientists, and systems analysts
Electrical and electronic engineers	Computer programmers
Electrical technicians	Computer and peripheral equipment operators
Electrical power line installers and repairers	Data entry keyers
Electronics repairers	Electronic equipment assemblers
Communications equipment operators	Data processing equipment repairers
Central office and PBX installers and repairers	Broadcast technicians
Calculating machine operators	Duplicating machine operators
Electronic semiconductor assemblers	Electromechanical equipment assemblers
Telephone and Cable TV installers and repairers	Electrical and electronic assemblers

In 1996, 4.2 million people worked in IT-related occupations. About one-third of these workers (1.4 million) were employed by IT industries and 2.8 million worked in non-IT industries. As an example, in 1996 there were 1.4 million computer scientists, systems analysts, computer engineers, and computer programmers. The services sector employed 47.7 percent of these workers—primarily in business services, health services, education, and engineering services. Durable goods manufacturing industries, financial services, and government were other large employers (Figure 13).

Figure 13. Employment of Computer Engineers, Scientists, Systems Analysts, and Computer Programmers, 1996



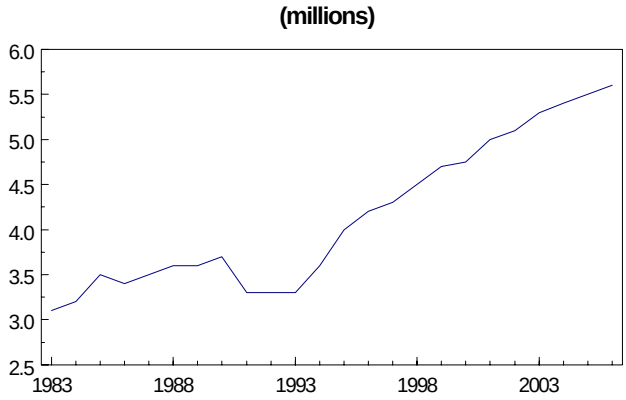
*/ including business, health, legal, education, social, & engineering services

**/Finance, Insurance, and Real Estate

Source: ESA estimates based on BLS data

The number of IT workers increased from 3.1 million in 1983 to 3.7 million in 1990 (Figure 14). After the slight decline in the early 1990s, IT jobs grew to 4.2 million by 1996. (Table 3 briefly describes some of these occupations.[15])

Figure 14. Employment in IT Occupations Across All Industries, 1983-2006



Source: ESA estimates based on BLS data

Table 3. Some IT-Related Occupations

Engineering, Science, and Computer Systems Managers plan, coordinate, and direct research, development, design, production, and computer-related activities. Many have a bachelor's or master's degree in computer or information science. In 1996, the mean annual wage of these managers was almost $66,000.

Computer engineers, scientists, and systems analysts--Computer engineers work with the hardware and software aspects of systems design and development. Computer scientists generally design computers and the software that runs them, and conduct research. Systems analysts use their skill in computers to develop business specific applications. Ph.D.'s or, at least master's degrees, are preferable for scientists and engineers in research labs or academic institutions. In 1996, the mean annual wage of computer engineers was almost $55,000. The mean annual wage of systems analysts and computer programmers, combined, was $48,000.

Electrical and Electronics Engineers design, develop, test, and supervise the manufacture of electrical and electronic equipment, including computer hardware, and communications and video equipment. A bachelor's degree is required for beginning engineers. In 1996, their mean annual wage was about $53,000.

Computer programmers write and maintain the detailed instructions that computers must execute to perform their functions. There are no universal training requirements for programmers, although the majority hold a four-year degree. In 1996, the mean annual wage of these workers (combined with systems analysts) was $48,000.

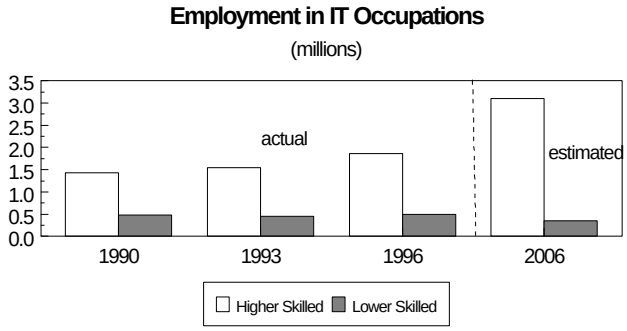
Communications Equipment Mechanics install, repair, and maintain complex and sophisticated communications equipment. Most employers prefer one to two years of training in electronics. In 1996, the mean annual wage for central office and PBX installers and repairers was about $40,000.

Broadcast Technicians install, test, repair, set up, and operate electronic equipment used to record and transmit radio and television programs. Employers prefer workers with training in broadcast technology or in engineering or electronics. A four-year college degree is not a prerequisite. In 1996, their mean annual wage was about $31,000.

Computer and Office Machine Repairers install, maintain, and repair computer and office equipment. Most employers prefer applicants with formal one- to two-year training in electronics specializing in computers. In 1996, their mean annual wage was $29,000.

BLS projects that 5.6 million workers will be needed to fill IT-related jobs by 2006. The demand for higher skilled IT jobs is expected to grow dramatically while the demand for lesser-skilled IT jobs is expected to decline (Figure 15). For instance, jobs for computer engineers, scientists, and systems analysts which typically require at least a four-year college degree, grew from 474,000 in 1990 to 874,000 in 1996. By 2006, BLS projects that 1.8 million people will be needed to fill these jobs. The demand for computer programmers, jobs requiring two to four years of college or advanced training, is expected to increase, rising from 548,000 in 1996 to 665,000 in 2006. On the other hand, lesser-skilled jobs like computer operators and duplicating machine operators, which only require a high school diploma, are expected to decline from 481,000 in 1996 to 342,000 in 2006.

Figure 15. Demand Should Grow for Highly Skilled IT Workers, Lower Skilled Jobs Decline



Higher skilled IT workers include elect. and comp. engineers, scientists, programmers, and systems analysts.
Lower skilled IT workers include computer and office machine operators.

