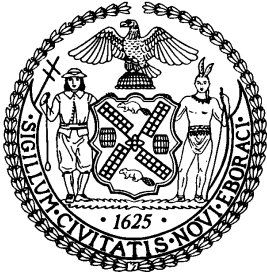


THE NYC SOFTWARE/IT INDUSTRY

How NYC Can Compete More Effectively in Information Technology

**Office of the Comptroller
City of New York
Alan G. Hevesi, Comptroller**

April 1999



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April 1999

TO THE PEOPLE OF NEW YORK CITY

The world economy is in the midst of a transformational growth driven largely by the computer and telecommunications revolution. This revolution has created a number of job and business opportunities for New Yorkers, especially in the software and information-technology industry.

This report is an attempt to measure the economic importance of the software/IT industry to New York City and to consider the steps that need to be taken to ensure its future growth.

The report finds that the City's software jobs have grown by an extraordinary average of 15.5 percent a year from 1992 to 1997. This compares with 11.1 percent a year for the nation, 10 percent a year for the State, 8.3 percent a year for upstate New York, and 5.3 percent a year for the City's suburban counties. The growth of the software/IT industry in the City is evident whether one uses a broad or a narrow definition of the industry.

The report's recommendations for strengthening the City's software/information technology industry address four main concerns:

1. Reduce the cost of space and communications for start-up companies, by encouraging utilities to lower telephone and electricity charges, by exploring the potential for incubators, and by encouraging cable companies to move faster on opening up cable facilities to high-speed two-way communication.
2. Strengthen math and science teaching in the public schools and urge CUNY and other universities to coordinate their computer-science resources so that the City can compete in this area with the best universities in the nation. Cooperate with university computer science departments that seek to work jointly with industry (e.g., with internships and development of faculty ideas) for their own benefit, for the benefit of their students, and for the sake of the City's future economy.

3. Given that Wall Street firms are reluctant to take on independent public offerings under \$20 million, explore how the City and State could encourage financial risk-takers to bridge the gap between the “angel” money for start-ups and eventual public offerings.

4. Encourage creation of consortia of computer-science and engineering faculties of area universities and local business schools. The consortia should include regional research laboratories, private industry, and local governments, with the goal of supporting the growth of start-up software firms in order to achieve cutting-edge excellence.

Finally, I thank the Comptroller’s Office staff members and other people who assisted in preparing this report, as identified on the next page. In particular, I am grateful to Bruce Bernstein of NYSIA and Tim Noble of Chase Manhattan Bank for working with my office to bring this report to fruition. Three other people also deserve special mention: Professor Henry Etzkowitz of SUNY at Purchase, who gave us good ideas and then good-naturedly allowed us to rearrange them; Tom Lipscomb of the Center for the Digital Future; and Rodney Alexander of the Institute of Business Trends Analysis at the Borough of Manhattan Community College.

Our City has long been a center for collecting, processing, and disseminating information. To continue playing a major role in the information economy, we must ensure that our workers have both the skills and access to intellectual resources necessary to compete in this new economy. I intend to do everything I can to support the industry.

Alan G. Hevesi

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EXECUTIVE SUMMARY

This report seeks to measure and evaluate the growth of the software and information-technology (IT) industry in New York City (NYC), to compare NYC with other cities, and to compare NY State with other states. It also identifies obstacles to the industry's growth and how NYC and NY State institutions can ameliorate them.

The software industry represents a source of new jobs and not incidentally a revolution in the workplace. The invention of movable type (credited to Gutenberg in 1447) meant that one person could communicate with virtually unlimited numbers of other people, but at a significant printing cost. Other inventions (such as those of Morse in 1837 and Marconi in 1895) made possible communication with virtually no marginal transmission cost, ushering in the radio and television broadcasting industries. Now, software is at the center of the latest Information Revolution, transforming the way we live and work. When the Internet fulfills its promise, people will be able to work anywhere.

“Software” describes the codes people write to instruct computer “hardware” (physical devices for computing) to do tasks people need them to do. Software tells computers how to collect, sort, and exchange data, whether in the form of words, numbers, drawings, or photographs. Businesses use software to manage their employees and production facilities, and to take orders and obtain payment from their customers.

In this report, the software industry is defined to include information-technology (IT) functions, i.e., all people employed in the “computer-services” category, except for those working on the hardware functions of leasing and repair. The industry is therefore defined as made up of firms (including units of larger companies) in one of the nine Standard Industrial Classification (SIC) codes 7371 through 7379, less the two hardware-related codes 7377 and 7378.

So defined, this report concludes, the software/IT industry has been growing rapidly in the United States, and that NYC had, as of 1992, lagged seriously behind Silicon Valley and the Boston/Route 128 area. But it also concludes that NYC has in recent years been sharing strongly in the growth of the software/IT industry and has carved out several important areas (notably Internet-related commerce) where it has become a leader.

The report's analysis and conclusions are subject to the following caveats:

- This study, like the software/IT industry itself, is a work in progress.
- Its focus is on the City and State, not on non-NY State parts of the NYC region, nor on national or international software developments.
- Many software industry data classifications are obsolete as the industry changes.
- Software-industry job data are self-reported and depend on judgments made by individuals designated by reporting firms to file unemployment insurance forms.
- Jobs in new firms tend to be under-reported.
- Employees in software activities at non-software companies are not included. They may add from double to five times the number of workers in self-identified software companies.

The Software/IT Industry in NY: Firms, Employees, and Wages. After losing ground within NY State in 1980-1992, NYC made important gains in 1992-1997. NY State had 7,446 software firms in 1997, following a fairly steady average annual increase between 11 and 12 percent (11.4 percent since 1980 and 11.8 percent since 1992). Of the NY State firms, 41 percent (3,013) were in NYC. The number of software/IT firms grew an average of about 10 percent since 1980, and a much faster 13 percent since 1992. Nearly one-third of the firms (32 percent) were in the NYC suburban counties, which experienced an average annual increase of about 12 percent in 1980-1997 and a much slower 9 percent in 1992-1997. The remaining one-fourth (28 percent) of the firms in 1997 were in the upstate counties. (See Summary Table.)

Summary Table. *The Software Industry in NY State, NYC, and NYC Suburbs, 1992 and 1997*

	NY State		NYC		Suburbs		Upstate	
	1992	1997	1992	1997	1992	1997	1992	1997
Firms, Number*	4,264	7,446	1,634	3,013	1,511	2,350	1,119	2,083
Employees, No.	45,633	73,597	14,370	29,550	13,161	17,056	18,104	26,992
Ave. Wages/Year**	\$51,538	\$59,745	\$69,269	\$69,247	\$53,187	\$67,771	\$36,259	\$44,268

* "Firms" include multiple locations within companies that report unemployment insurance separately.

** Wage rates for 1992 are inflation-adjusted, i.e., they are in 1997 dollars.

Source: NY State Department of Labor, unpublished data from ES-202 unemployment-insurance filings (which under-report new start-up firms) for the 4-digit SIC codes 7371-7376 and 7379.

Number of Employees. NY State had 73,597 employees working for software companies in 1997, up by an average annual rate of about 7 percent over 1980. NY City had 29,550 employees, 40 percent of the employees in the State, up by an average annual rate of 6 percent over 1980. NYC's suburban counties had 17,056 employees, up by an average annual rate of 6 percent over 1980.

Since 1992, NY State's computer-services job growth has begun to catch up with the nation's growth, as the State recovered from one of its worst-ever recessions. In 1980-1997, NY State's 3.2-fold increase in these jobs was well behind the national 4.6-fold increase. But for the industry in 1992-1997, the 1.6-fold increase in NY State was close to the national 1.7-fold increase.

The same pattern holds true for NYC. From 1980 to 1992, software jobs in NYC grew by an average of 2.4 percent a year, well below the national increase in computer-services jobs of an average of 8.8 percent a year. Since then, NYC's software jobs have grown by an extraordinary average of 15.5 percent a year, compared with 11.1 percent a year for the nation, 10 percent a year for NY State, 8.3 percent a year for upstate NY, and only 5.3 percent a year for suburban NYC. The growth of the software industry in NYC is evident whether one uses a broad or a narrow definition of the industry.

Average Wage. The average software-employee wage is \$59,745 in NY State. The average wage in 1997 was up in real (inflation-adjusted) dollars an average of 2.6 percent a year over 1980. In 1980-1992, real wage growth of computer-services employees in NY State was 2.3 percent, slower than the nation's 2.6 percent. But in 1992-1997, real wage growth of these employees in NY State was 2.8 percent, ahead of the nation's 2.3 percent.

In NYC, overall, the average software-company wage was \$69,247 in 1997, second only to the Finance, Insurance, and Real Estate (FIRE) category, up 60.7 percent in real dollars since 1980, or an average of 2.8 percent. However, software wages were unchanged in real dollars since 1992, because from 1992 to 1997, average wages grew only 2.7 percent a year and inflation also averaged 2.7 percent a year. The average wage in suburban NYC is \$67,771, an increase in real dollars of a remarkable 84.7 percent over 1980. While average software wages in NYC in nominal terms grew 7.5 percent a year from 1980 to 1997, most of the growth was in the 1980-1992 period, when it averaged 9.4 percent a year.

NYC's software sub-sectors show interesting differences in the 1992-1997 period. Two categories show very rapid growth in employees, i.e., computer-programming services (consulting firms that write customized programs for clients, SIC Code 7371) and information-retrieval services (firms that write software to select information from databases, Code 7375). These two categories also show flat or even declining average wages, suggesting that the average wage may have been depressed by the intake of many entry-level or non-technical supporting employees. The prepackaged software category (firms that prepare software for duplication and sale, SIC Code 7372) shows slower growth, but a 1996-1997 spike, in the average wage of its suburban NYC companies. In the case of the "all other" computer-related services category (SIC Code 7379), all measures are growing rapidly—firms, employees, and salaries—suggesting that this is an important SIC code for aggressive software companies that are hard to pin down to one of the other classifications.

The Software/IT Industry in NYC Compared with Other Cities/Areas. Because detailed data for many counties are not available for 1997, the analysis relies on 1996 county data for the 3-digit SIC code 737 (i.e., the sum of the nine 4-digit codes ending 71 through 79). Moreover, because comparative data are available only at the 3-digit level, the two hardware-related codes ending in 77 and 78 are included for inter-city comparisons. NYC had 2,560 computer-services firms (i.e., "establishments," including multiple branches of large firms), fourth in the nation and just below LA County, which has a population of 8.9 million compared with NYC's 7.3 million. The top-ranked cities/areas were Silicon Valley, CA (Santa Clara County and four counties north of it) and the four-county Boston/Route 128 area.

NYC had the sixth largest number of computer-services jobs, 25,716. Silicon Valley was in first place with 86,129 jobs, 4 percent of all private-sector jobs in the area. It was followed by Boston/128 with 55,956 jobs, 3.4 percent of private jobs. Los Angeles had 32,294 (1 percent), Dallas 31,892 (2.8 percent) and Seattle 28,955 (3.3 percent; this includes Microsoft's headquarters in nearby Redmond, WA).

Seattle, Dallas, and Atlanta all have an average of 21 employees per software firm. NYC has about half as many, 10. Average wages are highest in Seattle, \$113,970, the next two highest are Silicon Valley at \$77,392 and Newark (Essex County) at \$67,856. NYC ranks fourth at \$64,551, followed by Boston/Route 128 at \$63,825 and Chicago at \$57,703.

Conclusions. The message conveyed by the data is that NYC and NY State were slow to gear up for the growth of software/IT jobs in the 1980s, and lost ground in the 1989-1992 recession, but since 1992 both NYC and NY State have seen a rapid growth in software jobs.

Of the many lessons of this report, the most important one may be the dependence of the Information Revolution on creating economic value through sheer brainpower. The need in the Industrial Revolution was for physical capital to set up factories and buy raw materials. Today's needs still include physical aspects—not just needs for transmission wiring and computer hardware, but continuing physical needs related to the physical delivery of products bought and sold over the Internet. However, the critical need in this Information Revolution is now for human capital, i.e., basic intellect applied to high-level problem solving in cyberspace.

The City and State are catching up to the national leaders in this industry. The City has unique attractions, for example, its availability of public transportation and the breadth of its cultural life. It has a uniquely creative work force and access to markets, communications, and global finance. But obstacles remain in the way of a stronger software industry in the City and State. They relate to *the costs of doing business* (which in turn relate to taxation and the physical and regulatory infrastructure), *the educational infrastructure*, availability of *start-up financing*, and *regional* (including university-industry) *partnerships*.

Recommendations for Strengthening NYC's Software/IT Industry. Cities with an interest in attracting or keeping a particular industry have been able to influence the climate within which companies get started and grow. An aggressive and coordinated approach by the City and State, in conjunction with business and academic institutions, will allow NYC to consolidate its existing strengths and build a base for becoming a leader in information technology. The City and State need to pay more attention to the industry and take actions to improve the climate for software companies in each of four critical areas: costs (especially of communications and space), education, finance, and regional partnerships and consortia.

Cost of Business: Communications and Space. Among the most serious challenges faced by start-up software firms are wiring and connections for high-bandwidth communications, obtaining affordable 7-day, 24-hour space, keeping down other costs, and dealing with tax laws and other government regulations. Many small businesses find it difficult coping with the complex tax laws and regulations at the same time as they are attempting to compete in delivering a product. City and State officials could help with these problems in the following ways:

- Identify and seek to ameliorate physical obstacles to software-industry growth, such as finding new wired space for software firms. The City-supported Plug n Go program of the Downtown Alliance, featuring small-footprint pre-wiring and short leases, has been a successful innovation.
- Experiment with incubators or “technology parks,” expressly for high-tech start-up companies, in less expensive areas of NYC? such as in the neighborhood around some of the City's colleges. Incubator space provides start-ups the benefits of reduced-cost facilities and access to high-speed communications.

- The City should consider ways in which it can help to keep down costs for start-up firms, by providing access to low-interest mortgages or tax credits.
- Encourage the NY State Public Service Commission to maximize competition in the telecommunications industry for small companies. Work with Bell Atlantic and telecommunications companies to assist start-up companies with their telecommunications needs (e.g., faster installation of high-bandwidth T1 and T3 lines and ADSL technology). We should also attempt to obtain for small Internet-related businesses the lower telephone rates now enjoyed by large companies.
- Evaluate the costs and benefits of lowering the sales tax on telephone usage in return for lower local message rates or other charges.
- Work with cable television companies on facilitating widespread introduction of cable modems to open up interactivity to those with cable access.
- Encourage competition among electricity companies in the NYC area to reduce electrical rates for small companies. Con Edison's average rates per kilowatt-hour are half again higher than the national average and a multiple of the rates of utilities serving software companies in some competitive regions. As the Comptroller has urged before, the Public Service Commission should be encouraged to increase competition and lower electricity rates as quickly as possible so that NY State will remain competitive in this area. A potential inducement to lower rates that needs to be evaluated is a reduction in the State's gross receipts tax on utilities.
- Work with the software/IT industry to identify tax burdens that impede its development. Specifically, jointly propose legislative recommendations that would reduce (perhaps by raising the threshold) or phase out unique taxes such as the Unincorporated Business Tax, the commercial rent tax (already scheduled for elimination), and the alternative tax on shareholders of Subchapter C Corporations.
- The City should recognize the flow-through tax privileges of Subchapter S Corporations.

Educational and Recruiting Needs. While software jobs have been growing, they have not be growing as fast as they would if a larger volume of trained, employable programmers and computer-science graduates were flowing into the work force. While NYC produces more computer-science and engineering graduates than any other area, neither the quantity nor the quality is keeping up with demand by software companies. NYC needs at least one world-class software/IT center; this might be Brooklyn Polytechnic. As the demand for first-rate software developers grows, NYC area schools and universities need better equipment, instruction, research-grant money and direction:

- NYC needs a strong base for technical education, starting in the elementary schools.
- Existing employees need to have their skills upgraded continually through graduate-level adult-education courses.
- The NYC area universities need to work more closely with schools in upgrading the technical education of teachers. Steps in this direction include Columbia's Institute for Learning Technologies (with programs in 42 high schools) and NYU's Center for Advanced Technology, which has for years, in its Innovative Telecommunications Program, been focusing on training students for new media positions.

- CUNY needs to evaluate the creation of a CUNY-wide School of Computer Science. It could be partially supported with research funds. The City and State may need to invest in such an endeavor.
- Most urgent of all, the City's public and private universities should work together in coordinating their computer-science resources through consortia that include computer-science faculties, engineering schools, and business schools.

