



Globalization and Electronic Commerce: Environment and Policy in the US

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SUMMARY

- The United States is the global leader in both Business-to-Customer (B2C) and Business-to-Business (B2B) electronic commerce.
- This leadership comes in part from the historical US strengths in information technology, telecommunications, financial services, and transportation – all of which are essential enabling components of e-commerce.
- The huge size and strength of the US economy, the wealth of its consumer base, and the relatively open access to venture capital creates an attractive environment for e-commerce investment.
- Official US Government policy toward e-commerce is to let the private sector take the lead, with government helping to make the right business climate for innovation and investment.
- Prior US Government investments in essential e-commerce infrastructure for military purposes (e.g., digital computing, the Internet) as well as civilian purposes (e.g., interstate highways, air transport) have played an important role in allowing the US to take the lead in e-commerce.
- US Government policies favoring widespread economic liberalization since the 1970's in areas such as financial services, transportation, and telecommunications have played an important role in enabling and stimulating private sector investment and innovation in e-commerce.
- The collapse of the dot.com era in the 1990's hit key sectors of e-commerce hard, suggesting that some of the more dramatic and positive predictions of e-commerce growth and impact will either be delayed substantially or will not come to pass.
- The strength of surviving e-commerce companies (e.g., Amazon and eBay), as well as the relative stability of the technology sector (e.g., Cisco Systems, Dell, Intel, IBM) and the continued investment of large industry sectors (e.g., autos, finance) suggest that e-commerce is still growing and is here to stay.
- Consumers are intrigued by B2C e-commerce, and many have used such services, but serious concerns related to privacy and transaction security remain obstacles to universal adoption of B2C e-commerce.

INTRODUCTION

This paper reviews data related to the environment and policy dimension of electronic commerce in the United States. The US is a global leader in electronic commerce in terms of total e-commerce sales, the number of e-commerce start-ups, the number of established global e-commerce firms (e.g., Amazon, eBay, etc.). It is continuing to make rapid strides in development and deployment of electronic commerce, and will probably do so for the foreseeable future. This is in spite of a dramatic slowdown in the so-called dot.com sector of new, Internet-based companies, and general weakness in the US economy. The business trade press remains positive about the prospects for the growth of e-business: 25% of all public Net companies in the business are profitable, and the market has weeded out bad companies very quickly (Business Week 2002). Strong growth in e-business is visible in several industries including travel, financial services, media and advertising and retail. Areas such as access/infrastructure, and consulting and services have suffered due to over-investment and consolidation, and earlier incumbents are now in stronger market positions. The generally liberal US approach to economic growth, which depends on private sector initiatives and a reluctance on the part of the government to over-regulate, and the willingness of government to intervene in support of competition and trade, seems to be working well for the development of electronic commerce. The US seems poised to maintain its lead in the electronic commerce field.

The report uses data from a variety of sources to discuss e-commerce in three sections: national environmental factors influencing e-commerce; national policy factors influencing e-commerce; and the likely trajectory of e-commerce based on the foregoing analyses.¹

¹ It is difficult to get solid data on the phenomenon of e-commerce. The very definition of “electronic commerce” is in dispute. This project limits the term to execution of commercial transactions (e.g., order entry and payment) using an Internet-based infrastructure such as the World Wide Web. But there are other reasonable definitions that all include major elements of commerce that are executed primarily through use of electronic communications and information processing infrastructure, including electronic funds transfer (e.g., on-line banking), Electronic Data Interchange over value-added networks, and Internet-based product searches that do not result in on-line sales. It is sometimes difficult to sort out which definitions are being used in the published data. Data from commercial sources often incorporate what are, ostensibly, the same measures, but the results differ wildly from one source to the next. There are problems of insufficient data on key indicators required to understand the economic and social change dimensions of e-commerce. As a general rule, data drawn from expert organizations such as the United States Census Bureau are seen to be more reliable than data drawn from commercial consulting firms with a stake in the outcome of the issues being studied.

NATIONAL ENVIRONMENT

Population and Demographics

Some aspects of population and demographics are clearly correlated with the precursors of B2C e-commerce, such as use of computers and the Internet, but there are no data for drawing causal conclusions on this matter. The US is the third largest population in the world after China and India. The US Census Bureau's 2000 census plus amendments and estimates suggests that the U.S. population is slightly over 270 million. The US is mainly an urban/suburban population with a normal age distribution. About 80% live in cities, and 21% are under 15 years of age (Table 1).

Table 1. Demographics Indicators in the Americas

Demographic	Population 2000 ^a	Urban population (% of total) 2000 ^b	% over age 65 1999 ^c	% under age 15 1999 ^c
Argentina	37,032,000	89.90	9.58	27.91
Brazil	170,115,008	81.30	4.89	29.56
Canada	30,750,100	77.10	12.54	19.46
Chile	15,211,300	85.70	6.99	28.56
Mexico	98,881,000	74.40	4.50	33.93
United States	275,129,984	77.20	11.85	21.20
Venezuela	24,170,000	86.90	4.31	34.42
Latin America ^d	345,409,308	80.83	5.34	30.92
OECD ^e	1,115,304,202	77.55	12.63	20.43

^aSource: International Telecommunication Union, Yearbook of Statistics 1991-2000. Geneva: International Telecommunication Union, 2001. Geneva: International Telecommunication Union, January 2002. The data for population are mid-year estimates.

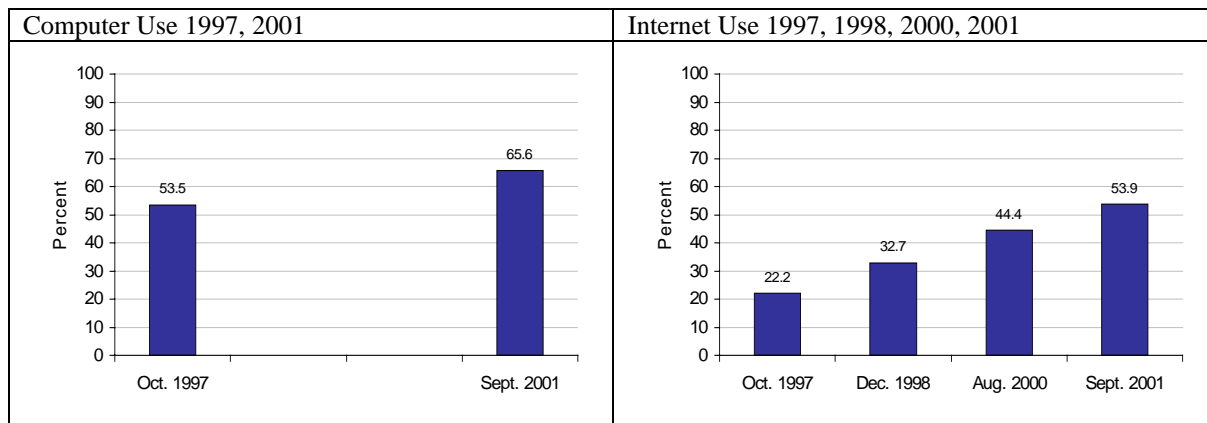
^bSource: World Bank Group, WDI Data Query located at <http://www.devdata.worldbank.org/data-query/>. WDI definition: urban population is the midyear population of areas defined as urban in each country and reported to the United Nations. It is measured as a percentage of the total population.

^cSource: World Bank, World Development Indicators CD-Rom 2001.

^dOnly countries included in the 44-country sample are used in the classification. Latin America here consists of the following countries: Argentina, Brazil, Chile, Mexico and Venezuela.

^eOnly countries included in the 44-country sample are used in the classification. OECD here denotes the OECD member countries, excluding Luxembourg, Slovakia and Iceland.

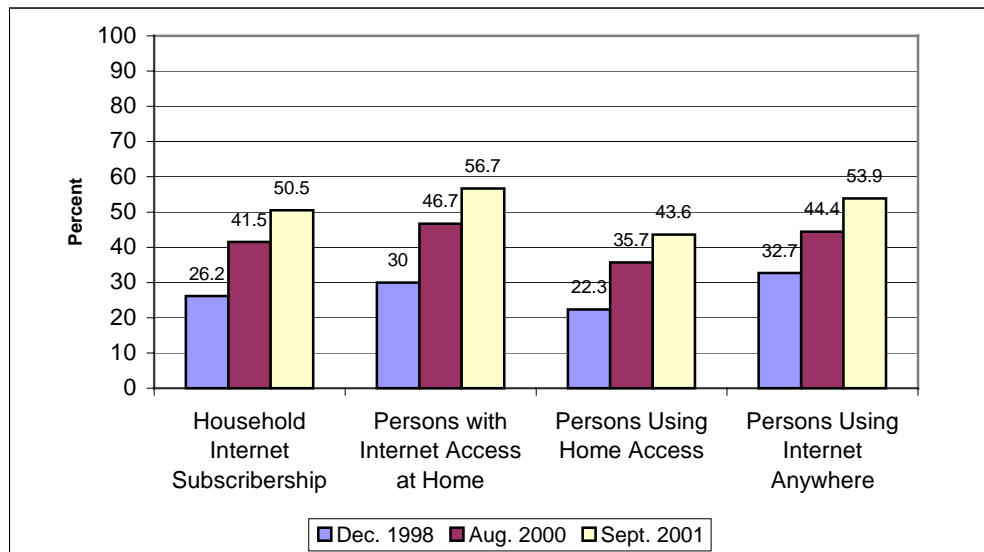
Figure 1. Internet Use From Any Location, Percent of Persons Age 3 +



Source: NTIA and ESA, U.S. Department of Commerce, using U.S. Census Bureau Current Population Survey Supplements

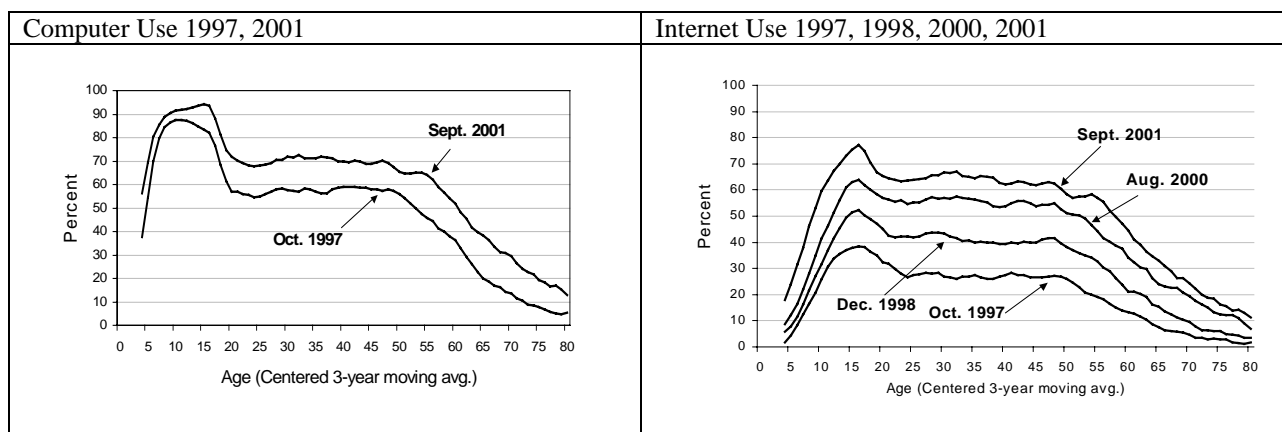
Use of computers and the Internet are expanding over time. By September 2001, almost 66% of the population (174 million) were computer users, and 54% (143 million) were Internet users. Since 1997, computer use has grown at an annual rate of 5.3%, and Internet use has grown at a rate of 20% (Figure 1). As of 2001, 50.5% of households had Internet connections and 56.7% of the population were living in households with connections, although only 43.6 percent of Americans claimed to use the Internet in their homes. Nearly 54% of the total population uses the Internet at some location (Figure 2).

Figure 2. Different Perspectives on Internet Access and Use



Source: NTIA and ESA, U.S. Department of Commerce, using U.S. Census Bureau Current Population Survey Supplements

Figure 3. Computer and Internet Use at Any Location Age Distribution (3 year moving average), percent of Persons Age 3 to 80

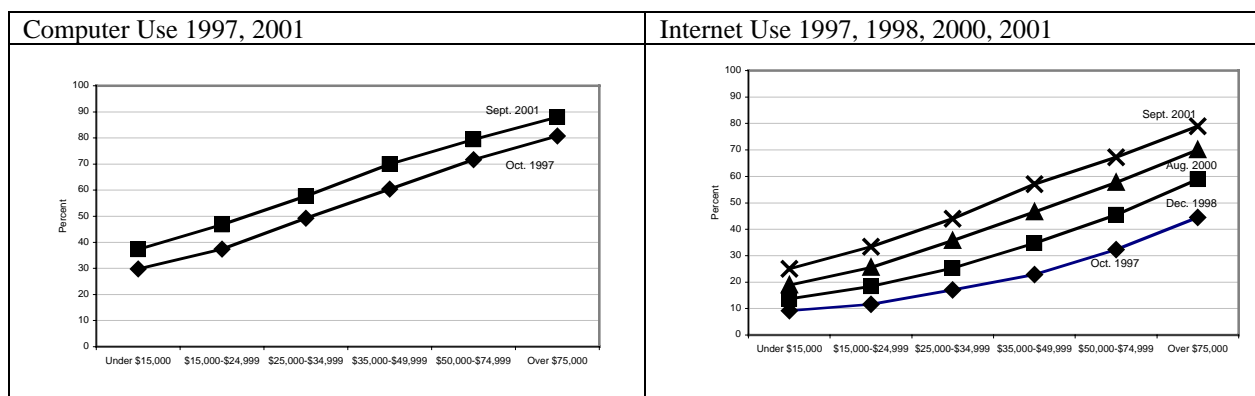


Source: NTIA and ESA, U.S. Department of Commerce, using U.S. Census Bureau Current Population Survey Supplements

Age strongly correlates with computer and Internet use. Children and teenagers are the heaviest users; people in their prime work years are substantial users; older people are less likely to be users (Figure 3). This is a consistent finding over time (NTIA 2002).

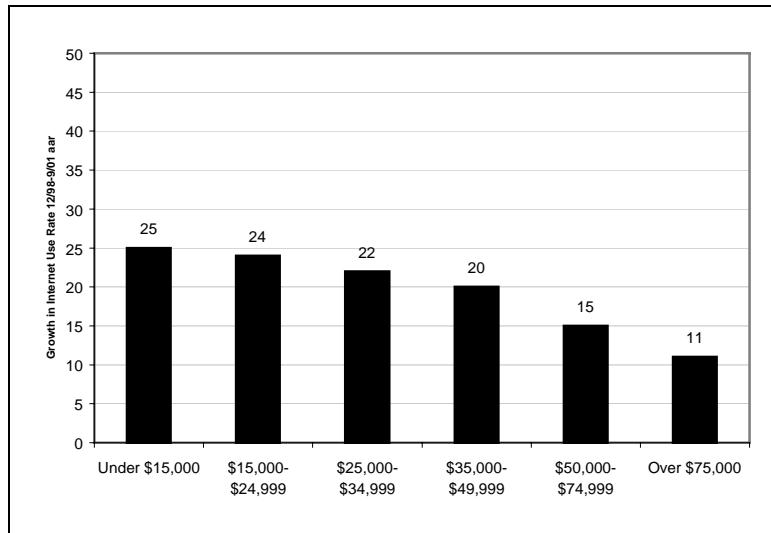
Family income also correlates with computer and Internet use. High-income households are more likely to be users than low-income households, although computer use increased steadily across all income categories over time due. Lately there has been substantial growth in computer use among lower income households (less than \$15,000 annually), registering growth from 30% of households in October 1997 to almost 40% in September 2001 (Figure 4). Internet use among lower income households grew 25% per year during this time, compared to an annual rate of 11% among high-income households (\$75,000 or more) (Figure 5).