Source: ESA estimates based on BLS data

The Internet is
also driving demand for workers with IT skills. Workers are needed to design Web pages, create graphics, code documents in Hypertext Markup Language (HTML) and program in Internet languages such as Java and C++. Webmasters responsible for the design, development, operation, and maintenance of Web sites earn starting salaries between $35,000 and $50,000; highly experienced webmasters earn $100,000 or more. Web developers, responsible for the actual creation of the Web site, are reported to earn a median salary of $55,000. On the lower end of the skill level in Internet jobs, customer service representatives that work for Internet Service Providers earn from $14,000 to $17,000 per year and up to $35,000 depending on experience.[16]

The demand for computer engineers, scientists, systems analysts, and computer programmers is expected to continue to increase through 2006. Despite this growth and anticipated demand, the number of U.S. graduates with a bachelor's degree in computer science declined by 40 percent

between 1986 and 1994. However, a bachelor's degree in computer science is not the only path of entry into an IT occupation. Other related academic fields, such as computer engineering and business information systems, can supply workers in these categories and even graduates in many non-science and engineering fields are employed in IT-related occupations.

At the same time demand for workers to fill IT-specific jobs is increasing, workers in a variety of non-IT occupations find themselves using computers and computerized devices–PCs, CAD, and CAM machines, computerized measuring and analytical instruments, testing and diagnostic equipment–to perform their jobs. Somewhat dated statistics (1993) show that nearly half of all workers regularly use a computer in their jobs, with even higher usage among more highly-skilled and educated workers.[17] Preparing students and workers to meet current and future labor market demand will require a new and determined commitment to education and training in mathematics and science.

DATA AND METHODOLOGY

DEFINING INFORMATION TECHNOLOGY INDUSTRIES

The first task in analyzing the IT sector was to choose a set of industries upon which to base the analysis. In this definition, IT industries produce, process, or transmit information goods and services as either intermediate demand (inputs to production to other industries) or as final products to consumption, investment, government purchases, or exports.[18] Other industries were considered to be IT industries since they provide the necessary infrastructure (communications) for the Internet to operate (Table 4).

IT industries are classified (and defined) according to the 1987 SIC manual, published by the Office of Management and Budget. IT industries are further separated into categories of Hardware, Software and Services, and Communications.

Hardware industries include computers and equipment, including their wholesale and retail sales, office machines, semiconductors, some other electronic component industries, and industries that produce measurement and laboratory analytical instruments. Wholesale sales of computers and equipment was included to capture the sales by manufacturers through their branch offices, accounted for by the Census as a wholesale sale. These sales were considered to be closely aligned with a manufacturer's sale; excluding their sale would result in a serious undercount. Retail sales were included in order to capture all other sales of computers.

Software and services industries include those that provide prepackaged software and services associated with computers. There is some concern that direct sales of software are underestimated because government data only detail the sales of prepackaged software for microcomputers. The cost of software loaded onto a mainframe computer for business or government use, therefore, may not be captured. A much greater problem exists with respect to international trade of software. In this case, the software cost reported to the Customs Bureau as an import might include only the cost of the cassette or CD-ROM. Once in the U.S., the software could be copied and resold any number of times. The same might be true for a U.S. manufacturer with foreign affiliates. In this case, the software could be developed in the U.S. and a single copy sent to their foreign affiliate and copied overseas to be used in their computer production. Accounting for these transactions is difficult to do, if not impossible.

Communications equipment and services industries were selected as IT industries since they provide the "infrastructure" that allows the connections between computers and servers that enable electronic commerce and provide the highways for access and movement.

Despite the attempt to cleanly designate the IT sector, there will always be some subjectivity with the data that are used to measure it. As IT goods and services are increasingly incorporated into non-IT goods and services, it is difficult to draw hard-and-fast boundaries. For instance, semiconductors are used in computers, but they are also used in automobiles, home appliances, and a variety of other goods. Because they provide computing power and intelligence to all of these products, we have included the entire semiconductor industry as IT. Similarly, the majority

of revenue by the telecommunications industry is still generated by traditional telephone service. Over time, however, virtually all IT investment will be part of interlinked communication systems.

Table 4. Information Technology Industries

Hardware Industries	SIC	NAICS
Computers and equipment	3571, 2, 5, 7	334111, 2, 3, 9
Wholesale trade of computers and equipment	5045 pt.	42143 pt.
Retail trade of computers and equipment 5734 pt.		44312 pt.
Calculating and office machines, nec	3578, 9	334119, 333313, 339942, 334518
Magnetic and optical recording media	3695	334613
Electron tubes	3671	334411
Printed circuit boards	3672	334412
Semiconductors	3674	334413
Passive electronic components	3675-9	334414, 334415, 334416, 334417, 334418, 336322, 334419
Industrial instruments for measurement	3823	334513
Instruments for measuring electricity	3825	334416, 334515
Laboratory analytical instruments	3826	334516
Software/Services Industries		
Computer Programming Services	7371	541513
Prepackaged software	7372	51121, 334611
Wholesale trade of software	5045 pt.	42143 pt.
Retail trade of software	5734 pt.	44312 pt.
Computer integrated systems design	7373	541512
Computer processing, data preparation	7374	51421
Information retrieval services	7375	514191
Computer services management	7376	541513
Computer rental and leasing	7377	53242
Computer maintenance and repair	7378	44312, 811212
Computer related services, nec.	7379	541512, 541519
Communications Equipment Industries		
Household audio and video equipment	3651	33431
Telephone and telegraph equipment	3661	33421, 334416, 334418
Radio and TV and communications equipment	3663	33422
Communications Services Industries		
Telephone and telegraph communications	481, 22, 99	513321, 513322, 51333, 51331, 513322, 51334, 51339
Radio broadcasting	4832	513111, 513112
Television broadcasting	4833	51312
Cable and other pay TV services	4841	51321, 51322

Note: Since the government is in the process of converting data collected under the SIC code to data collected under the NAICS code, both are provided here.

Due to the difficulty in isolating IT, no standard definition exists. Different governmental and private sector bodies propose their own definitions, sometimes breaking out IT as a separate sector, sometimes including it as part of a set of industries that they consider to be high-tech.

For example, BEA assesses high-technology industries. In addition to computer equipment and communications industries, their high-tech list includes those that produce an array of hardware for the national defense (military aircraft, aircraft engines, and electronics). The Bureau of the Census has just launched the use of the new industry classification system, called the North American Industry Classification (NAICS)–replacing the current SIC system–in their 1997 Economic Census. The NAICS provides for a new Information Sector, but its focus is primarily on industries that produce information and not hardware items such as computers or communications equipment.

The Organization for Economic Co-operation and Development (OECD) Statistical Panel of the Committee on Information, Computers, and Communications Policy, in August 1997, proposed a draft definition of the Information and Communications Technologies (ICT) sector.[19]

Industry associations have also produced varying definitions of IT and high-tech industries, but their selection was in part driven by their membership. For example, the American Electronics Association (AEA) provides an extensive list of industries that they consider as High Technology, inclusive of industries considered to be IT.[20] The Information Technology Institute's (ITI) list of IT industries includes a number of those that are also considered IT by the AEA, except for electronic component industries. Many of the industries included in these various definitions of IT are common. A number are not (Table 5).