Financial Needs. New Yorkers sometimes seem to take the attitude that because Wall Street is located in Manhattan, NYC businesses have access to all the financing they need. That is not the case. Most Wall Street investment bankers are looking mainly at middle-sized or large companies, usually to make them larger through mergers or new public offerings. Start-up technology firms require a venture-capital firm willing to look at companies at a very early state of development? without evidence of a final product, of a stream of revenues, or of any of the other usual requirements of an initial public offering. Because Silicon Valley has become the center of software-technology innovation, the venture capitalists with an interest in software are concentrated there. They are consequently much better organized than their NYC counterparts. To become more competitive, the following steps are recommended:

- To increase the visibility of the NY software industry among investors, a promotional office in the City or State should be established. Funding for the office might be on the basis that the City and State would each or together match private contributions for it.
- The "Angel" investor groups that have been created in other cities seem to be effective in sharing the due diligence tasks of investors. The possibility of a group of this type in NYC should be considered.
- The City and State should have a larger presence at software fairs (in state or beyond), such as the annual "Alley to the Valley" conference, as a forum for recruiting companies and staff to come to NYC.
- Similar networking conferences and groups within NYC also deserve City encouragement.
- The NYC pension funds have set aside funds for "alternative investments" that include venture capital for technology industries in NYC. Investments in the software and IT industries, with potentially high returns, deserve consideration for a share of these funds on a priority basis.
- The NY City Council enacted a proposal for a \$25 million loan program for technology-oriented industries. This later became a Loan Guarantee Fund to be implemented in conjunction with the NYC Partnership and NYC Investment Fund. This fund should be activated and implemented as soon as possible.

Regional Models. Universities, industries and governments need to work together to ensure a competitive environment. This suggests moving away from a company-based economic strategy to an industry-based one.

- NYC needs more entrepreneurial-university experiments of the kind initiated at Stanford, MIT, and SUNY at Stony Brook, involving computer-science programs and engineering schools and adding to them interested business schools, which have a long track record of working with business on an ongoing basis.
- NYC needs places where trainees can work with people who are actually developing new software. MIT, Stanford, and SUNY at Stony Brook have business-university partnerships

that should be emulated in NYC. This focus should extend to technical training programs, high schools, and continuing education programs of local universities. Software experts and their professional associations should be encouraged to share what they know by teaching, as volunteers or as adjuncts, in the CUNY or private universities and at lower educational levels, as a way of bridging the time lapse between what is known and how quickly it is taught. One of the great strengths of Silicon Valley is the collective willingness of its companies? beyond their legal rights? to allow their employees to share their knowledge, in the interest of keeping the area in the forefront of innovation. This information-sharing attitude may be dubbed the Linux Strategy, after the open-code operating system that is emerging as an alternative to proprietary operating systems.

- NYC and NY State public educational institutions should cooperate with industry job fairs to recruit the nation's best available software educators and researchers.
- The City could also work with the Congressional and State delegations to ensure that the immigration doors remain open for skilled software personnel from other countries and spur a more active role in developing new intellectual-property rules to extend copyrights to the Internet.
- To support its educational and recruitment efforts, NYC needs a stronger research presence in the form of university-connected technology centers with concentrations of start-up companies.
- Governments can be important players in building regional partnerships. They can help bring together financial resources, technical skills, and political support to fund research that might help a growing industry.
- NY State should consider a Small Business Innovation Research program for software development in the region.

I. INTRODUCTION AND CAVEATS

Like the stars and planets, cities have a gravitational field. They attract people and companies. Their lure is the availability of trained workers, of markets, of cost-efficient supporting services, and of financing. New York City has for decades attracted the most ambitious and best-educated people in the nation and the world.

But if the City is a magnet that attracts, it can also (like a magnet with reverse polarity) repel. NY City and NY State officials must be aware of the City's negatives and seek to eliminate or at least ameliorate them.

Also, over time the magnetic strength of a city can weaken. Networked computers, cell phones, and videoconferencing can reduce the importance of physical location.¹ Already, companies based in Manhattan have comfortably relocated their back offices in other boroughs or even other states.

The purpose of this report is to look at the software, and more broadly the Information Technology (IT) industry, in NY City. This industry has a special role to play in the City's economic-development strategy. As the City seeks to raise the proportion of its population that is employed, it needs new sources of jobs, and this opportunity exists in the software/IT industry. Nationally, the industry has been growing jobs at double the rate of the overall economy.²

This report seeks to understand the job-creation potential and what the City might do to make it a reality. It starts with a review of trends in the NY City and State software/IT industry, and compares them with other cities and states. It then considers possible Federal, NY State, and especially NY City actions that could strengthen the City's comparative advantages.

The report must begin with five Caveat Lectors ("let the reader beware") about the data reported here:

A. This Is a Work in Progress

The first caveat is that this analysis is a work in progress because the software/IT industry is in a state of rapid change. Revolutions take unexpected twists and turns, and the Information Revolution is no exception. Microsoft's surpassing of the total market valuation of IBM (and every other company), despite Microsoft's having lower profits and roughly one-fifth IBM's revenues, is a remarkable development. Other companies are growing as rapidly as Microsoft once did, and the race continues.

¹ For example, when the Chase Manhattan Bank organized itself for introduction of the new Euro currency, it developed the software in its European center and distributed the software to other locations.

² The Internet grew from 3 million to 100 million users between 1994 and 1997 and is doubling every 100 days. U.S. Department of Commerce, *The Emerging Digital Economy*, April 1998. Cited in Rodney Alexander and Chris O'Sullivan, "New York's Engineering and Technically Skilled Labor Supply," Report of the Institute for Business Trends Analysis, Borough of Manhattan Community College, February 1999, p. 5.

Whatever predictions may emerge from the report are tentative, to be modified by technological developments. The industry is changing in astonishing ways, driven by phenomenal advances in computer and telecommunications technology, in particular the rise of the Internet.

B. The Focus Is on NY City and NY State

The second caveat is that this report is prepared for a specific purpose. It is a snapshot of a changing industry in one place, NY City, and its suburban and upstate neighbors, to seek guidance for future policy for City government and other levels of government. This is not about the software industry in the world, the United States, or even the NYC metro area outside of NY State.

Silicon Valley and Boston's Route 128 and a few other software centers are reviewed for the purpose of learning from their experience. In making comparisons with other cities (see Section V), no attempt was made to adjust for Silicon Valley and Boston/Route 128 being much larger areas than NYC. Also, no attempt was made to assemble a comprehensive inventory of the U.S. or global software/IT industry.

C. Industry Jobs Data Are Self-Reported and Omit Small Firms

The best available historical data on job and compensation trends in the NYC software industry are from unemployment-insurance forms that are filed quarterly by all employers who have employees covered by unemployment insurance.³

The unemployment insurance forms generate "ES-202 survey data" that are the basis for payroll job reports by region. Several characteristics of the data are important to note:

- The numbers are self-reported by each "establishment" (separate employer location, whether it is a branch or a factory) in the state. Of all businesses with employees, 91 percent have only one location. But the other 9 percent are responsible for 62 percent of the private-sector work force.⁴
- The business classifications are based on the firm's (or the establishment's) view of the industry classification to which it belongs. An informal survey of software firms by the Comptroller's Office was conducted to determine SIC codes. It suggests that the accountant handling the unemployment insurance form commonly decides how to assign an industry code to the firm.⁵ Each firm's self-classification is checked by the 13-person

³ This is not to dismiss snapshot-type surveys such as the two conducted in 1996 and 1997 by Coopers & Lybrand LLP (now PricewaterhouseCoopers) for the New York New Media Association. It is only to say that to examine trends over the past two decades, an industry time series with some data consistency is essential.

⁴ Peter K. Eisinger, *The Rise of the Entrepreneurial State: State and Local Economic Development Policy in the United States* (Madison, WI: University of Wisconsin Press, 1988), p. 234.

⁵ Many senior software executives were unable to identify the SIC code to which their accountant has assigned their firm. From a survey of limited sample of companies, the companies appear to be making reasonable selections from the SIC-code categories available to them.

Classifications Unit at the NY State Department of Labor in Albany, and for issuers of stock is also checked by the Securities and Exchange Commission.⁶

- Finally, the unemployment-insurance data understate the job numbers because they do not include small start-up companies that have no full-time employees; the software industry has many free-lance consultants, including students working on a part-time basis.

D. Definitions of the Software/IT Industry Are Divergent and Changing

The fourth caveat relates to the definition of software or, more broadly, the computer-services or IT industry. Software is “a general term for the various kinds of programs used to operate computers and related devices.”⁷ Software in turn is often divided into two groups: application software (programs that do work users are directly interested in) and system software (operating systems and programs that support applications software).

1. Classification Problems

The definition of software is complicated by the fact that, as higher-level languages evolve, an increasing number of computer users are writing code. Someone writing in Java or C++ is readily classified as a programmer who is writing software. Also, someone who sets up a web site using a standard package is doing the work of a systems analyst rather than a programmer. However, someone writing in html (hypertext markup language), marking up a document so that it can flow seamlessly on the Internet, could be either a programmer or someone working with the content. Documents that used to be sent out to programmers for computer typesetting are now “typeset” in-house. In these cases, where does code writing stop and document markup begin? The line of demarcation is shifting.

Adding IT to “software” broadens the definition of software to include management functions up the line, and related functions such as systems analysis and systems integration. But the software/IT industry is not the same as the New Media⁸ industry. The New Media include many people and firms that overlap with the software/IT label. But the industry also includes a variety of creative artists and communications specialists that do not, because they are not trained in the technology by which their work (writing, photography, art, advertising) is processed and communicated (via a hard record or over the Internet). Similarly, the software/IT industry includes many computer-related specialists (e.g., developers of software for payroll management or trading) who have nothing to do with media.

The distinction is important because looking at the New Media as one industry tends to blur the economic-development lessons for NYC and NY State. The lessons are much clearer when the focus is restricted to technology. The fact is, NYC has no trouble attracting people in the arts

⁶ Some companies in the software business have been reportedly attempting to speed up their processing at the S.E.C. by identifying themselves with other than a 737 SIC prefix. But the S.E.C. says it reviews these codes and corrects them. Edward Wyatt, “Feasting on a Banquet of Internet Offerings,” *New York Times*, April 12, 1999, p. C9.

⁷ The source of the language within quotation marks is from the “whatis.com” web site.

⁸ Mark Stahlman, co-founder (with Brian Horey) of the NY New Media Association, coined both the “New Media” as the name of the industry and “Silicon Alley” as its NYC location.

and communications. NYC is the undisputed world center of communications and few would argue with its being given the title of the world center or at least the largest single marketplace of cultural creativity.

Where the City is weak is on the technology side. NYC does not produce very many doctorates in computer science, for example. It does not offer an abundance of inexpensive, well-wired space for start-up Internet companies. It is not the center of the venture-capital industry in relation to software development.

Separating the software/IT industry from New Media throws the City’s weaknesses into relief. So while advertising the City’s New Media strengths may be a good way to promote the City from a positive perspective, this report may be more useful as an action guide to eliminating or ameliorating the City’s negatives.

2. Some SIC Codes Are Becoming Obsolete

Until 1999, the industry classifications according to which employers identify the industry to which they belong are the Standard Industrial Classification (SIC) codes. The SIC codes have extensive manufacturing subcategories but are weak on classifying services. They are also closed codes in that they don’t provide for easy expansion of categories.

The general computer-services category is 3-digit SIC Code 737, “software and computer-related services,” commonly abbreviated, for example in the Federal Reserve Bank of NY review of New Media, as “computer services.” The Federal Reserve survey uses all nine of the 737 SIC subcategories, including two subcategories—7377 (computer leasing) and 7378 (computer repair)—that have little to do with New Media (see Table 1-1).⁹

Table 1-1. *Definitions of the Software/IT Industry and Related Industries*

Definition	SIC Codes Included (Prefix 737-)								
	1	2	3	4	5	6	7	8	9
1. “Software and Computer-Related Services”, SIC	?	?	?	?	?	?	?	?	?
2. “Computer Services,” FRBNY									
3. “Software/IT” (seven categories), NYCC	?	?	?	?	?	?			?
4. “Software” (five categories), NYAS	?	?	?	?	?				
5. “Other Media” (four categories), CBC	?	?	?		?				

Note: 7371=Computer programming services. 7372=Prepackaged software publishing. 7373=Computer integrated systems design. 7374=Data processing and preparation. 7375=Information-retrieval services. 7376=Computer-facilities management services. 7377=Computer rental and leasing. 7378=Computer maintenance and repair. 7379=Computer-related services.

Sources: (1) SIC=U.S. Department of Commerce, *Standard Industrial Classifications* (SIC) Code 737. (2) FRBNY=Federal Reserve Bank of NY. (3) NYCC=NYC Comptroller. (4) NYAS=NY Academy of Sciences. (5) CBC=Citizens Budget Commission.

Software came into use as a term to describe computer-related activity that is not directly connected with computer hardware. But the 3-digit SIC code contains nine 4-digit subheadings,

⁹ Jason Bram and Mike De Mott, in “New York City’s New-Media Boom: Real or Virtual?” Federal Reserve Bank of NY, *Current Issues in Economics and Finance*, October 1998, 4:10.

of which two are hardware-related, i.e., 7377 (computer leasing) and 7378 (computer repair). These two codes are excluded whenever the data are available down to the 4-digit level. The other seven codes define the software industry in this report.

Other studies of the software industry use even narrower definitions. The NY Academy of Sciences (NYAS), in its ongoing research uses *five* of the 4-digit SIC codes, excluding SIC codes 7376 (computer facilities management services) and 7379 (other computer-related services), as well as 7377 and 7378. While the 7376 category may appear to be a strictly managerial function, in practice it is highly software-intensive, and the 7379 code is a very large and growing category that includes many software firms avoiding other categories they find too restrictive relative to what they do.

The Citizens Budget Commission (CBC) includes only *four* of the 4-digit SIC codes, 7371-7373 and 7375, and calls them “other media.” In addition to the categories excluded by the NYAS, the CBC excludes 7374 (data processing). Data processing can be a lower-order function than software development, but as the old service bureaus become obsolete the companies doing data processing are commonly also developing software along with their data-inputting activities.

3. Coming: The Open-Ended NAICS Codes

The SIC classifications are being changed in an attempt to make it easier to keep up with changes in service activities. The unemployment insurance form is being overhauled in 1999 and the SIC codes will be replaced by the North American Industrial Classification System (NAICS). The NAICS codes will permit much greater flexibility in tracking services, by using an open-ended format that is easily extended, while preserving the researcher’s ability to track trends. Most SIC codes can be directly translated into the NAICS codes; the exceptions are cases where the SIC codes are split. (See Table 1-2.)

Table 1-2. *Definitions of Software and Other Computer Services, SIC vs. NAICS*

SIC Code	Description	NAICS Code	Description**
7371	Computer Programming Services	541511	Custom Computer Programming Svces
7372	Prepackaged Software		
	Publishing	51121	Software Publishing
	Reproduction	334611	Software Reproduction
7373	Computer Integrated Systems Design	541512	Computer Systems Design Services (pt)
7374	Data Processing and Data Preparation	51421	Data Processing Services (pt)
7375	Information-Retrieval Services	514191	On-Line Information Services
7376	Computer-Facilities Management Svces	541513	Computer-Facilities Management Svces
7377*	Computer Rental and Leasing	53242	Office Machinery and Equipment Rental
7378*	Computer Maintenance and Repair		
	Retailing and Repair	44312	Computer and software stores (pt)
	All Other Repair	811212	Computer and Office Machine Repair
7379	Computer-Related Services, NEC		
	Disk and Diskette Conversion	51421	Data Processing Services (pt)
	Computer Systems Consultants	541512	Computer Systems Design Services (pt)
	All Other	541519	Other Computer-Related Services

* These two subcategories are *excluded* from software; the other seven are included; see Table 1-1 note.

** pt="partial," meaning no one-to-one correspondence between the NAICS code and the SIC code; the SIC code has been split into two or three pieces and new codes have been assigned to the parts.

Source: Bureau of Labor Statistics and Census Bureau (www.census.gov). SIC=Standard Industrial Classification, the manufacturing-based system last reviewed in 1987. NAICS=North American Industrial Classification System, which takes more account of services and is being implemented as part of NAFTA in 1999. NEC=Not elsewhere classified.

The NAICS codes make clear that software development is the technological component of the information industry. But the basic problem, that the information is self-reported by establishment, remains. Most establishments are separate firms. Large firms in traditional industries like advertising, broadcasting, publishing, and telecommunications may have internal software- or code-writing units groups to follow and test out new technologies, but they are not necessarily separately sited; and, if not separate, would not be captured by an establishment survey. These might be identifiable by occupational titles like software engineers, but the Bureau of Labor Statistics occupational surveys do not presently have enough classifications to be useful for this purpose. The NAICS codes will improve the clarity of the reporting definitions and will permit more flexibility in future for bringing definitions into line with industry practice.¹⁰ But they will not solve the basic (and inherent) problem that establishment reporting masks the multiplicity of functions and skills within a primary industry code.¹¹

¹⁰ For example, dividing up "software publishing" is a step forward. But distinctions remain to be made, for example, between the "value-added" reseller and the originator of a software package. Similarly, distinctions remain between the conceptual design of integrated systems and the practical integration of existing systems. The Internet and web site arena is exploding with new activity that will require a new taxonomy.

¹¹ Bram and De Mott (previously cited, 1998) conclude, after comparing surveys of New Media jobs with reported jobs in the computer-services industry, that many new New Media jobs are hiding in the traditional information industries. This conclusion follows directly from Caveat C (on software definitions) and the definition of New Media jobs (see note to Table 1-1).

