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INDUSTRY STUDIES 2000

Information Systems

ABSTRACT

The Information Industry is a robust element of the U.S. economy. Information technology has 7% of the GDP and 10% of the U.S. workforce, and experienced an annual growth of 13%. The Internet, networks and information technology are changing the way we do business. But more importantly, the drivers of that change are the individual industries themselves, and how they utilize the technology – not the Information Industry itself.

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PLACES VISITED

DOMESTIC

AT&T, Washington, DC

Bell Atlantic, Washington, DC

Cisco Systems, San Jose, CA

ComCast Cable, Alexandria, VA

Competitive Telecommunications Association, Washington, DC

Dresdner RCM Global Investments, San Francisco, CA

Executive Office of the President, Office of Management and Budget

Exodus Communications, Santa Clara, CA

Federal Bureau of Investigation, Computer Crimes Unit, National

Infrastructure Protection Center, Washington, DC

Foundry Networks, San Jose, CA

Globalstar Corp., San Jose, CA

Handspring, Mountain View, CA

Henry L. Stinson Center, Washington, DC

Information Technology Association of America, Washington, DC

INTEL, Santa Clara, CA

Lucent Technologies, Washington, DC

Microsoft Federal Systems, Washington, DC

National Cable Television Association, Washington, DC

Netscape, Mountain View, CA

Oracle Corporation, Redwood Shores, CA and Washington, DC

Qualcomm, Washington, DC

Semiconductor Industries Association, San Jose, CA

Silicon Graphics, Inc., Mountain View, CA

Software and Information Industry Association, Washington, DC

Sun Microsystems, Menlo Park, CA

Sun/Netscape Alliance, Washington, DC

Teledesic, Washington, DC

Teligent, Washington DC

3Com Communications Corp., Santa Clara, CA

US Dept. of State, Washington, DC

INTERNATIONAL

American Chamber of Commerce, Beijing, China; Bangkok, Thailand; and Singapore

Asian Technology Information Program, Tokyo, Japan

Business Week, Beijing, China

Communications Authority of Thailand, Bangkok, Thailand

Economic Development Board, Singapore

Exodus Communications, Tokyo, Japan

Hewlett-Packard, Singapore

Information Development Authority of Singapore, Singapore

Lucent Technologies, Beijing, China

Maritime Port Authority of Singapore, Singapore

Ministry of Transportation and Commerce, Bangkok, Thailand

Motorola (China) Electronics, Ltd., Tangu Tianjin, China

Nippon Telegraph and Telephone (NTT), Tokyo, Japan

Sony Media Center, Tokyo, Japan

TECH Semiconductor, Singapore

TRADOS Corp., Beijing, China

U.S. Embassy, Singapore

U.S. Information Technology Office, Beijing, China

INTRODUCTION

The Information Industry is the engine driving the economy. Over the last decade, IT has proliferated to the point that it impacts all other industries, government and almost every American on a daily basis. Much has happened in the last 12 months. Electronic commerce is now focused on business to business. Security and privacy concerns have replaced Y2K as the most pressing issues. Microsoft, a cornerstone of the industry, is threatened with a government directed break up, the results of which no one can predict.

   In an industry where change occurs at a blistering pace, strategic vision is measured in months vice years. The transforming medium for the global economy, the Information industry will have a significant impact on our national defense in the new millennium. The purpose of this study is to give an overview of the Information industry, the challenges it presents to government and a prediction of the road ahead.
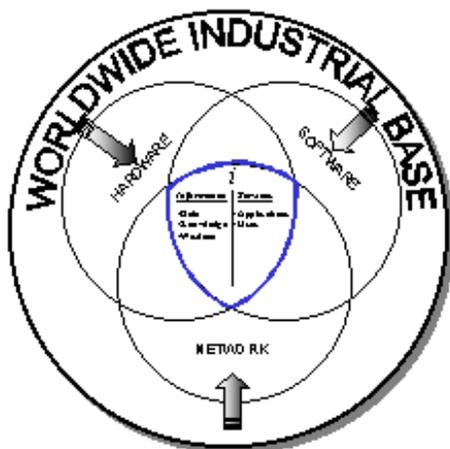
THE INDUSTRY DEFINED

Figure 1: Information Industry Defined

Using a "systems approach" to define the boundaries of the Information industry requires focusing on inter-industry relationships and technology flows. These boundaries are changing continuously over the life cycle of the industry as a result of new and improved technology. The basic Information industry, as depicted in Figure 1, is founded on three technology bases: the software that processes information, the hardware it runs on, and the networks that tie individual systems together. At the intersection of these three technologies we find information and services. Information in small isolated parts is data; when value is added we get knowledge; add experience, and true wisdom is the result. At the moment, we assimilate data into knowledge and wisdom but in the near future, information technology will enable us to capture wisdom on demand. The creation of new applications and uses of information and knowledge have resulted in the expansion in the service industries to new areas never imagined in the past.

CURRENT CONDITION

Trends in Sales/Shipments. The U.S. is the world leader in production and consumption of information technology and services[i]. As shown in Figure 2, the value of product shipments (operating revenue for services) has steadily grown, increasing from a total value of $283 billion in 1992 to $539 billion in 1997 (constant 1998 dollars) [ii].
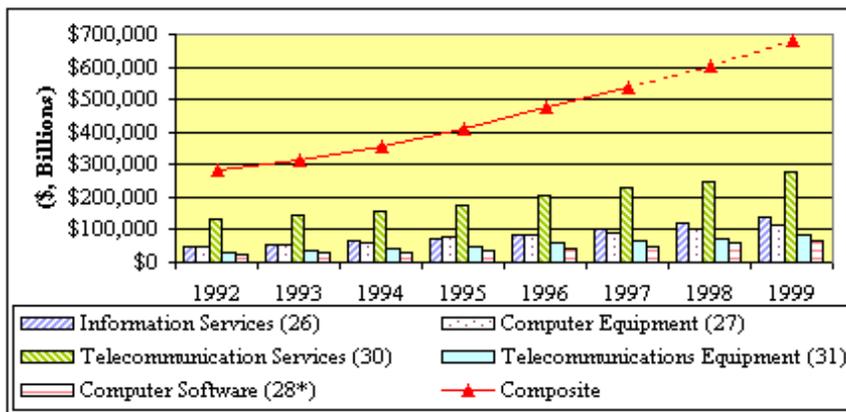
Figure 2: Information Industry Value of Product Shipments[iii]

This growth trend continues and is expected to reach nearly $680B in 1999 once the trade figures are tallied[iv]. The industry as a whole experienced an average annual growth of 13% with specific sub-industries ranging from a low of 10% for Telecommunications Equipment to 17% for Information Services. In terms of Gross Domestic Product (GDP), the Information Industry has steadily increased its share from 5.7% in 1992 to an expected value of 7.2% in 1999[v]. This growth in the Information Industry's share of the economy is remarkable, especially since information technology prices, adjusted for quality and performance improvements have been falling while prices in the rest of the economy have been rising.