Table 5. Comparison of Industries Selected as IT (or High Tech) by Different Organizations

SIC	Industry	This Study	ITI	AEA	NAICS
3571	Electronic computers	yes	yes	yes	no
3572	Computer storage devices	yes	yes	yes	no
3575	Computer terminals	yes	yes	yes	no
3577	Computer peripheral equipment	yes	yes	yes	no
5045 pt.	Wholesale trade of computers and equipment	yes	no	no	no
5734 pt.	Retail trade of computers and equipment	yes	no	no	no
3578	Calculating and accounting machines	yes	yes	yes	no
3579	Office machines, nec	yes	yes	yes	no
3671	Electron tubes	yes	no	yes	no
3672	Printed circuit boards	yes	no	yes	no
3674	Semiconductors	yes	no	yes	no
3675	Electronic capacitors	yes	no	yes	no
3676	Electronic resistors	yes	no	yes	no
3677	Electronic coils	yes	no	yes	no
3679	Electronic components, nec	yes	no	yes	no
3695	Magnetic and optical recording media	yes	no	no	no
3823	Industrial instruments for measurement	yes	no	yes	no
3825	Instruments for measuring electricity	yes	no	yes	no
3826	Laboratory analytical instruments	yes	no	yes	no
3651	Household audio and video equipment	yes	no	yes	no
3661	Telephone and telegraph equipment	yes	yes	yes	no
3663	Radio and TV communications equipment	yes	no	yes	no
4812	Radiotelephone communications	yes	no	yes	yes
4813	Telephone communications	yes	yes	yes	yes
4822	Telegraph and other message communications	yes	no	yes	yes
4832	Radio broadcasting	yes	no	no	yes
4833	Television broadcasting	yes	no	no	yes
4841	Cable and other pay TV services	yes	no	yes	yes
4899	Communications services, nec	yes	no	no	yes
7371	Computer programming services	yes	yes	yes	yes
7372	Prepackaged software	yes	yes	yes	yes
5045 pt.	Wholesale trade of software	yes	no	no	no
5734 pt.	Retail trade of software	yes	no	no	no
7373	Computer integrated systems design	yes	yes	yes	no
7374	Computer processing and data preparation	yes	yes	yes	yes
7375	Information retrieval services	yes	yes	yes	yes
7377	Computer services management	yes	yes	yes	no
7378	Computer rental and leasing	yes	yes	yes	no
7379	Computer related services, nec	yes	yes	yes	no
	Other Industries				
2711	Newspaper publishing	no	no	no	yes
2721	Periodical publishing	no	no	no	yes
2731	Book publishing	no	no	no	yes
2741	Misc. Publishing, including databases	no	no	no	yes
2761	Manifold business forms	no	yes	no	no
2771	Greeting card publishing	no	no	no	yes
3652	Phonographic records	no	no	yes	no
3669	Other communications equipment	no	no	yes	no
3812	Search and navigation equipment	no	no	yes	no
3822	Environmental controls	no	no	yes	no
3824	Fluid meters and counting devices	no	no	yes	no
3827	Optical instruments	no	no	yes	no
3829	Other measuring and controlling devices	no	no	yes	no
3844	X-ray apparatus	no	no	yes	no
3845	Electromedical apparatus	no	no	yes	no
3861	Photographic equipment and supplies	no	yes	yes	no
7383, 89	News syndicates, business services, nec	no	no	no	yes
78	Motion pictures	no	no	no	yes

the "home insurance basics" area online to learn about homeowner's, renter's and condo or co-op owner's insurance policies, coverages, features about the home or apartment that affect the rate of the premium, and steps that can be taken to lower the premium. The auto insurance marketplace provides that information and also pulls together information from sources including the Federal Bureau of Investigation, the Insurance Research Council and others to advise the visitor about his level of risk for injury, theft, and accidents, given where he lives and what kind of car he drives. At the beginning of 1998, Quicken InsureMarket offered online auto insurance quotes and transactions in one state and referrals to insurance agents in fifty states. Over the upcoming months, Quicken InsureMarket will expand this service to customers in additional states.

Benefits to Business

Insurance carriers that offer their term life products today via the Quicken InsureMarket Web site benefit from real-time sales and lead generation, enhanced customer service through the company's toll-free number, and direct marketing links to Quicken.com with its tens of millions of site visitors monthly. Insurance carriers can potentially save hundreds of dollars for each policy sold online.

Internet Distribution Costs 50-100% Less Than Selling Through Traditional Agents

Traditional agent fee:	$400-700
InsureMarket fee:	$200-350
Savings:	$200-350/policy

Source: InsureMarket estimates, based on figures for term life policy of $400,000 with $700 annual premium

Benefits to Consumers

Quicken InsureMarket offers one-stop shopping for insurance products and information. A visitor to the site can compare policies, receive real-time quotes and purchase online or through an insurance agent.

Consumers may benefit from lower prices than they might have found elsewhere, simply because of the ability to comparison shop on InsureMarket's site. As online competition increases and the share of the insurance company's online business grows, and as consumers are able to more easily compare insurance prices, insurance prices for consumers are likely to come down.

Future plans

IIS launched its Quicken InsureMarket auto insurance service in early 1998 and plans to enhance it over the upcoming months. IIS also plans to add home, annuities, long-term care, disability and business insurance marketplaces to the Web site.

Quicken InsureMarket anticipates that more of its existing and future insurance carrier partners will enable customers to purchase policies online. Quicken InsureMarket will help streamline the application process by knitting together the customer, the carrier and the third-party sources necessary for completing the application process. For instance, instead of having to make a separate call to schedule a medical exam, the customer may be linked directly to a local paramedic, find a convenient time and schedule the appointment online. Similarly, a customer applying for auto insurance may not have to wait until his driving record is pulled from the Department of Motor Vehicles (DMV). With an online link to a DMV's records, the carrier will have that information in close to real time so that the application can be processed more quickly.