E. Most In-House Software Staff Are Not Classified as Software Workers

The industry-code approach by establishment leaves out software development within companies using their own software staff, a potentially sizeable group of people. This group is classified with the company's primary industry. The size of the software industry is therefore from this perspective understated.¹² Two estimates of the nature and extent of the missing personnel are: (1) the information-resources personnel count at Con Edison and (2) a survey of the relative use of in-house web-site designers compared with external consultants (such as Razorfish).

1. In-House Software Personnel Exceed Consultants at Con Edison

How in-house and external information resources staffing relate to one another may be exemplified by outlining one large information resources department in February 1999, that of Con Edison. Out of 14,125 Con Edison employees, 433 were in Information Resources, and of that number 140 were employed in software development or applications, strictly defined. In addition to the 433 staff members, Information Resources had another 127 consultants. The consultants represented 23 percent of the combined effort, while the in-house personnel represented 77 percent. That's a ratio of 3.4 in-house personnel to every 1 external consultant. Even within the software sector of Information Resources, where the consultants in the case of Con Edison are concentrated, the ratio is 1.3 in-house to 1 external. (See Table 1-3.)

Table 1-3. *Con Edison Staffing of Software and Other Information Resources, February 1999*

	Strictly Software Applications			Other Information Resources			Total Information Resources		
	No.	Percent	Ratio	No.	Percent	Ratio	No.	Percent	Ratio
In-House Personnel	140	56%	1.3	293	94%	15.4	433	77%	3.4
External (Consulting) Personnel	108	44%	1	19	6%	1	127	23%	1
Total	248	100%		312	100%		560	100%	

Source: Lisa Frigand, Con Edison, February 1999.

Note that the external software consultants are not necessarily themselves reported as software/IT employees. They would be so reported only if they are on an unemployment-insurance form that has a software-related SIC code.

¹² On the other hand, not all employees of software firms, especially when they grow past the start-up phase, are doing software work. This is true of any other SIC code, and mailroom, janitorial and other staff tend to be less costly than the software-oriented principals. But from the perspective of the City and in relation to City economic-development policy, independent software firms are more important than the in-house personnel for purposes of generating an industry that will "export" to other parts of the United States and overseas. If software developed for a single company has applications elsewhere, this work is most likely to be carried out by an independent firm (for one thing, a company is unlikely to be able to sell its software directly to its competitors, although stranger things have happened in Silicon Valley).

2. Survey: Most Corporate Web Sites Designed In-House

The size of in-house software development staff may also be estimated by a Chase Manhattan December 1998 survey of its Internet customers. It found that of the 64 percent of 166 Internet customers that have a web site, 42 percent developed their site using in-house employees, whereas only 22 percent used an outside consultant.

When asked who gives the best advice on developing a web site, the responses were: #1, in-house staff (54 responses), #2, marketing and advertising experts (47 responses), and finally computer/software vendors (31 responses). This suggests that 60 percent of the outside consultants are marketing and advertising consultants, not software firms. Many NYC marketing and advertising companies may be providing advice to their clients on purchase or development of in-house software in the course of providing marketing services.

If these numbers are reasonably representative (the survey was not rigorously scientific but also does not appear obviously biased), the ratio of in-house software-development staff to all external consultants is 2 to 1, but the ratio of in-house staff to software-firm consultants is 5 to 1. This would imply there are 150,000 in-house software experts (105,000 in end-user firms and 45,000 in marketing, communications, or other non-software consulting firms) compared with the 30,000 people working for software companies. Given the size of the NYC corporate population and the intensity of the use of technology of many of the industries in NYC, such as communications and finance, insurance, and real estate (FIRE), it is a fair bet that NYC is number one in in-house corporate software-development personnel. Although in some cases the NYC headquarters brings in software that is developed in other cities, it is equally likely that companies export to their offices in other cities software developed in NYC.

Of the 25 percent that did not have a web site, 44 percent said they plan to use in-house personnel and 38 percent plan to use an outside consultant. This number is closer to a ratio of 1 to 1, but it is probably less reliable than the ratio of those who have already installed a web site (one likely outcome of using a web site consultant is for in-house software staff to be added at the consultant's recommendation).

Collectively, the caveats suggest that the data used in this report for describing the software industry, i.e., the number of firms and the number of employees, may be understated. More research is needed on the activities of software-related staff within large companies, especially multinationals with offices in other software centers, before definitive statements can be made about the size and importance of the software industry in NYC. However, the information in the following report does provide a useful and reasonably reliable measure of trends in the software industry in NY State and other states, and NYC and other cities.

II. SOFTWARE/IT INDUSTRY TRENDS WITHIN NY STATE

This section measures the growth of software firms, employees, and average wage in NY State since 1980, comparing the State as a whole with NYC, the NYC suburbs, and upstate. It defines the software industry as the seven SIC codes 7371-7376 and 7379.¹³

A. Number of Firms

NYC has the highest concentration of software-industry firms in NY State. Its share fell to 38.3 percent in 1992 from 47.3 percent in 1980, but recovered slightly by 1997 to 40.5 percent. Most of the remaining firms in the State are in the NYC suburbs, with 31.6 percent of firms in 1997, up slightly from 30.7 percent. The upstate share of firms has risen to 28 percent in 1997 from 22 percent in 1980. (See Table 2-1.)

Table 2-1. *Number of Software Firms and Ave. Annual Growth, NYS, NYC, etc., 1980-1997*

Year	NYS			NYC		Upstate	
	Number of Firms	Number of Firms	Share of NYS	Number of Firms	Share of NYS	Number of Firms	Share of NYS
1980	1191	366	30.7%	563	47.3%	262	22.0%
1981	1479	449	30.4%	703	47.5%	327	22.1%
1982	1796	578	32.2%	833	46.4%	385	21.4%
1983	2059	685	33.3%	930	45.2%	444	21.6%
1984	2409	799	33.2%	1095	45.5%	515	21.4%
1985	2865	972	33.9%	1274	44.5%	619	21.6%
1986	3212	1104	34.4%	1394	43.4%	714	22.2%
1987	3452	1210	35.1%	1479	42.8%	763	22.1%
1988	3654	1259	34.5%	1585	43.4%	810	22.2%
1989	3835	1313	34.2%	1641	42.8%	881	23.0%
1990	4046	1371	33.9%	1711	42.3%	964	23.8%
1991	4220	1475	35.0%	1658	39.3%	1087	25.8%
1992	4264	1511	35.4%	1634	38.3%	1119	26.2%
1993	4486	1590	35.4%	1713	38.2%	1183	26.4%
1994	5016	1771	35.3%	1912	38.1%	1333	26.6%
1995	5520	1900	34.4%	2073	37.6%	1547	28.0%
1996	6310	2074	32.9%	2450	38.8%	1786	28.3%
1997	7446	2350	31.6%	3013	40.5%	2083	28.0%
Growth 80-97, %	11.4%	11.6%		10.4%		13.0%	
Growth 80-92, %	11.2%	12.5%		9.3%		12.9%	
Growth 92-97, %	11.8%	9.2%		13.0%		13.2%	

Source: NY State Dept. of Labor, unpublished ES-202 data. These numbers are for firms with one of seven 4-digit SIC codes, i.e., 7371-7376 and 7379, excluding 7377-7378 (the hardware-related categories). See Table 1-1.

“Firms” means either independent companies or separately filed locations of a larger company. “NYC suburbs” means the 10-county definition of the NYC area (i.e., the NYC and Nassau-Suffolk Primary Metropolitan Statistical Areas or PMSAs), less NYC, i.e., Nassau, Suffolk, Westchester, Putnam, and Rockland counties. Growth = average annual growth, percent. Note that at the end of the 1980-1992 period (i.e., in 1990-1992) NYC saw negative growth.

¹³ See Table 1-1 for definitional notes and references.

The City's share declined in 1980-1992 because it grew by an average of 9.3 percent a year in 1980-1992, much more slowly than in the suburban or upstate areas, which both grew by more than 12 percent a year. The 1990-1992 period was one of decline for NYC whereas elsewhere in NY State the number of firms continued to grow. But in 1992-1997, NYC and upstate grew by about the same rate, 13 percent a year, while suburban NYC lagged with a growth of only about 9 percent.

B. Number of Employees

The number of employees in software firms in the NY State as a whole has grown steadily since 1980 except for the recession years 1990-1991. NYC had 40.2 percent of the software jobs in 1997, a 15.5 percent average annual increase over 1992, double the average growth rate of the rest of the state. But during the 1980-1992 period, the rest of the state grew much faster than NYC, which eked out a 2.4 percent average annual growth rate (NYC was hard hit by the recession and 1992 was a low point). (See Table 2-2.)

Table 2-2. *No. Employees in Software Firms, Share of NYS & Growth, 1980-1992 & 1992-1997*

	NYS	Suburban NYC		NYC		Upstate	
Year	Number of Jobs	Number of Jobs	Share of NYS	Number of Jobs	Share of NYS	Number of Jobs	Share of NYS
1980	22763	6805	29.9%	10781	47.4%	5177	22.7%
1981	26021	7070	27.2%	13082	50.3%	5868	22.6%
1982	28214	8419	29.8%	12964	46.0%	6830	24.2%
1983	29642	9403	31.7%	13117	44.3%	7121	24.0%
1984	32508	10572	32.5%	13852	42.6%	8086	24.9%
1985	35123	11197	31.9%	13820	39.4%	10107	28.8%
1986	39692	12118	30.5%	17059	43.0%	10517	26.5%
1987	42136	11986	28.5%	19531	46.4%	10619	25.2%
1988	43480	12454	28.6%	19743	45.4%	11282	25.9%
1989	47662	14184	29.8%	19637	41.2%	13845	29.0%
1990	47693	14323	30.0%	18332	38.4%	15039	31.5%
1991	42422	13937	32.9%	14107	33.3%	14379	33.9%
1992	45633	13161	28.8%	14370	31.5%	18104	39.7%
1993	48373	13070	27.0%	15473	32.0%	19832	41.0%
1994	51264	12982	25.3%	17599	34.3%	20684	40.3%
1995	56842	13467	23.7%	20466	36.0%	22909	40.3%
1996	65586	16056	24.5%	24859	37.9%	24669	37.6%
1997	73597	17056	23.2%	29550	40.2%	26992	36.7%
Growth 80-97, %	7.1%	5.6%		6.1%		10.2%	
Growth, 80-92, %	6.0%	5.7%		2.4%		11.0%	
Growth 92-97, %	10.0%	5.3%		15.5%		8.3%	

Source: See Table 2-1.

The suburban NYC share of jobs has been declining steadily since 1980, as its growth is outpaced by in NYC and upstate. This reflects the prominent position of suburban giant IBM in 1980 and IBM's decline in relative importance since 1980, as IBM's former dominance in hardware was eclipsed both by other hardware manufacturers and by the explosion of software jobs. While Computer Associates and other software firms have grown up in the meantime, the NYC suburban areas have taken a beating from the relative decline in NASA and Pentagon-

related spending in the 1990s. Long Island's many contractors and subcontractors reduced their employment during the period. For example, Grumman's Long Island-based personnel dropped precipitously from 25,000 in 1986 to 5,100 in 1994, when it became a subsidiary of Los Angeles-based Northrop Corp, and to 3,000 in 1998.¹⁴ Upstate has 36.7 percent of the NY State software jobs in 1997 compared with 22.7 percent in 1980. The NYC share rose to 40.2 percent in 1997, up from 31.5 percent in 1992.

The average number of software employees per firm has fallen over the long term, since 1980, from about 20 to a range of about 7 to 13. Software experts suggest this may reflect the declining need for lower-cost data processing personnel, as the old "service bureaus" with large inputting staffs are replaced with in-house staff supplemented with more highly skilled external consultants on training, systems management, and trouble-shooting. As the need for lower-cost personnel declines and the average cost of personnel in a firm rises, the firm tends to employ fewer of them. This long-term trend (since 1980) toward higher qualifications is offset by the short-term (since 1992) rapid expansion of some firms, which has tended to add lower-level personnel.

C. Average Wage

The average wage per software employee in NYC has been consistently higher than that in suburbs, upstate, and NYS since the early 1980s. But compared with 1992, the average wage in NYC in 1997 actually declined slightly, while it grew 16 percent in NY State and 27 percent in the NYC suburban area. (See Table 2-3, next page.)

The zero increase in NYC software salaries (actually, a slight real decline) between 1992 and 1997 may be explained in four ways:

1. The number of NYC software firms (including branches of larger companies) grew 13 percent a year during the period. This implies a substantial number of start-up companies, which tend to pay lower salaries (and instead offer equity).
2. Internet and other software stocks rose dramatically in value during the period. This has made equity (including equity options) compensation an attractive alternative to salary increases for both employers and employees. This has contributed to a lowering of average salaries in the industry.

¹⁴ Grumman data from Richard Dunne, Northrop Grumman Corp., February 8, 1999. The cuts in production-related staff were more severe than in software staff, because Grumman's production on Long Island ceased completely.

Table 2-3. Average Wage of Software Company Employees in 1997 Dollars

	NYS	Suburban NYC		NYC		Upstate	
	Dollars	Dollars	Compared with NYS	Dollars	Compared with NYS	Dollars	Compared with NYS
1980	38,881	36,696	94.4%	43,096	110.8%	32,972	84.8%
1981	38,848	34,962	90.0%	43,361	111.6%	33,473	86.2%
1982	40,382	36,720	90.9%	45,454	112.6%	35,274	87.4%
1983	41,508	38,092	91.8%	46,961	113.1%	35,977	86.7%
1984	43,172	39,775	92.1%	48,123	111.5%	39,123	90.6%
1985	44,088	41,167	93.4%	50,482	114.5%	38,577	87.5%
1986	47,680	44,459	93.2%	55,278	115.9%	39,057	81.9%
1987	51,942	47,573	91.6%	61,224	117.9%	39,803	76.6%
1988	52,771	48,618	92.1%	62,370	118.2%	40,562	76.9%
1989	51,299	49,808	97.1%	62,672	122.2%	36,679	71.5%
1990	51,479	49,404	96.0%	65,258	126.8%	36,656	71.2%
1991	50,530	50,186	99.3%	64,847	128.3%	36,812	72.9%
1992	51,538	53,187	103.2%	69,269	134.4%	36,259	70.4%
1993	51,906	52,993	102.1%	67,924	130.9%	38,688	74.5%
1994	53,341	57,774	108.3%	68,074	127.6%	38,020	71.3%
1995	54,810	57,563	105.0%	67,276	122.7%	42,056	76.7%
1996	57,584	65,367	113.5%	66,531	115.5%	43,506	75.6%
1997	59,745	67,771	113.4%	69,247	115.9%	44,268	74.1%
Change 80-97, %	2.6%	3.7%		2.8%		1.7%	
Change 80-92, %	2.4%	3.1%		4.0%		0.8%	
Change 92-97, %	3.0%	5.0%		0.0%		4.1%	

Source: See Table 2-1.

3. The number of employees grew nearly 16 percent a year. Therefore, companies may have hired more entry-level people and this in turn may have brought down the average salary per firm.

4. New Media, especially web-site-development, firms tend to pay less than firms in other types of software development.

D. Conclusions

About 40 percent of NY State software-industry firms and 40 percent of software-company jobs are located in NYC. The suburban areas have just over 30 percent of the firms. A notable trend for the State has been the shrinking of software-firm size. In 1980, software firms employed an average of 20 employees, by 1997 the average size had declined to 10-employees per firm. The growth of small firms in NYC has brought about a decline in real wages during the 1990s, as small firms have been more likely to give equity as a form of compensation and hold down salaries.

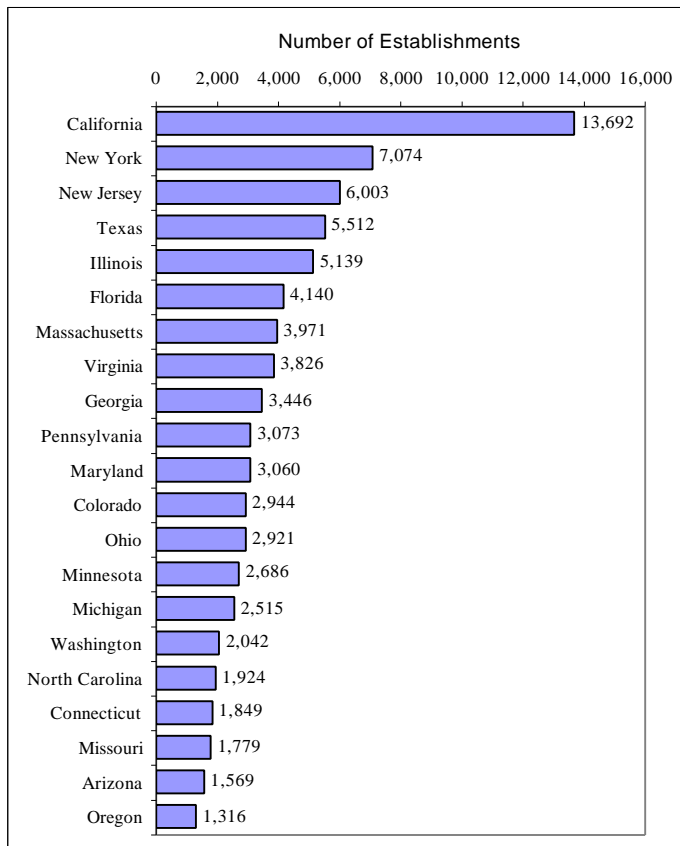
III. NY STATE COMPARED WITH OTHER STATES

This section compares NY State with the other states (and with the nation) in number of firms, employees, and wages, using 1996 data, the latest year for which comparable data are available, for the computer-services industry (4-digit-code data for all states are not available). The numbers include hardware-related services related to computer leasing or repair, but the effect on the numbers compared with the previous section is not great because the hardware categories have been declining and are small in recent years. Because of its size, the NY State computer-services industry is significant relative to other states, but it lags far behind other regions.