Information Technology Agreement (ITA).   The ITA is a plurilateral trade agreement that requires signatories to eliminate their tariffs on information technology (IT) products by January 1, 2000. The agreement covers approximately 95% of world trade, currently estimated to exceed $1Trillion, in defined IT products (not services).[vi]
1998 National Defense Authorization Act (NDDA). The U.S. controls the export of High Performance Computers. Per NDDA guidance, the US applies export control based on the speed of the microprocessor and the risk posed by the recipient country.[vii]
Privacy. The US, adheres to a policy of industry self-regulation with respect to privacy. The European Union however, has comprehensive privacy legislation. This legislation, the <u>Directive on Data Protection,</u> posed a potential impediment to US companies operating in the European market. Transfers of personal data can only take place to non-EU countries that prove an "adequate" level of privacy protection[viii]. Under the "Safe Harbor" Arrangement, U.S. organizations voluntarily agree to adhere to "safe harbor" principles that bridge the gap between the US and EU systems for governing privacy.[ix]
Intellectual Property Rights. The United States has the strongest enforceable legal protection of software in the world. U.S. firms can rely on copyright protection, embodied in the 1980 Computer Software Copyright Act and to a lesser extent, patent protection. In addition, the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement provides the most comprehensive multilateral protection on intellectual property.

Productivity Trends & Comparison to International Trends

The Information Industry has shifted markedly away from vertically organized companies toward reliance on global linkages and outsourcing from both U.S. and foreign sources, especially in manufacturing. The computer manufacturing industry lost over 30% of its workforce due to increasing use of automation, and the globalization of the industry (using offshore companies to supply hardware that is manually assembled). Major US vendors implemented build-to-order and configure-to-order processes instead of manufacturing to meet a demand. This significantly lowered inventory costs and enabled them to deliver their products more quickly[x].

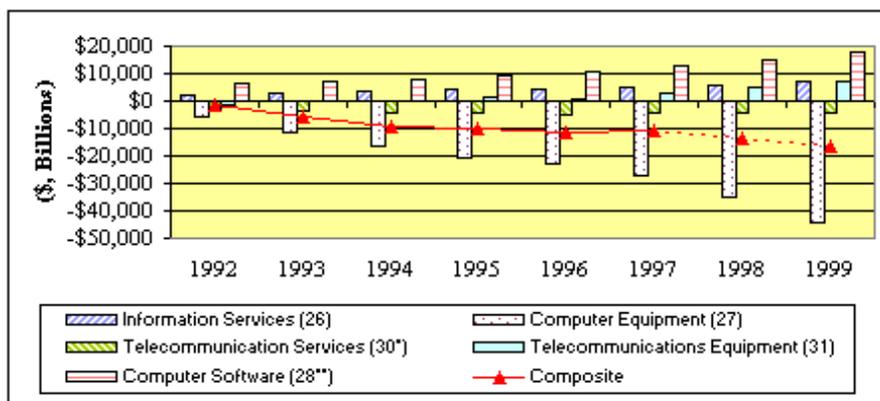## *International Competitiveness.*

Figure 3: Information Industry Trade Balance[xi]

Figure 3 presents the trade balance information for the U.S. Information Industry. Overall, the Information Industry experienced a slight trade deficit from 1992 through 1997. This trend is expected to continue into the 21st Century. While trade surpluses have occurred for computer software, telecommunications equipment and Information Services, a trade deficit exists for telecommunications services and computer hardware and peripherals. The trade deficit in computer equipment is largely a manifestation of globalization and outsourcing of the industry. Large computer companies like Apple, Compaq, Dell and HP have major manufacturing operations located overseas in Asia, Latin America and Europe. These same companies outsource peripheral device manufacturing such as mice, keyboards, memory chips and motherboards

to Taiwan and other Asian suppliers. If export controls continue to fall, the outlook for U.S. computer equipment exports is very promising. Asia and the EU will remain the largest regional computer equipment markets outside North America. Although considerably lower in value, emerging markets in Middle East, Africa, Latin America and Eastern Europe will grow at a much faster average annual rate. Japan will continue to be the largest single market for systems overseas. Japanese

firms pose the biggest challenge to U.S. computer equipment manufacturers, and will try to use their substantial financial resources to price their products aggressively and wrest market share from U.S. suppliers[xii].

Workforce. Worker productivity remains high. From the second quarter of 1999 until the second quarter of 2000, the unemployment levels across America hovered at a remarkably low 4.1%. During the week of March 18, 2000, the number of "First-Time Jobless claims," a key gauge of economic trends, hit a 26-year low.[xiii] Classical economic theory predicts inflation to rise with unemployment at these levels, but so far, there has been no substantial increase. Worker productivity grew 5% in the third quarter of 1999 and 6.4% in the fourth quarter of 1999.[xiv] Since 1995, the output per hour of workers outside the finance sector increased at nearly double the average pace of the preceding 25 years.[xv]

Technology. Today, 450 million computers are in use worldwide. Of the entire computer processing power ever built, 90% was deployed in the last two years.[xvi] In 1996, Bell Labs filed one patent per day, now they average four patents per day.[xvii] From the first quarter of 1998 to the first quarter of 1999, revenue in the Internet economy grew 68%. During this same period, online sales exploded 127% to $176.4 billion.[xviii]