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	1997	1998	1999	2000	2001	2002
Media	$0.9B	$1.9B	$3B	$4.4B	$5.8B	$7.7B
Direct mkting	$0.1B	$0.2B	$0.4B	$0.6B	$0.9B	$1.3B

Total	$1B	$2.1B	$3.3B	$5B	$6.7B	$9B

See: Jupiter Communications. 1998 Online Advertising Report. Media includes directory listings and classifieds, direct marketing includes sales partnerships and other direct marketing revenues.
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	1996E	1997E	1998E	1999E	2000E	2001E	2002E
JUPITER	$276 M	$827 M	$1.9 B	$3.2 B	$4.7 B	$6.5 B	$8.9 B
FORRESTER	NA	$654 M	$1.5 B	$2.8 B	$4.7 B	$7.4 B	NA
ROBERTSON STEPHENS	$150 M	$500 M	$1 B	$1.6 B	$2.6 B	NA	NA

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APPENDIX 5

RETAIL OF TANGIBLE GOODS: ANALYSIS AND CASE STUDIES

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FIGURES

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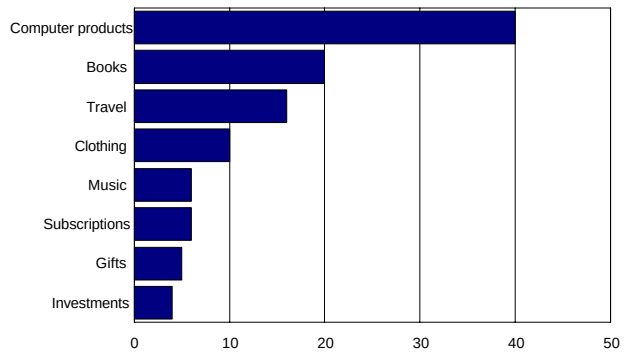
In 1994 and 1995, very few retailers were present on the Internet. Large information technology companies including IBM, MCI, and media giant Time Warner, established "cybermalls" early on and attempted to rent virtual space to interested retailers. Start-ups like Amazon.com, CDNow and N2K, Peapod, and Virtual Vineyards saw an opportunity to become the first Internet retailers in their specialty market segments of books, music, groceries and wine. These new Internet-only businesses had a head start of one to two years during which they invested heavily to build a brand image and gain market share before super retailers like Walmart, Barnes and Noble, the Gap, and J.C. Penney equipped their Web sites with a sales capability.

Today, even though Internet retail still represents but a small fraction of total retail, Internet consumers have a wide variety of shopping alternatives and products from which to choose. They can access sites that specialize in books, computer goods, groceries, music, magazines, hosiery, sporting goods, candles, flowers, and a range of other products. These sites may be sponsored by well-known store-based retailers, manufacturers, media companies, or wholesalers; they may be hosted by information technology companies present only on the Internet or via a toll-free telephone number.

Figure 1. What Do People Buy on the Net?



Source: Forrester Research

With sales topping $850 million in 1997, PC hardware and software is the largest specialty retailing area on the Internet.[1] Consumers can shop for desktop computers, notebooks, software and accessories direct from the manufacturer, via a reseller, well-known retailers with large store networks and new retailers with a presence limited to the Internet. Egghead.com, a $361 million computer reseller,[2] began offering hardware and software products from its Web site in February 1996; nine months later, consumers could directly download selected software products to their PCs. In January 1998, Egghead announced that it would close its network of retail stores and stake its future on Internet commerce.

Books and music are other large categories of Internet commerce (Figure 1). Amazon.com closed 1997 with sales of $148 million. Barnes and Noble reports that its Web-based business, launched in mid-May 1997, generated about $14 million during its first nine months of business. The company expects its 1998 sales to exceed $100 million.[3]

N2K and CDNow, two of the largest music sites, posted $6.5 million and $9.5 million in net revenues respectively for the first nine months of 1997. N2K's full-year 1996 revenues were just under $1.7 million; CDNow's were $6.3 million.[4]

Gifts and flowers are other important Internet retail categories. 1-800-FLOWERS had online sales of $30 million during 1997, for 10 percent of the company's total revenues. Garden Escape, a Web site selling plants, gardening supplies, tools and equipment, reports that its sales have been growing 30-40 percent every month since its fall 1995 launch.

Hallmark, the world's leading creator and marketer of greeting cards and personal expression products, recently launched its site in December 1997, offering more than 1,100 cards and 100 multimedia/animated greeting cards, gifts, and other services.

Super retailers like Walmart and direct marketer, Cendant Corporation (formerly CUC International), present consumers with one-stop shopping under one roof. Both companies' Web sites offer a vast selection of products across different product categories. As in its stores, shopping at Walmart.com is free of charge, and consumers can choose to make single or bulk purchases. Shoppers at Cendant's netMarket pay a $69 annual membership fee in order to purchase from their selection of over 1 million products.[5]

Not only have specialty and mass-market retailers established Web presences; businesses that do not traditionally compete for consumer retail spending have also established consumer-oriented Web sites.

Online service providers like America Online (AOL) and Earthlink Network, search engines like Yahoo! and Excite, and content businesses like Time Warner's Pathfinder bring together leading retailers for one-stop shopping, commonly organized by product type (books, computers, consumer electronics, furniture, etc.) and type of retailer (department store, mass merchandiser). In order to participate, retailers pay these companies some combination of rent, transaction and advertising fees.

For instance, tenants that qualify as "anchors" (a concept akin to department stores in shopping malls) on AOL's Shopping Channel pay for prominent placement in the Shopping Channel and advertising rotations to AOL's more than 11 million members. AOL also has exclusive advertising partnerships with retailers such as Barnes & Noble and the Cendant Corporation. For tens of millions of dollars over a multiyear period, AOL reserves the shopping space in particular product categories for these partners, advertises and markets their products on AOL's online service and/or aol.com, and participates with them in joint technical development and research.

Excite and Yahoo! hope to make the shopping experience more convenient for the consumer by providing intelligent software agents that scan the product databases of participating retailers and present only those that carry a particular product. The agent saves the consumer the time and effort he otherwise would have spent "visiting" each Web site in search of the product. The agent also presents price and delivery information that allows the consumer to comparison shop, weighing price, brand and availability when making the decision to purchase.

Internet consumers can participate in virtual auctions at sites like Onsale and First Auction. These sites combine entertainment and shopping, with real-time auctions that take place 24 hours a day, each one lasting for a few hours. Bidders compete with each other for a limited number of products, bidding the price up at set increments. In the past, the products offered at auction sites were limited to computer products and consumer electronics; today, bidders can also take home golf clubs, jewelry, clothing and a variety of other products.

Even buying a car—more of an investment than a typical retail purchase—is possible through a number of auto marketplaces, online classified sites, and manufacturers' own sites. Web shoppers can view pictures of different car models and read extensive information on the car's features, performance and reviews. Financing and insurance options are also available online. The existing distribution system and franchising laws require that a licensed dealer closes the transaction, so today's Internet-based businesses have direct links to dealership sites or send leads to dealerships who follow up with interested customers.