A. Number of Firms by State

The computer-services data are based on unemployment-insurance filings, which cover firms and separate locations or “establishments” (branches, factories) within larger firms that file their unemployment insurance forms independently. NY State ranked second in 1996, with 7,074 firms. California had the largest number of firms, 13,692. Oregon had the lowest number of the top 20 states, 1,316 establishments. (See Chart 3-1.)

Chart 3-1. *No. of Computer-Services Firms, Top 20 States, 1996*



Source: U.S. Bureau of Labor Statistics, data for computer-services (SIC Code 737, including the two 4-digit SIC code hardware-related categories of computer leasing and repair, which by 1996 were small). See note to Table 2-1.

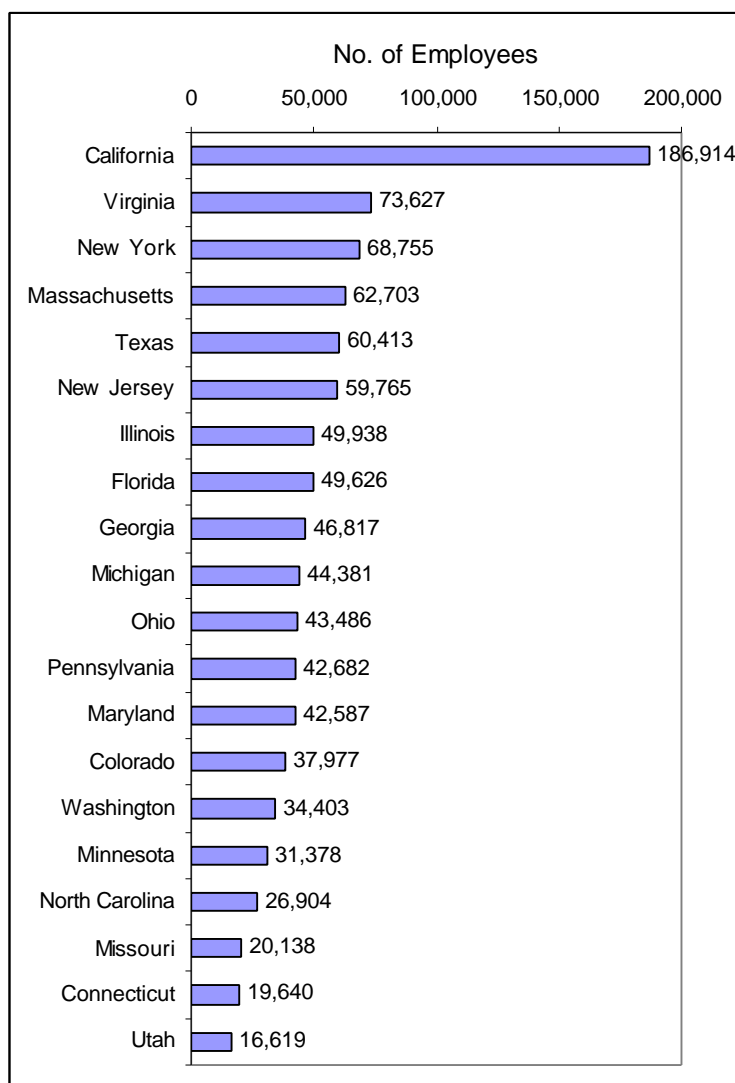
B. Number of Jobs by State

Software jobs are compared among the states in numbers of computer-services jobs, growth, share of total jobs and jobs per firm.

1. Number of Jobs

NY State in 1996 had nearly 69,000 computer-services jobs, the third-highest number of such jobs within the top 20 states. California had nearly 190,000, about three times of NY State, and Virginia was second with about 74,000 jobs, slightly more than NY State. (See Chart 3-2.)

Chart 3-2. *No. of Computer-Services Jobs, Top 20 States, 1996*



Source: U.S. Bureau of Labor Statistics. See note to Chart 3-1.

2. Job Growth

Based on 1995-1996 growth (latest available data), NY State ranks high in the increase in jobs in the computer-services industry among large states. Growth was fastest in California, with a 17.9 percent increase in computer-services jobs, followed by Washington State, 16.3 percent.¹⁵ NY State, with a 15 percent increase, is ahead of Massachusetts and Virginia and has nearly three times the growth of New Jersey. (See Table 3-1.)

Table 3-1. *Growth in Computer-Services Jobs, 1996 vs. 1995, Ranked by Percent Change*

Rank	State	1996	1995	Percent Change
1	California	186,914	158,536	+17.9
2	Washington	34,403	29,581	+16.3
3	New York	68,755	59,794	+15.0
4	Massachusetts	62,703	54,715	+14.6
5	Texas	60,413	53,368	+13.2
6	Virginia	73,627	67,117	+9.7
7	New Jersey	59,765	56,542	+5.7

Source: U.S. Bureau of Labor Statistics, unpublished data.

Although NY State rates third in growth of computer-services jobs between 1995 and 1996, after California and Washington, NYC's computer-services jobs alone grew 20.8 percent during that year, faster than California. By comparison, suburban NYC grew 18.8 percent and upstate grew 7.6 percent.¹⁶

3. Computer-Services Jobs as Share of Total Jobs

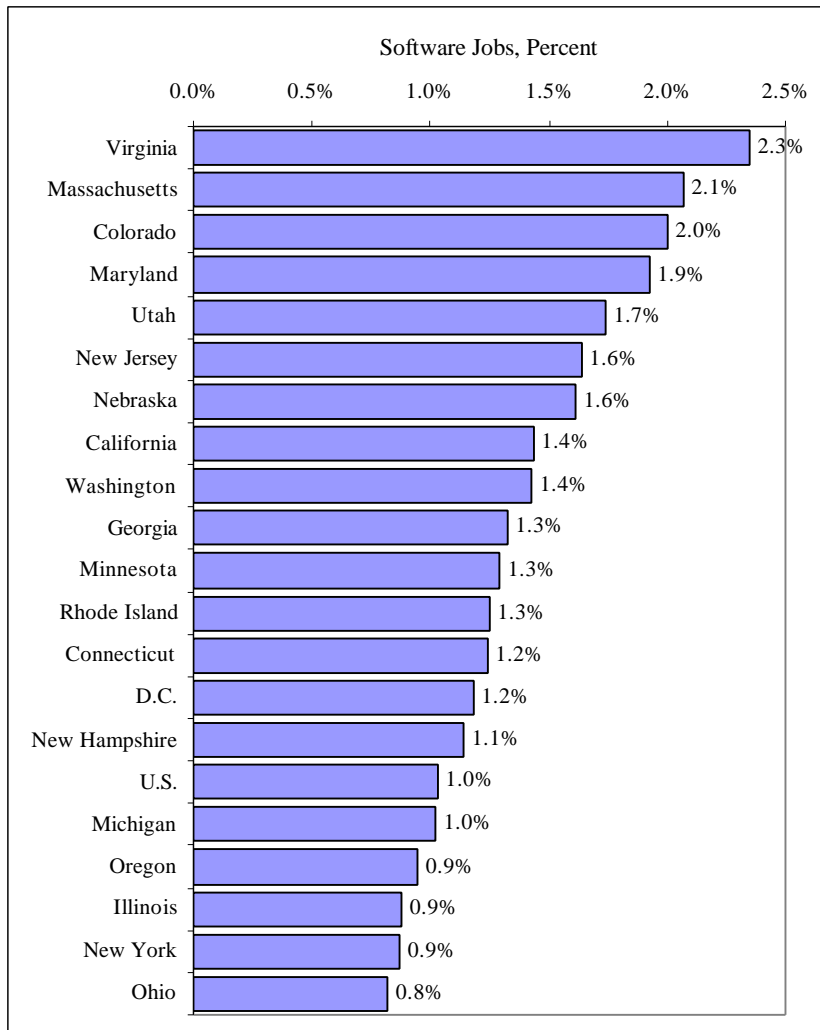
Dividing the number of computer-services jobs by the number of all jobs, NY State ranks 19th out of the 50 states plus the District of Columbia, with 0.9 percent, slightly below the national average of 1.0 percent. Virginia was highest, with 2.3 percent. Virginia is the home of America OnLine, Inc. (in Dulles), the largest Internet service provider, classified in SIC Code 7375 (informational retrieval services), with 8,500 employees nationwide. One of Virginia's large independent software firms is Best Software in Reston (\$47 million revenues). But Virginia also has many software firms and offices of firms headquartered elsewhere (like IBM, CSC, and EDS), that do government- or defense-related work and are located near the Pentagon and CIA in Alexandria, Crystal City, or McLean. Massachusetts ranks second, with 2.1 percent of all of its jobs in computer services; it is the home of The Learning Company in Cambridge (\$392 million revenues) and the INSO Corp. in Boston (\$82 million) and FTP Software in Andover (\$68 million). Colorado is third, home of Rogue Wave Software in Boulder (\$40 million). Maryland

¹⁵ An independent survey by CorpTech suggests that the national growth in software-related jobs in 1998 was 10 percent. The rolling-sample monthly survey of 7,674 firms in proprietary categories of software development, covers only firms with fewer than 1,000 employees; the change was measured from December 1997 to December 1998.

¹⁶ These numbers are for all computer-services jobs (all nine 4-digit SIC codes in the 737 category). If the same calculation is made for NYC for software jobs only (seven of the nine 4-digit SIC codes), the City grew by 21.5 percent between 1995 and 1996. See Table 4-5, middle column. One can properly infer from the difference between the two numbers that jobs in computer-hardware-related services were declining in NYC between 1995 and 1996.

ranks fourth, home of defense-related software firms. Utah is fifth at 1.7 percent; it is the home of Novell (\$885 million). New Jersey and Nebraska tie for sixth place, with 1.6 percent. California is eighth, home of Adobe in San Jose (\$912 million) and 23 other software firms with revenues of \$50 million or more. Washington ranks ninth, dominated by Microsoft (\$13.1 billion), but with two other firms with revenues above \$100 million (Wall Data Inc. in Kirkland and WRQ in Seattle). Georgia, Minnesota, and Rhode Island tie for tenth place, at 1.3 percent. Connecticut and the District of Columbia tie for 13th place, 1.2 percent. New Hampshire is 15th at 1.1 percent. Michigan, 16th, is at the U.S. average of 1.0 percent. Tied for 16th place are Oregon, Illinois, and NY State.¹⁷ (See Chart 3-3.)

Chart 3-3. *Computer-Services Jobs as a Share of Total Jobs, Top 20 States, 1996*



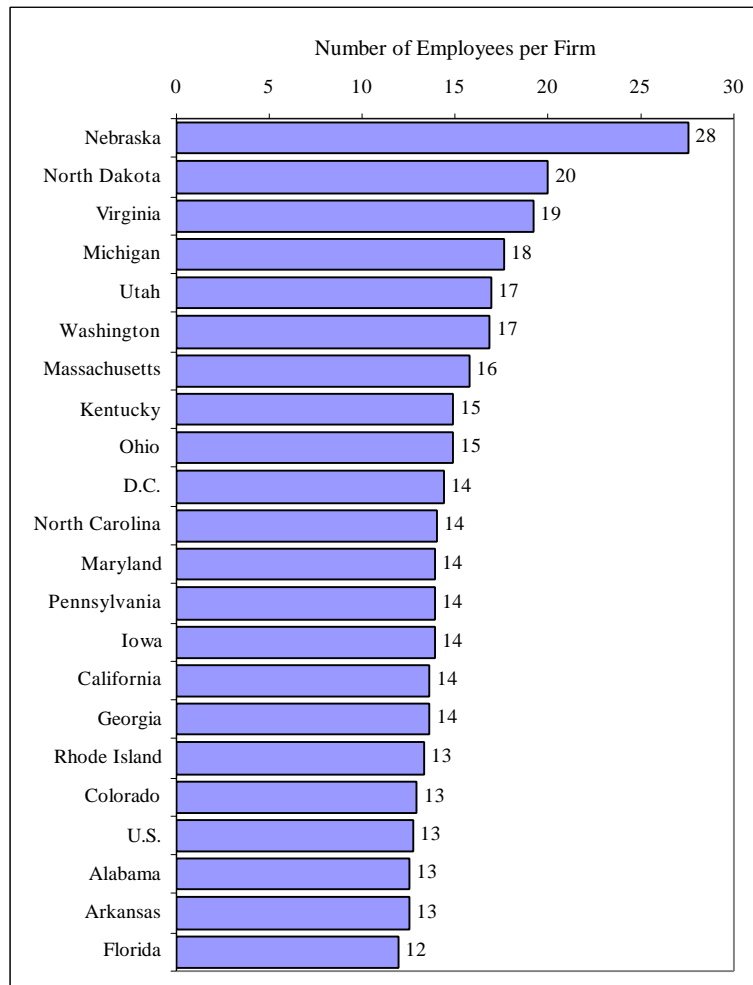
Source: U.S. Bureau of Labor Statistics. See note to Chart 3-1.

¹⁷ The companies cited for some states are “independent U.S. personal software firms” in 1997, as listed in “The 1997 Softletter 100,” available on the web at www.softletter.com. Cited in Citizens Budget Commission, “Media and Communications Industries in NYC,” December 8, 1998. However, this list is no way complete. America OnLine, for example, is not on the Softletter 100 list, but should be included in any computer software list because, as already noted, it is in code 7375; data on the company are from www.aol.com.

4. Jobs per Firm

Computer-related services are highly decentralized. The average size of the U.S. firm (or “establishment” in cases of separate locations within a firm) is 13 employees. Interestingly, the less dense parts of the United States appear to have denser concentrations of computer-services employees. In Nebraska and North Dakota the average size of firms is 28 and 20. NY State does not rank among the 20 states with the largest number of employees per firm. (See Chart 3-4.)

Chart 3-4. *No. of Employees per Firm, Top 20 States, 1996*



Source: U.S. Bureau of Labor Statistics. See note to Chart 3-1.

C. NY State Jobs Compared with the Nation

The data show that since 1992 computer-services jobs in NY State have grown about 1 percentage point more slowly than in the nation, a better record than in 1980-1992, when NY State grew nearly 3 percentage points more slowly. To put it another way, since 1980, NY

State's 3.2-fold increase in computer-services jobs was well behind the national 4.6-fold increase. But for the industry since 1992, the 1.6-fold increase in NY State is close to the national 1.7-fold increase. (See Table 3-2.)

Table 3-2. *Number and Growth of Computer Services Employees, NYS and U.S., 1980-1997*

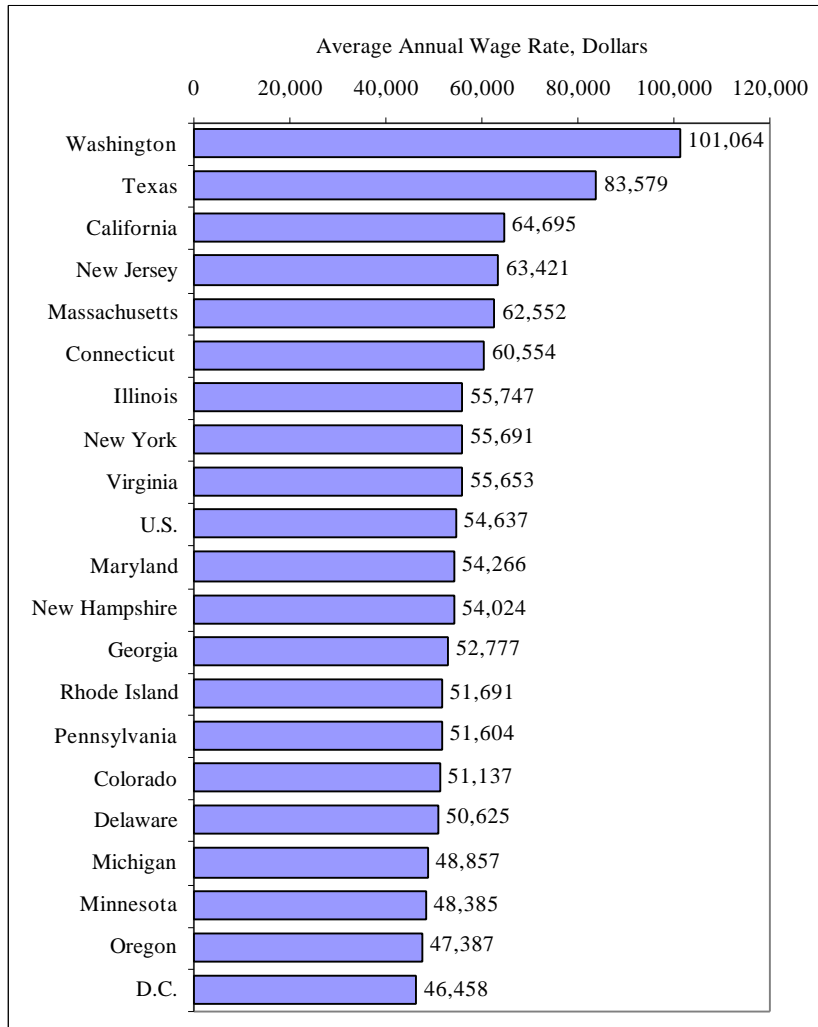
	NYS		U.S.	
	Number	Percent Change	Number	Percent Change
1980	23,975	-	304,300	-
1981	27,521	14.8%	336,600	10.6%
1982	29,562	7.4%	364,600	8.3%
1983	31,059	5.1%	415,600	14.0%
1984	34,001	9.5%	474,400	14.1%
1985	36,736	8.0%	541,500	14.1%
1986	41,890	14.0%	588,100	8.6%
1987	44,719	6.8%	628,600	6.9%
1988	46,105	3.1%	673,300	7.1%
1989	50,159	8.8%	736,300	9.4%
1990	50,461	0.6%	771,900	4.8%
1991	45,156	-10.5%	797,000	3.3%
1992	48,271	6.9%	835,500	4.8%
1993	51,046	5.7%	892,800	6.9%
1994	54,121	6.0%	958,600	7.4%
1995	59,797	10.5%	1,089,900	13.7%
1996	68,770	15.0%	1,227,700	12.6%
1997	76,812	11.7%	1,410,600	14.9%
Average 80-97	7.1%		9.4%	
Average 80-92	6.0%		8.8%	
Average 92-97	9.7%		11.0%	

Source: U.S. Department of Labor.