E-tailing. The explosion in Internet commerce goes far beyond people buying books from Amazon.com and checking auction prices on eBay. Abraham Gulkowitz, Chief Global Strategist for the Deutsche Bank summed it up saying, "The Internet is empowering the final consumer, lowering costs, speeding information flows, and transforming the distribution of goods and services."[xix] The Internet brought "online shopping" to consumers and drove many "bricks and mortar" companies to go on-line or lose market share. Consumer shopping on the web is only the tip of the electronic commerce iceberg, as this year truly gave birth to "business to business" or B2B. Cisco Systems claims a $2 billion savings after four years by adopting electronic ordering, manufacturing, human resources, and finance systems. Some of the first B2B systems in place at Sprint, Office Depot, and Caesars Palace claimed reductions in buying costs by 12% in the first two months. Any skepticism in the future of B2B was eliminated in February 2000, when General Motors, Ford, and Daimler-Chrysler announced to merge their Internet-based supply exchanges in a joint venture to connect them with 30,000 suppliers.[xx] Boeing, Lockheed Martin, Raytheon, and British Aerospace will form a B2B market place for aerospace parts and services, envisioned to be open to parts suppliers, airlines, the Department of Defense and European Nations.[xxi] In 1999, the worldwide B2B market was $145 billion with projections to grow to $7.2 trillion by 2004,[xxii] nearly 7 percent of the expected $105 trillion total global economy[xxiii].

CHALLENGES

Governmental Regulatory Challenges

Commerce. The Cook Report entitled "The Battle for Cyberspace" specifies the current regulatory challenge to the market as: "Processes developed to service pre-Internet circuit switched telecommunications systems {which} don't afford policy makers any way to deal fairly with Internet disruptions".[xxiv] These Internet disruptions or challenges include international trade regulation, disputes among domain naming systems, verification of digital signatures and contract specifications, protection of intellectual property, and anti-trust measures. Other regulatory challenges include legal issues dealing with Internet taxation and consumer protection.

Protection. *Infrastructure protection* consists of such elements as encryption and network protection aspects. Recent protection challenges include dealing with hackers and crackers, the denial of service attacks on AOL, Yahoo and eBay and cyberterrorism.[xxv] *Citizen Protection* includes such issues as universal access, the digital divide, voting on the Internet, Internet content, and privacy issues. Government regulation in this area will impact filtering and rating systems, freedom of speech, and may impact widespread use of the Internet in other areas including access to government information, gambling, day trading, and cyber crime.

Market Force Challenges. These include marketplace volatility and an apparent inability to self-regulate. The rise of huge multi-faceted corporations, created by the joint ventures and mega-mergers within the information industry (such as the proposed America Online/Time Warner merge and that between MCI/Sprint), are attempts to cover every potential market segment from cable to media to information services. These mega-companies concern themselves with three main areas: expanding markets, technical convergence and capital formation, with market expansion most critical. These areas present their own host of challenges including trade regulation, integrity and reliability of the infrastructure and workforce issues. Other market force challenges include: fast technology cycles requiring significant capital investment; corporate security; adaptation to new electronic methods of payment; requirements for quality of service guarantees; corporate espionage; data mining; and finally increasing productization and sale of information.

Consumer Usage Challenges. Of all the consumer usage challenges, privacy issues are the most widely discussed. Concerns over the unwitting dissemination of personal data remain the primary consumer usage challenge. Other challenges include sender anonymity, child protection, Internet addiction, quality of service, and information glut. They also include free speech issues, equal access to high-speed services, such as ADSL or cable modem.

OUTLOOK

When projecting the future health of the Information Industry, it is important to look at three areas: political factors, social factors, and the ability of the industry to maintain its position in the global

marketplace.

Political Factors. The mergers of large IT related corporations like AOL with Time Warner impact the political agenda and fuel the ongoing debate about infrastructure access. Other short-term political issues include the final decision on accepting China into the World Trade Organization and the ramifications of software piracy. Closely related is the federal government's final relinquishment of some of the international access to encryption technology. Long-term political factors include privacy, infrastructure protection, government regulation of broadband and the outcome of the class action suit against Microsoft. These factors will be discussed in detail later. Political factors also include government decisions regulating bandwidth and concurrent access of infrastructure and bandwidth.[xxvi] Lastly, it remains to be seen what the implications for the industry will be when the Microsoft anti-trust litigation is finalized.

Social Factors. Long term social factors include education, intellectual property and behavioral concerns. The US will have to grapple with the need for IT education standards starting in elementary education if we are to compete and be the global leaders in the IT revolution. There will be quite a debate on the definition and protection of intellectual property. What are the rights of the creator of the information and its use; who owns intellectual property in an IT environment?

Preeminence in the Global Marketplace. IT will continue to retain its dominance in the global marketplace, if several areas receive the benefit of transparency and healthy growth. These areas include: educating the IT workforce; immigration policies allowing an increase of IT professionals; growth of the internet backbone; development of several broadband technologies to enable the necessary large pipes; and efforts to provide universal access for all (Americans and worldwide).

GOALS AND ROLES OF NATIONAL GOVERNMENT

Six broad goals are proposed based on the issues and the outlook for the Information revolution discussed above.

Open world markets and interoperable systems for electronic commerce and trade. National government must act to retain access to existing markets while fostering access to new markets, and encouraging development of electronic commerce capability worldwide. In cases where international agreements are required, either for standard protocols such as electronic data interchange or Internet protocol, the government must protect the interests of US citizens and businesses by promoting open information interchange and electronic transactions.

Make online Internet access available and affordable for all Americans. The purported 'Digital Divide' warrants government attention. Variables such as income, ethnicity and race, language and disability need to be examined to determine their impact on access to and participation in the information economy. Some programs are already in place to increase Internet access. For example, the education rate (e-rate) program, administered by the FCC, provides a 20 to 90 percent discount on

telecommunications services, Internet access and internal connections to public and private schools and libraries.[xxvii] A Presidential directive would provide power to mobilize the industrial, governmental and community resources required to close the "digital divide."