Figure 4. Computer and Internet Use From Any Location by Family Income, Persons Age 3 +



Source: NTIA and ESA, U.S. Department of Commerce, using U.S. Census Bureau Current Population Survey Supplements

Figure 5. Growth in Internet Use by Family Income, Percent of Persons Age 3 + (Annual Rate) December 1998 to September 2001



Source: NTIA and ESA, U.S. Department of Commerce, using U.S. Census Bureau Current Population Survey Supplements

Economy and Industry Structure

The size of the US economy and the wealth of the population is probably a strong factor affecting the development of e-commerce, although there is no causal data to prove this. The US Gross Domestic Product was US\$ 10.198 trillion in 2001 (Table 2).² US GDP grew steadily during the 1990's, ranging from 2.91% to 5.20%. The United States is one of the world's wealthiest nations, with average personal income of US\$ 36,210.70 in 2000. The US has a somewhat less even income distribution (i.e., more of the wealth is held by the top 20% and less is held by the bottom 20%) than the OECD average, but is more even than other countries in the Americas, except Canada. The wealth of the US is probably an enabler of e-commerce. Substantial disposable income provides attractive opportunities for innovators in B2C marketing efforts, and the strength of the economy on the consumption side is mirrored on the production side, opening opportunities for B2B e-commerce.

² Source: <http://www.bea.doc.gov/bea/dn/nipaweb/index.asp>

Table 2. Wealth Indicators in the Americas

Wealth	GDP in billions US\$ 2000 ^a	GDP per capita 2000 ^a	Share of income or consumption, richest 20% 1987-1998 ^b	Share of income or consumption, poorest 20% 1987-1998 ^b
Argentina	\$285.04	\$7,697.26	n.a.	n.a.
Brazil	\$595.46	\$3,500.33	63.80	2.50
Canada	\$708.73	\$23,048.11	39.30	7.50
Chile	\$70.54	\$4,637.67	61.00	3.50
Mexico	\$574.24	\$5,807.43	58.20	3.60
United States	\$9,962.65	\$36,210.70	46.40	5.20
Venezuela	\$120.48	\$4,984.85	53.10	3.70
Latin America ^c	\$1,645.78	\$4,764.72	59.03	3.33
OECD ^d	\$25,461.49	\$22,829.19	40.19	7.71

^aSource: International Telecommunication Union, Yearbook of Statistics 1991-2000. Geneva: International Telecommunication Union, 2001. ITU definition: the data are current price data in national currency converted to United States dollars by applying the average annual exchange rate (from the International Monetary Fund, IMF) to the figure reported in national currency. GDP per capita is calculated by dividing GDP in United States dollars by the mid-year estimate of population obtained from the United Nations.

^bSource: United Nations Development Programme, Human Development Report 2000. New York & Oxford: Oxford University Press, pp. 169-172.. Dates for the data vary by country from 1987 to 1998.

^cOnly countries included in the 44-country sample are used in the classification. Latin America here consists of the following countries: Argentina, Brazil, Chile, Mexico and Venezuela.

^dOnly countries included in the 44-country sample are used in the classification. OECD here denotes the OECD member countries, excluding Luxembourg, Slovakia and Iceland.

Firm Size, Industry Structure and Concentration

Firm size, industry structure and industry concentration might affect e-commerce development, and there is speculation about how this might occur. Some claim that more concentrated industries have an e-commerce advantage due to economies of scale and scope, and the ability to build e-commerce on the back of already large production and distribution capacity. Others argue that smaller firms have an advantage in e-commerce due to their flexibility and the opportunity to enter the markets at a relatively low cost, previously accessible only to large firms. There is little evidence to draw conclusion, however.

Nearly 90% of US firms are small, with less than 20 employees, while less than 1% are large firms employing more than 500 people (Table 3). This concentration has increased very slightly since 1990. Over all NAICS sectors, about half of the workforce is employed by firms less than 500 employees in size, about 23% are employed by firms between 500 and 10,000 in size, and about 27% are employed by firms greater than 10,000 in size.

Table 3. Percent of US Firms at Various Employment Size, 1990 and 1999

Workforce employment (as % of total)		50%			50%
Employment size		<20	20+	100+	500+
% US firms	1990	89.40	10.61	1.67	0.28
% US firms	1999	89.30	10.70	1.75	0.30

Source: <http://www.census.gov/epcd/www/smallbus.html>

Data on industry concentration in the U.S. provides at best suggestive indications of the role of industry concentration in e-commerce. Low concentration (the top 50 companies control less than 40% of their respective markets) does not seem to affect e-commerce environment, but greater concentration might be a factor in the emerging B2B e-commerce market.³ The US computer-related industries and transportation equipment industries are somewhat more concentrated. In 1997 the top fifty US computer and electronic product companies controlled 55% of the US market; the top four controlled 19.1%; and the top eight controlled 28.1%. In the transportation equipment manufacturing industry, the top 50 companies controlled 77.5% of the market, and the top four controlled 49.7% (Census 2001). Both industries have pioneered supply chain management strategies related to B2B e-commerce. The computer and electronic equipment industry has made extensive use of IT in manufacturing and distribution (e.g., Intel, Cisco, IBM, Dell). The transportation equipment industry, especially automobile manufacturing, has been at the forefront of technology use such as electronic data interchange (EDI) that increases production and supply chain efficiencies.⁴ Industry concentration might provide the means to explore and promote e-commerce activity, but the data do not permit the conclusion that industry concentration is a likely cause of e-commerce growth.

Importance of Foreign Multinational Corporations

US multinational firms probably play a larger role in the evolution of e-commerce in other countries than do foreign multinational corporations in the US. Although gross foreign direct investment as a percent of GDP grew steadily from 2.91% in 1995 to 5.20% in 2000, relatively little of the United States economy is under the direct influence of foreign multinational firms. There are some exceptions, however. Foreign direct investment has had a striking effect on the US domestic auto manufacturers in the past thirty years. Japanese and other foreign OEMs have built assembly plants in the US, often bringing about changes in domestic company practices and strategies. Also, the lines between “foreign” and “domestic” are becoming blurred. Daimler bought Chrysler, the Ford Motor Company bought Jaguar and Volvo, General Motors bought Saab, etc. The so-called “international multinationals” might eventually exert more influence over e-commerce in the US than the foreign multinationals.

³ In the order of total value of shipments: machinery, fabricated metal, plastics and rubber, miscellaneous, printing and related support, wood, apparel, furniture and related. Source: US Census, 1997. <http://www.census.gov/prod/ec97/m31s-cr.pdf>

⁴ This study looks at actual sales over the Internet as the key indicator of e-commerce. However, this masks what might be vital signs in the evolution of e-commerce more broadly. The auto industry provides a good example of this. The auto industry has not seen significant B2C car sales, in large measure because state laws prohibit direct sales of autos from manufacturers to customers in order to protect auto dealers. Thus, it might be concluded that there is little B2C e-commerce in autos. In fact, an extensive on-line industry has grown up around provision of complementary information that can directly affect auto sales. This includes sites that provide extensive information for comparison of automobile features and prices as with <http://carpoint.msn.com/>, on-line automobile loan origination such as <http://www.auto-loan.com/>, assistance from companies like <http://www.autobytel.com/> that facilitate customer purchases from regional auto dealers, and assistance from manufacturer-sponsored sites such as <http://www.forddirect.com/> that work with local dealers to help customers with purchases.

Openness to Foreign Trade and Investment

There is no evidence that foreign trade and investment have had any effect on the evolution of e-commerce in the US⁵. Although the United States has few barriers to foreign trade and direct foreign investment, the US economy is overwhelmingly a domestic economy (Table 4). Total exports of goods and services seldom exceeded 11% of GDP during the decade of the 1990's, while imports have increased from around 11% in the early 1990's to nearly 15% in 2000. Total exports and imports account for between 20% and 25% of GDP.

Table 4. US exports and imports, 1990-2000 (USD billions)

	Goods		Services		Total		% of GDP	
Year	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
1996	618.4	808.3	255.8	154.8	874.2	963.1	11.2%	12.3%
1997	688.9	885.1	277.5	170.7	966.4	1055.8	11.6%	12.7%
1998	681.3	930.0	283.6	186.7	964.9	1116.7	11.0%	12.7%
1999	698.3	1046.9	291.5	193.7	989.8	1240.6	10.7%	13.4%
2000	785.6	1244.9	317.3	221.9	1102.9	1466.8	11.2%	14.9%

Source: Bureau of Economic Analysis, National Income and Product Accounts Tables, <http://www.bea.doc.gov/bea/dn/nipaweb/index.asp>

Human Resources

Education is probably a critical enabling factor in electronic commerce. The level of educational attainment in a population is correlated with economic productivity and earning potential. Of US adults over age 25, over 80% had completed high school and about one quarter had completed at least four years of college. Those over 18 who complete only high school have average earning power of US\$ 24,500, while the average for those who complete college is US\$ 45,600. Higher level of disposable income are correlated with computer and Internet use, and probably affect B2C e-commerce positively.

One aspect of human resources related to e-commerce is the character of educational experience in computer and Internet use. The extension of Internet access to nearly all public schools is very likely to increase access to the technology in ways relevant to e-commerce, but this does not mean that students will be adequately trained in use of the technology to conduct e-commerce. In any case, few students will have the opportunity to engage in e-commerce activity while in school. Market data on the number of students per computer in public elementary, middle and senior high schools shows steady improvement (Table 5, Table 6). A substantial fraction of the school-aged population now has access to Internet-enabled computing, but the data do not indicate what actually is done with the computers, or the nature of the instruction the students are receiving.

⁵ Although some authors may argue differently (e.g., Caselli & Coleman, 2001, Shih, Dedrick & Kraemer, 2002).

Table 5. Number of Students per Computer in US Public Schools, 1985 and 2000

	1985	2000
Elementary	79.3	6.9
Middle/Junior	61.2	6.3
Senior High	51.5	5.6
All	63.5	6.3

Source: Market Data Retrieval, Shelton, Conn. via <http://www.infoplease.com/ipa/>

Table 6. Percentage of US Public Schools with Internet Access, 1995 and 2000

	1995	2000
Total	50%	98%
Elementary	46%	97%
Secondary	65%	98%

Source: National Center for Education Statistics, Internet Access in U.S. Public Schools and Classrooms: 1994–2000

Another aspect of education relevant to e-commerce is the creation of a workforce with advanced skills capable of building the required infrastructure. The production of PhDs in computer science, information science, and mathematics has been rising steadily, and might play a role in e-commerce⁶ (Figure 6). In addition to education, the US has accommodating immigration policies and a creative business environment with high wages that attracts talented foreign engineers and scientists to the US.

Infrastructure

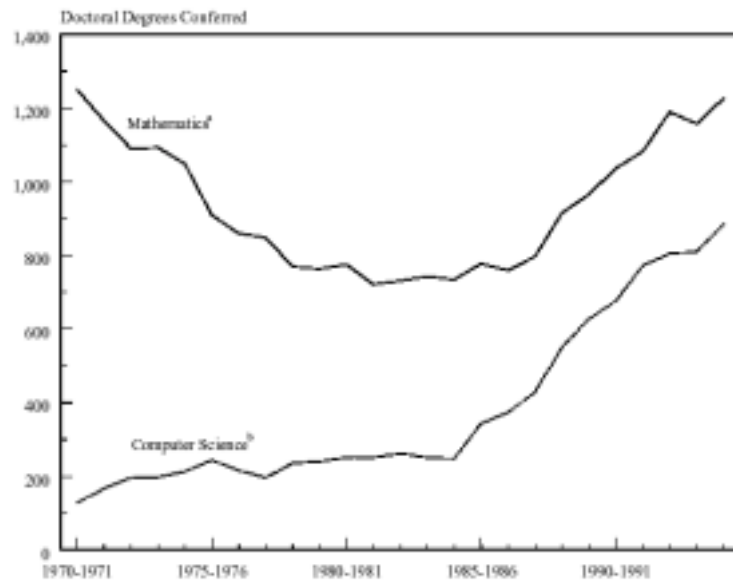
Five kinds of infrastructure – communications, information processing, Internet, transportation, and enterprise – are arguably the most important factors in US experience with e-commerce to this point. The essential concept of electronic commerce is that a key change in the communications infrastructure, especially the Internet, enables a fundamentally new kind of commerce. Whether electronic commerce is genuinely a new form of commerce is open to dispute, but there is no doubt that technological improvements in Internet technologies and advances in transportation, logistics and business processes are having important effects on commerce.

Telecommunications Infrastructure

Change in the communications infrastructure, especially the Internet, is the defining enabler of e-commerce. The US has traditionally had a strong lead in the field of communication as seen in the areas of telegraphy, telephony, radio, television, satellite communications, digital communications, and fiber optics. Indeed, perhaps cellular telephony is the only area of communications technology where the US has lagged behind some other industrial nations. In

⁶ Although the US is characterized by an unusually high degree of reliance on private sector initiatives in information industries, those initiatives are often shaped or even created by government action through long-term research and university-led initiatives such as the development of major Internet-based protocols (Tuomi 2001).

Figure 6. Doctoral Degrees in Computer and Information Sciences and Mathematics Conferred by Institutions of Higher Education, Academic Years 1970-1971 to 1994-1995



Source: Congressional Budget Office based on data from Department of Education, National Center for Education Statistics, Higher Education General Information Survey and Integrated Postsecondary Education Data System.

^a Includes degrees in statistics

^b Includes degrees in general computer and information sciences, computer programming, data-processing technology/technician, information science and systems, computer systems analysis, and other information sciences.

the area of wired communications US has led the shift towards packet switched networks, which have become the key element in the telecommunications infrastructure enabling e-commerce. The ARPA-Net, developed for the US Department of Defense, evolved into the Internet by developing the TCP/IP protocol stack. Although the World Wide Web application protocol was not created in the US (it was developed in Switzerland in an European Physics Research Laboratory), the first commercially successful graphical user interface (MOSAIC) running on top of http/HTML was developed in the US. The development of MOSAIC laid the groundwork for Netscape and MS Internet Explorer, the world's most widely used web browsers that now form the critical technical element in most e-commerce B2C transactions.

In the year 2000 the US had about 700 subscribers to fixed-line telephones and 398 subscribers to cellular telephones per 1,000 population (Table 7). By 2002 the number of cellular subscribers had surpassed 50%. The advanced telecommunications services market has grown steadily, and investment in infrastructure for advanced telecommunications has remained strong in spite of slowing general investment trends.

The US has long had a convention of flat rate local telephony service. This might have been an important but indirect enabler of B2C electronic commerce because Internet users on dial-up service do not incur high telephony charges while searching on-line for product specifications and pricing (Figure 7). In the EU countries, by contrast, Internet users with a dial-up connection

are face high, time-dependent telephony rates that might inhibit Internet use and B2C e-commerce. This pattern might change with the expansion of broadband services over cable television infrastructure, or Digital Subscriber Line service on copper telephone lines. During the first half of 2001, the number of cable modem users increased by 45% reaching 5.2 million (Table 8). Over two thirds of US households subscribe to cable TV services, and the cable TV companies are quickly making network improvements to offer cable Internet service. The National Cable and Telecommunications Association (NCTA) estimates that 17% of homes with personal computers and that have access to Cable TV are now using cable Internet service.⁷ ADSL is expanding more slowly than cable broadband, with a growth rate of 36% and 2.7 million respectively in the first half of 2001.