D. Average Wage by State

NY State's computer-services wage rate of \$55,691 per year ranked eighth out of the 50 states and the District of Columbia, well above the national average of \$54,637 per year. Washington State had the highest wages, \$101,064 per year, driven by Microsoft, followed by Texas, home of Texas Instruments, Dell, Compaq, and Micrografx, Inc. and California. (See Chart 3-5.)

Chart 3-5. Average Annual Wage Rates, Top 20 States and U.S. Average, \$, 1996



Source: U.S. Bureau of Labor Statistics. See note to Chart 3-1. This chart is not adjusted for cost of living because the variation within states (between cities and rural areas) is as large as variations among states.

NY State showed a 24.1 percent growth in computer-services wages, after Washington, up 46.5 percent, and California, up 26.5 percent. (See Table 3-3.)

Table 3-3. Wages, Computer-Services Jobs, Ranked by Percent Change, 1996 vs. 1995, \$ bil.

Rank	State	1996	1995	Percent Change
1	Washington	3.476	2.373	46.5
2	California	12.092	10.213	26.5
3	New York	3.829	3.086	24.1
4	Massachusetts	3.922	3.255	20.5
4	Texas	5.049	4.190	20.5
6	Virginia	4.098	3.461	18.4
7	New Jersey	3.790	3.375	12.3

Source: Bureau of Labor Statistics, unpublished data.

E. Average Real Wage, NY State and the Nation

The average NY State software industry wage was up in 1996 by 50 percent in real (inflation-adjusted) dollars over 1980. This is an average increase of 2.4 percent a year. However, the growth was uneven. In 1980-1992, real wage growth of computer-services employees in NY State was 2.2 percent, slower than the nation's 2.6 percent in the nation. But 1992-1997, real wage growth of these employees in NY State was 2.8 percent, ahead of the nation's 2.2 percent. (See Table 3-4.)

Table 3-4. *Average Computer-Service Wages, NY State and U.S., 1980-1996*

	NYS				U.S.			
	Nominal \$	Percent Change	Real (\$97)	Percent Change	Nominal \$	Percent Change	Real (\$97)	Percent Change
1980	18,954		39,503		13,552		26,397	
1981	20,881	10.2%	39,606	0.3%	15,320	13.0%	27,051	2.5%
1982	22,936	9.8%	41,131	3.8%	17,597	14.9%	29,267	8.2%
1983	24,610	7.3%	42,142	2.5%	20,168	14.6%	32,499	11.0%
1984	26,882	9.2%	43,836	4.0%	20,803	3.1%	32,135	-1.1%
1985	28,328	5.4%	44,537	1.6%	21,982	5.7%	32,789	2.0%
1986	31,513	11.2%	47,957	7.7%	23,102	5.1%	33,831	3.2%
1987	35,764	13.5%	51,797	8.0%	23,966	3.7%	33,860	0.1%
1988	38,126	6.6%	52,674	1.7%	25,966	8.3%	35,228	4.0%
1989	39,206	2.8%	51,304	-2.6%	28,039	8.0%	36,293	3.0%
1990	41,711	6.4%	51,469	0.3%	29,936	6.8%	36,761	1.3%
1991	42,713	2.4%	50,412	-2.1%	30,766	2.8%	36,255	-1.4%
1992	45,117	5.6%	51,403	2.0%	31,323	1.8%	35,832	-1.2%
1993	46,780	3.7%	51,745	0.7%	32,611	4.1%	36,222	1.1%
1994	49,051	4.9%	52,989	2.4%	33,750	3.5%	36,551	0.9%
1995	51,596	5.2%	54,364	2.6%	34,968	3.6%	36,826	0.8%
1996	55,686	7.9%	57,021	4.9%	36,817	5.3%	37,685	2.3%
1997	59,120	6.2%	59,120	3.7%	40,011	8.7%	40,011	6.2%
Ave. 80-97	6.9%		2.4%		6.6%		2.5%	
Ave. 80-92	7.5%		2.2%		7.2%		2.6%	
Ave. 92-97	5.6%		2.8%		5.0%		2.2%	

Source: NYS Department of Labor and U.S. Bureau of Labor Statistics.

F. Conclusions

NY State has the second largest number of software firms after California and employs the third greatest number of workers, 68,755 in 1996. NY State added jobs at a rate of 15 percent in 1996, slightly below Washington's growth rate of 16.3 percent. However, comparing the share of computer jobs to total jobs by State, serves to lower NYS's ranking to 19. The computer-services wage rate for NYS was \$55,691 in 1996, making it the eighth-highest-paying employer of computer-services personnel in the nation.

IV. SOFTWARE/IT INDUSTRY TRENDS IN NYC

This section analyzes the software industry in NYC, starting with the number and growth of software firms and jobs, then wages, and finally the software/IT industry compared with other NYC industries. The purpose of this analysis is to identify the fast-growing and declining subsectors within the industry in NYC. The number of software jobs and average wage rates are then compared with other industries in NYC.

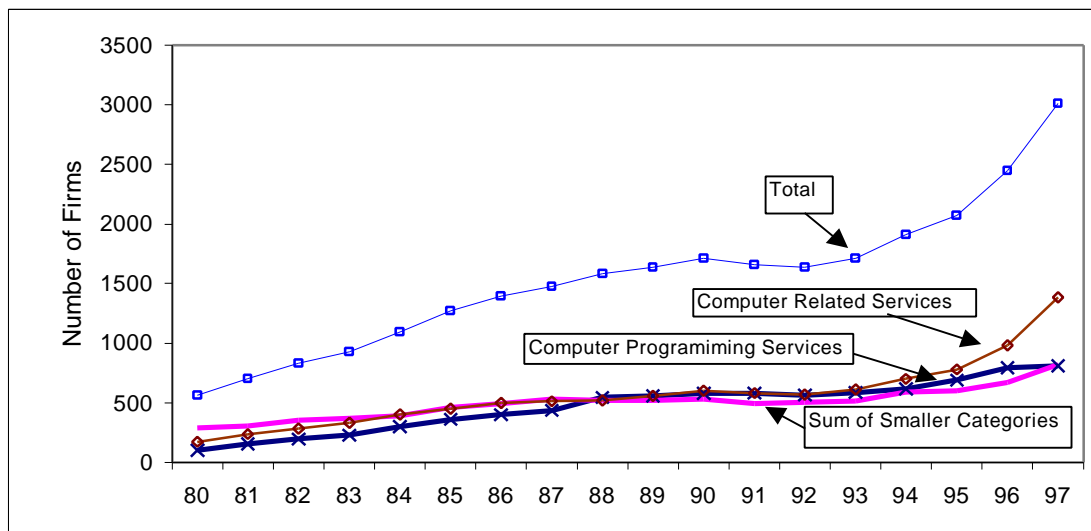
A. Trends in NYC, 1980-1997

By nearly all measures, the NYC software industry in 1980-1997 has shown an upward trend.

1. Number of Firms in NYC

The number of firms in NYC grew significantly in the 1980s, then declined slightly in 1991-1992, picking up again in 1993, and growing sharply in 1996-1997. The two largest categories of firms are “computer-related services” and “computer programming services,” which both exceed the sum of firms in all other categories. (See Chart 4-1.)

Chart 4-1. *No. of Firms, Software Industry, NYC, 1980-1997*



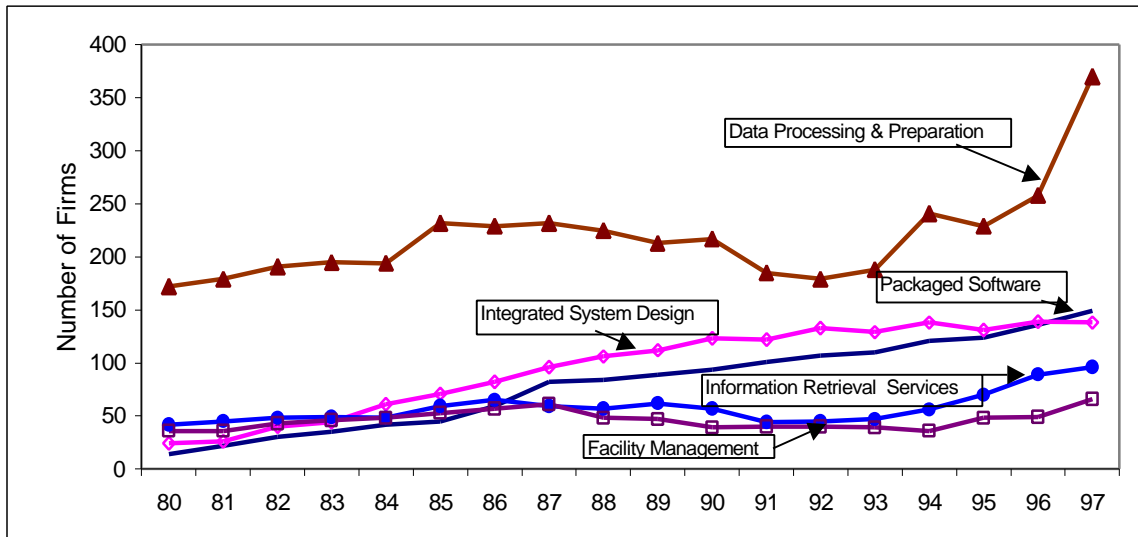
Source: NYS Department of Labor. This chart should be read in conjunction with Chart 4-2, which breaks up the firms that are aggregated in the category “sum of smaller firms” (meaning the sum of the firms in the categories with the smaller number of firms). The data are for the nine 4-digit categories in SIC code 737 less the two hardware-related categories of computer leasing and repair. Most of the entities that are summed in the chart are independent firms. But some are branches or other independent locations (“establishments”) of larger firms, which prepare their unemployment-insurance filings separately from their headquarters.

Computer programming is the basic software category, but as software languages evolve into higher levels of power, programmers become more related to content than they used to be. This may be why the subcategory of “computer-related services” has been growing so rapidly, an indication of changes in the industry toward content-oriented problem-solving, a “convergence”

of different categories of computer services. Firms that are closer to content may prefer to self-identify their area of activity as more general than any of the traditional SIC subcategories

The five smaller categories of software that are combined can be shown as their separate components: data processing and preparation (the largest category of this group and by far the fastest growing in recent years), packaged software, integrated system design, information-retrieval services, and facilities design. (See Chart 4-2.)

Chart 4-2. *No. of Firms, Software Industry, NYC, 1980-1997*



Source: NYS Department of Labor. These categories are aggregated in Chart 4-1. See notes to Chart 4-1.

Again, the rapid growth of “data processing and preparation” may reflect a move toward greater identification with content as increasingly content-friendly software is developed and applied. The decline in 1985-1992 was associated with the going out of favor of the computer service bureau, which used to help with word processing or accounting. As new software was development, the service-bureau functions were brought in-house. Now, observers of the industry suggest that the explosion of content and new software is creating a renewed demand for external assistance with data processing, this time with more of an emphasis on processing visual data (for example, transferring photos to video).

The total number of NYC firms in the software industry rose at an annual average of 10.7 percent from 1980 to 1997. However, the 1992-1997 annual average growth was much higher, 13.2 percent; this performance has been largely driven by the computer-related services subcategory, which grew by 20.1 percent annually. Data processing and preparation, which grew at an annual average of 0.6 percent in 1980-1992, expanded at an annual average rate of 16.9 percent in 1992-1997. Similarly, information-retrieval services, computer-facilities management, and computer-related services grew at a much faster rate in 1992-1997 compared with 1980-1992. On the other hand, the number of firms in computer programming services, prepackaged software, and computer integrated system design firms grew much less after 1992

than before 1992, perhaps (from discussions with those in the industry) reflecting the relative maturity of these subcategories. (See Table 4-1.)

Table 4-1. *Number of Software Firms, NYC, and Average Annual Change, 1980-1997*

	Number			Average Annual Change, Percent		
	1980	1992	1997	1980-1997	1980-1992	1992-1997
Computer Programming Services	101	564	810	13.0 %	15.4 %	7.5 %
Prepackaged Software	14	107	149	14.9 %	18.5 %	6.8 %
Computer Integrated System Design	24	133	138	10.8 %	15.3 %	0.7 %
Data Processing & Preparation	172	179	370	4.6 %	0.3 %	15.6 %
Information-Retrieval Services	42	45	96	5.0 %	0.6 %	16.4 %
Computer-Facilities Management	36	40	66	3.6 %	0.9 %	10.5 %
Computer-Related Services	174	566	1384	13.0 %	10.3 %	19.6 %
Total	563	1634	3013	10.4 %	9.3 %	13.0 %

Source: NYS Department of Labor. See notes to Chart 4-1.

To sum up, three subcategories show the large increases since 1992, and these happen to be the three subcategories that are most closely related to content:

- *Computer-related services firms*, SIC Code 7379, have been growing by 20 per cent a year since 1992. NYC has the fastest growth of firms and jobs in NY State in recent years. Suburban areas show the next fastest growth in firms, but upstate areas show the next fastest growth in jobs. Suburban wages have been the next highest after NYC since 1986.
- *Data processing and preparation firms*, SIC Code 7374, have been growing by nearly 17 percent a year since 1992. NYC has been close in number of firms to the NYC suburban areas, but broke away in 1997. The jobs in this category have been stagnant however, and upstate firms have more than twice as many of these jobs as either NYC does or the NYC suburban areas do. Wages have been flat upstate, declining in suburban NYC, and have been increasing only in NYC.
- *Information-retrieval services firms*; SIC Code 7375, have been growing by nearly 17 percent a year since 1992. The number of firms actually declined in 1997 in the NYC suburban areas, but jobs continued to grow sharply, suggesting that some firms are increasing their market share or their degree of centralization. NYC continues to lead in incomes, with an average wage in 1997 of more than \$60,000; suburban firms paid less than \$50,000.¹⁸

The growth of firms in the software industry is therefore in the direction that NYC has a comparative advantage, i.e., in content.

2. Classification of Newly Capitalized Internet Firms in NYC

Nearly two-dozen NYC-based Internet firms will have been capitalized since February 1998 (when DoubleClick went public) to June 1999. A listing of their classifications may help identify how they are (or in some cases are not) identified as software firms. (See Table 4-2.)

¹⁸ For details on all seven of the 4-digit SIC codes included in the definition of software firms, see Appendix A (all three NY State regions) and Appendix B (suburban NYC only).