Provide a predictable, minimalist, consistent and simple legal environment for E-commerce. Government should establish a predictable and simple legal environment based on a decentralized, contractual model of law rather than one based on top-down regulation Any government action should "ensure competition, protect intellectual property and privacy, prevent fraud, foster transparency, support commercial transactions, and facilitate dispute resolution."[xxviii] Providing such an assured 'level playing field' that allows unfettered competition by any capable participant, while also protecting individuals' privacy and property rights is one of the government's most significant responsibilities.

Set the public standard based U.S. Government information sharing and e-business initiatives. As required by an executive memorandum in December 1999, agencies must promote access to government information. Furthermore, the memorandum challenges agencies to make major transactions with the Federal Government available online by the year 2003.[xxix]

Make cyberspace secure for private and public business, with U.S Government systems as a model of Information Security.   The federal government must lead by implementing its own protected information systems, a model to be emulated. Additionally, it must partner with the information infrastructure industry, owners of most of the National Information Infrastructure. These partnerships should promote cooperation to identify problems, vulnerabilities and solutions, as well as fund investment in research and development for information security.

Ensure an adequate and current IT workforce for America. To battle the increasing shortage of IT workers both for government and the commercial sector, the government must be very active in advancing legislation that allows appropriate levels of immigration / work visas to augment our national workforce. For the government sector, best practices from the commercial sector offer ways to recruit and retain IT workers.   For example, the U.S. Census Bureau is offering a signing bonus for potential new employees.[xxx] Another example is the President's $25 million funding proposal for the Federal Cyber Services Training and Education Initiative.[xxxi] The government must also encourage private sector training innovations for both new and old employees and promote IT education in our schools.

     While the preceding six goals are pertinent to the overall industry, there are also specific implications for National Security. The technology, capability advancements and growth of the information industry may bring revolutionary change to the way the US prepares and executes peace operations or war.

Defense Mobilization The use of improved information management systems and electronic commerce also improves the responsiveness and cost effectiveness of the

federal and DOD procurement process. These tools improve our ability to manage personnel systems, better link the active and reserve components, and enable more efficient coordination and management of personnel mobilization requirements.[xxxii] The services should continue investment in these systems across the active, guard and reserve components. DOD should continue evolution of business practices matching changes in commercial practices. These practices should include appropriate regulation and commercial agreements to expedite procurement of surge requirements. The capabilities discussed above may benefit mobilization requirements for wartime contingencies.

Acquisition. The DOD needs to ensure that evolving communication and IT standards support military requirements, or else develop technology and/or modify military requirements to best use commercial capabilities. This requires government participation in standards coordinating forum, both nationally and internationally. Ever increasing commercial network and communications equipment capabilities, availability of COTS MIS services, and more affordable communications access via commercial circuits and satellite systems address many previous defense information and communications shortfalls. However, the government must continue to focus acquisition efforts on integrating this technology into weapon systems, tactics and doctrine, developing an integrated, global C4ISR system and addressing unique "Last Mile" requirements.[xxxiii] These investments will enable systems that offer improved effectiveness through capabilities such as shared battlespace awareness and precision targeting.

Research and Development(R&D). While industry is investing large sums on R&D, much of this focus is on near-term efforts to bring products and services to market.[xxxiv] The government should support advanced research and development for information technologies to enable long-term improvements to the US national information infrastructure and advanced computing technology capabilities. This long-term research has and will continue to provide the technologies and applications that benefit US citizens, economic growth, and international competitiveness.[xxxv] DOD efforts should focus on specific defense needs necessary to achieve the technological advances to implement DOD's Joint Vision 2010 and evolve the services of the future.

ESSAYS ON MAJOR ISSUES

ISSUE: SECURITY

   With the Year 2000 problem behind us, IT security issues have moved to the forefront. Events to date have shown concerns over computer and network security to be very real. For instance, in February 2000 extensive "Denial of Service" (DoS) attacks were launched against about a dozen of the larger Internet Web sites. In May, the "I Love You" virus disrupted systems worldwide. These attacks highlighted once again well-known facts about vulnerability of computer networks. Despite how diligent a company is at plugging it's own security holes, it is still vulnerable to other

sites that are not as careful to protect themselves. Additionally, few sites have the resources to aggressively track and install patches to fix vulnerabilities as they are discovered, nor are many web sites or ISPs willing to bring their systems off line to install the fixes.

Prosecution of "cyber-criminals" is exceedingly difficult due to the worldwide nature of the Internet. Both of the attacks cited here now appear to have originated outside the US. A skilled hacker will weave a path to his victim using a multitude of computers located in several countries. This results in significant delays as international law issues are resolved, making investigation and prosecution difficult.

Equally challenging is the total anonymity the Internet can provide. When the Department of Justice released their report on Unlawful Conduct on the Internet, this lack of accountability was identified as a significant handicap – but their view caused an immediate negative reaction from citizens and privacy groups worried about excessive government intervention in private affairs. The ACLU doesn't view anonymity as a "thorny issue", but as a constitutional right. [xxxvi]

Recognizing the magnitude of the problem, the Administration has ramped up its information assurance (IA) efforts. The President's budget submittal for 2001 asks for $2.03B for Information Assurance efforts (a 17.5% increase).[xxxvii] The President also submitted a request for $9M in supplemental funding for FY2000 to initiate immediate security R&D work.[xxxviii]

There exists a consensus of opinion from the private sector that the government needs to avoid legislation of the Information Industry and allow it to self-manage. Despite this call for government "hands off", the lack of diligence on information security matters by the commercial sector may make it necessary. To date, the Government has envisioned its role as both a model for effective security practices and as a source of advice. While the Internet is primarily commercially owned and operated, its position as a critical piece of the national infrastructure makes it a government responsibility to ensure its availability.

The real question is whether industry self-regulation can work. The only way the marketplace will do so is if it is in their best interests – whether economically or perhaps to stave off Government involvement. Who will decide what is to be done, how will costs be shared, and how will participation be enforced? Industry attempts to form a mechanism to do this are still rudimentary. The Information Technology Association of America (ITAA) is now attempting to form a Information Sharing and Analysis Center (ISAC) among its members for coordination and information exchange.