Table 7. Telecommunications indicators in Americas

Telecommunications Infrastructure	Telecomm Investment as % of GDP, 2000 ^a	Main phone lines per 1,000 population, 2000 ^a	Cell phone subscribers per 1,000 population, 2000 ^a	% Digital phone lines, 2000 ^a	CATV subscribers per 1,000 population, 2000 ^a
Argentina	.67	213.17	163.37	100.00	159.32
Brazil	1.49	181.80	136.31	92.50	13.70
Canada	.57	676.51	284.60	99.70	259.41
Chile	1.56	221.22	223.62	100.00	45.20
Mexico	.89	124.72	142.33	99.98	23.11
United States	.29	699.74	397.91	91.60	252.13
Venezuela	.24	107.80	217.46	80.00	40.21
Latin America ^b	1.05	165.38	150.46	95.02	35.25
OECD ^c	.73	524.53	457.27	94.82	145.37

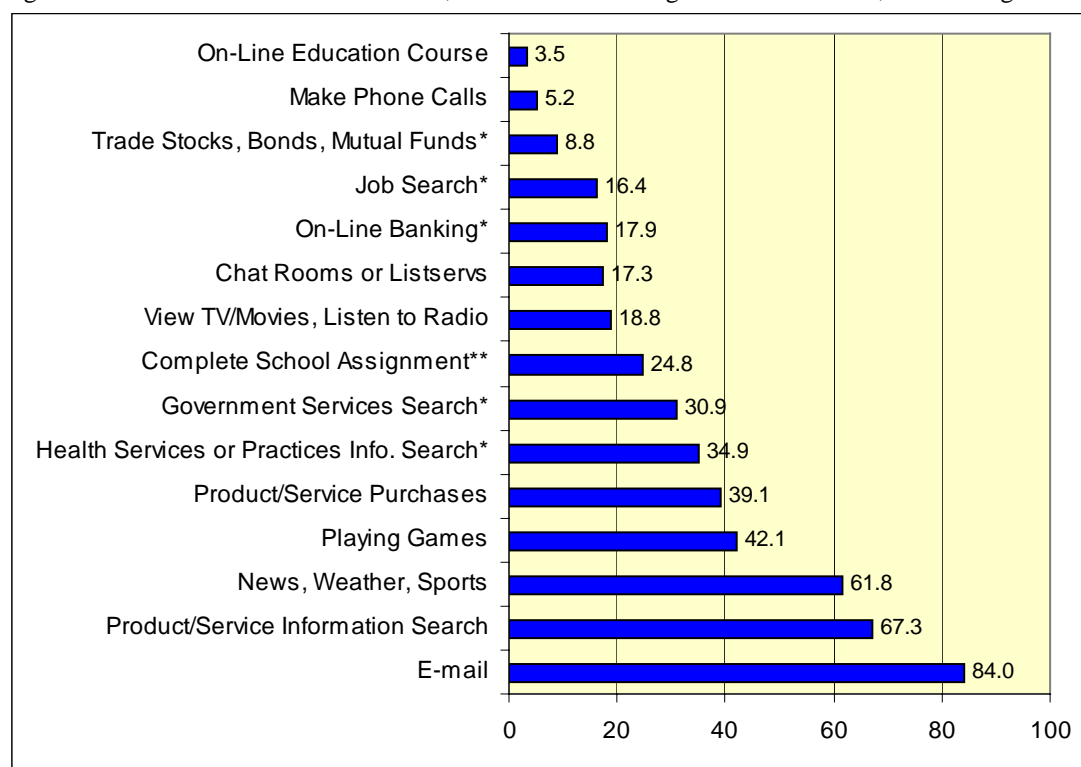
^aSource: International Telecommunication Union, *Yearbook of Statistics 1991-2000*. Geneva: International Telecommunication Union, 2001. ITU definitions: main telephone lines refer to telephone lines connecting a customer's equipment (e.g., telephone set, facsimile machine) to the Public Switched Telephone Network (PSTN) and which have a dedicated port on a telephone exchange (most countries also include public payphones); telecommunications investment refers to the annual expenditure associated with acquiring ownership of property and plant used for telecommunication services and includes land and buildings; cellular mobile telephone subscribers refer to users of portable telephones subscribing to an automatic public mobile telephone service using cellular technology that provides access to the PSTN; digital per cent refers to the percent of main lines connected to digital exchanges (indicator does not measure the percentage of exchanges which are digital, the percentage of inter-exchange lines which are digital or the percentage of digital network termination points); CATV subscribers refers to households which subscribe to a multichannel television service delivered by a fixed line connection. The per capita values are calculated using the estimated mid-year population value.

^bOnly countries included in the 44-country sample are used in the classification. Latin America here consists of the following countries: Argentina, Brazil, Chile, Mexico and Venezuela.

^cOnly countries included in the 44-country sample are used in the classification. OECD here denotes the OECD member countries, excluding Luxembourg, Slovakia and Iceland.

⁷ <http://www.ncta.com/press/press.cfm?PRid=238&showArticles=ok>

Figure 7. Activities of Individuals Online, 2001 As a Percentage of Internet Users, Persons Age 3+



* These online activities surveyed individuals age 15 and over only.

** This activity was asked of all respondents. If the response was restricted to individuals enrolled in school, the percentage of Internet users completing school assignments would increase to 77.5 percent.

Source: NTIA and ESA, U.S. Department of Commerce, using U.S. Census Bureau Current Population Survey Supplements

Table 8. Broadband Internet Adoption

Broadband technology	Users in 2001, thousands	Increase from the first half of 2001
ADSL	2,700	36%
Cable	5,200	45%
Satellite & WLAN	200	73%

Source: FCC (www.fcc.gov 1996)

Digital television and wireless digital communications might be significant influences on e-commerce in the future. Digital television brings television and the Internet closer, and offers the prospect of e-commerce using devices that are essentially hybrids of TV and Internet-enabled PCs. Wireless communications extend the capabilities of cellular telephony in interesting ways; for example, to allow users to pay for goods and services using their cellphones. It is too early to determine the effects of such developments on e-commerce.

Information Technology Infrastructure

Information processing technologies are a key enabler of the aforementioned changes in communications technology, and thus are central to the rise of e-commerce. The US has long been a leader in the area of computing technology, from the mainframe strengths of IBM and the

minicomputer strengths of Digital Equipment Corporation, to the world of personal computers dominated by the Intel/Microsoft nexus and Apple Computer. The world's first robust distributed computer network and application, the Semi-Automated Ground Environment (SAGE) for early warning, was built for US air defense in the 1950's and 1960's. SAGE spawned many important developments, including computerized air traffic control, computerized transaction systems (especially airline reservation systems), and secure data communications which all form the backbone of automatic execution of conventions of exchange. In the early 1970's US commercial organizations such as IBM and DEC led the way in the development of communications networks and electronic mail and file exchange on their proprietary V-NET and DECNet networks. During the late 1970's and early 1980's the US established itself as one of the world's leading users of the first generation B2B systems relying on Electronic Data Interchange (EDI) protocols (ANSI/X12 standard). These enabled automation of payments and integration of business transactions across organizational borders, especially in the retail, computer and car industries. Intel Corporation, formed by engineers from Fairchild where the integrated circuit semiconductor device was created, has grown into the world's leading supplier of microprocessors and assorted chip sets. Microsoft has become the world's largest and most powerful software company, dominating the market in PC operating systems and leveraging that advantage in a wide array of applications and utilities. Apple Computer, widely credited with first demonstrating the viability of the personal computer, remains an important force for innovation in spite of its relatively small market share. The invention of the physical Ethernet transmission protocol during the late 1970's by Xerox Corporation started a whole new industry in computer networking, that has since produced companies like 3COM and Cisco, as well as drawn active participation by earlier telecommunications hardware manufacturers such as Lucent, Alcatel, Nortel, NTT, and others.

The US is now the leading country in the development of second generation B2B platforms, and is active in the W3C and OASIS standardization organizations pursuing interoperability through XML (Extended Markup Language), SOAP (Simple Object Access Protocol), and UDDI (Universal Description, Discovery and Integration). Several US B2B e-business standards such as EbXML and BizNet currently form the backbone of major initiatives within emerging industry-wide e-market places like Rosettanet (electronics), Covisint (car industry), and ESteel (steel industry). The US information technology infrastructure is highly developed given the large size of the United States (Table 9). In 2000, revenues paid to IT vendors were 64% above the average for OECD, and the number of PCs per 1,000 population was 585, outpacing that of OECD-average by 87%.

Internet Infrastructure

Internet infrastructure arises from both communications and information processing infrastructure, and is arguably the key infrastructure of e-commerce. The US has much higher diffusion of Internet than the rest of OECD, and is inferior in the Americas only to Canada (Table 10). The US e-commerce industry recognizes that the US is so advanced in Internet use that it might see slower growth rates than the rest of the world as the country approaches saturation: eMarketer forecasts US growth of about 12% per year compared with 28% globally (eMarketer 2001, p.37). About 80% of users who use the Internet at home connect via a regular

“dial-up” telephone line (Figure 8). Broadband capability using cable modems and digital subscriber lines (DSL) serves 12.9 percent and 6.6 percent of users, respectively, and is increasing rapidly (Figure 9).

Table 9. IT Infrastructure indicators in the Americas

IT Infrastructure	IT as % of GDP, 2000 ^a	PCs per 1,000 population 2000 ^b	IT Production, US\$M 2000 ^c	Hardware Exports, US\$M 1999 ^c
Argentina	1.29	51.31	n.a.	n.a.
Brazil	2.38	44.09	\$9,083.78	\$321.00
Canada	3.83	390.24	\$3,361.73	\$4,496.64
Chile	1.67	166.80	n.a.	n.a.
Mexico	1.00	50.57	\$10,281.00	\$6,950.00 ^f
United States	4.56	585.18	\$88,488.62	\$38,488.00
Venezuela	1.30	45.51	\$254.02	\$2.00 ^f
Latin America ^d	1.60	52.22	\$19,618.79	\$7,273.00
OECD ^e	3.60	312.01	\$231,341.80	\$182,730.10

^aSource: International Data Corporation, The 2000 IDC Worldwide Black Book, IT is defined as “the revenue paid to vendors (including channel mark-ups) for systems, software, and/or services.”.

^bSource: International Telecommunication Union, Yearbook of Statistics 1991-2000. Geneva: International Telecommunication Union, 2001.

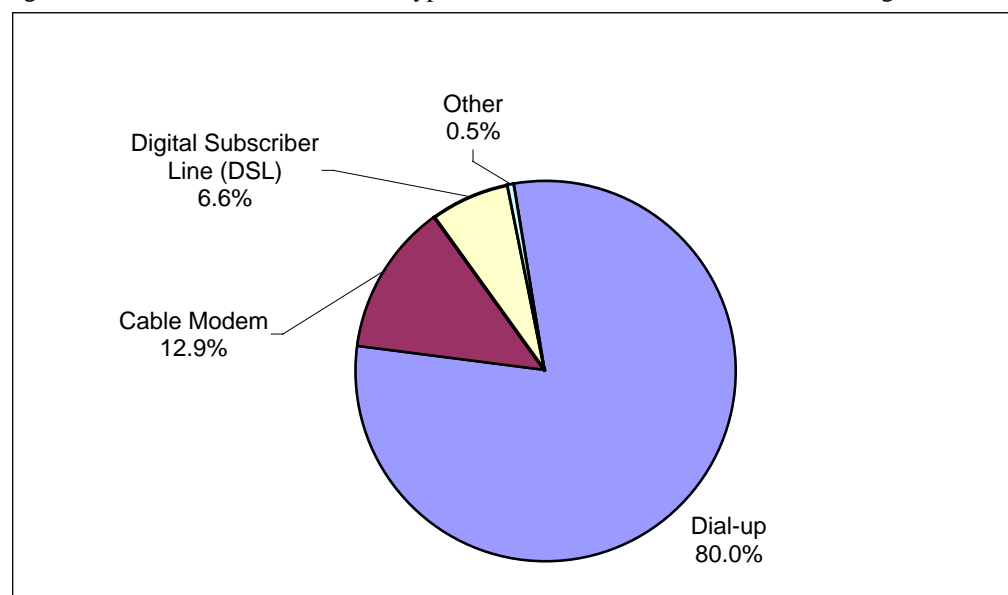
^cSource: Reed Electronics Research, The Yearbook of World Electronics Data, 2000. Surrey, UK: Reed Electronics Research, 2000.

^dOnly countries included in the 44-country sample are used in the classification. Latin America here consists of the following countries: Argentina, Brazil, Chile, Mexico and Venezuela.

^eOnly countries included in the 44-country sample are used in the classification. OECD here denotes the OECD member countries, excluding Luxembourg, Slovakia and Iceland.

^f1998 data

Figure 8. Home Internet Connection Type, 2001. As a Percent of Individuals Using the Internet at Home



Source: NTIA and ESA, U.S. Department of Commerce, using U.S. Census Bureau Current Population Survey Supplements

Table 10. Internet infrastructure indicators in the Americas

Internet Infrastructure	Internet hosts per 1,000 population 2000 ^a	Internet users per 1,000 population 2000 ^a	Access cost, 30 hours, peak, US\$ 2001 ^b	Access cost, 30 hours, off-peak, US\$ 2001 ^b
Argentina	7.30	67.51	\$92.02	\$91.59
Brazil	5.15	29.39	n.a.	n.a.
Canada	76.88	413.01	\$24.87	\$24.87
Chile	4.91	166.80	n.a.	n.a.
Mexico	5.65	27.43	\$30.78	\$30.78
United States	292.83	346.58	\$22.05	\$22.50
Venezuela	.67	39.30	n.a.	n.a.
Latin America ^c	5.20	39.66	\$61.40	\$61.19
OECD ^d	91.76	256.03	\$39.43	\$29.66

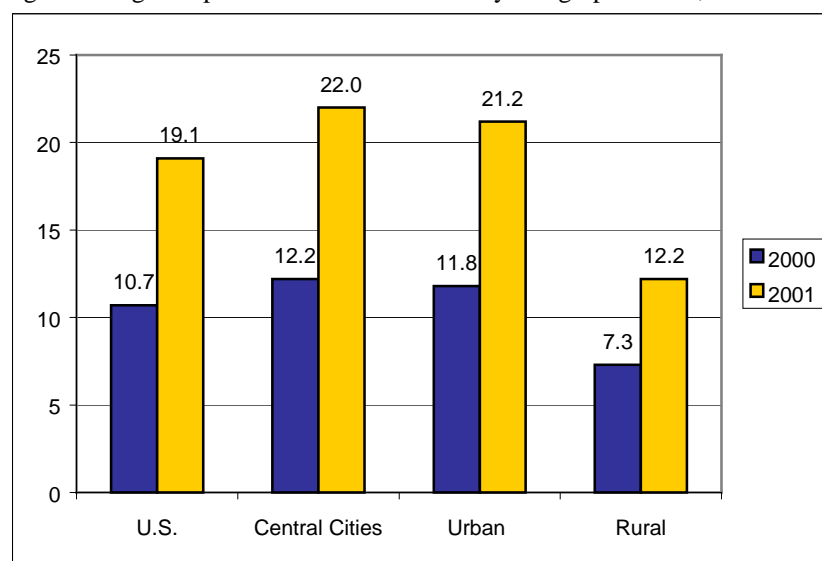
^aSource: International Telecommunication Union, Yearbook of Statistics 1991-2000. Geneva: International Telecommunication Union, 2001. ITU definitions: internet hosts refers to the number of computers that are directly connected to the worldwide internet network (note, however, that the statistic is based on country code in host address and may not correspond with actual physical location); internet users is an estimate of the number of internet users.

^bSource: International Telecommunication Union, World Telecommunication Development Report 2002, Reinventing Telecoms. Geneva: International Telecommunication Union, 2002.

^cOnly countries included in the 44-country sample are used in the classification. Latin America here consists of the following countries: Argentina, Brazil, Chile, Mexico and Venezuela.

^dOnly countries included in the 44-country sample are used in the classification. OECD here denotes the OECD member countries, excluding Luxembourg, Slovakia and Iceland.