JD Power & Associates estimates that about 10 percent of all new car and truck buyers used the Internet as part of their shopping process in 1996. By 2000, at least 21 percent of all new car and truck buyers will use the Internet.[6]

The National Automobile Dealers Association (NADA), which represents more than 20,000 car dealers nationwide, reports that more than half of new-car dealerships have a Web site. Forty percent of the remainder plan to launch one within six months. Dealers with Web sites sell five cars a month on average over the Internet—double the number a year ago. Consumers use the sites to access vehicle inventory information, schedule sales appointments, order new and used cars, and apply for financing (Figure 2).[7]

Figure 2. What Consumers Can Do at Auto Dealers' Web Sites*

Access vehicle inventory	>50%
Schedule sales appointment	28%
Order new and used cars	22%
Apply for financing	26%

*Chart represents percent of dealer sites offering a given feature.
Source: National Automobile Dealers Association, October 1997

The largest volume of car sales is being driven by car marketplaces, like Auto-by-Tel, AutoVantage, AutoWeb and CarPoint. These services charge participating dealerships fees for listing their cars on the service.

Auto-By-Tel works with 2,700 dealers nationwide and refers more than 100,000 purchase requests to them each month. The company currently generates over $500 million in vehicle sales per month, or $6 billion on an annualized basis.

AutoVantage, owned by the Cendant Corporation, reports that it works with 1,000 dealerships nationwide and refers 30,000 customers to them each month.[8]

AutoWeb, a service based in Santa Clara, CA, has a network of 1,200 dealers in the U.S. and Canada and refers 110,000 purchase requests per month, up from 15,000 per month a year ago. In November 1997, the company announced its one millionth purchase request.[9]

Analysts estimate Internet retail at between $1.3 - $4 billion for 1997, a fraction of the $2.5 trillion consumer retail market. By the year 2000, U.S. online consumer retail could be as little as $7 billion or as high $37 billion.[10] If mail order sales are used as an indication of the potential for Internet retailing, as some suggest, the figure could reach $115 billion in five to eight years.[11] Some who offer this comparison to mail order believe that the Internet has three advantages over that channel. It offers consumers a more complete assortment, better and more complete information, and over the long term, better prices.

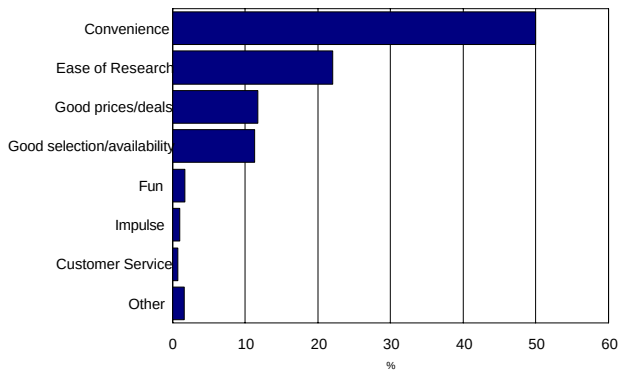
The growth of online consumer retail is being driven by cost savings, the ability to customize marketing, and increased consumer demand.

Consumer Demand

According to a Fall 1997 survey conducted by CommerceNet and Nielsen, 10 million people in the U.S. and Canada have used the Internet to make a purchase. This represents almost a doubling from their survey conducted six months earlier, when they found 5.6 million purchasers among the Internet users in North America.[12]

A larger number of people use the Internet to shop before making a purchase offline. A recent study by Ernst & Young shows that 64 percent of Internet users research products online and then buy them at stores or by telephone.[13]

Figure 3. Reasons Why People Shop Online



Source: Forrester Research

AOL reports that 79 percent of its members have window-shopped for products and services online. Forty-two percent have made purchases online at some point.[14]

When asked why they use the Internet to make a purchase, Internet users cite convenience. (In fact, 40 percent of the transactions made with retailers on AOL are made during hours when traditional malls are closed.[15]) Ease of research and good prices rank a distant second and third in the order of reasons given (Figure 3).[16]

Lower Operating Costs

Virtual stores report lower operating costs than their physical counterparts. They typically limit their operations to advertising and marketing, site content, establishing relationships with manufacturers or distributors, accounting functions and customer service. Rent and depreciation, store personnel, utilities and other expenses of a physical store infrastructure are almost entirely avoided. Internet-only stores may not even take possession of the goods, leaving fulfillment activities—warehousing and distribution functions—to third parties. More than one-fourth of Web sellers currently outsource these functions.[17]

NECX Direct, an online computer products store, is linked electronically to two distributors, Ingram and Merisel, which ship orders directly from their warehouses. Ordering, payment, invoicing and inventory management are handled electronically. It cost NECX Direct about $1 million to establish its Web site. The online division operates with a staff of 40 employees, including a Webmaster and developers, networking staff, graphics designers, telephone sales and support personnel, merchandisers, buyers and management. The company reports that its online operating model is cheaper than traditional mediums because fewer people are involved in each transaction.[18]

Comparing Amazon.com to a large traditional bookseller illustrates some key differences in an Internet-versus-physical-store business model. During the fall of 1997, Amazon's gross margin (retail sales minus cost of goods sold) was 19.5 percent of retail sales compared to this retailer's 36.7 percent.[19] The traditional retailer purchases its books from publishers and benefits from discounts due to its large sales volume. Up until very recently, Amazon purchased its books almost exclusively from wholesalers, paying markups the traditional retailer largely avoids. Aggressive price discounting online further erodes the gross margin of the online retailer. Amazon has recently begun to purchase more titles directly from publishers to reduce its purchasing cost.

As a virtual retailer, Amazon has no physical store infrastructure. Rent and depreciation represent less than 4 percent of Amazon's sales compared to 13 percent for the traditional retailer, and its labor costs are lower as a percentage of sales. Amazon has less capital tied up in inventory: its books turn 20-40 times per year versus two to two-and-a-half times per year for the traditional retailer. On the other hand, Amazon's advertising and marketing costs have been high relative to

its sales volume. In a new and rapidly growing market, it is not unusual for companies to invest heavily to build a brand and capture market share. Over time, as sales volumes increase, advertising and marketing expenses decline as a percent of sales.

Distribution requirements differ greatly for traditional store retailers and companies selling through the Internet. Large store retailers purchase large quantities of a single item and deliver them in pallet (large) quantities to a warehouse or directly to a store. Rarely do they deliver goods one-by-one to a customer's home or office. Internet retailers, on the other hand, require a distribution system that moves goods from a manufacturer or a warehouse to a customer's home, typically within a week or less.