Current IA problems indicate we don't have the time to sort this through in a consensus fashion – immediate action is necessary. The consensus among security experts is that the information industry has been woefully negligent. [xxxix] There seems to be little incentive to improve the security features of commercial products because the user demand is not there. The director of the Carnegie Mellon University Computer Emergency Response Team stated to a Congressional committee that they

were finding the same security problems in new versions of products, that had been identified years ago in earlier versions. [xl] Additionally, in the majority of intrusions, the problem appears to be that sites themselves are not fixing known vulnerabilities and implementing basic security policies and procedures.

There is no one solution to computer security, nor is there a "state of safety" that can be achieved. New vulnerabilities will continue to be identified and countermeasures developed. Users -- corporate, government, and private -- must continually evaluate their systems and ensure that new patches are installed expeditiously. As the economic and personal impact of attacks increase, there will be increased public frustration with both Industry's continued fielding of vulnerable products/services and the Government's inability to cope with the problem. This will likely result in more direct Government involvement with demands for new government access to private systems, a subsequent loss of personal privacy, and increasingly stricter fines and penalties for those convicted.

ISSUE: INFORMATION PRIVACY

The Internet is quickly changing from the purely communications tool of its origins to a dynamic commercial network linking all players in the supply chain. Consumers are in a position to reap the benefits of this through greater convenience, increased choice, lower prices, more information on products and services and the ability to personalize products and information. Unfortunately advances in technology are rarely neutral. Consumers will enjoy greater connectivity to the global economy at the expense of their personal privacy. The following privacy threats have emerged with the growth of the Internet and e-commerce.

The Electronic Trail

The very technologies that underpin the Internet (communication protocols and browser interfaces) mandate that a certain amount of information be transferred and stored between the two communicating computers. The electronic trail occurs at many levels in between. There are advantages to the user in having Internet activity recorded, as in aiding online navigation, but at the same time there is an electronic imprint of all Internet activity. Once information is 'out there' in cyberspace it stays there. Every email is logged at each hop of its journey. All bulletin board posts and mailing lists are logged and archived. Consumer personal information, necessary for online transactions, may be stored indefinitely in the merchant server.

Consumer Profiling

One of the most practical of our present safeguards of privacy is the fragmented nature of personal information. It is scattered in little bits across the geography and years of our life. Retrieval is impractical and often impossible. A central data bank removes completely this safeguard.[xli]

Perhaps the biggest single emerging threat to privacy is the aggregation of personal information into single databases. Electronic commerce is a necessity for those businesses wishing to compete nationally and globally. Customer information will be the driver of their growth. There is danger in that this customer information will reside only in the hands of a few large organizations that control a broad cross section of the media. These organizations will enjoy an unparalleled ability to push sanitized messages, to restrict the content available and to greatly influence the behavior of individuals.

The Internet has greatly enhanced the capacity for business to access, gather, record, process, sort, compare and link data. New methods for processing the vast accumulation of data make it possible to identify trends and to allocate resources in real time. The shear quantity of and ease with which information can be accessed and compiled from the Internet is a new phenomenon that can not be underestimated. Large disparate businesses can aggregate customer data from different sectors of their business to a central database enabling for clearer analysis and better decision making. If online data such as cookies, click stream data and other Web site analysis can be matched with offline data such as purchase histories and demographic information then a very useful consumer profile is revealed.

Two recent partnerships clearly illustrate the direction marketers are heading - the integration of offline consumer data with online consumer data. DoubleClicks, the largest online marketing firm, with an estimated 30 million cookies in its database, has announced a merger with Abacus Alliance which has a database of over 88 million consumer records retrieved from more than 2 billion off line catalogue transactions. Abacus' sophisticated data analysis and predictive models honed via direct mail, combined with DoubleClicks online experience makes for a potent combination. In the words of one privacy advocate "This would represent a surveillance machine of unprecedented breadth and depth, posing unacceptable privacy dangers to the public." [xlii]

ISSUE: ELECTRONIC COMMERCE

"Traditionally, Ford has not been good at selling anything except cars. But we'll use the Net to sell testing lab space, design time, and production capacity." This quote from Mark Duhaime, manager of purchasing systems at Ford[xliii], illustrates the dramatic way business is evolving from traditional business practices to electronic commerce (eCommerce) on the Internet. In the next five years, U.S. sales[xliv] over the Net will soar to $2.7 trillion and up to 20% of all commerce will move online.[xlv]

Transforming Ways Markets Conduct Business

Conducting commerce over the Internet has quickly become an integral part of modern business. Electronic marketplaces are emerging and the opportunities abound. eCommerce gives companies a *new global sales channel*, making it one of

the few technology initiatives that play a *strategic role in generating revenue* and *interacting with customers*. An Electronic Commerce solution provides more opportunities to develop a *relationship with the customer* as an individual, while doing so at lower cost than through conventional media.

New Trading Models – New eMarket Mechanics

In the next three years, the biggest impact for business will come from emerging electronic marketplaces. First, because that is the natural leverage of new networking-techniques offered by the Internet. In place of today's sequential industry connections, the exploding number of interconnections will create a new market structure – eBusiness networks – in which partners can switch allegiances without cost, information and best practices spread like wildfire, and market feedback can flow in real time. eMarkets will face rapid vertical integration and will grow to provide a single access point for commerce and information within an industry. Second, there is an unchallenged trend towards connecting products with services. The vision of one connected transaction process could become reality. The high connectivity and easy exchange of information will not only vertically integrate businesses along the value chain, but will also weave together marketplaces. In this environment, participants may enter one marketplace to perform one simple transaction process – like putting their petrochemical needs up for bid – but will be led down an orchestrated path through other interrelated sites.

New freedom of action will follow: auction, aggregator, bid system and exchange will alter many industry marketplaces. Consumer portals like Yahoo and eBay are only beginning to tap the potential for eCommerce. Although more choices will lead towards more flexible agreements, building strategic alliances – and building them early – is key. The previously mentioned example of the automotive-parts exchange[xlvi] linking the three biggest car manufacturers with Commerce One, the leader in eCommerce, points the way. Besides seller and buyer transaction fees, marketing fees, and custom tailored storefronts, firms will plan to capitalize on the vast amount of information they will gather in their online venues. Service and information will be the currency of the future knowledge based society.