Figure 9. Higher-Speed Internet Connection by Geographic Area, as a % of Total U.S. Internet Households



Source: NTIA and ESA, U.S. Department of Commerce, using U.S. Census Bureau Current Population Survey Supplements

Transport Infrastructure

The development of the transport infrastructure, especially for freight, is a key factor in the evolution of e-commerce activity. In the year 2000, almost 75% of B2C e-commerce was done by catalog and other non-store retailers (US Census Bureau 2002, Table 5). This commerce depends on the so-called “integrated forwarders” in the small package market. The most famous of these is Federal Express, which pioneered the advent of time-definite delivery and next-day service, but United Parcel Service, DHL and the US Postal Service are also part of this infrastructure. B2B e-commerce is dependent on the global freight transportation industry, which is fragmented among several vertical niches, including warehousing, trucking, railways, airfreight, and ocean freight. The core operation of contemporary transport infrastructure requires inter-networked IT tools and B2B systems. For example, the National Transportation Exchange’s online network helps keep trucks full, while ocean container space is being auctioned via GoCargo’s Internet exchange (eMarketer 2001, p.58).

Enterprise Infrastructure

The readiness of firms to begin e-commerce, which we call enterprise infrastructure, is a vital factor influencing the development of e-commerce. One aspect of enterprise infrastructure is access to the Internet. In 2002 more than 6.3 million, or 82% of all American businesses, were connected to the Internet, while more than 90% of medium and large businesses were connected⁸ (Table 11). Some sectors have more developed enterprise infrastructure than others. For example 25% to 49% of suppliers and/or customers in the electronics, IT, and telecommunications sectors are included in electronic supply chain activity (Table 12). Electronics and IT businesses generate nearly one-third of their revenues from e-business, but spend less than 5% on IT.

Table 11. Number of US businesses connected to the Internet, 200-2003 (as a % of total in a respective category)

	Medium/Large-sized businesses	Small businesses
2000	109000 (91%)	4462 (60%)
2001	115000 (95%)	5896 (78%)
2002	120000 (98%)	6301 (82%)
2003	122000 (99%)	6639 (85%)

Source: (eMarketer 2001, p.65)

Table 12. IT spending and e-Business Revenues among technology leaders in the US industry, 2000

	Electronics	IT	Telco
Revenue spent on IT	5%	4%	18%
Suppliers included in electronic supply chain	27%	43%	31%
Customers included in electronic supply chain	25%	49%	40%
Companies with profitable e-business operations	33%	79%	56%
Share of revenue from e-business (including EDI)	31%	31%	15%

Source: InformationWeek, 2000. In (eMarketer 2001, p.36, p.58)

⁸ eMarketer considers a business to be connected to the Internet if a significant portion of senior level employees are actively using the Internet on a regular basis to conduct research, gauge competitive activity, gather customer acquisition data or for other business purposes (eMarketer 2001, p.65).

Access to the Internet is only one aspect of enterprise infrastructure. Equally important is the package of complementary capabilities required to put the rest of the infrastructure to constructive use in e-commerce. Most of this package comes from the traditional modes of commerce. The US has a highly developed infrastructure for commerce, including the infrastructures of communication, information processing, and transport discussed above. There is also substantial institutional infrastructure, including a single currency (the US dollar), a monetary system to stabilize that currency, a robust legal system to ensure consistency and uniformity in commercial activity, and social conventions of trade and business practice enforced through socialization processes (e.g., training in business schools) and voluntary organizations (e.g., Better Business Bureau). Add to these specialized technical services for tasks such as credit data reporting and transaction processing. In principle, all of these might facilitate e-commerce, but some might inhibit e-commerce if changes must be made to either enable e-commerce practices or to give e-commerce some advantage that helps level the playing field against more established practice (e.g., digital signatures, taxation rules, discussed below).

The prevailing model of commerce resides in the collective knowledge of people engaged in commercial activity. It grew up in an era in which e-commerce was not possible. A modified model will be necessary to make e-commerce successful, and that will require a process of learning throughout the society. For example, retail banking was originally done either face-to-face or via mail, then expanded to use of Automated Teller Machines, and is now expanding into on-line banking. Similarly, entertainment media products (e.g., music recordings) traditionally delivered through retail stores are likely to move toward direct distribution to customers over computer networks. The knowledge required to transform enterprise in the e-commerce era is as yet sparse. It is largely anecdotal in the form of case studies of firms such as Amazon.com that pioneered on-line bookselling, eBay that revolutionized on-line merchandise resale, and Dell Computer that has exploited B2B e-commerce in its manufacturing and supply chains and B2C e-commerce in selling its products to end users. Such studies show that e-commerce can bring dramatic changes to supply chains and retail channels, but there has not yet been enough careful analysis at the sector and industry levels to determine how widespread such changes might be. Continued investment by US firms in developing knowledge and managerial capacity to do e-commerce can be expected to enable growth in scope and volume of e-commerce over time.

Financial Resources

Use of Credit Cards

The credit card is the most important payment mechanism in B2C commerce, and is a key factor enabling such commerce. The credit card was invented in the US by Diners Club and has expanded into a global service infrastructure. Most of the development of the credit card infrastructure can be traced to private sector initiatives, but the evolution of the credit card was deeply dependent on the regulatory apparatus of national and state government. For example, federal law exempts a credit card customer from liability above \$50 for illegal use by a third party due to lost or stolen credit cards and credit card numbers. Such regulations have been

instrumental in stabilizing the credit card industry and turning it into one of the world's most important means of exchange. The credit card is only one form of payment card, the others being debit and stored-value (smart) cards. Payment cards broadly are a significant determinant of e-commerce revenues around the world. In 1998, the number of payment cards (credit or debit) per 1,000 population in the US was 2,767 (eMarketer 2001, p.15). There is a direct correlation between payment card penetration rates and e-commerce revenues per capita (eMarketer 2001, p.14).

The darker side of the credit cards as a payment mechanism shows up as consumer privacy concerns and criminal activity involving credit card number theft and identity theft. There have been no authoritative, systematic studies of these problems related to e-commerce, *per se*, but there have been many reports from market research firms. An example is a report from CNET News (2002) that quotes Gartner Group claims that web-based merchants lost \$700 million in merchandise in 2001 due to credit card fraud, that such losses cost Web stores between 5 percent and 8 percent of sales, that 5.2 percent of online shoppers have experienced credit card fraud, and that 1.9 percent of online shoppers have been victims of identity theft. Many consumers are concerned about these issues but it is difficult to ascertain from the studies that have been done what effect these concerns have had on actual consumer behavior (Table 14). The growth in e-commerce suggests that, at the worst, such problems are slowing but not stopping progress, and thwarting credit card number theft and identity theft might accelerate the growth in e-commerce.

Venture Capital

Availability of venture capital plays a key role in experimentation with and deployment of e-commerce. The US generates the vast majority of its investment capital from within as opposed to foreign sources, and it has a large venture capital sector. During the 1990's venture capitalization dramatically expanded. So-called dot.com startups received venture capitalization of \$45 million in 1969, \$6 billion in 1995, and \$103 billion in 1999 (Table 13). The boom created legends in which small companies with little more to offer than a concept for doing business on the Internet received large venture capital investments, went public, and made their founders wealthy overnight. The exuberant mood created by this phenomenon led to a dramatic increase in availability of venture capital, thus fueling what might be seen in retrospect as an inflationary spiral in venture capitalization (See Figure 10). The dot.com bubble then burst, and the market had a sobering drop. Venture capital all but dried up for small entrepreneurs without a strong business case and a sound plan for growth. Yet, two important consequences of the dot.com boom can be seen: US capital markets are very flexible and can respond quickly to innovation, and many of the enterprises funded in the dot.com boom have survived (e.g. Yahoo, Amazon, and eBay) and are continuing to demonstrate the power of B2C electronic commerce.

Table 13. Investment by venture capitalists in information technology and other industries, January 1, 1995, through December 31, 1998

Industry	Amount of investment (Millions of dollars)
Information Technology	
Computer software and services	12,722
Communications	8,054
Semiconductors and other electronic components	2,659
Computer hardware	2,529
<i>Subtotal</i>	<i>25,964</i>
Other Industries	
Medical and health related	6,624
Other products	4,786
Consumer related	4,000
Biotechnology	3,670
Industrial and energy	1,593
<i>Total^a</i>	<i>46,636</i>

Source: Congressional Budget Office (CBO 1999) based on data from Venture Economics Information Services.

^a Includes disbursements in a miscellaneous category that total less than \$1 million.

Figure 10. US Venture Capitalists Investments, 1996-2001

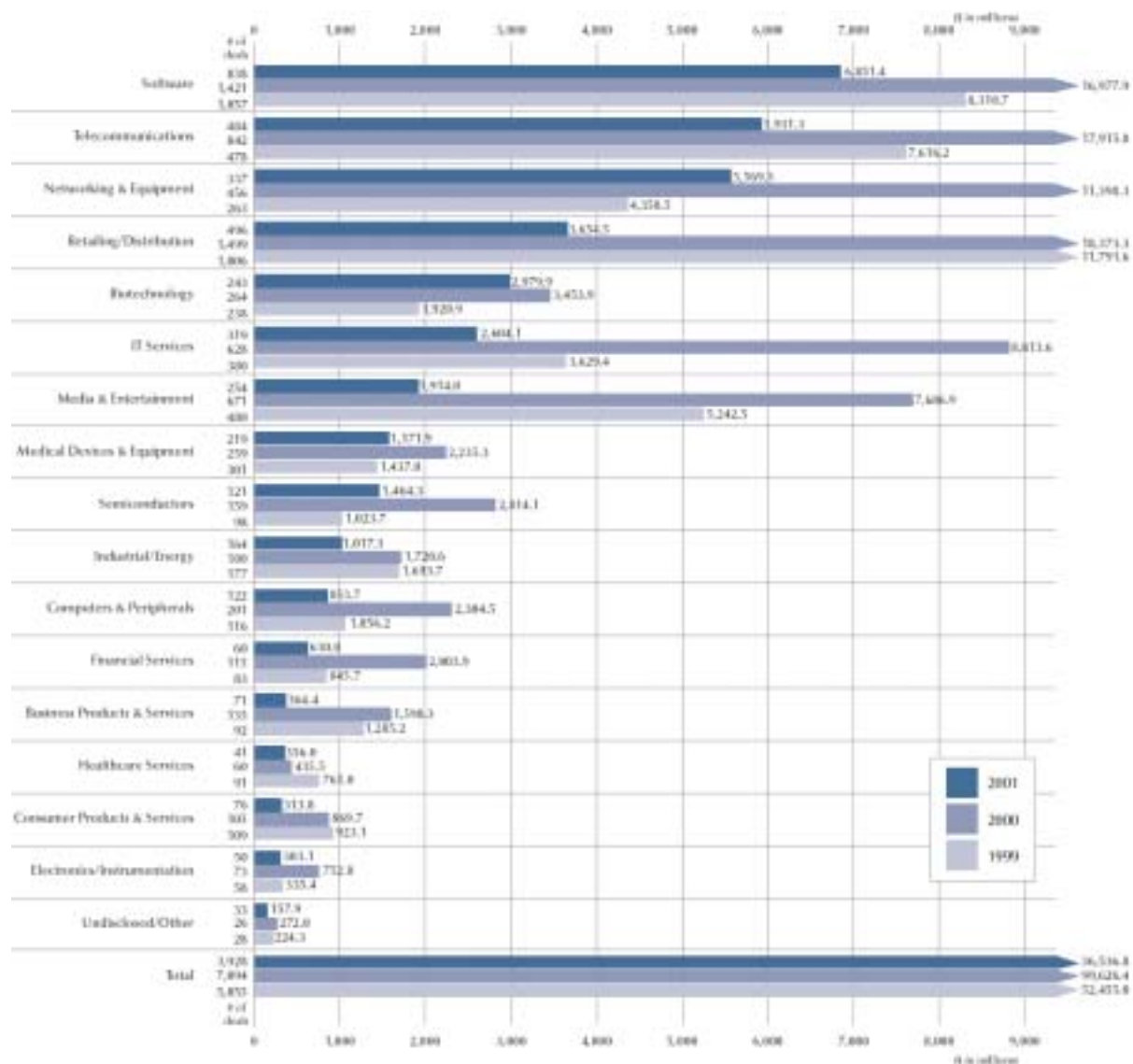


Source: (PricewaterhouseCoopers 2002, p.1)

The venture capital market was hurt by the doc.com collapse, but it was not destroyed. Venture capitalists invested \$7.1 billion in entrepreneurial enterprises in the fourth quarter of 2001, reversing a downward trend that began in the third quarter of 2000 (PricewaterhouseCoopers 2002, p.4). In fact, 2001 ranked as the venture capital industry's third best year since 1996 in terms of total dollars invested, and Silicon Valley remained the leading region for VC investments in the US. Based upon the dollars invested, a larger proportion of first-time financings went to early-stage companies in 2001 than in 2000 (PricewaterhouseCoopers 2002, p.8). The robust US venture capital market will likely remain an important and positive force in the further development of commerce. This is true especially if software, networking

and equipment, and telecommunications remain the leading industries for VC investments (Figure 11).

Figure 11. Venture capital investments by industry, 1999-2001



Source: (PricewaterhouseCoopers 2002, p.2)

Business Readiness for E-Commerce

Business readiness for B2B e-commerce can be determined by the entrepreneurial culture of willingness to engage in e-commerce. Readiness for B2C can be seen in consumer attitudes toward e-commerce.

Entrepreneurial Culture

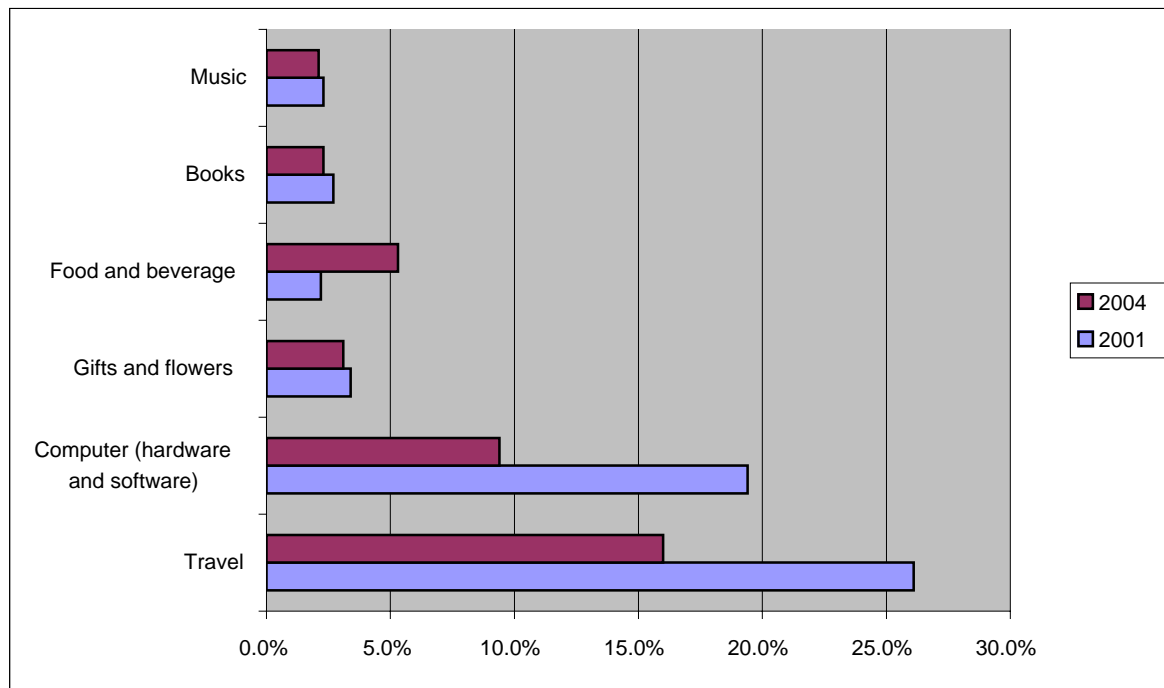
A strong entrepreneurial culture is an important factor in the development of e-commerce. There are no easy measurements for entrepreneurial culture, but one common proxy is the relative importance of small and medium-sized enterprises in the economy. More SMEs typically signals greater entrepreneurial activity. According to eMarketer market research firm (eMarketer 2001), in 2002 there are 122,000 large firms in the U.S., and over 7.6 million SMEs: 2% and 98% of all the U.S. firms, respectively. To the extent that having a large fraction of enterprise in small firms encourages competition, the US has an excellent competitive environment. In 2002, 82% of these SMEs were connected to the Internet, while the number of active websites was expected to double from 34% to 63% between 2000 and 2003. As noted above, the US is also strong in the generation of venture capital, providing capitalization for new innovations.