Table 4-2. *NYC-Based Internet Cos. Capitalized 1998-1999, Ranked by 1998 Revenues*

Rank	Company	Year Est.	What It Does	Emp.	98 Rev. (\$mil.)	Largest Shareholder(s) and Underwriter(s)
1	DLJ direct	1988	On-line discount brokerage service	374	\$117.9	DLJ. DLJ.
2	DoubleClick	1996	On-line advertising network SIC #7319	482	\$80.2	Officers hold a large portion of shares: Kevin O'Connor, Kevin Ryan, et al. GS.
3	Barnesand noble.com	1997	On-line bookseller	654	\$61.8	Barnes & Noble; Bertelsmann; Leonard Riggio. ML.
4	Juno	1995	E-mail and internet service provider	147	\$21.7	D.E. Shaw & Co.; News Corp; Prospect Street Ventures. SSB.
5	Mapquest	1996	On-line map publisher	222	\$17.6	Trident Cap.; Weston Presidio Cap.; Highland Capital Partners. BB, RS.
6	iVillage.com	1995	On-line community aimed at women	200	\$15.0	America Online; NBC; Rho Mgmt. Trust. GS.
7	Razorfish	1995	Web site designer and programmer	380	\$13.8	Omnicom Group; Spray Ventures; Jeffrey A. Dachis. CSFB.
8	Multex	1993	Distributes brokerage firm research	149	\$13.2	Isaak Kareave; Chase Venture Cap.; Euclid Partners. BS.
9	Alloy Online	1996	On-line community for young adults	20	\$10.2	Brand Equity Ventures; Matthew Diamond; James K. Johnson Jr. BB, RS.
10	Stock Point	1997	Financial brokerage service	45	\$9.2	Steven Malin; Harry Simpson; A. G. Huston. Whale Securities.
11	Theglobe.com	1995	On-line personal services, SIC #7310	120	\$5.5	Directors: Michael Egan, Todd Krizelman, Stephan Paternot, et al. BS.
12	Star Media	1996	On-line service for Latin America	247	\$5.3	F. J. Espuelas; J. C. Chen; Chase Venture Cap. GS.
13	TheStreet.com	1996	subscription-based financial news service	122	\$4.6	James J. Cramer; Martin Peretz; NYTimes Co. GS.
14	Miningco.com	1996	Human guidance to the Internet, SIC #7373	113	\$3.7	Scott P. Kurnit; C-Max Capital; Open Text. BS.
15	EarthWeb	1994	On-line service to IT firms, SIC #7374	63	\$3.4	Warburg Pincus Ventures, L.P. JPM.
16	Fashionmall.com	1994	On-line shopping mall	16	\$2.1	Benjamin Narasin; Richard A. Eisner & Co.; FM/CCP Investment Prtners. Gruntal.
17	Wit Capital	1996	Investment bank and brokerage firm	99	\$2.0	Capital Z Fin.; Draper Fisher Jurvetson; A. D. Klein; GS to buy 22 percent. BS.
18	iTurf	1995	On-line community for teenage girls	25	\$1.9	Delia's Inc. BT Alex. Brown. BT Alex. Brown.
19	Media Metrix	1995	On-line provider of usage statistics	88	\$1.8	Tod Johnson; NPD Group; Greylock IX. DLJ.
20	Mail.com	1994	Free e-mail provider	96	\$1.4	Gerald Gorman; Lycos. SSB.

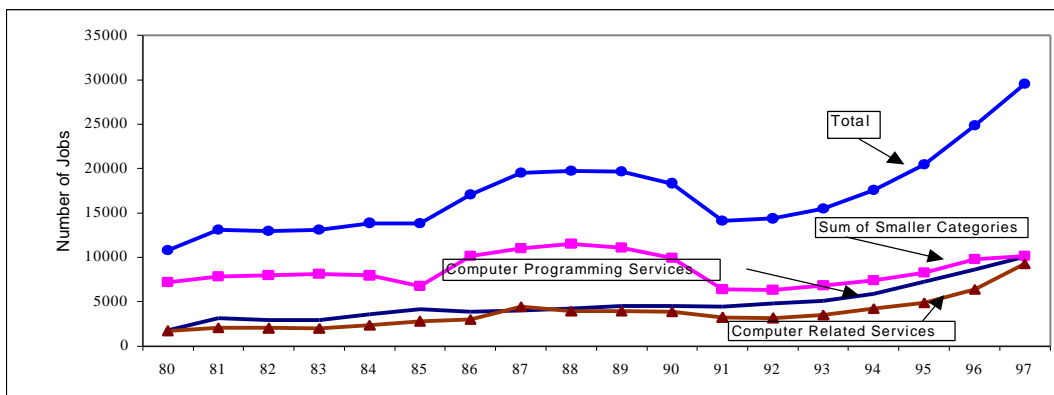
Source: "Growing Up in the Alley," *NYTimes*, March 29, 1999, p. C4; "Goldman Sachs to Take Stake in Wit Capital," *NYT*, March 30, 1999, pp. C1, C26, company data from Bloomberg L.P.; and company interviews. DoubleClick's and Theglobe.com's SIC codes are both in the #731 sector, i.e., advertising. BB=BancBoston; BS=Bear Stearns; CSFB=CS First Boston; DLJ=Donaldson Lufkin & Jenrette; GS=Goldmans Sachs; JPM=JPMorgan. RS=Robertson Stephens; SSB=Salomon Smith Barney. EarthWeb and Theglobe.com followed DoubleClick public in November 1998. The others have gone public in 1999 or are in registration.

Of the SIC codes that have been identified, all are in the 7300 two-digit sector. Two are in the software classifications of the 7370 series. The two that are one self-identified as in the software industry are DoubleClick and Theglobe.com, which identify themselves as being in the advertising industry.

3. Number of Jobs

As the number of firms rose in the 1992-1997 period, so did the number of employees. In fact, as one might expect, the changes in the number of employees closely follow changes in the number of firms. The number of employees, except for a late 1980s hump in the total for smaller categories, remained fairly flat until 1992, and then began to rise. (See Chart 4-3.)

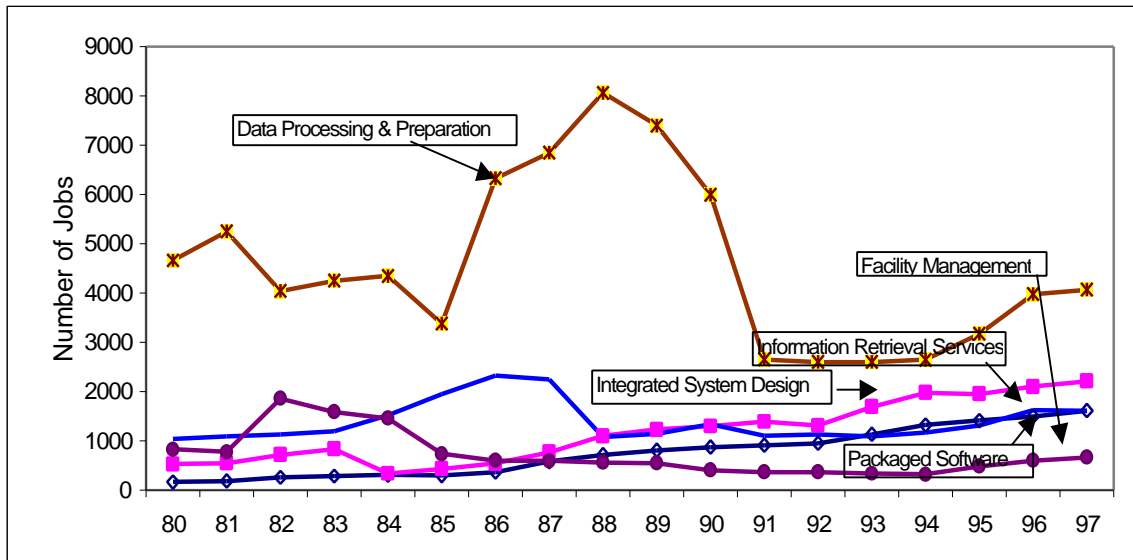
Chart 4-3. *No. of Jobs, Software Industry, NYC, 1980-1997*



Source: NYS Department of Labor. See notes to Chart 4-1.

The hump in the combined categories is explained entirely by the growth in 1985-1988 in data processing jobs. This is probably related to the intensified computerization of Wall Street that was occurring at the time along with the boom in stock prices through 1987. The collapse of stock prices in October 1987, followed in 1989 by the beginning of a national recession, contributed to a drastic loss of one out of ten jobs in NYC between 1989 and 1992. Many data-processing jobs moved out of NYC during the period as pressures for cost-cutting in a recession environment increased. (See Chart 4-4.)

Chart 4-4. *No. of Jobs, Software Industry, NYC, 1980-1997*



Source: NYS Department of Labor. See notes to Chart 4-1.

Total NYC software jobs grew from 1980 to 1997 at an average annual rate of 6.8 percent. But most of this growth, 15.6 percent, occurred in 1992-1997, compared with only 3.1 percent in 1980-1992. Jobs in most of the software-industry categories rose faster during 1992-1997. But two codes, prepackaged software and computer integrated system design, had higher growth rates before 1992. Computer-integrated-system-design firms grew only 0.9 percent in the 1992-1997 period, but jobs in that sector grew by 11.5 percent in the same period. (See Table 4-3.)

Table 4-3. *Number of Software Employees, NYC, and Average Annual Change, 1980-1997*

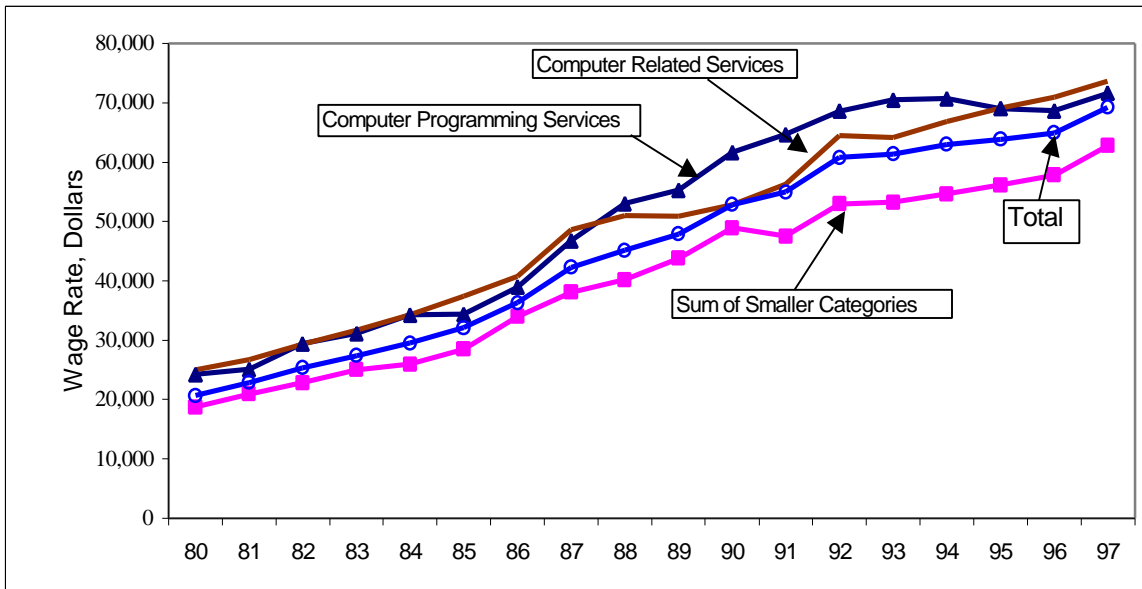
	Number			Average Annual Change, Percent		
	1980	1992	1997	1980-1997	1980-1992	1992-1997
Computer Programming Services	1,812	4,819	10,080	10.6 %	8.5 %	15.9 %
Prepackaged Software	159	951	1,616	14.6 %	16.1 %	11.2 %
Computer Integrated System Design	526	1,308	2,207	8.8 %	7.9 %	11.0 %
Data Processing & Preparation	4,656	2,600	4,062	-0.8 %	-4.7 %	9.3 %
Information-Retrieval Services	1,032	1,126	1,615	2.7 %	0.7 %	7.5 %
Computer-Facilities Management	827	368	664	-1.3 %	-6.5 %	12.5 %
Computer-Related Services	1,769	3,198	9,306	10.3 %	5.1 %	23.8 %
Total	10,781	14,370	29,550	6.1 %	2.4 %	15.5 %

Source: NYS Department of Labor. See notes to Chart 4-1.

4. Wage Rates

Average annual wage rates rose consistently for all three main software categories in 1980-1997. As of 1997, computer-related firms paid their employees an average of \$73,705, slightly more than computer-programming firms did (paying an average of \$71,638). But during the first half of the 1990s the computer-programming firms paid the most, in a period when their employment growth was higher than that of computer-programming firms. (See Chart 4-5.)

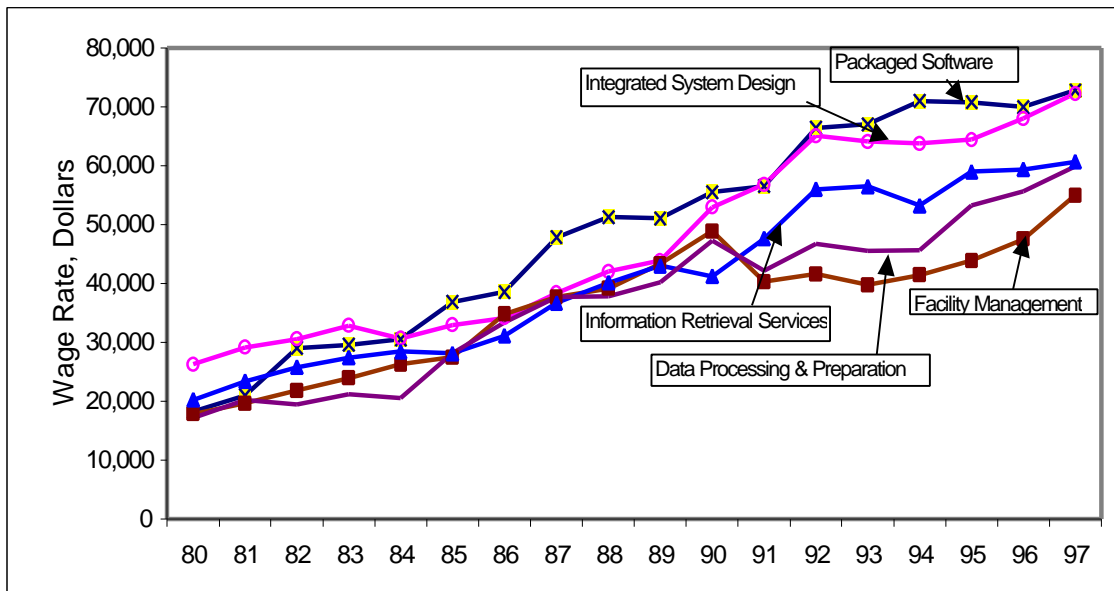
Chart 4-5. Average Annual Wage Rate, Software Industry, NYC, 1980-1997



Source: NYS Department of Labor. See notes to Chart 4-1.

The wage-growth trend holds up for the smaller software categories, with the highest average wages in 1997 for packaged-software firms, \$72,821, and integrated-system-design firms, \$72,260. The lowest average wages were for facilities-management firms, \$59,919. (See Chart 4-6.)

Chart 4-6. Average Annual Wage Rate, Software Industry, NYC, 1980-1997



Source: NYS Department of Labor. See notes to Chart 4-1.

Wage rates continued to rise in 1980-1997 at a steady pace, regardless of the change in firms or number of employees. Total wages rose at an average of 7.4 percent between 1980 to 1997. However, the increase was much more rapid between 1980 and 1992 than from 1992 to 1997. (See Table 4-4.)

Table 4-4. *Average Software Wages, NYC, and Average Annual Change, 1980-1997*

	Wages, \$			Average Annual Change, Percent		
	1980	1992	1997	1980-1997	1980-1992	1992-1997
Computer Programming Services	24,220	68,644	71,638	6.6 %	9.1 %	0.9 %
Prepackaged Software	18,230	66,453	72,821	8.5 %	11.4 %	1.8 %
Computer Integrated System Design	26,279	65,079	72,260	6.1 %	7.8 %	2.1 %
Data Processing & Preparation	17,837	41,585	54,972	6.8 %	7.3 %	5.7 %
Information-Retrieval Services	20,241	55,996	60,676	6.7 %	8.8 %	1.6 %
Computer-Facilities Management	17,199	46,727	59,919	7.6 %	8.7 %	5.1 %
Computer-Related Services	24,965	64,473	73,705	6.6 %	8.2 %	2.7 %
Total	20,678	60,798	69,247	7.4 %	9.4 %	2.6 %

Source: NYS Department of Labor. See notes to Chart 4-1.

After adjusting the growth rates for inflation, NYC software employees had zero growth in salaries from 1992 to 1997, despite the rapid growth in the number of jobs. (See Table 4-5.)