Challenges

The spreading "Gold Rush" mood of the eCommerce upheaval also holds many challenges. The biggest is moving from "The Wild West" towards a fully functioning market place. However, although the tele-commu-ni-cations market is very dynamic, liberalization of old policies and procedures occurred slowly. As discussed earlier, a secure and trusted environment is essential for eCommerce. Secure payment capability is also necessary. Once established, cyber money and secure online transactions will boost eCommerce.

Concerning the eMarketplace guidelines, vertical integration and electronic trade will drive a higher level of cooperation across industry players – edging up against today's definition of anticompetitive practices. E-Commerce will revolutionize supply chain management, production, and internal and external business processes. It will also require companies to adapt new strategies. The need to rely more on knowledge will create new forms of organizational structure. The shift to online business is unstoppable. Products and production will still be crucial, but services related to eCommerce linked with more information, hold real value for the future.

ISSUE: BANDWIDTH

The Telecommunications Industry continues to experience a dramatic evolution due to the constant demand for "transportation of information". This demand comes primarily from the explosive growth of the Internet and related services. The drivers of telecommunications industry development include diversification of services, particularly in the data transmission sector, the necessity to allow end user access to the broadband technology, constant evolution of the regulatory framework, and seamless infrastructure. Convergence is the current model by which the telecommunications industry will evolve, with integrated data, video and telecommunication services as the new standard. The traditional gap between voice and data services is disappearing due to the rise of integrated services. Additionally, data traffic will likely surpass voice traffic within a few years. Consequently, telephone, telecommunications and cable companies are adjusting to this technology convergence. Traditional telephone companies face significant business challenges. Data revenues are lower than voice revenues. The price of bandwidth is dropping, a trend most analysts expect to continue. Therefore, value added services are necessary to assure revenue stream and profits for those formerly dependent primarily on voice traffic customers.

Rapid development of national and international telecommunications backbones has provided the "macro" solution to bandwidth demand. However, reaching across the "last mile" remains a problem. Residential broadband service is still in a development stage. Existing entries into the home are the primary focus today, such as digital subscriber lines (DSL) across telephone lines or cable modems across cable TV connections. Various wireless protocols hold promise also. According to the research firm Renaissance Worldwide, in 1999, however, less than 7% of US households had DSL or cable access in 1999, growing to almost 23% by 2004.

Regulation

The federal government took additional action in deregulating the telecommunications industry in 1996, allowing any telecom company to conduct business in any part of local or long distance service. This legislation has driven phone, cable and Internet service providers to engage in a fierce battle for the last mile broadband service. Post-1996 Telecommunications Act issues are: access of the local service companies to the long distance market, full compliance of the "Baby Bells" leasing infrastructure to other local service companies, requirement for the cable companies to open their network to Internet service providers and the FCC's review procedure for telecommunications mergers.

Technology Development

Wireline Transmission: Advanced development of electro-optic technology has allowed rapid deployment of high bandwidth networks around the world.

Competition between builders of high-bandwidth networks is increasing. Available bandwidth for national and international telecommunications exceeds demand, resulting in unused network capacity. Increased wide area network bandwidth has resulted in continually reduced connectivity prices. This trend will continue.

Wireless Transmission: Wireless technologies have enabled increased competition with other media as wireless services expand. These services include cellular telephone, specialized mobile radio, wireless area data transmissions, point and multi-point distribution services, paging services, and satellite services. New technologies address the demand for broadband services to small businesses, residential and personal cellular communications. Some of these technologies involve the use of micro-cell data networks, microwave mini-links in dense areas, and most recently the use of laser beam-based data networks.

Satellite services continue to satisfy global markets, but the insertion of these services in mobile voice and data has not yet been successful. Motorola's Iridium program failed, which has had a sobering effect throughout the satellite communications industry. Finally, frequency spectrum and bandwidth limitations may constrain continued wireless expansion.

ISSUE: ANTITRUST AND INTELLECTUAL PROPERTY

Two of the most pressing legal issues in information technology involve antitrust actions and intellectual property. Both enhance economic performance and consumer welfare, but in opposite ways. The former seeks to curtail monopoly power while the latter grants a limited, temporary monopoly. The challenge is to balance these concepts.

Antitrust Policy

By the end of the nineteenth century, technological advances encouraged firms to increase productivity through economies of scale. The cornerstones of modern antitrust law date from this period. The Sherman Antitrust Act prohibits anti-competitive agreements and abuse of monopoly power. The Clayton Act bars anticompetitive mergers. This legislation and the body of law that has grown from it concentrates on firm structure and price competition. In the information technology arena, however, the question is whether this focus is applicable. This debate concentrates on three major areas: the economics of network industries; the economic importance of innovation; and the pro-competitive effects of limited competition cooperation (e.g. in the setting of standards).

A synergistic effect occurs when other individuals positively relate demand for a product to its usage. Additional users adopting the same standard of compatibility (e.g. VHS v. Beta videocassette tapes) increase average value to consumers. Eventually, the market may experience "tipping," a point where just one product remains and a single standard dominates. Tipping maximizes the size of the market

and creates consumer benefits. In information technology, the largest benefit is a de facto standard for compatible software. Unfortunately, this standard may also create a monopoly. Monopolies exist where a single producer supplies a product with no close substitutes. The monopolist's power could then be used to raise prices and inhibit innovation. Innovation has been key to US economic performance and must be preserved.

How can antitrust law deal with threats to innovation? The relationship between an industry's market structure and the amount of innovative activity in that industry may differ from the relationship between market concentrations and short-term price competition, the conventional focus of antitrust. The evidence suggests that large firms created by some recent mergers will have neither a special tendency nor reluctance to engage in innovation. But, is this conclusion applicable to the information technology industry? Will improvements be restricted in order to preserve monopoly power? For example, will Microsoft pace operating system or application improvements in such a way to maximize profits? Will potential entrants and innovators be chilled from the market through a belief that any product they develop will be copied and bundled to a monopolist's core product (e.g. Microsoft Internet Explorer versus Netscape Navigator)? These are some of the issues the courts have been called upon to investigate and possibly remedy.