Consumer Preferences and Attitudes

Consumer preferences and attitudes are central to the future of e-commerce, and with a few caveats, US consumers seem willing to use e-commerce. U.S. B2C e-commerce sales in 2002 broke records, topping US\$17 billion in the first quarter (Cox 2002). The travel industry led, followed by computer hardware and software (Figure 12). Online orders in the first quarter of 2002 grew by 33.9% to 91.47 million, with an average of \$127 per purchase, up 5.3% from \$120 a year earlier (Cox 2002). These data suggest positive consumer attitudes towards e-commerce. Much of the activity in B2C e-commerce is in products and services consumed mainly by wealthier individuals (travel, autos, computer equipment and software), that might draw the attention of other retail sectors that hope to tap into similar markets. In spite of this growth, B2C e-commerce defined strictly as on-line purchase is not a dominant online activity. Email and product/service information search, news and online gaming are all ahead of service/product purchases (Figure 7). However, every important aspect of purchasing except the final transaction might occur over Internet infrastructure, while the purchase occurs over telephone or in person, so the actual on-line purchase is probably not a complete indicator of e-commerce.

US consumers are more comfortable sending their credit card numbers over the Internet than are users in the other comparison countries (Canada, UK, Italy, and France), but half of those surveyed were concerned about this, and it is the top concern of US users (Table 14 and Table 15). Interestingly, the largest percentage of users reporting that they did not have a credit card to make purchases was from the US. This might be explained by the fact that the largest category of users in the US is young people, who in many cases do not have access to credit cards. Other objections to shopping on-line include the desire to see the merchandise in person, a reluctance to pay shipping costs, problems related to prices, and inability to communicate directly with responsible parties.

Figure 12. US B2C e-commerce revenues, by category, 2001 & 2004, as a % of total¹



Source: (eMarketer 2001, p.51)

¹ Total: 2001 – \$65.90 (100%); 2004 – \$125.60 (100%)

Table 14. Why non-buyers worldwide do not buy online, by country, 1999

	US	Canada	UK	Italy	France
Uncomfortable sending credit card information	50%	72%	59%	74%	79%
Prefer to see product before buying	41%	67%	57%	35%	35%
No credit card	37%	27%	12%	24%	11%
Can't get enough product information	22%	13%	12%	17%	8%
Not confident with online merchants	20%	34%	20%	11%	39%
Can't talk to salesperson	17%	36%	7%	14%	22%

Source: Ernst & Young, 1999. In eMarketer, 2001 (eMarketer 2001, p.15)

Table 15. Concerns of online buyers worldwide, by country, 1999

	US	Canada	UK	Italy	France
Shipping costs too high	53%	46%	45%	39%	54%
Need to try on for fit	38%	34%	45%	43%	16%
Prices too high	37%	29%	27%	27%	22%
Not appropriate for large items	37%	35%	11%	21%	22%
Not appropriate for luxury items	27%	23%	19%	35%	32%
Want to see/feel item	23%	23%	30%	16%	14%
Not appropriate for perishable items	21%	23%	18%	15%	22%

Source: Ernst & Young, 1999. In (eMarketer 2001, p16)

Summary of National Environment for E-commerce Readiness

Several national environmental factors contribute to the development of e-commerce in the U.S.

General E-Commerce Factors

- The U.S. economy provides the world's leading test bed for the development of e-commerce.
- The US educational system is preparing millions of competent Internet users and thousands of knowledgeable entrepreneurs who can exploit e-commerce opportunities, and is playing a key role in the reduction of the digital divide.
- The US computer manufacturing sector leads the world in creation of information infrastructure for e-commerce.
- The US telecommunications infrastructure is the best developed among large markets, enabling key aspects of e-commerce, and access to high-speed Internet capability (broadband) is growing at a rapid pace.
- US transportation and logistics capabilities provide vital complementary capabilities in movement of materials and products, and US transport/logistics firms are among the world's most advanced in application of IT to their operations.
- The entrepreneurial culture of the US is likely to help the US remain the world leader in e-commerce.
- Heavy use of the Internet for search activities, including product and price searching, contributes indirectly to e-commerce, even when actual purchases are not made on-line.

B2B factors:

- A US bias toward technological innovation increases the likelihood that companies will engage in B2B activities.
- Key high-technology companies such as Dell, Intel, AT&T, Microsoft, Apple, Cisco, IBM and so on are driving e-commerce evolution both as suppliers of critical infrastructure and as influential users of new, technology-enabled B2B business models.
- The combination of a competitive global landscape and the potential for efficiency gains and competitive advantage is sparking explorations for B2B solutions in all major industrial sectors of the U.S. economy.

B2C factors:

- The US consumer population is large and wealthy.
- The long US tradition of aggressive retail competition has produced a consumer population that is sophisticated in its ability to seek high quality and low prices.
- The top on-line product categories (travel, computer hardware and software) are targeted to people with high or medium income, attracting attention from all retail sectors.
- Decreasing prices for PCs and Internet access accelerate Internet penetration.
- Computers and Internet access in schools are bridging the digital divide and exposing young people to the potential of B2C e-commerce.
- Teenagers and young adults are the most aggressive Internet users, and are a consumer sector of increasing importance.
- The dominance of English on the Internet facilitates use.

NATIONAL POLICY

National policy in the United States can be a bit confusing for those unfamiliar with the constitutional structure and operation of the country. While those outside the US naturally see the US Federal Government as the dominant actor in the US public sphere, the vast majority of important governmental policies affecting the daily lives of people in the US occur at the level of the 50 state governments and tens of thousands of local level governments. This paper's concentration on Federal legislation and policy makes it an incomplete review, but in some ways the Federal government is the best place to start such a review. The so-called "Commerce Clause" of the Constitution of the United States (Article I, Section 8, Clause 3) says that Congress retains the power "...to regulate Commerce... among the several States...." The clause has long been held to give more power to Congress than to the states in regulating business activities that affect more than one state. Generally, states are prohibited from restricting or burdening commerce that crosses their borders from another states. Thus, the following account can be taken as a good summary of national policy regarding e-commerce in the US.

The first, focused statement of national policy for e-commerce is found in the Clinton Administration's policy initiative on National Information Infrastructure (NII), published as *The National Information Infrastructure: Agenda for Action* of September 15, 1993 (<http://www.ibiblio.org/nii/toc.html>). It encompassed everything that produces, contains, processes, or uses information, in whatever form, or whatever media, as well as the people who develop the information, applications, and services, etc (Kahin 1997, 163). The Clinton Administration's Framework for Global Electronic Commerce issued on July 1, 1997, expanded on the NII with five principles:

- Promote private sector investment and careful tax and regulatory policies to encourage innovation and promote long term investment and wise procurement of services.
- Serve as catalyst for technological innovation and new applications via government research programs and grants to help the private sector develop and demonstrate technologies needed for the NII.
- Protect intellectual property rights via domestic copyright laws and international intellectual property treaties to prevent piracy and protect the integrity of intellectual property.
- Coordinate with other levels of government and with other nations on information that crosses state, regional, and national boundaries, to avoid unnecessary obstacles and prevent unfair policies that handicap U.S. industry.
- Provide access to government information and improve government procurement.

Neither of these initiatives resulted in an aggressive programmatic or legislative agenda, but they were a point of departure for the legal, financial, social, and technological enablers in the development of the Internet and electronic commerce. The Clinton Administration left office in January of 2001. The Bush Administration did not follow with significant, specific policies related to the Internet or to electronic commerce in its first year, focusing instead on appointments and key agenda items such as tax reduction and an education reform bill. Following the September 11, 2001 terrorist attacks the administration focused mainly on the war on terrorism.

Policy Institutions

Commerce in the US is influenced by policy arising from Congress in the passage of legislation, from many executive branch agencies in the implementation of legislation, and from the Federal Courts in the interpretation of legislation and executive actions. The results of this process are often in conflict with one another on partisan or ideological grounds. E-commerce is an emergent phenomenon, and governance is evolving during a major change of political direction (e.g., from the Clinton to Bush administrations). There is no single actor or agency with anything remotely approaching “responsibility” for e-commerce, and it is not possible to create a list of actors or agencies that would fit this description. The best that can be provided is a sketch of key actors and agencies that have sought to play particular roles (Table 16).

Table 16. Important policy institutions

Institution	Policy Roles Regarding E-Commerce
Congress	Enacts legislation related to e-commerce and controls the financing of federal government actions
Administration	President signs legislation into law and executes law as he interprets it; directs all federal mission agencies
Office of Management and Budget	Sets budget and priorities for federal agencies, including activities related to e-commerce
Justice	FBI investigates and federal prosecutors prosecute violation of laws related to e-commerce
Treasury	Internal Revenue Service implements tax policy related to e-commerce; banking regulators govern online banking and other payments practices including electronic funds transfer.
Commerce	Promotes e-commerce activity through studies sponsored by the National Telecommunications and Information Administration
Transportation	Facilitates and regulates passenger and freight transport that uses or is vital for e-commerce
FCC	Has plenary jurisdiction over common carrier communication and exercises considerable influence over the evolution of digital data communication
SEC	Regulates many aspects of securities trading, including on-line trading aspects of e-commerce
National Science Foundation	Makes major investments in research related to information technology that affect e-commerce
Federal Reserve	Regulates key aspects of banking and finance that affect e-commerce; operates the world's largest electronic funds transfer network (FEDWIRE) involving over 9,000 depository institutions.
Federal Courts	Interpret the constitutionality of federal and state legislation, and have decided many cases related to regulated common-carrier infrastructure, Internet-based commerce taxation, attempts to control content on the Internet, etc.

Enabling Policies

The United States has had relatively consistent macroeconomic policies for the past generation. The vast majority of productive activity in the US related to electronic commerce is a private

sector affair and, there has been a slow but steady shift toward more private, market-based approaches to provision of key utilities and services such as telephony, electric power, and transportation. This has been a long-standing tendency of the US, and the actual changes being made are phased in over relatively long periods of time. Policy changes are steady and gradual rather than sudden or surprising.

Seven aspects of economic policy are at least, in principle, important in establishing the current position of the US in the IT industry, and in e-commerce:

- Telecommunications liberalization
- Broadband telecommunications policy
- Financial deregulation
- Education and immigration policy
- Tax treatment of electronic transactions
- e-Government initiatives
- Adjustments to the legal framework of commerce

Telecommunications Liberalization

Several long-standing aspects of telecommunication policy have facilitated e-commerce evolution in the US. One is flat-rate local telephone service (a single monthly fee for unlimited use) that probably contributed to high Internet penetration. Over 80% of Internet users in the US use dial-up connection, and flat-rates mean they do not have to worry about high connection fees. Another is encouragement of competitive data communications through policies that prohibited the country's major telephone service provider (AT&T) from engaging in value-added information services such as protocol translation (e.g., EBCDIC to ASCII computer code). The signals could run over AT&T infrastructure, but value-added network (VAN) services such as Electronic Data Interchange (EDI) were provided by competitive service providers that helped pave the way for both B2B and B2C e-commerce.

The common carrier side of US telecommunications has changed markedly in the past twenty years since a Federal court consent decree broke the US telephone industry into two major pieces. Under the decree, local telephone service was retained in regulated monopolies called Local Exchange Carriers (LECs), while long-distance services were deregulated and made competitive under companies called Inter-Exchange Carriers (IXC's) such as the deregulated AT&T and competitors such as MCI and SPRINT. Ten years later, the Telecommunications Act of 1996 pushed deregulation further, specifying procedures whereby the LECs could extend their services into long distance provision, while the IXCs could enter local service. However, this has not yet happened to any great degree due to difficulties among the LECs in opening the local loop to real competition. Whether the benefits of deregulation have met the expectations of its proponents is not entirely clear, but the deregulation process begun with the breakup of AT&T has had profound consequences in opening telecommunications to competition, including competition related to e-commerce.

Telecommunications Broadband Policy

Broadband allows much faster Internet access over the existing communications infrastructure of cable television (Cable Internet) and telephone lines (Digital Subscriber Line, or DSL). The number of US broadband users as a percentage of total adult Internet users has been growing quickly, and in 2002 was expected to double by 2003 to reach 21.2% of all users. Most of these connections are via Cable Internet provided by cable television companies. About 93% of the 2.7 million high-speed DSL connections are provided by incumbent local exchange carriers (ILECs), with the Regional Bell Operating Companies (RBOCs) making up 86%. Only about 7% of are reported by the competitive LECs (CLECs).

From a regulatory perspective, broadband involves different kinds of industries and technologies under different regulatory regimes. It is complicated because it is hard to distinguish between information services and the underlying telecommunications carriers when the owners of facilities integrate carrier and information service functions (NAS 2002). The roots of the uneven distribution of broadband service (i.e., the low use of DSL) are in the recent tradition of telephone regulation in the US. The 1996 Telecommunications Act required that ILECs must open access to its basic physical infrastructure to enable competitive DSL providers to implement their systems. Further, the ILECs had to unbundle their own DSL services so competitive ISP's could sell Internet access over the ILEC DSL infrastructure. Whatever the intention of the Act, the ILECs have maintained overwhelming market share among residential DSL customers due to their scale and scope economies (NAS 2002). ILECs have been hit with high fines as penalties for not providing adequate CLEC access to their lines, but their behavior regarding access does not seem to be changing quickly (www.fcc.gov 2002). A new class of CLECs has emerged offering DSL, and these might spur ILEC investment in DSL, but progress remains relatively slow compared to cable broadband service (NAS 2002). An important advantage of DSL is the fact that each subscriber has a fixed service level that is not degraded as additional broadband users join.

While the common carrier telephony side of broadband has been confused, the cable TV side has moved forward aggressively. Unlike common carriers, cable operators do not have to offer nondiscriminatory transmission service to the public. They maintain considerable control over the content that is transmitted over their distribution facilities, asserting First Amendment rights in a manner that has been upheld by the courts. Cable operators are not required to offer access to unaffiliated content providers who wish to distribute their products to cable subscribers, although most do so. No single cable operator has sufficient high-quality content to fill its capacity, and customer demand for content is strong. The US cable plant began to be upgraded to fiber and hybrid fiber/coaxial cable in the early 1990's and the new infrastructure can provide high-speed, broadband Internet access (NAS 2002). Cable television companies have been adding high-speed Internet service at relatively low capital cost and competitive prices, and cable-based broadband has been growing rapidly. The technology of cable broadband is such that increasing use on given circuits degrades the bandwidth and speed available to individual users, creating congestion problems when use grows. The dominant positions of local cable carriers makes it unlikely that competitive cable providers will soon enter the market in the local loop, and cable broadband prices might rise as congestion increases.

Financial Deregulation

The US financial markets are the least regulated of any large economy. There has been no substantial change in financial deregulation in the past few years that would affect electronic commerce in major ways. The aftermath of the Enron bankruptcy in early 2002 appears to be producing a tightening of financial reporting requirements and further separation of auditing from consulting. However, these changes are not likely to affect e-commerce significantly in the short run.