Just as in mail order purchases, the Internet customer typically pays the full charge for the home delivery service. Depending on the method of shipment, home delivery can add significantly to the price of the product.[20] The high cost of delivery will likely have an influence on the way customers shop: rather than purchasing one item at a time, they will bundle several items in a single purchase to save on delivery charges. Over time, delivery charges will decrease as the volume of Internet retail increases. Like their larger store-based counterparts, Internet businesses will benefit from the economies of shipping larger quantities to a given geographic area and then distributing them locally, and likely pass these savings on to their consumers.

Direct marketers that sell via the Internet report lower operating costs versus their telephone and catalog sales operations. The Cendant Corporation reports that it loses $9 per new member in its telesales operation during the first year of membership when it factors in the sales and marketing expenses to acquire that new member. Because of its lower sales and marketing costs to acquire new Internet members, Cendant makes a profit of $10 for each new member in the first year. By the second year of membership, Cendant makes $30 per member in telesales and $40 per Internet member.

One-to-one Marketing

A shopkeeper in a small store may remember the purchases of his regular customers. A salesperson in a large store with customer traffic that changes daily has a very difficult time keeping track of a customer's purchases to be able to make individual recommendations.

Though not yet widely in practice, the Internet offers the opportunity to profitably market directly to narrow bands of customers, and even to market to customers one-by-one. Software programs detect when an individual customer enters a Web site, greeting the customer by name, much as a neighborhood shopkeeper might recognize a regular customer. Querying one or more databases reveals that the customer has recently purchased a pair of blue jeans and an Extra-large sweater or books on the topic of travel in Italy. On the Internet, the store might prompt the customer to purchase another sweater in a similar style or a shirt to go underneath the sweater. It might notify the customer when new travel books have been published, or suggest books on Renaissance art.

Researchers are working to develop software agents that learn the behaviors and preferences of individuals. As these technologies become more sophisticated, Internet businesses are likely to employ them to assist in one-to-one marketing.

If Web users become convinced that businesses will protect their privacy at the same time they make targeted offers, one-to-one marketing will become commonplace.

The Future

The retail sale of tangible goods on the Internet is likely to grow more slowly than business-to-business Internet commerce or commerce of goods and services that can be delivered digitally. How quickly it evolves will depend on consumers' trust of the medium, the sophistication and efficiency of distribution, and the speed at which the Internet becomes a mass market.

The most frequent complaint from online shoppers is that finding and buying things on the Internet is slow and complex. Some of that is due to delays in accessing information because of slow modems. Some of it is due to sites that are poorly organized, making it difficult to find things.[21] As bandwidth to the home increases, delays should be minimized. Search and categorization tools currently being developed should make navigating the Internet easier and more intuitive for users.

The tools are not yet in place to authenticate Internet businesses or to safeguard privacy. Leading Internet retailers worry that bad actors may lead to a backlash against the industry. Without authentication tools, a site can claim to be a retailer, but not be legitimate. A site may abuse a customer's privacy by collecting and sharing information without the individual's knowledge or consent. Or, a retailer might sell a customer a product but provide inadequate customer service.

As digital signature and certification authorities become widespread, and as privacy guidelines are more widely adopted, consumers will have better information and more control over where they shop. Industry groups like shop.org, launched in 1996 by leading Internet retailers, and others, have been formed to establish and promote good business practices for Internet retailers to ensure consumers have a problem-free online shopping experience.

Some consumers still fear giving their credit card online. Ernst & Young discovered that 68 percent of consumers who have yet to make a Web purchase say they are uncomfortable sending their credit-card numbers across the Internet. To address these concerns, a new industry in security services has been developing. Ernst & Young estimates that the market for firewalls and encryption was approximately $1 billion in 1996 and is projected to grow to $5 billion by 2000.[22]

Industry efforts to improve security through encryption like Secure Sockets Layer (SSL) and the newer Secure Electronic Transaction (SET) appear to be making an impact. 1-800-Flowers reports that fewer than one-third of its customers worry about credit card security, compared to

almost 75 percent last year.[23]

The growth of Internet retail will also depend on how quickly retailers and manufacturers establish a presence on the Web. Most of them have a Web presence, but it tends to be limited to information about the company and store locations. Only 12 percent of retailers and 9 percent of manufacturers currently sell via the Internet.[24] Few have the experience or the infrastructure to deliver orders directly to end customers. In addition, selling online is likely to have an impact on their existing store sales and, in the case of manufacturers, their relationships with wholesalers and retailers.

Web sites marketing cars describe the uncertainty of the legal and regulatory environment as another potential inhibitor to the growth of Internet commerce. If a state interprets the business model of an online auto marketplace as functioning like a brokerage, the marketplace will have to become licensed in every state and modify its business practices, or shut down in that state. If, on the other hand, a state interprets the business as an advertiser or marketer, the licensing requirements would not apply. How and whether an auto site can offer financing and insurance also centers around how states interpret their role.

Online auction sites raise other regulatory questions. Many states have statutes governing offline auctions, requiring professional licensing of auctioneers and registration of the auction with local authorities. In many states, municipalities are also authorized to regulate and/or license auctions. Online auctions differ from physical auctions in that bids placed in an online auction may come in from many different states, not just a single location. In addition, the frequency of online auctions (sites operate 24 hours a day and new auctions begin as frequently as every few minutes), for example, would prohibit the business from registering each auction with local authorities.

Most of these concerns are expected to be addressed as the market develops. Some will be addressed by technological advances; others by competitive dynamics and government action.

AMAZON.COM

From little more than a concept two and a half years ago, Amazon.com has grown to a $148 million business with customers in more than 150 countries, attracting them with a choice of 2.5 million titles, discounts of up to 40 percent, and search tools and book reviews that Amazon hopes make buying a book that much easier. By the end of 1997, over 1.5 million customers had shopped at Amazon.

Amazon is not a traditional bookseller. It has no physical stores, so it does not support the cost of the space and the labor to staff the stores. Moreover, because it is not constrained by physical space, Amazon offers a selection of books much greater than any single traditional bookstore. Amazon tries to find its customers any book a customer might request, whether in print or out of print, promising to get the book for them within a couple of days (for those in print) or as quickly as they can find it (for those out of print).