Microsoft Case - Implications.

The Microsoft case will have a large impact on both the information technology industry and antitrust law. It is clear that the government's decision required a balance between current competition concerns and long-run innovation interests. Such a balancing act is particularly difficult in a dynamic, technologically complex industry that may change dramatically if left on its current path. The central question is whether free markets will self correct in a integrated environment. Though appeals will likely prolong the case, it is clear the government determined Microsoft had tipped the market through improper means and significant remedies are needed. The ripple effect of this decision could become a bow wave as it reaches out across the industry and broader economy.

Intellectual Property:

Intellectual property rights are the life-blood of the information technology industry. Without these exclusive rights, and their enforcement, no software writer would toil to write code. Unfortunately, these rights are not universally granted or enforced in the global economy. The result is software piracy, defined by the Software Publishers Association as the unauthorized duplication of computer software. Such piracy significantly cuts annual revenue in retail sales and is a global problem. Piracy flourishes because of the high cost of software. Industry efforts to protect their products have focused on technical methods and expansion and enforcement of legal methods.

To assist with the problem, Congress passed the Electronic Commerce and Digital Copyright Protection Act in 1998. The Act makes it a crime to break "digital wrappers" that protect electronically encrypted intellectual property or to sell

equipment to penetrate such encryption. Unfortunately, this is legislation also erodes the fair use doctrine under which copyrighted works may be used for limited personal, educational and research purposes and could eventually lead to fee-per-use systems. The legislation is, however, a good first step.

The second major issue in the piracy area is legislation against piracy, and its enforcement. In the global economy, the best hope to stem software piracy is in the World Trade Organization and the TRIPS agreement. TRIPS prohibits piracy and all WTO members must sign on to TRIPS. Therefore, by expanding WTO memberships to such nations as China (where software piracy exceeds 95%), an obligation to prevent piracy will become law. The United States needs to give as much support as possible to expanding anti-piracy legislation.

There is, however, still the problem of enforcement. For example, while it is true that developing nations have the highest piracy rates, it is the developing nations that have the highest piracy losses (because of the volume of software employed). If a nation like the United States cannot adequately enforce intellectual property rights, what is the solution both domestically and internationally?

ISSUE: INFORMATION TECHNOLOGY WORKFORCE

In order to maintain a competitive advantage in the global marketplace and continue our long-term economic prosperity, the United States must make a substantial investment in human capital, particularly the information technology workforce. Soon most, if not all, employees will require computer literacy and technology related skills in order to succeed in the "digital economy."[xlvii] Members of the private-sector Council on Competitiveness recently identified strengthening the workforce as the single greatest challenge we face over the next decade.[xlviii]

The Bureau of Labor Statistics projects that database administrators, computer support specialists, computer engineers and systems analysts will be the fastest growing occupations in the years 1996-2006.[xlix] The Information Technology Association of America estimates that over 800,000 of the 1.6 million U.S. IT workers in demand in the year 2000 "will likely go unfilled."[l] Resolving this crisis is vital for our continued economic prosperity and long-term national security. How can we ensure the workforce and ultimately our nation are prepared to compete in the new economy? The solution can be broken down into four basic categories: data collection and analysis, recruiting, training, and retention.

Data Collection and Analysis

The Computing Research Association recently published "The Supply of Information Technology Workers in the United States," a 1999 study to improve understanding of the supply and demand for IT workers.[li] Their research found that federal data was by far the most important and reliable, but had some serious shortcomings making it difficult to conclusively determine the overall shortage. More timely and comprehensive supply and demand data must be collected with greater coordination among federal agencies in order to improve future analysis and conclusions and develop appropriate

policy recommendations.

Recruiting

The shortage of workers has forced employers to broaden the search for qualified applicants to traditionally underrepresented groups in the IT field, including minorities, women, disabled and older employees. In order to be successful, employers must commit additional resources to recruiting and become actively involved in the education pipeline to ensure an adequate supply of future workers.[lii]

Another way to increase the supply of IT workers is to recruit overseas. The U.S. Immigration and Naturalization Service issues H-1B visas, allowing workers to enter the United States for employment in specific fields where there is a supply and demand imbalance. A near-term increase in the number of H-1B visas should be accompanied by a substantial commitment by perspective employers to help American workers and students compete for these same jobs in the future.[liii]

Training

A responsive education system and dynamic training infrastructure are key to providing a larger pool of potential IT workers. Our higher education system "remains the foundation for providing IT workers"[liv] but requires substantial improvement. Universities and colleges need to become more responsive to industry needs, along with offering more associate degrees and requiring all students to take basic IT courses.

At the lower education level, "many students do not learn the basic skills of reasoning, mathematics and communication that provide the foundation for higher education or entry-level jobs in IT work."[lv] In order to improve these basic skills in elementary and high schools, and recruit qualified students, improvements are required in student counseling, teacher training and curriculum development.[lvi]

Other important training opportunities requiring additional emphasis and resources include school-to-work programs and solutions like the Federal Cyber Services Training and Education Initiative. This initiative promotes high school student participation in summer work and internship programs leading to IT certification and future employment.[lvii]

Incumbent worker training is also vital to maintain a qualified IT workforce. With changes in the industry and workforce requirements occurring at a blistering pace, incumbent workers need to continuously update their skills. In order to continue our economic prosperity, we must institutionalize retraining in our business and government cultures.