Table 4-5. *Change in Real Average Wage, NYC, Seven Software Categories, Percent*

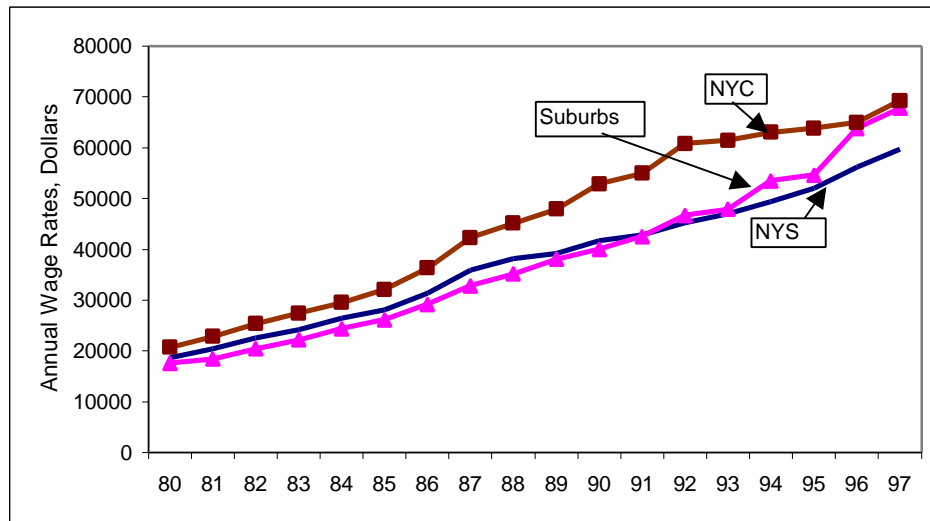
	Real Wage Rates, Average Annual Change, Percent		
	1980-1997	1980-1992	1992-1997
1. Computer Programming Services	2.2 %	3.9 %	-1.7 %
2. Prepackaged Software	4.1 %	6.2 %	-0.8 %
3. Computer Integrated System Design	1.7 %	2.6 %	-0.5 %
4. Data Processing & Preparation	2.4 %	2.1 %	3.1 %
5. Information-Retrieval Services	2.3 %	3.6 %	-1.0 %
6. Computer Facilities Management	3.2 %	3.5 %	2.5 %
7. Computer Related Services	2.2 %	3.0 %	0.1 %
Total	3.0 %	4.2 %	0.0 %

Source: Derived from Table 4-3. Inflation-adjusted growth rates computed by the NYC Comptroller's Office.

Two explanations were suggested earlier to explain the low growth rates of real wages. One was a lowering of staff skills as the number of employees has increased. The other was the psychological effect of the growth in value of Internet stocks, with many employees in the industry being compensated not just with wages, but also with stock options and wealth expectations.

Software salaries have been growing steadily since 1980 and grew in NYC more sharply than in suburban NYC or NY State through 1991. Then wage increases flattened out in NYC but grew rapidly in suburban NYC. (See Chart 4-7.)

Chart 4-7. Average Software-Firm Wages, NYC, NYC Suburbs, and NY State, 1980-1997



Source: See Table 3-1.

Possible reasons for the low growth in real NYC salaries, despite the high demand for software workers, have already been suggested. However, the comparable numbers for NYC’s suburban areas do not show the same line being held on higher wages, even though growth in these suburban locations was not as rapid as in NYC. Theories could be offered to explain this, but in the absence of additional data they would be speculative. (See Table 4-6.)

Table 4-6. Average Annual Changes in Wage Rates for Different Software Businesses, NYC Suburbs, 1980-1997

	Average Annual Change in Wage Rates		
	1980-1997	1980-1992	1992-1997
Computer Programming Services	2.9%	3.4%	1.5%
Prepackaged Software	8.3%	6.1%	13.4%
Computer Integrated System Design	2.5%	1.8%	4.2%
Data Processing & Preparation	2.9%	1.9%	5.4%
Information Retrieval Services	3.0%	6.1%	-4.4%
Computer Facilities Management	3.4%	3.3%	3.8%
Computer Related Services	0.6%	0.6%	0.7%
Total	3.9%	3.3%	5.3%

Source: NYS Department of Labor.

B. Comparison of Industries within NYC

The software industry has expanded in NYC not only in absolute terms, but also in relative terms. As of 1997, one percent of private-sector jobs, or 29,550 jobs, were in the software industry compared with 0.4 percent (10,781 jobs) in 1980. Within the service sector, 2.3 percent of jobs were in the software industry as of 1997, compared with 1.2 percent in 1980. (See Table 4-7.)

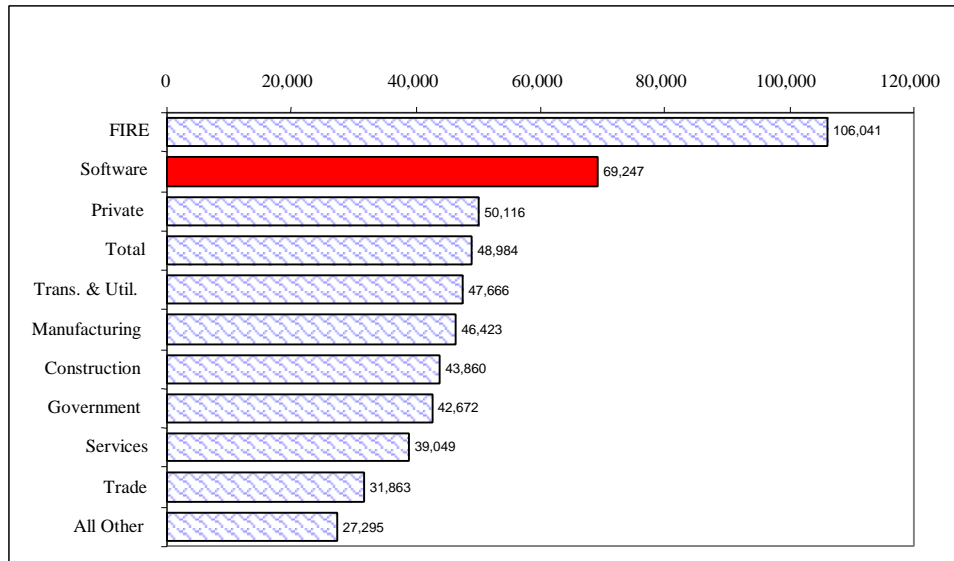
Table 4-7. *Software Jobs as Share of All Private and Service Jobs, NYC, Percent, 1997*

Year	Private Jobs	Service Jobs	Software Jobs	Share of Private, %	Share of Services, %
1980	2,785,000	893,100	10,781	0.4%	1.2%
1981	2,842,700	933,200	13,082	0.5%	1.4%
1982	2,827,900	949,600	12,964	0.5%	1.4%
1983	2,833,900	973,200	13,117	0.5%	1.3%
1984	2,898,200	1,006,600	13,852	0.5%	1.4%
1985	2,931,400	1,038,500	13,820	0.5%	1.3%
1986	2,967,100	1,078,700	17,059	0.6%	1.6%
1987	3,009,600	1,108,400	19,531	0.6%	1.8%
1988	3,010,000	1,123,100	19,743	0.7%	1.8%
1989	3,006,700	1,147,200	19,637	0.7%	1.7%
1990	2,954,900	1,149,000	18,332	0.6%	1.6%
1991	2,782,100	1,096,900	14,107	0.5%	1.3%
1992	2,697,200	1,093,100	14,370	0.5%	1.3%
1993	2,703,800	1,115,800	15,473	0.6%	1.4%
1994	2,744,000	1,148,000	17,599	0.6%	1.5%
1995	2,779,300	1,183,600	20,466	0.7%	1.7%
1996	2,823,200	1,226,700	24,859	0.9%	2.0%
1997	2,886,300	1,270,700	29,550	1.0%	2.3%
Ave. 80-97	0.2%	2.1%	6.1%		
80-92	-0.3%	1.7%	2.4%		
92-97	1.4%	3.1%	15.5%		

Source: NYS Department of Labor.

As the relative importance of the software industry expands, the average wage paid to workers in the industry also increases. Average wage rates in the software industry are higher than every sector except finance, insurance, and real estate (FIRE). (See Chart 4-8.)

Chart 4-8. *Wage Rates in Different Sectors, NYC, \$, 1997, Ranked*



Source: NYS Department of Labor.

C. Conclusions

Despite a small drop in growth during NYC's recession in the early 1990s, the City has seen an upward growth in the number of City-based software firms and employees. The strongest growth has been in the category of "data processing and preparation," a particularly important category of business services. Other strong growth categories were "computer-related service firms" and "information-retrieval service firms." All categories of firms saw a rise in wages between 1980 and 1997, although there was zero real wage growth between 1992 and 1997.

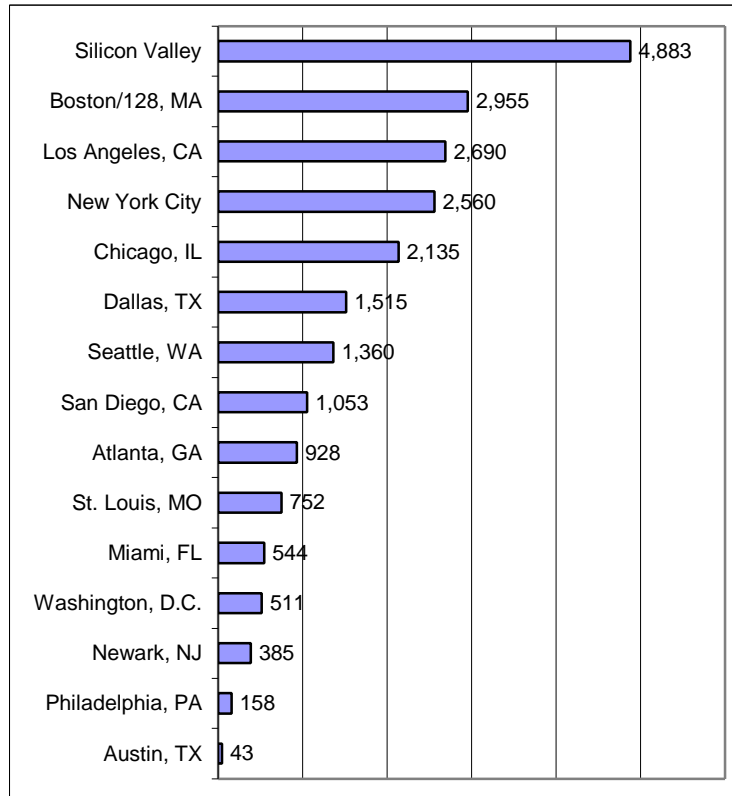
V. NYC COMPARED WITH OTHER CITIES

As in the case of the states, the broad computer services category (SIC 737, which includes the two computer-related services categories of leasing and repair) is the only one for which comparative data are available. This section compares NYC with 14 other cities active in software development, counting Silicon Valley and Boston/Route 128 each as one city.

A. Number of Firms

NYC ranks fourth in number of firms, after Silicon Valley (broadly defined as five counties; see note to Chart 5-1), Boston/Route 128, and Los Angeles. Silicon Valley has the largest number of firms by far, but it is also much larger in area than NYC and the other cities. (See Chart 5-1.)

Chart 5-1. *Number of Computer-Services Firms, NYC and 14 Other Cities, County Data, * 1996*



*The data are for counties as follows: Silicon Valley=Alameda, San Francisco, San Mateo, Santa Clara (Silicon Valley's central county, Greater Palo Alto), and Santa Cruz Counties. Boston/128=Essex, Middlesex, Norfolk, and Suffolk (Boston) Counties. Los Angeles=LA County. NYC=the five counties/boroughs. Chicago=Cook County. Seattle=King County. Atlanta=Fulton County. Miami=Dade County. Newark=Essex County. Austin=Travis and Williamson Counties. The definitions of Silicon Valley and Boston/Route 128 correspond to those used by AnnaLee Saxenian, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128* (Cambridge, MA: Harvard University Press, 1994), p. 2. If Northern Virginia were added to Washington, DC, the area would rank among the top five (See Chart 3-1).

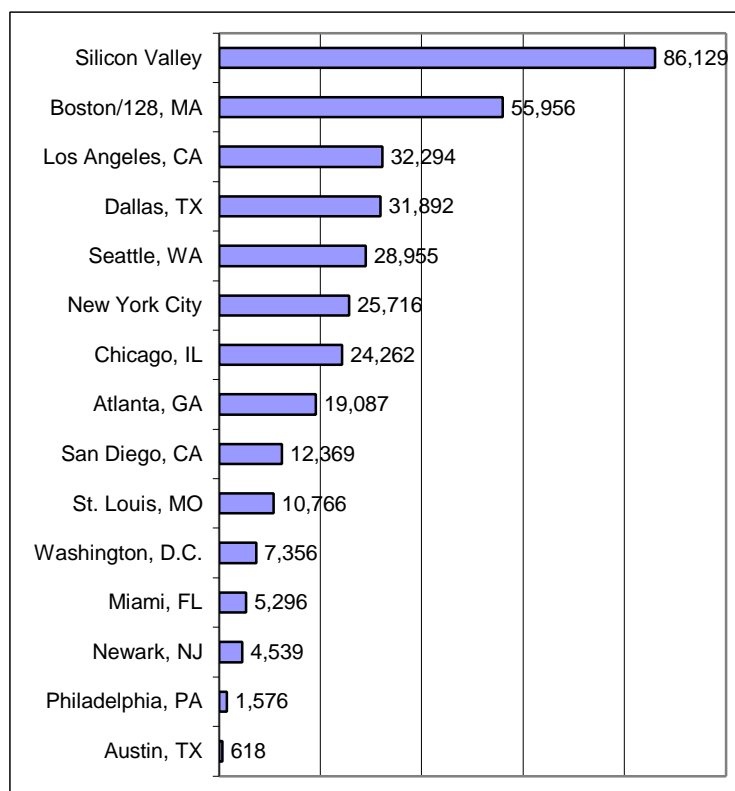
Source: Bureau of Labor Statistics, unpublished county data. While most reporting entities are independent firms, the number also includes multiple locations (branches, production facilities) within a firm that file their unemployment insurance forms separately.

Boston/Route 128 (also broadly defined to include 4 counties) is slightly ahead of Los Angeles. NYC has nearly as many computer-services firms as Los Angeles County, which has substantially more residents, about 8.9 million (compared with NYC's 7.4 million). The next four cities are Chicago, Dallas, Seattle, and Houston.

B. Number of Employees

The ranking of number of employees follows the general ranking of the number of firms, except that NYC and Chicago both drop down two places. Silicon Valley leads with about 86,000, followed by Boston/Route 128 at 56,000, and Los Angeles and Dallas at 32,000. Seattle and NYC are fifth and sixth. (See Chart 5-2.)

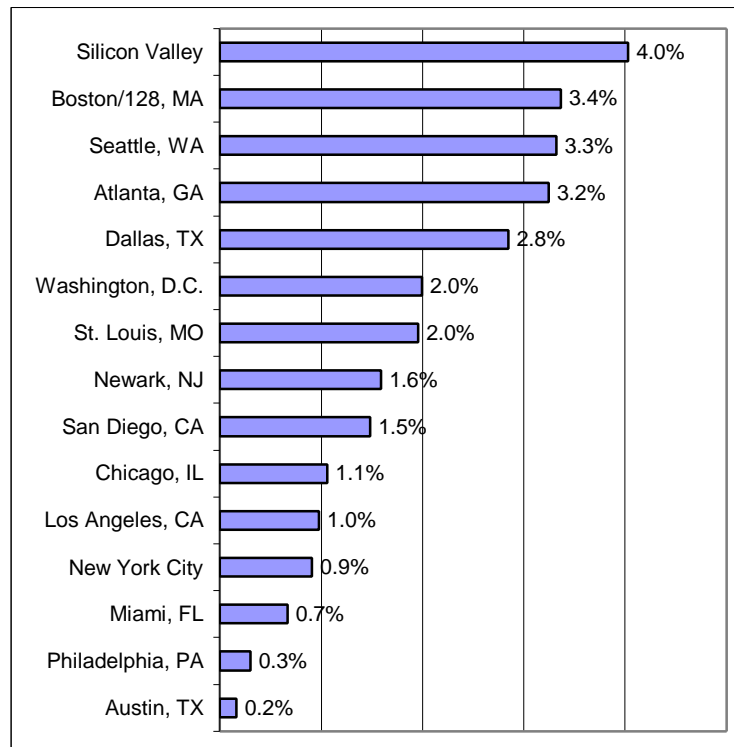
Chart 5-2. *No. of Computer-Services Jobs, NYC vs. 14 Other Cities/Areas, by County, 1996*



Source: Bureau of Labor Statistics, unpublished county data. See note to Chart 5-1 for identification of multi-county areas. If Northern Virginia were added to Washington, DC, the area would rank among the top four. See Chart 3-2.

The ratio of computer-services jobs to all private-sector employees in NYC is the same as the number reported for NY State, 0.9 percent or 9 per thousand, and is the fourth lowest of the 15 cities, ahead only of Miami, Philadelphia, and Austin at 2 per thousand. This compares with 40 per thousand in Silicon Valley, 34 per thousand in Boston/Route 128, 33 per thousand in Seattle, and 32 per thousand in Atlanta. (See Chart 5-3.)

Chart 5-3. *Computer-Services/All Private Jobs, NYC and 14 Other Cities, County Data, 1996*

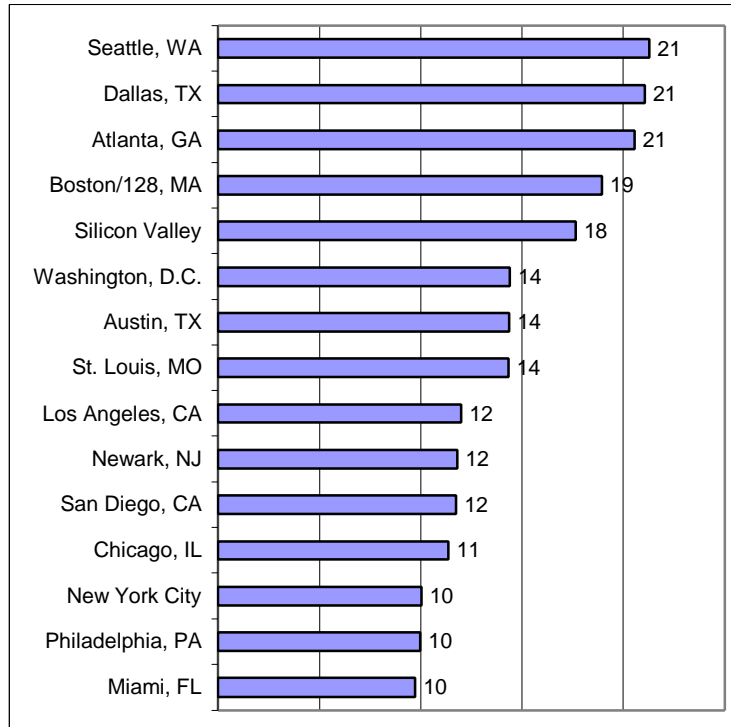


Source: Bureau of Labor Statistics, unpublished county data. See note to Chart 5-1.