Education and Immigration Policies

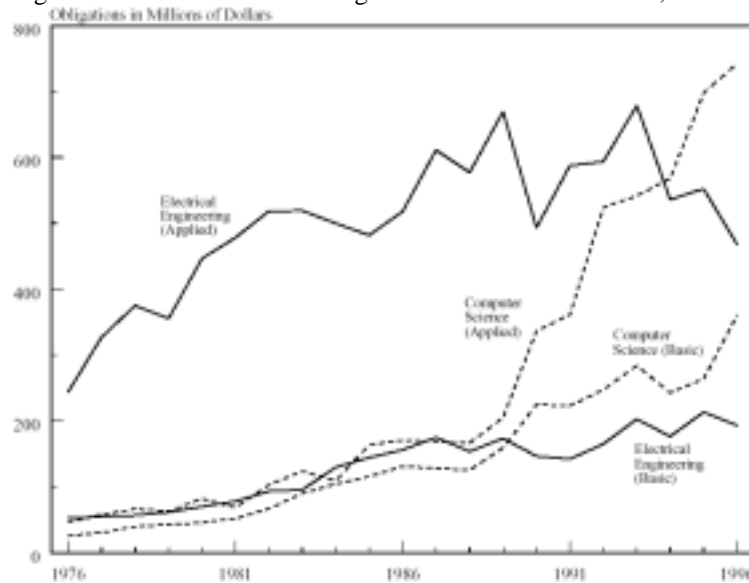
Education is generally a state and local policy domain in the US, and little of the education policy at those levels affects e-commerce directly. The most important education policy initiative at the Federal level related to e-commerce is in section 254 of the 1996 Telecommunications Act that entitled eligible schools and libraries to apply for discounted access to eligible telecommunications and internal connections services, including Internet access (http://www.fcc.gov/wcb/universal_service/schoolsandlibs.html). This has significantly expanded public school access to the Internet. It is arguable that this policy will have an indirect effect of exposing potential e-commerce users to the Internet where they might not otherwise have had that opportunity. No direct effects can be measured, however. The Federal government does sponsor research and development in science and technology related to e-commerce, especially in basic and applied computer science (Figure 13). Despite some ups and downs, overall federal investment in basic and applied research at universities rose through the 1990's (Figure 14).

Immigration policy is the sole responsibility of the US Federal Government. The only significant relationship that might exist between immigration policy and e-commerce relates to the ability of foreign experts who work in e-commerce related fields to enter and work in the US. The high technology industries, especially in the computing field, lobbied the Federal Government in 1998 to expand the number of H1-B visas for highly skilled workers from 65,000 to 115,000 for the years 1999-2001 (<http://www.techlawjournal.com/congress/s1723h1b/Default.htm>). There is no direct evidence that this had any effect on e-commerce, and in any case, the recession in the industry following the dot.com bubble has dramatically decreased the problems of labor shortage.

Tax Treatment of Electronic Transactions

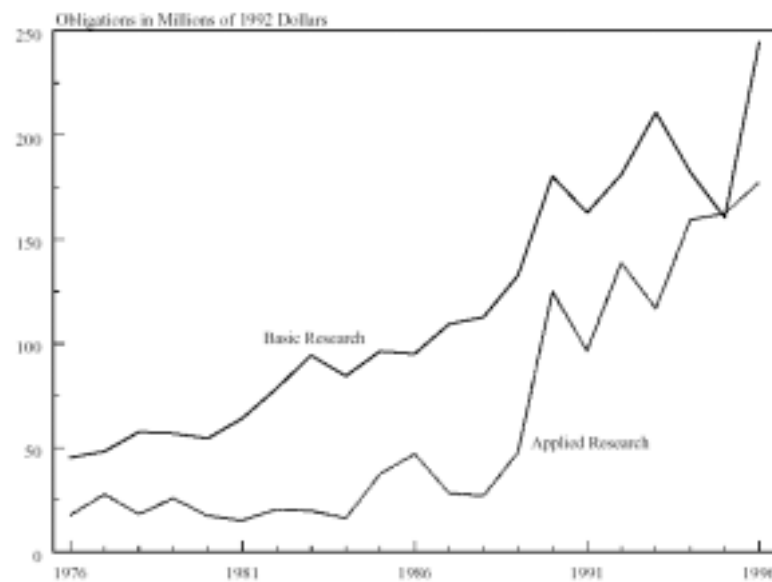
US states can set their own taxes related to income, property, sales and so forth. However, there has been a great deal of controversy in the past thirty years regarding whether a state can establish sales and other forms of tax on products and services provided by companies outside the state. The federal courts have ruled that a state may enforce collection of sales taxes only on products or services that are sold by companies that have an actual physical presence inside the state for purposes of the sale. Under this ruling, a company that lies outside a state's boundaries,

Figure 13. Total Federal Funding for Research Related to IT, Fiscal Years 1976-1996



Source: Congressional Budget Office based on data from National Science Foundation.

Figure 14. Federal Funding to Universities and Colleges for Basic and Applied Research in Computer Science, Fiscal Years 1976-1996



Source: Congressional Budget Office based on data from National Science Foundation.

collects orders from customers inside the state, and delivers the merchandise to the customers using mail or package courier need not collect sales taxes. Thus, “mail-order” products and services are not currently taxed unless the selling company has at least one physical store operating within the state. This has been important in electronic commerce, because much of B2C e-commerce is similar to mail order sales. In those cases where states have attempted to tax electronic commerce sales, federal legislation blocking “taxing the Internet” has taken precedence. For example, on November 28, 2001, President Bush signed the Internet Tax Non-Discrimination Act that bans Internet taxes until at least 2003.

Preferential tax treatment gives e-commerce a price discount compared commerce that is trading in similar products and services using non-electronic means. Companies doing e-commerce argue that they need this tax advantage because varied and complicated state tax laws would deter online customers from a mode of commerce that is just getting started. However, the states, led by the National Governors Association, claim they are losing money on two fronts: the tax dollars they would have gained with taxation ability, and the loss of business among brick-and-mortar companies that are taxed. States earned \$140 million in taxes from online purchases, but the \$525 million in taxes that might have been collected were not. California lost the most revenue from uncollected taxes (See Table 17). A study by the University of Tennessee has estimated that by 2003 states could lose as much as \$3.2 billion in tax revenue on Internet purchases (eMarketer 2001, p.119).

Table 17. Revenues lost from uncollected online sales tax in the US, 1999 (in millions)

California	\$73.8
Texas	\$51.9
Illinois	\$32.6
Florida	\$30.3
New York	\$26.6

Source: Forrester Research, 2000

E-Government Initiatives

A major effort to enact national policy related to e-government came from the Clinton Administration's Working Group on Electronic Commerce's (WGEC), and its report "Leadership for the New Millennium, Delivering on Digital Progress and Prosperity," released in January of 2001. Among other things, this report noted that the Internet had the potential to improve delivery of government services and make government more transparent, responsive and efficient. Similar concerns were reflected in the report of The National Commission on Libraries and Information Science (NCLIS), which noted that information created by the federal government is owned by the public and should be accessible to the public so people can fulfill their civic responsibilities and improve their quality of life. Although hundreds of laws establish the requirement and authority of agencies to disseminate public information, little distinction has been made between "passive dissemination" and "proactive dissemination." Central information service agencies will remain important, but these agencies need new business models that reflect the realities of the Internet and the World Wide Web. The private sector is expected to play a key role in further distributing public information and enhancing its value (NCLIS 2001). Between 1994 and 2001, the Clinton Administration took a number of steps to address the promise of e-government:

- Launched a website (<http://www.FirstGov.gov>) with easy, one-stop access to all Federal government online information and services.
- Made it possible for taxpayers to use the IRS e-file program to file taxes from the convenience of their homes quickly and simply.
- Enabled vendors who conduct business with the government to use a totally paperless procurement process (<http://www.fts.gsa.gov>).

- Sponsored an e-Voting Workshop to explore the issues raised by online voting, including privacy, security, authentication, broad and equitable access, and the potential impact on representative democracy.
- Created systems to enable the public to download from the Internet and print the forms for 500 of the most common government functions.
- Increased means for electronic payments in Federal government financial transactions.

The Bush Administration has not made e-government a central feature of its program, but it has continued a number of the initiatives in e-government begun by the Clinton Administration.

Adjustments to the Legal Framework of Commerce

The US national policy in development and deployment of electronic commerce follows the five policy principles noted earlier:

- The private sector should lead.
- Governments should avoid undue restrictions on electronic commerce.
- Where governmental involvement is needed, its aim should be to support and enforce a predictable, minimalist, consistent and simple legal environment.
- Governments should recognize the unique qualities of the Internet.
- Electronic commerce over the Internet should be facilitated on a global basis.

Key legislation related to e-commerce is summarized in Table 18.

Electronic Signatures

President Clinton signed the Electronic Signatures in Global and National Commerce Act (E-SIGN) into law on June 30, 2000 (<http://www.doc.gov>). E-SIGN ensures the legal validity of electronic signatures and contracts, permits electronic delivery of legally-required notices and disclosures, and allows record retention requirements to be met through electronic means. It applies to all transactions in or affecting interstate or foreign commerce, although states may modify or supercede the provisions of E-SIGN with regard to their own laws if it adopts or enacts the Uniform Electronic Transactions Act (UETA). By the end of 2000, twenty-two (22) states had adopted or enacted UETA (WGEC 2001).

Electronic signatures are supposed to reduce the time-consuming and costly efforts to sign documents, but security concerns, competing e-signature standards, and preference for paper have slowed progress (CNET News 2002). The law makes electronic signatures as valid as those made on paper, but does not specify exactly what constitutes an electronic signature. The law overturns an emerging consensus favoring signature security based on public key infrastructure (PKI). E-SIGN allows contracting parties to choose the technology for authenticating transactions, throwing the standards question open once again. The law also provides little legal resource to protect parties from fraudulent use of their e-signature (CNET News 2002).

Table 18. e-Commerce-related legislation and policy action

Legislation	Status/content
Digital signatures and Document Legitimacy	E-SIGN Act signed into law by president Clinton June 30, 2000. Ensures the legal validity of electronic signatures and contracts, permits electronic delivery of legally-required notices and disclosures, and allows record retention requirements to be met through electronic means. Slow adoption due to several concerns. The Uniform Electronic Transactions Act (UETA) states that “contracts and records are not invalid simply because they are in an electronic format rather than on paper.”
Privacy	The Children's Online Privacy Protection Act requires sites collecting information about minors to disclose what information they are collecting and how it will be used. The Online Personal Privacy Protection Act is under consideration in the US Senate, requiring “opt-in” by Internet users for any site/service that collects sensitive personal information, and “opt-out” for less sensitive personal information. The Safe Harbor Accord between the U.S. and the European Union was enacted to protect consumer information in the international arena.
Security	In 2000 the Department of the Treasury established the Financial Services Information Sharing and Analysis Center. The center has helped protect members from the distributed denial of service attacks. National Infrastructure Protection Center (NIPC). Coordinated by FBI. Detecting and responding to cyber attacks on critical infrastructures such as electronic commerce sites. The FBI has also created the National Infrastructure Protection and Computer Intrusion (NIPCI) Program.
IPR/Copyright	Computer Crime and Intellectual Property Section (CCIPS). Created 1991 by the US Justice Department (JD). The JD has added nine units to a program called CHIP (Computer Hacking and Intellectual Property). The CHIP team members complement the network of prosecutors at CCIPS. No Electronic Theft Act. Signed into law December 16, 1997. Closed loopholes in the criminal law so those who intentionally distributed copied software over the Internet would face criminal penalties irrespective of whether they profit from their actions. The Digital Millennium Copyright Act (DMCA) is Congress’s third attempt to clarify digital IP issues in the law. The DCMA bans independent research related to anticopying technologies.
Content regulation	Communications Decency Act (CDA), February 8, 1996, and Child Online Protection Act, October 21, 1998, attempted to regulate content seen by some as obscene or harmful to minors (mainly graphic sexual content). The CDA was struck down by the Supreme Court for being too restrictive and inhibiting of First Amendment rights to freedom of speech and expression. The COPA was overturned by a Federal Appeals Court and has been heard by the Supreme Court. The Supreme Court did not strike COPA down altogether, but sent it back to the Appeals Court for more consideration.
Taxation	WTO electronic commerce declaration which includes a moratorium on customs duties on electronic transmissions. Adopted in May 1998. The Clinton-Gore Administration worked to ensure that no new taxes were imposed on e-commerce. OECD 1998 taxation framework. Deals with products like software that are delivered online. November 28, 2001: Internet Tax Non-Discrimination Act bans Internet taxes until at least 2003
Encryption	Policy on export of encrypted products. Developed by the Administration in cooperation with industry, law enforcement and privacy groups. Created in the fall of 1999. Allows U.S. companies to sell encryption products to most end users in global markets. The National Institute of Standards and Technology has developed a Federal Public Key Infrastructure to increase consumer confidence in electronic transactions.

Privacy and Security

There is no explicit national legislation related to privacy in e-commerce, or on the Internet for that matter. The major legislative effort in this area is now underway in the form of Senate Bill 2201, the Online Personal Privacy Protection Act, sponsored by Senator Hollings. This legislation would require Internet-based services that collect personal information on individuals to require “opt-in” (the user must give informed consent to permit information collection) on sensitive information (e.g., health information, ethnicity, sexual orientation) and “opt-out” provisions for less sensitive information. It would also require any services holding such information to make clear and easy access for individuals to check the information held on themselves, and to correct or challenge inaccuracies. There is no way to predict the outcome of this legislative effort. On the technology level the U.S. companies have been leading the effort behind the technology initiative P3P, which forms part of the W3C standards for e-business infrastructure (others being XML and SOAP). P3P enables consumers to define their desired levels of privacy while interacting with different businesses and decline any transactions that would violate their privacy profiles as defined through the P3P standard.

There has been more attention to security. In January of 2000, the Clinton Administration issued the National Plan for Information Systems Protection, a strategy for protecting its computer networks from deliberate attacks. The initial plan focused on federal efforts to protect the nation’s critical information infrastructures, with plans to bring in infrastructure owners and operators and the broader business community. A Partnership for Critical Infrastructure Security was established by the Department of Commerce with over more than 120 partnership companies. Following a spate of denial of service attacks in February 2000, the administration gathered leaders of Internet and e-commerce companies, civil liberties organizations, and security experts at a White House Cyber Security Summit. The Summit called for the private sector to take responsibility for leading in computer and network security. The Department of the Treasury established the Financial Services Information Sharing and Analysis Center (<http://www.fsisac.com>) involving many of the nation’s largest banks, security firms, investment companies and insurance companies. The center has helped protect members from the distributed denial of service attacks. The FBI also plays a role in security by coordinating the National Infrastructure Protection Center (NIPC) (<http://www.nipc.gov>) to detect and respond to cyber attacks on critical infrastructures such as electronic commerce sites. The FBI has also created the National Infrastructure Protection and Computer Intrusion (NIPCI) Program in the 56 FBI field offices across the country, and as of late 2000 had 193 agents investigating computer intrusion, denial of service, and virus cases. The U.S. Government is an observer in the efforts of the Council of Europe to develop a draft treaty on cyber-crime. This treaty provides for criminal laws on computer crime, procedural tools for law enforcement related to such crime, and helps ensure cooperative international law enforcement efforts. Security of key information systems has become a more serious concern since the September 11, 2001 terrorist attacks.

Intellectual Property Rights

There has been considerable policy action related to intellectual property in the past decade that affects e-commerce. The earliest major action in this area was the 1991 creation by the US

Justice Department Criminal Division of the Computer Crime and Intellectual Property Section (CCIPS). The Federal Bureau of Investigation and the U.S. Customs Service subsequently launched a law enforcement initiative aimed at piracy and counterfeiting of intellectual property, both domestically and internationally (<http://www.cybercrime.gov/ipinitia.htm>) (www.cybercrime.gov 2002). The Department of Commerce in the Clinton Administration worked to achieve ratification of the World Intellectual Property Organization (WIPO) Copyright Treaty and the WIPO Performances and Phonograms Treaty. These were intended to ensure that international copyright rules keep pace with technological change. International standards are included to protect copyrighted digital content in computer programs, movies, musical performances, sound recordings, and other information and entertainment products (WGEC 2001).

Under the Bush Administration, and prior to the September 11 terrorist attacks, the Justice Department expanded its Computer Hacking and Intellectual Property initiative whereby prosecutors working closely with the federal agencies and local high technology companies increased referrals of cases to law enforcement (www.cybercrime.gov 2002). Of course, since September 11, 2001, much of the Justice Department's efforts have moved to homeland security and away from other enforcement. It is not clear what effect this will have on enforcement of intellectual property law.