Retention

With the high cost of recruiting and training employees, especially during a worker shortage, retention is one of the most important aspects of maintaining a competitive workforce. When "longtime recruiters and compensation experts say the scramble for talent is the most intense they have ever experienced,"[lviii] retention of current workers requires new and innovative approaches in order to succeed. This same retention problem applies to government employees and may require unique policy solutions including recruiting, training and monetary incentives.
IT graduate student and faculty retention is another important aspect to ensure academic institutions maintain a proper teaching force. Without their expertise, "there will not be an adequate supply of teacher-scholars left to train the next generation of IT workers."[lix]

CONCLUSION

We have explored a myriad of issues associated with Information technology, systems and its uses. Government and industrial cooperation on these issues, coupled with an eye on the international front, will only serve to strengthen this industry. The health and future of this industry is excellent with high expectations to continue to innovate and grow. As we compare where we have come from – industrially -- to where we are now – informationally -- we see some striking personalizations that information technology can bring:[lx]

INDUSTRIAL AGE	INFORMATION AGE
Mass Production	**Mass Customization**
Mass Marketing	**One to One Marketing**
Customer Research	**Customer Participation**
Optimization of Physical Chains	**Optimization of Information Chains**
Physical Collaboration with Suppliers	**Information Collaboration with Suppliers**
Excellent Customer Service	**Customer Self Service**
Physical Location	**Virtual Globalization**
Prompt delivery of Physical Products to the Door	**Online Delivery of Virtual Products**
Knowledgeable Sales Help	**Software Agents**

Economic health is the barometer of a nation. Whether the measurement index is inflation, employment, growth, trade, or interest rates, they all weave into a fabric of national power. It is from this fabric that national leaders fashion our presence on the world stage. We have seen true transformation of a world in just half a lifetime, largely due to information system technology. The next half is directionally sound. The United States is the leader in Information Systems. As we globally expand technology, we also bring our democratic ideals and values with us. As Thomas Jefferson once said, "Information is the currency of democracy".

[i] Department of Commerce, U.S. *Industry and Trade Outlook*® *'99*, New York:
McGraw Hill Co. and U.S. Department of Commerce/International Trade Administration, 1999, p. 26-1.

[ii] Department of Commerce, *U.S. Industry and Trade Outlook*® *'99.* The Information
Industry was subdivided into five sub-industries based on the Standard Industrial Classification System
(SIC) codes: Information Services, Computer Equipment, Computer Software, Telecommunications Services and Telecommunications Equipment. Shipment data was collected separately for individual factories
or establishments (located within the United States) rather than for entire companies. Although most factories
or establishments make or sell a variety of products, for statistical purposes individual concerns are classified by
the SIC code of their most prominent product/service.

[iii] Economic data for Computer Software (28) was obtained from the following reference:
Business Software Alliance (BSA), *Enhancing Trade Opportunities for the Software Industry*,

20 March 2000, http://www.bsa.org/policy/trade/intro_c.html, Fig. 2, p. 7.

[iv] As of April 2000, the most recent trade figures available are for 1997.

[v] GDP data was obtained from the Department of Commerce, Bureau of Economic Analysis, http://www.bea.doc.gov/bea/dn/gdplev.htm, and were adjusted to constant 1998 dollars.

[vi] *Information Technology Agreement*, International Trade Administration, U.S. Department of Commerce, 19 March 2000, http://infoserv2.ita.doc.gov/ocbe/HotPolic.nsf/e41a11bbbbf467a6852565310074 e6f7/4e2b8c9a4336484a85256534005a688d?OpenDocument, p. 1.

[vii] *Fact Sheet -- Export Controls on Computers,* Office of the Press Secretary, The White House, July 1, 1999, http://www.bxa.doc.gov/HPCs/WhiteHouseHPCFactsheet.html, p. 2.

[viii] *Draft International Safe Harbor Privacy Principles Issued by the U.S. Department of* Commerce, Department of Commerce, 29 March 2000, http://www.ita.doc.gov/td/ecom/RedlinedPrinciples31600.htm, p. 1.

[ix] Commerce Secretary William M. Daley Hails U.S.-EU "Safe Harbor" Privacy Arrangement, p. 1

[x] Department of Commerce, *U.S. Industry and Trade Outlook*® *'99,* 27-4

[xi] Except for software, all trade balance data was obtained from the appropriate sections of the Department of Commerce, U.S. *Industry and Trade Outlook*® *'99* (see note 2 above). Software Trade balance data was derived from Business Software Alliance (BSA), *Enhancing Trade Opportunities for the Software Industry* Figure 8. Telecommunication Service trade balance data was estimated by the author for 1998 and 1999 based on the trend of the proceeding years.

[xii] Department of Commerce, *U.S. Industry and Trade Outlook*® *'99*, pp. 27-6 -- 27-7.

[xiii] Investor's Business Daily, "Labor Market Stays Vibrant; Claims Fall to 26-Year Low," March 24, 2000

[xiv] Weber, Joseph; Andy Reinhardt; & Rich Miller, "Tight Labor? Tech to the Rescue," Business Week, March 20, 2000

[xv] Investor's Business Daily, "Greenspan Cites Labor Productivity For Gains," March 23, 2000

[xvi] Murphy, Micheal, "5 High-Tech Stocks Every Investor Must Own," Investment Report, January 2000

[xvii]Barrett, Amy, "The Best Performers," Business Week, March 27, 2000

[xviii] University of Texas at Austin Business School, "Measuring the Internet Economy," October 1999

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[xx] Rosenberg, Joyce M., "B2B Sites Assist Small Businesses," Associated Press, March 26, 2000

[xxi] Reuters, "Top Defense, Aerospace Concerns Link To Form Online Parts Mart,"

Investor's Business Daily, March 27, 2000

[xxii] Gartner Group, "Gartner Group Forecasts Worldwide B2B E-Commerce to Reach $7.29 Trillion in 2004," http://www.gartnerweb.com/public/static/aboutgg/pressrel/pr012600c.html

[xxiii] "1999 CommerceNet/Nielsen Demographics of the Internet Overview Report", *CommerceNet/Nielsen* , June '99

[xxiv] The Battle for Cyerspace, http://cookreport.com/ipbattle.shtml

[xxv] Cyber terrorism Hype, International, 21 Oct 1999. http://jir.jaes.com/smaple/jir0525.html

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[xxvii] News Release, "FCC Chairman Kennard Celebrates the Success of the E-Rate in Connecting Over 1 Million Classrooms to the Internet," Online FCC website, November 17, 1999.

[xxviii] Ibid.

[xxix] Office of the Press Secretary, "Electronic Government," White House Memorandum, December 17, 1999, page 1.

[xxx] The Washington Post, Census Bureau advertisement, Technology Employment Section, March 5, 2000, page 1.

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