At the same time, Amazon shares typical retailers' goals of attracting and keeping customers. As a young company, Amazon spends heavily on advertising and marketing to build its brand name. It draws visitors to the store through advertising, both on the Web and off. But getting someone into the store is only part of the battle. Amazon believes that making the shopping experience as intuitive and enjoyable as possible is what turns the visitor into a customer. Amazon's sophisticated online search tools let the visitor quickly navigate the vast selection of books to find a specific author and title; they also let visitors take their time to browse through subject areas. Brief descriptions and book reviews give additional information a potential buyer might need to make a purchase. These tools, combined with a very simple and quick check-out process, help convert window shoppers into customers. Amazon recorded its millionth customer in October, 1997 then attracted another 500,000 by the time the year drew to a close. And customers appear to be satisfied with the experience: 58 percent of Amazon's orders come from repeat customers.

Because a customer does not walk into the store, pick up the book and carry it home, Amazon has more work to do once the sale is made to get the book to the customer's home or office. In its early days, Amazon relied almost exclusively on large book wholesalers like Ingram and Baker and Taylor for its inventory. Amazon's Seattle warehouse stocked only a couple thousand titles. As the company has grown larger, its strategy for order fulfillment is changing. To drive down cost and to meet its corporate goal of shipping 95 percent of its orders the same day, Amazon has begun to increase the inventory it keeps on hand. Rather than pay the additional markups that the wholesalers charge, Amazon now purchases some of its titles directly from publishers and stocks them in an expanded Seattle warehouse and a second warehouse in Delaware. At the close of 1997, Amazon's warehouses stocked more than 700,000 books, including partially filled orders.

Amazon believes that it has an inherent cost advantage versus traditional book sellers. Because Amazon does not support a physical store infrastructure, it benefits from lower rent and depreciation and lower labor costs relative to traditional booksellers. For instance, rent and depreciation represent less than 4 percent of Amazon's sales and 13 percent of the sales of a large

store-based retailer.[25] Amazon quotes sales/operating employee of over $300,000 versus $100,000 for the traditional retailer.

Amazon has less capital tied up in inventory. Its books currently turn between 20-40 times per year versus two to two-and-one-half times for the traditional bookseller.[26] As Amazon continues to stock more titles in its own warehouses, its inventory turns are likely to fall, but the company believes they will still be far higher than those of store-based retailers.

When it does not stock a book, Amazon receives payment for its goods before it has to pay its vendors. Rather than paying interest on money tied up in inventory, Amazon earns interest on its own sales. Other booksellers have money tied up for the books that stock their stores and warehouses and do not receive payment until the books are sold. Then, they receive payment from customers once the books are sold.

At this early stage of its operating history, Amazon has not yet made a profit.

Through 1997, it purchased most of its books through wholesalers, paying markups that traditional booksellers avoid by buying direct from the publisher. At the same time, online booksellers have been engaged in aggressive price discounting. These two factors contribute to a gross margin that is lower than that of its larger competitors.[27] And, in order to build its brand name, Amazon's expenses in advertising and marketing are a high share of its total cost structure.

Amazon has been taking steps to buy more of its books directly from publishers in order to improve its gross margins. As volumes increase, Amazon expects its advertising and marketing expenses to decline as a percentage of sales.

AUTO-BY-TEL

Auto-by-Tel launched its Web site in March 1995. During its first nine months of operation, the company processed a total of 43,000 purchase requests, and 70 percent of these requests resulted in sales at participating dealerships. In 1996, Auto-by-Tel received 345,000 purchase requests, for more than $1.8 billion in auto sales.[28] As of the end of November 1997, the Web site is generating $500 million a month in auto sales (or $6 billion on an annualized basis) and processes over 100,000 purchase requests each month. Over 1.3 million car buyers have shopped at Auto-by-Tel.

Auto-by-Tel shoppers can access model and pricing information, including dealer invoice pricing and manufacturer rebate information on all new and used cars from 2,700 dealers it has accredited across the country. Along with a picture of the car and brief descriptions, the customer can access new-car and used-car pricing from third party sources like AutoSite, Edmund's, CarCenter and Kelley Blue Book.

After deciding which car to buy, the customer enters the zip code where he or she lives and the make and model of the car desired. A screen pops up requesting which color exterior and interior is preferred, the type of transmission, how many cylinders, and if it is available in both door model options, to choose between a 2-door or 4-door model. Then, the customer completes a new car purchase request, selecting the manufacturer options to include on the car: radio, power windows, anti-lock brakes, sunroof, etc. With these selections and some contact information for the customer, the request goes to the Auto-by-Tel dealer closest to the customer's home. Within 24 hours, the dealer contacts the customer with a no haggle price.

For customers wishing to obtain financing, Auto-by-Tel provides rate information compiled by Bank Rate Monitor on different financing rates available in the city where the customer lives. Options are explained by the dealer and all the paperwork is prepared before the customer arrives to complete the transaction and pick up the car. Auto insurance quotes from AIG are also available online or by calling an AIG representative. The customer is also asked whether or not he wishes to acquire service agreements or after-market products available from their dealer. If interested, the customer can compare retail list prices and special Auto-by-Tel prices for each.

Auto-by-Tel charges the dealer a sign-up fee and flat monthly fee, ranging from $995 to $2,500, regardless of how many customers it sends to the dealer. For the fee, dealers are connected to Auto-by-Tel's proprietary server-based dealer communication network. In addition, Auto-by-Tel provides dealers with training for servicing Internet customers. The company has found that Internet customers expect a higher degree of professionalism and knowledge from the sales representative than a customer walking in to the showroom.

The National Automotive Dealers Association estimates that it costs the average dealer $101,500 to sell 100 cars, or about $1000 per car. With Auto-by-Tel, a dealer can sell 100 cars for $20,000, for a savings of $800 per car. Because Internet customers have access to both

manufacturers' suggested retail price and the dealers' cost, the company expects that the gross margins for Auto-by-Tel sales at participating dealers are likely to be lower than for their showroom sales. But, because their costs are so much lower, they can afford to pass some of these savings to customers in the form of lower prices.

Auto-by-Tel just expanded its site to include a used car service. Customers can search a database of 20,000 certified used cars, and see the condition of the car through digital photographs available online. The site was launched in June 1997. In January 1998, Auto-by-Tel received 600,000 inquiries against the database for that month alone.

CENDANT CORPORATION - NETMARKET

Cendant Corporation is a $5.3 billion consumer goods and business services company with more than 66.5 million members worldwide. It is a membership-based company which allows its members to shop by computer, bypassing retail stores.