The most important legislation related to intellectual property is the Digital Millennium Copyright Act (DMCA) that was signed into law October 28, 1998. The law was passed mainly at the request of the recorded entertainment industry to prevent theft of copyrighted materials in digital form. In summary, the act provides the following (<http://www.loc.gov/copyright/legislation/dmca.pdf>):

- Criminalizes circumvention of anti-piracy measures in commercial software;
- Outlaws manufacture, sale, and distribution of code-cracking devices for illegal copying of software except when conducting encryption research, assessing product interoperability, and testing computer security systems;
- Exempts some nonprofit libraries, archives, and educational institutions;
- Limits liability of nonprofit institutions of higher education for copyright infringement by faculty members or graduate students;
- Holds Internet service providers not liable for copyright infringement liability for simply transmitting information over the Internet, but expects them to remove from users' web sites material that appears to infringe copyright;
- Requires web-casters to pay license fees to record companies;
- Requires the US Copyright Office to recommend to Congress ways to promote distance education while balancing the rights of copyright owners and the needs of users;
- Protects traditional rights, remedies, limitations, and defenses to copyright infringement such as fair use.

The law appears to be having some effect on behavior. For example, Antony Felton, a leading scholar in the field of copyright protection design, chose not to publish his research after threat of prosecution under the law by powerful recording company interests. In another incident, Russian programmer Dmitry Sklyarov was jailed for several months in the US for disclosing at a

US conference software code developed in Russia, where there is no law forbidding violation of IP rights, that would enable copying eBook materials (Mathewson 2002).

Inconsistent application of laws to different types of intellectual property is an issue. For example, the software industry has much stricter enforcement than the music industry, although the software industry's practices are starting to spill over into other media. DVDs already have anti-copying technology (though it has always been quickly broken), and audio CDs are starting to be manufactured with several anti-copying provisions. The industry is also seeking to protect streaming media (music and video) with some kind of watermarking technology. In light of these advances there is, however, a considerable debate over the right measures to protect and enforce intellectual property rights, and to what types of media and content these measures should be extended. At the same time the rapid evolution of distributed peer-to-peer technologies (e.g. Kazaa, Gnutella) is undermining any legislative efforts to ban the distribution of content in digital form over the Internet.

Content Regulation

The Communications Decency Act was signed into law on February 8, 1996. The Act attempted to reduce or eliminate pornography on the Internet by imposing severe penalties on those who provided such material to anyone under 18 years of age. The legislation was bitterly opposed by civil libertarians as well as many in the online service provision community. The Act was struck down by the US Supreme Court on June 26, 1997 on the grounds that it violated the First Amendment's guarantee of freedom of speech. The broadest provisions of the law were found objectionable because they would, in effect, limit adults to speech fit for children. The essence of the judgment was that the First Amendment leaves no any proper place to government in determining what is "inappropriate" Internet content for adults (Singleton 1997). A successor bill, the Child Online Protection Act, attempted to get around the Supreme Court's objections to the Communications Decency Act by requiring "filtering" on any computer used in a public place that might be used by children. It was signed into law October 21, 1998 and immediately challenged in Federal Court. On February 1, 1999 the Federal District Court in Philadelphia struck down the law. The Supreme Court heard the case in May of 2002, but did not uphold it or strike it down. Instead, it remanded the case back to the Federal District Court with a directive to reconsider the decision in light of certain concerns raised by the Supreme Court.

Encryption

The Clinton Administration recognized the potential of encryption technology for ensuring privacy and facilitating security in electronic commerce transactions (WGEC 2001). Setting cryptography policy has been difficult and contentious (Kahin 1997, p.177). On one hand, the software industry has claimed that export restrictions limit its ability to compete in international markets where powerful encryption software is already available. The Clinton Administration has countered that criminals, drug traffickers and others could take advantage of encryption to threaten public safety and national security. Initially the administration tried to constrain the use of advanced encryption technology, but it changed its position in the fall of 1999. Working with

industry, law enforcement and privacy groups, it created a new policy that allowed U.S. companies to sell encryption products to most end users in global markets (<http://www.bxa.doc.gov/Encryption/pdfs/Crypto.pdf>). It also opened advanced encryption exports to the 15 member nations of the European Union as well as eight other trading partners that agreed to incorporate policies related to encryption that had been adopted by the European Union (<http://www.bxa.doc.gov/Encryption/pdfs/EncryptionRuleOct2K.pdf>) (WGEC 2001). The political dimensions of the encryption debate have been altered radically by the September 11, 2001 terrorist attacks, but there is as yet no clear pattern of policy emerging.

Financial Issues

The United States advocates that governments should refrain from imposing unnecessary restrictions on electronic commerce that can inhibit its growth. Since May of 1998, the United States has worked with 137 WTO members to formally extend the WTO electronic commerce declaration that includes a moratorium on customs duties on electronic transmissions (WGEC 2001). There is a growing recognition that imposing customs duties on electronic transmissions might be an inefficient way to raise revenue. Also, the burden of instituting and complying with this mechanism might outweigh potential benefits and discourage investment in electronic commerce. The US also has worked successfully outside the WTO to negotiate statements with twelve countries (Australia, Chile, Colombia, Egypt, Japan, Jordan, the Philippines) on the goal of maintaining the current practice of not imposing customs duties on electronic transmissions. The Clinton Administration worked to ensure that no new taxes were imposed that discriminated against Internet commerce, and that existing taxes should be consistently applied. It also worked within the OECD on an implementation of the OECD's 1998 taxation framework conditions of neutrality, efficiency, certainty and simplicity, effectiveness and fairness, and flexibility. One issue of concern is how to deal with products like software that are delivered online. The US has worked with the European Union to ensure that any such taxation by EU-member states is consistent with the OECD-agreed principle of neutrality (WGEC 2001).

Summary of National Policy and Implications for E-commerce

National policy related to e-commerce can be summarized as follows:

- The US follows long-standing policy of letting the private sector facilitate rapid progress in the development and deployment of e-commerce.
- Within the US Federal Government there is no simple institutional authority for policy regarding e-commerce, and many actors and agencies play roles that sometimes conflict with one another.
- A consistent policy of economic liberalization over the past quarter century, culminating in deregulation of telecommunications, has enabled experimentation and innovation supportive of e-commerce.
- Broadband communications is expanding, providing high-speed Internet access to a large portion of the population, but policy still remains confused regarding the two primary forms of broadband service provision, cable television and digital subscriber lines.

- US financial markets are among the least regulated in the world, opening the door for innovation in e-commerce related to banking and securities trading.
- National policy providing support from the universal service fund for discount Internet service to schools and libraries has expanded the use of the Internet in those institutions, with likely supportive effects for e-commerce over the long run.
- The future of taxation on Internet-related sales and services remains uncertain, but the continuation of the ban on taxation through at least 2003 continues to provide an advantage for e-commerce.
- The Clinton Administration put considerable effort into e-Government initiatives, and encouraged such initiatives at the state and local level, but there is as yet little to be seen from the Bush Administration on such matters.
- E-commerce should benefit, in principle, from the passage of legislation legalizing electronic signatures, but adoption has been slow and problems in the law create obstacles.
- Privacy of personal information in on-line activities is a major and growing concern for many consumers, prompting consideration of legislation in Congress that would regulate such activity under a fair information practice framework.
- Considerable effort has been made to improve security of information infrastructure, with more to be expected following the terrorist attacks of September 11, 2001 but the effects for e-commerce are difficult to determine.
- Major efforts have been made to improve protection of intellectual property rights in on-line activity, especially the Digital Millennium Copyright Act aimed at piracy of digital content, but the effects on e-commerce are as yet unclear.
- Lawmakers have twice tried to restrict content, especially pornography, on the Internet, only to have their efforts struck down as unconstitutional by Federal Courts; implications for e-commerce seem minimal except as regards sale of on-line pornography.
- The Clinton Administration saw a gradual relaxation of restrictions on encryption technology, but these might be reversed following the September 11, 2001 terrorist attacks.

CONCLUSIONS

Diffusion of E-commerce

By any measure, e-commerce is diffusing. If one defines e-commerce as commerce in which purchase transactions are executed on the Internet, the level of e-commerce activity will be dependent on the diffusion of the Internet. This means only that Internet diffusion enables e-commerce; it does not mean that the availability of Internet access will necessarily result in e-commerce. By the end of the year 2000, the US had an estimated 80.5 million Internet hosts, or 292.83 per 1,000 – three times the average for OECD (Table 10). The number of secure servers that are likely to support e-commerce financial transactions was 28.30 per 100,000 population – again, three times the average for OECD (Table 19). However, the number of secure servers amounts to only 0.1% of Internet hosts, suggesting that the vast majority of hosts do few B2B or B2C financial transactions. With the data available it is not possible to estimate the actual number of web sites engaged in e-commerce.

Table 19. E-Commerce indicators in the Americas

E-Commerce	Secure servers per 100,000 population 2000 ^a	Secure servers with strong encryption per 100,000 population 2000 ^a	B2B trade in US\$M 2000 ^b	B2C trade in US\$M 2000 ^b	% E- Commerce Sales of GDP 2000 ^b
Argentina	.66	.35	\$634.99	\$52.58	.24
Brazil	.59	.34	\$1,720.78	\$202.86	.32
Canada	15.73	14.97	\$12,923.30	\$2,649.52	2.20
Chile	.87	.43	\$228.61	\$15.86	.35
Mexico	.25	.13	\$1,753.86	\$82.35	.32
United States	28.30	25.11	\$118,457.20	\$44,084.29	1.63
Venezuela	.41	.27	\$285.44	\$9.10	.24
Latin America ^c	.50	.28	\$4,623.66	\$362.74	.30
OECD ^d	10.09	8.39	\$268,500.30	\$69,146.65	1.33

^aSource: Netcraft. <http://www.netcraft.com>. Strong encryption is defined as having a key length greater than 40 bits (systems limited to a 40-bit key are classified as 'weak' since it has been shown that messages encoded using a 40-bit key with RC4 can be broken in about a week by a good computer science student using facilities available in a good computer science lab).

^bSource: IDC, Internet Commerce Market Model, Version 8.1 (2002).

^cOnly countries included in the 44-country sample are used in the classification. Latin America consists of the following countries: Argentina, Brazil, Chile, Mexico and Venezuela.

^dOnly countries included in the 44-country sample are used in the classification. OECD consists of the following countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

The US leads in e-commerce in the Americas (Table 19). Leaving aside Canada, the US leads every major measure by a factor of between 20:1 and 200:1. This general observation holds true for aggregate indicators of Latin America. The aggregate indicator of the OECD also trails the US in proportional measures, but not surprisingly, it leads the US in absolute measures such as the total amounts of B2B and B2C trade due to the fact that the aggregate OECD economy is substantially larger than that of the US, even subtracting the US from the total. The one interesting anomaly is Canada. Although Canada trails the US significantly in almost every category, it leads the US in estimated percent of GDP in e-commerce sales for year 2000.

B2C e-commerce depends on consumer access to the Internet. The United States is a large country with an extraordinarily high degree of computer and Internet use. That use is also rising at a rapid pace. The US might soon be in a position where virtually the entire population has some form of access to computers and the Internet. There is still a significant gap between low and high-income families when it comes to use of computers and the Internet at home, but the greatest increase in Internet use from 1998 to 2001 was among households with the lowest income. The digital divide measured strictly as access to the Internet seems to be waning when access in schools is factored in. Internet use is rising as a result of the increasing affordability of personal computers and the declining cost of Internet access. US per capita GDP is twice that of the average for OECD countries, while peak hour Internet access in the US costs about half that of the OECD average (Table 2 and Table 10). Although most at home access in the US is still through dial-up connections, increasing competition in broadband services is reducing access charges (Table 8). It is reasonable to expect that use of electronic commerce will become easier throughout the society in the coming years.

The estimated volume of B2C trade in the U.S. in 2000 was \$44,084.29, or nearly 64% of total OECD B2C trade. Several factors still constrain B2C e-commerce, however (Table 14 and Table 15). Less than 30% of Internet users are reported to purchase on-line on a regular basis (at least once a month). The largest and by far most active group of Internet users are teenagers who do not have credit cards and thus cannot easily purchase items via e-commerce. About 37% of on-line shoppers in the U.S said they do not buy online due to difficulty with payment mechanisms, and over 40% did not buy because they preferred to see product before purchase. Travel (26.1% of total) and computer hardware and software (19.4%) dominated purchases. Books and music accounted for 2.7% and 2.3%, respectively, in the year 2001 (see Figure 12).

B2B e-commerce depends on business access to the Internet. According to the NTIA (2002), in the year 2000, 85% of small companies had PCs, and 61% of those companies had Internet access. These numbers for medium- and large-sized companies were 100% and 91%, respectively⁹. In the period from August 2000 to September 2001, Internet use at work among employed adults age 25 and over increased from 26.1 percent to 41.7 percent. As is often the case, different sources provide different numbers on the same measures. For the year 2000, eMarketer (2001) saw 91% of medium- and large-sized firms¹⁰ connected to the Internet and projected 99% to be connected by 2003. Small-sized firms (<100 employees) were estimated to

⁹ Data for PC penetration: IDC; data for Internet penetration: (eMarketer 2001, p.71)

¹⁰ We use eMarketer's data who define medium-sized firms as having 100 to 500 employees, while large-sized businesses have more than 500 employees.

be connected at the 60% level and projected rates of 85% by 2003¹¹. It is estimated that only 57% of medium- and large-sized companies and 34% of small companies have active, purposeful websites, but these percentages are expected to grow to 85% and 63%, respectively, by 2003. The vast majority of small businesses use the Internet for e-mail and promotional activities (Table 20).

Table 20. Small business use of the Internet (those that use the Internet), 2000

e-Mail	51%
Marketing/promotion	30%
Customer service	21%
Company purchasing	21%
Sales	9%
Billing	3%

Source: PSI Global, 2000. In (eMarketer 2001, p.66)

The number of US firms purchasing online is a key measure of B2B e-commerce activity. There is much speculation about B2B growth, but few good measures of what is actually happening. Growth in e-commerce will probably be largely among firms that are purchasing online. Non-strategic purchasing, or indirect procurement, is believed to be the current primary driver behind e-commerce activity. At the beginning of 2000, PricewaterhouseCoopers announced that only 40.3% of large companies had the ability to take orders online, while 28.2% permitted payment to be made via their website (eMarketer 2001, p.180). This situation is a reflection of current priorities among U.S. businesses for the Internet strategies. A survey conducted by General Management Technologies estimated that in the year 2000, 80% of companies aimed their e-commerce strategies at improving customer services, whereas only 30% focused mainly on selling products (eMarketer 2001, p.180). Despite the relatively low number of businesses having implemented sales and purchases via their websites, the estimated value of US B2B trade reached \$118,457.20 billion in 2000, or 44% of total OECD B2B trade (Table 19).

The US has the world's most substantial infrastructure for e-commerce, the highest penetration of this infrastructure into the population, and the highest measured rates of e-commerce purchases. It is reasonable to infer that infrastructure and penetration enable e-commerce, but it is not possible to determine the degree to which infrastructure or diffusion actually cause e-commerce activity. Nevertheless, substantial e-commerce activity is underway, and the full set of factors explaining this phenomenon remains to be explicated.

Key Factors Influencing Future E-commerce Diffusion

The most important factors influencing future electronic commerce diffusion will probably be the robustness and capacity of the infrastructure to handle such commerce, the readiness of companies to offer goods and services over electronic commerce infrastructure, and the willingness and capacity of customers to engage in electronic commerce for the procurement of goods and services. The infrastructure seems to be ahead of other factors in the US, although much remains to be done in the areas of user interface design, security, privacy, and fault

¹¹ IDC reports 61% of small firms connected to the Internet in 2000, as compared to 60% given by eMarketer.

tolerance. There are many problems with company willingness and ability to engage in electronic commerce, from lack of knowledge about how to do so, to concerns about problems of intellectual property, security, and maintenance of customer relations. Many customers are willing to engage in electronic commerce, but problems remain.