After a couple of false starts in the early 1970s and 1980s trying to create a market for online retail before there were PCs in the home, Cendant's (formerly CUC International) business started to take off with phone and catalog sales.[29] The concept was simple: Cendant planned to link manufacturers with their end consumers, skipping the steps in-between. Cendant would work both ends, getting enough manufacturers to work with them to build an attractive product selection and signing up enough customers so that they could negotiate the best prices with the manufacturers. Cendant would do the advertising and marketing, take the orders and pass them through to their suppliers. Customers would get the product at wholesale and pay shipping charges to get it delivered to their home. Revenues to Cendant would come in the form of membership fees. By 1993, the concept had blossomed into a $2 billion business.[30]

Cendant experimented with America Online (AOL) initially, then launched its own site called Shoppers Advantage in the fall of 1995. Without doing major promotions of its online presence, it sold $400 million worth of products in 1996. More recently, Cendant has partnered with AOL and now offers numerous co-branded sites to AOL members. Cendant also launched its own site, netMarket, in July of 1997.

For $1.00, visitors to netMarket can become trial members for a three-month period and have access to over 1 million products and services with a 2-year extended warranty. Products cover approximately 20 percent of an average family's shopping needs, from cars to electronics and cameras, books, appliances, luggage, perfume, flowers and gifts, computer hardware and software, video games, and a variety of other goods and services. After the trial period expires, the annual interactive membership fee of $69 applies.

Cendant projects it will have facilitated the sale of more than $1.2 billion over the Internet during 1997. Each month, it adds 100,000 new interactive members.

Cendant's business model relies almost entirely on membership fees. The company reports that because it does not make its money on transactions, it sells products to retail customers at, or near, wholesale prices. If customers feel they are getting a value, Cendant figures they will buy a membership. And, once customers have paid their annual fee, they have a reason to check out what Cendant has to offer. The cycle continues.

Before the decade comes to a close, Cendant plans to offer a product selection to cover 95 percent of the products a typical household would buy.

Benefits of the Internet

As Cendant already operates without the confines of physical stores, it has the ability to offer a huge array of products, even through its telesales and catalog business. The Internet takes that to a next step. The benefits the Internet provides beyond that are:

- *Lower operating costs***:** As a direct marketing company, Cendant does not incur many of the costs of a traditional retailer. The company reports that its margins are therefore 8 to 10 times higher. The Internet only improves the situation. In its telesales operation, Cendant loses $9 per new member during the first year of their membership. On the Internet, they make $10. By the second year, Cendant makes money either way: $30 per member in telesales, $40 over the Internet.

- *Higher average purchase***:** Because it is easier to sell something visually than it is to do verbally, Cendant's online customers tend to buy up to three times as much as its telesale customers.

INTERNET SHOPPING NETWORK/FIRST AUCTION

A wholly-owned subsidiary of the Home Shopping Network, the Internet Shopping Network (ISN) presents two different retail models to Web users: the Computer Superstore—a virtual superstore selling 40,000 computer-related products and First Auction—a site that conducts real-time auctions of computer, consumer electronics and general merchandise. Both sites operate 24 hours a day, 7 days a week.

Combined, the two sites had sales of $15 million in 1997. Based on the pace that sales increased through the year, ISN anticipates that 1998 sales could reach $38 million.

Computer Superstore

To fit the online marketplace in its infancy—early Web "surfers" were high-tech, higher-income and predominantly male—ISN launched a business selling computer hardware and software. Computer products appealed to the early Web audience and had a track record with telephone and catalog sales that demonstrated that people would buy them on specification—sight unseen.

Marketing and technology drive this Internet-only business. Customers are attracted to the site by well-placed advertising, an extensive product mix and low prices. Computers behind the scenes receive customer orders from the Web site, process them and pass them along to a distributor. The distributor picks the item from its inventory, packages it, and FedEx ships it directly to the customer's home.

The Computer Superstore reports having a lower cost structure than traditional retailers because it doesn't support the costs of operating a physical store infrastructure, with the corresponding rent, labor, utilities and inventory costs. Nor does it incur the costs of warehousing and shipping. Reduced costs flow to lower prices to the customer.

The company provides the following example of the retail price and margins of three different selling vehicles for a well-known hand-held electronic personal organizer:

ISN Sells for Less Than Traditional Retailers

	ISN	Mail order	Store
Retail price	$260	$275	$292
Cost	$234	$234	$234
Margin	$26 (10%)	$41 (15%)	$58 (20%)

At the close of 1997, The Computer Superstore site had 175,000 members and attracted 25,000 visitors every day.

First Auction

ISN thinks the auction model will sweep the Web, appealing to Internet users who are adventurous, looking to be entertained, and seeking a bargain. Auctions take advantage of the interactive nature of the Web, allowing people from all over the country to bid against each other in real-time. They "transform a traditional shopping experience into an entertainment experience." First Auction plays to the entertainment element, starting many of its bids at $1.00, well below a product's cost. Bidders respond, competing with each other to take possession of whatever items First Auction is offering at the moment—whether golf clubs, CD players, television sets, jewelry or something else that's caught the bidder's eye.

The site auctions off over 5,000 items a week. Products, along with their picture, specifications and starting price, appear at the top of the First Auction home page. To place a bid, visitors must register with the site—providing name, address, email, phone number and credit card information (which is encrypted to ensure security). The Bid page shows how many units are up for bid, the starting bid, bid increments, the top bids so far, and the start and end time for the auction. The new bidder enters a bid, upping the price by the preset increment. This bid is posted on the Bid page under an alias. At the close of the auction, the bidders with the highest bids "win." (In almost all cases, more than one unit of a product is offered for bid.)

First Auction changes its auction items based on its inventory. It buys end of life, close-out merchandise at large discounts from distributors with inventories they cannot move through traditional channels. By getting the product at a low price, First Auction can offer a very low starting bid (often below cost). The difference between this model and the virtual superstore model is that First Auction takes possession of the merchandise, warehouses it and is responsible for getting it to the customer. Still, with the discounts they get and the volume of traffic they anticipate, ISN believes that First Auction can make money and customers can get bargains.

Launched in July 1997, First Auction's membership roster approached 100,000 people by the end of 1997, and 30,000 people visited the site each day.

30. Ibid.

31. Tadjer, Rivka. “Many Ways to Go Online - - Can a service provider be your quick ticket to online brand-name recognition?” *CommunicationsWeek*. July 28, 1997. http://www.techweb.com/se/directlink.cgi?CWK1997072850065

32. Goth, Nikki C. “Sweet Smell of Success.” H!TS supplement, Red Herring online. Spring 1997. http://www.herring/com/hits/03/800.html

33. Ibid.

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