In B2C electronic commerce, a key issue for the future will be the degree to which teenagers engage in electronic commerce. They have the highest Internet penetration rate of any age group; over three-quarters of US teens are active Internet users, accessing the Internet for at least an hour per week. Teens prefer email or online chatting, but also use the Net for school-related research and shopping. However, lack of credit cards inhibits teen use of electronic commerce. Changes in credit card issuance rules or the advent of “Cyber-cash” and other alternative e-commerce payment systems might stimulate the growth of online consumption among teens. Major US banks have already started offering pre-paid payment cards with VISA and MasterCard logos to teenagers. Electronic commerce retailers are likely to target young people as customers, but parents will face concerns about dissemination of personal information, piracy, and aggressive commercial solicitations (eMarketer 2000, p.12).

Entertainment is also likely to be a major factor in spurring the growth of electronic commerce in the business-to-consumer sector. Whether Internet users are scaling down their consumption of traditional media in lieu of Internet use is still being debated. While the amount of time Internet users spend online remains significantly less than the amount of time spent consuming traditional media, Internet users tend to spend less time watching television, listening to the radio or reading than non-users (eMarketer 2000, p.13). A major possible obstacle to increased dissemination of entertainment via the Internet is fear of intellectual property theft that discourages producers from entering this promising market segment. The major counter-example to this is the phenomenal growth in so-called Massively Multiplayer Online Games (MMOGs) such as EverQuest and Starcraft Legacy that have player communities estimated to be in the hundreds of thousands to millions.

An important factor governing the growth of electronic commerce is the extent to which traditional modes of commerce react as the use of electronic commerce rises. It has been well established in the history of innovation that ultimately superior technologies can replace older technologies much more slowly than expected because the older technologies undergo rapid improvement under pressure from the new technology innovation (Schmookler 1966). A good example is the slow replacement of sailing ships by steam-driven ships during the late 19th century, despite the clear superiority of steam for propulsion (Gilfilan 1935). As the steam ships began to penetrate the North Atlantic market, the shipwrights of the traditional sailing ship industry exploited every avenue of improvement to keep sailing ships ahead of the new steam vessels. Traditional business-to-business and business-to-consumer modes of commerce will not simply wither away in the face of e-commerce. Instead, it is likely that major improvements in current ways of doing things will emerge in rapid fashion as electronic commerce takes off.

Finally, the societal and organizational learning curves required to deal with electronic commerce effectively are likely to be steeper than originally recognized. It is easy to underestimate the huge amount of knowledge that has been accumulated in traditional modes of commerce. Much of this knowledge is tacit, difficult to ascertain and explain. But it is

nonetheless very real, and often essential to getting work done. It will take time to learn how to do electronic commerce successfully at organizational, institutional and social levels.

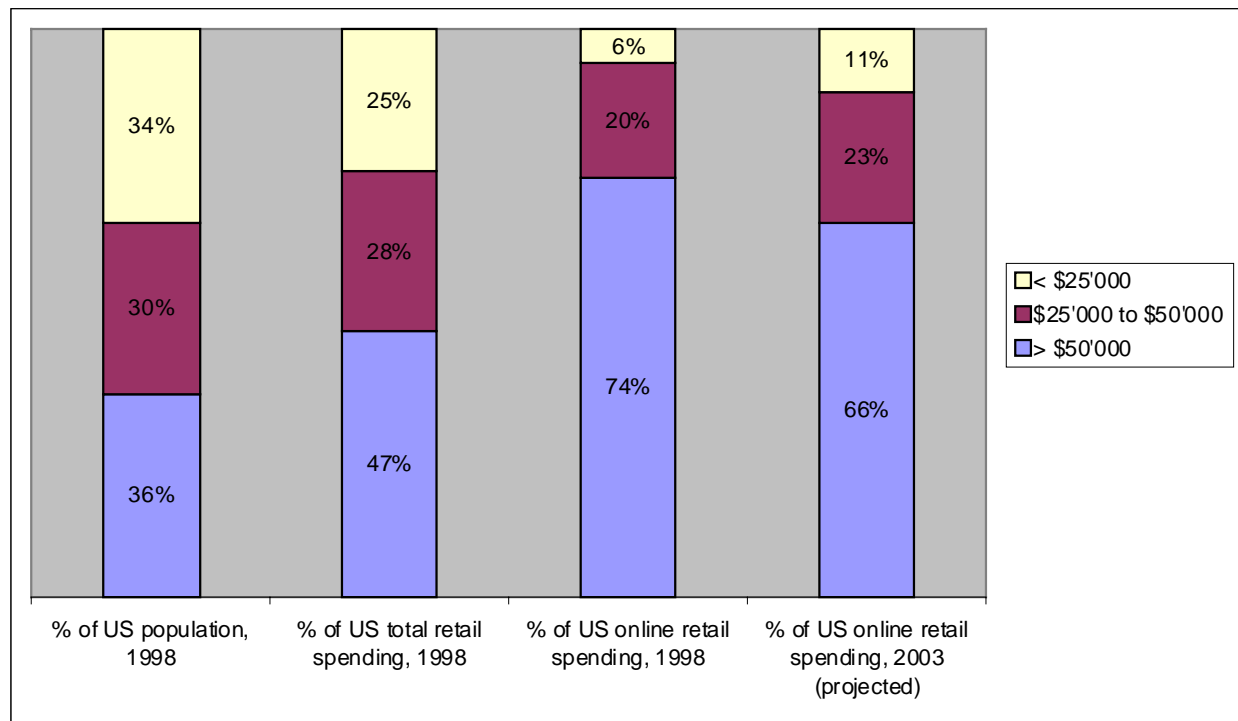
Drivers and Inhibitors

The growth in B2C e-commerce is due mainly to the convenience of performing on-line all the chores that go into shopping. Language is not a barrier in the US; most web sites use English as a first language. It is easy to search for product information, availability, and prices online. There are web engines that crawl the web finding prices for various items from various vendors, and post the comparison prices with information about the customer service of the vendors. The payment infrastructure of credit cards makes purchasing easy. A robust system of freight transport makes delivery to the household routine. B2C e-commerce for physical products is conceptually just an extension of catalog-based mail-order. US shoppers have more than a century of experience with mail-order dependent entirely on the postal system, and nearly a half century of experience with mail-order using the telephone for order-entry.

The main inhibitor for B2C e-commerce is the density and effectiveness of the traditional retailing structure, both in physical establishments and in mail-order. These well-embedded modes of commerce are formidable substitutes for e-commerce, and they come with the advantages that they are ubiquitous and nearly everyone already knows how to use them.¹² In addition to the competition from traditional modes of retail commerce, e-commerce faces other obstacles. One is the lack of Internet penetration into households, especially those with lower incomes. Low-income households contribute 25% to total US retail purchases but only 6% to the U.S. total on-line retail spending (Figure 15). They must often access the Internet from locations other than home (e.g., schools, libraries) where privacy and security can be problematic. Inability to do physical product inspection is another problem. In a physical store, a customer can examine the actual object to be purchased. This is impossible for physical objects in B2C e-commerce. The prospect of poor customer service is daunting to customers who fear that they might have difficulty with a purchase, and are not sure they can obtain redress from the on-line vendor, although this is less of a problem in the US than in other countries. Finally, there are serious issues of payment with B2C e-commerce. Many potential consumers such as those from lower-income groups and the young cannot obtain credit cards – the only payment medium for much of B2C e-commerce. Others are reluctant to disclose their credit card numbers on a web site for fear of theft or fraud, or because they are concerned about disclosure of personal information to third parties.

¹² Given the fact that there are no *a priori* measures of what B2C e-commerce diffusion *should* be, it is just as sensible to view current penetration levels as amazingly high as it is to see them as depressingly low.

Figure 15. On-line retail spending by household income



Source: Forrester Research Inc., "Retail's Growth Spiral," November 1998. In (Fishbein 2002, p.132)

It is a bit more difficult to gain perspective on the drivers and inhibitors of B2B e-commerce than it is for B2C e-commerce. The reliable sources of data from the US Census and similar agencies do not extend to areas of business strategy. One is left mainly with data from private firms that often have promotional biases with respect to e-commerce. That said, the data available suggest that the main drivers for B2B e-commerce are competitive pressures to lower transaction costs and improve customer relations and product support. U.S. firms face competition from domestic competitors, and in many cases, severe price competition from foreign producers with very low cost structures. Improved supply chain management and customer relationship management are important tools for competing (eMarketer 2001, p.183). Executives report that the Internet allows better management of data that affect company relationships with their clients and suppliers (eMarketer 2001, p.184). A possible driver for B2B e-commerce is the lure of becoming a monopoly or oligopoly producer capable of coercing suppliers and customers. The dot.com bubble era provided tantalizing evidence that e-commerce could facilitate "winner take all" outcomes in which one or a few dominant firms would take the whole market (cf. Bollier 1977). It is virtually impossible to determine how many firms might pursue B2B e-commerce for such reasons; it is doubtful they would admit to such a strategy even if they were following it. But such motivations can have powerful effects. The intensity of this speculation has died down somewhat following the collapse of the doc.com phenomenon, but the notion remains relevant and it is the subject of considerable academic investigation.

As with B2C e-commerce, proven and established practices remain the major impediment to e-commerce proliferation. However, there are other problems with B2B e-commerce as well. Based on surveys of business executives, two key inhibitors of B2B diffusion are fear of the business reorganization required to be successful in e-commerce, and concern that e-commerce

initiatives would go awry despite best efforts. Survey data from KPMG revealed that 30% of executives believe that e-commerce will change the definition of their company's core business (eMarketer 2001, p.175). Another survey by PricewaterhouseCoopers' revealed that 69% of surveyed CEOs feared that they would not be capable of planning well enough prior to embarking upon e-commerce initiatives, and 34% worried that their efforts would fail (eMarketer 2001, p.177). E-commerce can create difficulties for firms whose business models are not easily integrated into the Internet (Kenney in preparation, p.19). Such concerns are exacerbated when business moves offshore. IDC reported that during the year 2000, 60% of firms were expanding their Internet presence to other countries, compared to 37% in 1999 (eMarketer 2001, p.15). These companies found that their websites were successful at attracting new business from overseas, but with the new business came a great deal of additional work in redoing product specifications, arranging logistics and insurance, and establishing payment terms. Additional complexity arose from distance and language barriers, government regulation, and customs issues (eMarketer 2001, p.15). These factors do not prohibit implementation of B2B e-commerce. They simply make clear the challenges involved.

Key Environment and Policy Factors

Five factors can be identified as vital for the success of e-commerce in the US.

Telecommunications deregulation. The early deregulation of the telecommunications business in the US created a highly competitive market and fostered creation of fertile business environment. FCC decisions in the 1970s separating data from voice communications permitted new entrants to specialize in data communications. Losing data communications did not appear serious to AT&T in the 1970s, and neither AT&T nor the other telephony firms showed much interest in operating the NSF Internet backbones in the late 1980's. This created market opportunities for startups such as UUNet and PSINet that became early Internet service providers. The flat rate structure in local telephony (a holdover from the Bell Operating Companies) was important for the diffusion of online services in the home market. As bandwidth costs came down, use of the telecommunications system and the Internet grew.

Venture capital. The availability of venture capital allowed US startups to pursue creation of websites, software, web hosting, data infrastructure, and infrastructure equipment. It is not easy to determine the full effect of ready venture capital on e-commerce. On one hand, ready availability of venture capital can be said to have reduced the most important entry barrier for fledgling firms, and allowed the entrepreneurs to focus on their business operations. Without question, the ready money made possible the growth of ancillary services necessary for any industry. Law firms, accountants, employment agencies, executive search firms, and investment banks expanded in centers of the Internet industry such as Silicon Valley. New entrants appeared in data communications infrastructure, communications equipment, web hosting, Internet software, and websites. On the other hand, readily available venture capital might not be an unalloyed blessing. As the crash of the dot.com era suggests, "irrational exuberance" in any investment market has downside consequences. The easy availability of venture capital in the heady days of the dot.com boom arguably deluded some entrepreneurs into thinking that their business plans were sound when they were not, and encouraged them to pursue additional rounds

of capitalization rather than building up the core business. It is axiomatic that new paradigms in commerce such as e-commerce cannot proceed without capitalization from some source, and the venture capital market of the US did provide the major source of such capitalization during the dot.com boom. The ideal mechanism for capitalizing the development of e-commerce from this time forward is not yet clear.

Transport infrastructure. The government has long been a key provider for infrastructure such as highways, seaports, airports, and rail. The regulatory changes in interstate trucking in the late 1970's and in the airline industry in the early 1980's allowed new entrants and fostered competition. This competitive environment spurred high-reliability shipment infrastructure, time-definite delivery, shipment tracking, and other innovative services that enable B2B and B2C electronic commerce.

Human Resources. The US has long been a leader in industrial research. The Xerox Palo Alto Research Center, Intel, IBM, AT&T Bell Labs, Microsoft and many other organizations have been recognized as innovation leaders. US universities have produced a substantial portion of the world's leadership in information technology. Faculty and students led the Internet revolution and played key roles as technical talent in early Internet commercialization efforts. Digital Equipment Corporation and Sun Microsystems, which created the vital computer infrastructure for the Internet, arose from efforts by university researchers. The major portals (Yahoo!, Excite, and Lycos) the first important browser firm (Netscape) and two of the most used search engines (Inktomi and Google)¹³ had their roots in US universities.

Liberal Policies on Taxation and Content. The free-wheeling nature of the Internet has encouraged innovation. The privilege of a tax-free environment for Internet transactions has provide a subsidy that advantages such transactions relative to brick-and-mortar commerce, and effectively adds a margin of revenue to companies engaging in e-commerce. The fact that the US Federal Courts have constrained efforts to control content on the Internet has helped preserve the open-ended nature of the phenomenon and permitted experimentation and innovation.¹⁴

¹³ Whereas Google hosts a site "powered" by Google's proprietary search engine, Inktomi offers information search and retrieval products to its many corporate customers.

¹⁴ One of the more interesting dimensions of the liberal bias toward content is the presence of the pornography industry in e-commerce. The nature of the industry makes it difficult to collect complete statistics on its size and operations, but some illustrative facts are worth noting. One is that pornography *can be* a lucrative business. To cite just one example, upscale hotel chains such as Hyatt, Sheraton and Hilton were earning upwards of \$150 million per year in the mid-1990's simply by offering 'pay per view' pornography to their guests (Cronin and Davenport, 2001). There is much speculation and argument about the size of the US pornography industry, with estimates ranging from a high of \$14 billion to a low of just \$500 million (Forbes, 2002). In any case, the issue is not how big the business is, but how well suited to promotion of e-commerce it might be. Here the history of pornography grows interesting. Evidence suggests that the French tele-text system Minitel was a major beneficiary of sexually-related service advertising during its early years, and a similar case can be shown for value-added services over telephony in the US through so-called 976 services (Johnson, 1996). These technologies, as with the Internet, allow the dissemination of controversial material into the privacy of one's local environment – a condition that does not mean much when purchasing everyday goods and services. It is not easy to tell whether trade in controversial content such as pornography will prove to be a major driver of entertainment-oriented e-commerce, but past experience with new communications media suggests it is worth watching.

Future Trends

Electronic commerce can be expected to diffuse in the US at a healthy pace in the next few years, although there is no indication that it will meet the expectations of its most enthusiastic proponents. The rise of e-commerce is likely to follow the rise of other systematic inventions that have caused rethinking of activities far beyond the reach of the innovations themselves. No one predicted in the dawn of the automobile age that automotive transport would transform not only personal transit, but also the design of cities, the relationship between home life and work life, the practices of production and consumption, and even the nature of family formation. Whether the implications of electronic commerce rival those of the advent of the automobile is not obvious, but there is little doubt that the emerging era of electronic commerce will bring many surprises.

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