C. Number of Employees per Firm

Seattle has the highest number of employees per firm, 21, tied with Dallas and Atlanta. A city with a high number of employees per firm in an industry is more likely to be dominated by a few giant companies in the industry (in the case of Seattle, by Microsoft). Another possible interpretation is that these cities are in a relatively settled phase of their life cycle of innovation than the other cities. NYC with only 10 employees per firm is well below the mean and ranks third lowest with Philadelphia and Miami. San Francisco by itself ranks lowest, with 9 employees per firm, which possibly suggests that it continues to be in an active start-up phase. With several software companies going through capitalizations in March 1999, NYC may be entering a different phase of its software-industry growth cycle and the average number of employees per firm may increase from internal firm growth or from mergers. (See Chart 5-4.)

Chart 5-4. *Computer-Services Employees per Firm, NYC and 14 Other Cities, Co. Data, 1996*



Source: Bureau of Labor Statistics, unpublished county data. See note to Chart 5-1.

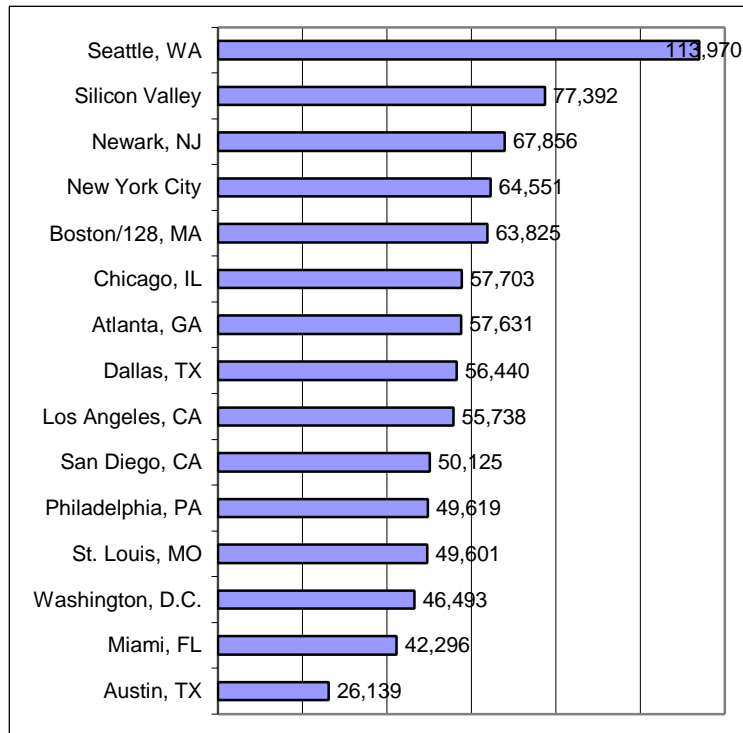
D. Wages per Employee, 1996

Wages are compared both in nominal terms and as adjusted by the cost of living in each city.

1. Nominal Wages

The Seattle area had by far the highest average 1996 wage for software employees, of the 15 cities compared, \$114,000. Silicon Valley ranked second with about \$77,000, and Newark (Essex County) ranked third with \$68,000. NYC was fourth with \$65,000. At the other end of the scale, Austin ranked last at \$26,139. (See Chart 5-5.)

Chart 5-5. Wages per Computer-Services Employee, NYC and 14 Other Cities, Co. Data, 1996



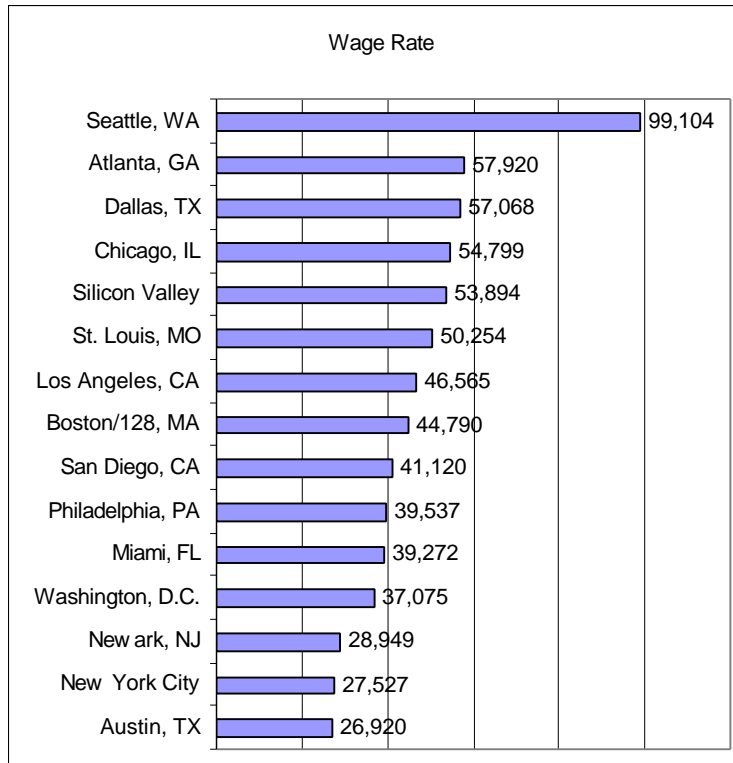
Source: Bureau of Labor Statistics, unpublished county data for establishments based on unemployment insurance filings. See note to Chart 5-1.

2. Wages Adjusted for the Cost of Living

When adjusted by the ACCRA cost-of-living data, NYC software wages drop from fourth highest of 15 cities/areas to second lowest, just ahead of Austin, TX. On the other hand, the ACCRA data are based on average prices of available private-sector housing in Manhattan and therefore overstate actual average costs of housing in NYC.¹⁹ (See Chart 5-6.)

¹⁹ ACCRA, the American Chamber of Commerce Research Association, is based in Louisville, KY. The cost of living data are collected item by item by cooperating chambers of commerce in each city. Organizations that provide data to companies on relative living costs for their employees do not show such a large disparity between costs in NYC and other cities, but their data are proprietary.

Chart 5-6. *Wages per Computer-Services Employee, NYC and 14 Other Cities, Co. Data, Adjusted for Cost of Living, 1996*



Source: See Chart 5-5. The data were adjusted based on the ACCRA cost of living data, *Statistical Abstract of the United States, 1997*. ACCRA=American Chambers of Commerce Research Association.

E. Conclusions

NYC ranks fourth in its number of computer-services firms compared with other U.S. cities, but sixth in the number of employees. NYC is home primarily to smaller start-up firms and thus has a low ratio of 10 employees per firm, considerably lower than Seattle, Dallas, and Atlanta, which have an average of 21 employees. Its average 1996 salary for software/IT workers was fourth-highest of 15 major cities/areas, but when adjusted for cost of living the NYC salary ranked second lowest.

VI. NYC'S STRENGTHS AND WEAKNESSES

A strategic plan generally starts with an assessment of the existing environment and the strengths and weaknesses of the entity doing the planning. For the City to help software companies grow, the first step is to understand why they come here or start up here, and why they leave or avoid the City.

Fortunately, several such assessments have been conducted in recent years. The needs of software companies have been assessed from a variety of perspectives. Assessments have been made by KPMG LLP (then KPMG Peat Marwick), with the NY Software Industry Association (NYSIA) in 1994 and by Coopers & Lybrand LLP (now PricewaterhouseCoopers), with the NY New Media Association (NYNYMA), in 1996 and 1997.

A significant difference between the two surveys is that the partner associations have different constituencies. NYNMA includes people on the creative (artistic, not necessarily technical) side of the New Media, whereas NYSIA is strictly for the technically competent software writers.

A. NYC's Strengths: Creative Talent, Customers, Capital

The main ways in which NYC serves as a magnet were identified in 1994 by the KPMG-NYSIA report. NYC's strengths were all related to the size of NYC's business, financial, and labor markets. The strengths were (1) customer proximity, (2) capital accessibility in Wall Street firms, and (3) availability of qualified technical personnel.²⁰

The 1996 Coopers-NYNMA survey was commissioned to Response Analysis Corp., which surveyed 8,000 companies involved with the New Media to rate the New York area on its strengths and weaknesses, and their relative importance to the companies. The survey concluded that NYC ranks highly in many categories that are vital for nurturing industries in their infancy, such as access to creative talent, customers, and capital. Interestingly, while the weighted rating put the same three strengths at the top of the list as the 1994 KPMG-NYSIA survey, the order was different.²¹ Access to creative talent was at the top of the Coopers-NYNMA list and access to capital was at the bottom. (See Table 6-1.)

²⁰ KPMG Peat Marwick, *Software Industry Survey: 1994 Metropolitan New York Region* (Montvale, NJ: KPMG Peat Marwick, 1994).

²¹ The Coopers-NYNMA survey has a category "Access to key partners," which can be interpreted as either financial partners or creative/technical partners, in which case the results fold into the other categories.

Table 6-1. NYC's Strengths for New Media Companies, 1996, Ranked by Weighted Rating

Rank	Competitiveness Factor	A. Rating	B. Importance	C. Weighted Rating
1	Creative Talent	+31	4.6	143
2	Key Partners	+16	3.0	48
3	Customers	+5	4.1	21
4	Capital Sources	+12	1.2	14
5	Credibility and Image	+7	1.5	11
6	Educational Resources	+6	0.8	5

Notes: A=Original survey figures, out of 100, less their midpoint of 45. B=Original measure of the importance of each factor in the original survey, out of 100, divided by 10. C=A x B.

Source: Data from Response Analysis Corp. survey (Dec. 1995 to Feb. 1996), summarized in Coopers-NYNMA report. Adjusted and weighted ratings by the NYC Comptroller's Office.

The Coopers-NYNMA report was updated in 1997, with results similar to 1996. Of the competitiveness issues that were rated as primary, the Coopers surveys agreed with the KPMG-NYSIA survey that the NYC area is most competitive in: (1) Creative talent, (2) Content ownership and other assets of strategic partners, (3) Customer access, and (4) "Credibility" or "image."

The Coopers-NYNMA report gave a different picture from the KPMG-NYSIA report in reporting on access to Wall Street. While it is a competitive strength for NYC, Wall Street access was not considered very important in either the 1996 or the 1997 survey, presumably because venture capital firms are well established in Silicon Valley, which is the major city competing with New Media firms. While Wall Street has a competitive advantage in larger equity issues, the smaller capital needs of start-up companies are better taken care of by the venture capital firms, and there are few such firms in NYC.

B. NYC's Weaknesses: High Taxes, Shortage of Technical Skills

Since this report is about how to improve conditions in NYC for software companies, the City's weaknesses (the ways in which it repels rather than attracts) are of even more interest than its strengths. The main weaknesses found by KPMG in 1994 were generalized ones, namely the high cost of living (cited by 86 percent of respondents), high taxes, and the high cost of space. The high cost of living is indicated by the last chart in the previous section, which shows that while NYC software salaries are fourth highest of 15 cities/areas, they drop to second lowest when adjusted for cost of living.

The two Coopers reports found that while creative (editorial/artistic) talent in NYC is considered tops, the software programming talent is not. At the most advanced levels, academic institutions in NYC and the region do not produce as many computer-related graduate degrees (notably Ph.D.s in computer science) as, for example, Stanford and MIT. The Coopers reports found NYC barely competitive in two areas that are considered important for software companies: (1) Access to software talent, and (2) Availability of technology infrastructure.

The Coopers-NYNMA reports considered NYC noncompetitive primarily in three areas: (1) Cost of facilities, (2) Other costs; and (3) Overall quality of life.²² NYC also has other weaknesses, including in its technology infrastructure and tax policies, and in its supply of a qualified workforce. (See Table 6-2.)

Table 6-2. NYC's Weaknesses for New Media Companies, 1996, Ranked by Weighted Rating

Rank	Competitiveness Factor	A. Rating	B. Importance	C. Weighted Rating
1	Overall Cost of Business	-27	2.8	-76
2	Local Tax Policies	-32	1.4	-45
3	Quality of Life	-22	1.7	-37
4	Access to Programmers	-5	3.7	-19
5	Technology Infrastructure	-3	2.6	-8

Notes: A=Original survey figures, out of 100, less their midpoint of 45. B=Original measure of the importance of each factor in the original survey, out of 100, divided by 10. C=A x B.

Source: Data from Response Analysis Corp. survey (Dec. 1995 to Feb. 1996), summarized in Coopers-NYNMA report. Adjusted and weighted ratings by the NYC Comptroller's Office

²² Coopers & Lybrand, *Opportunities & Challenges of New York's Emerging Cyber-Industry* (NYC: C & L, 1996 and 1997), p. 11.

High taxes dropped down in importance between the 1994 KPMG-NYSIA survey and the 1996 and 1997 Coopers-NYNMA surveys. In that period, the City was recovering. Some of the jobs that were lost in NYC's 1989-1993 recession (during which taxes were increased) were regenerated, City revenues were rising again, and the City was cutting several taxes.

C. Conclusions: A Strategic Assessment

The answers to the Coopers-NYNMA survey can be grouped by general factors. This shows that NYC's major negative is its high cost of doing business. That means the cumulative effect of high cost of space, high cost of personnel, shortcomings in the quality of life, and hidden costs of doing business stemming from an inadequate technology infrastructure. (See Table 6-3.)

Table 6-3. *Strategic Assessment of NYC's Strengths and Weaknesses for New Media Companies*

General Factors	Specific Factors	Weighted Ranking	Comments
1. GREATEST PROBLEM: COSTS OF DOING BUSINESS	Cost of Doing Business	-76	Four out of five of the City's negatives are in this area, i.e., the high cost of doing business, or living, in NYC.
	Local Tax Policies	-45	
	Quality of Life	-37	
	Technology Infrastructure	-8	
2. GREATEST ASSET: EDUCATION/TALENT AVAILABILITY	Creative Talent	+143	The City's creative talent is the best, but its software staff is not.
	Educational Resources	+5	
	Programmers	-19	
3. SECONDARY ASSET: CAPITAL ACCESS	Capital Sources	+14	Capital access is not important enough by itself for a firm to be in NYC.
	Credibility and Image	+11	
4. SECONDARY ASSET: POTENTIAL PARTNERS	Key Partners	+48	Firms are drawn to NYC by the existence of other firms.
	Customers	+21	

Source: Derived by the NYC Comptroller's Office from the data in Tables 6-1 and 6-2.

From the survey (which is broadly confirmed by similar surveys conducted by other organizations), NYC's greatest drawback as a place to do business for New Media companies is its high cost relative to other locations (weighted negative of 76). Its greatest asset is its breadth and depth of creative talent (weighted positive of 143), although its educational resources are not rated highly and the skills of its programmers at the time of the survey were also not rated highly. Its next-most-important asset (a positive of 48) is its potential for finding business partners, whether as co-producers or as clients.

The results imply that a priority for the City must be to reduce its costs and improve its educational resources, especially in the programming area.

The remainder of this report is devoted to a detailed review of each of the four general factors, with view to moving from the general recommendations in the previous paragraph to specific recommendations that target remedies for the City's problem areas.

VII. NYC'S HIGH COST OF DOING BUSINESS

The major three “cost of business” negatives for the City relate to (1) generalized cost of business and tax considerations, (2) overall quality-of-life considerations, and (3) the cost of and availability of its technology infrastructure, especially the communications infrastructure (telephone and fiber-optic).

A. Cost of Business and Taxes

Some of the costs of doing business in NYC are related to the fact that the City is densely populated. The prime residential and business locations will always be costly.

Other costs relate to the existence of monopolies in the City. The City and State must continue to do everything possible to deregulate monopolistic industries and to work for rate reductions and increased competition in the provision of services to NYC businesses and the public.

Still other costs are related to NY State's history of activist government. NY State is the second-highest taxed state, after Alaska. When local taxes are averaged in, NY State is number 1 in taxes.²³ Business Week rated NYC 124th and Jersey City 125th out of 125 cities where business could “earn and save” money, i.e., where “life is cheap.” Top of the list were Ann Arbor, Mich., Fort Wayne, IN, and the New Haven area, CT.²⁴

There are limits to tax reduction in a state that has accumulated so much debt. But as the economic boom, and its related government surpluses, continues, tax cuts continue to be considered.

One way for the software/IT industry to promote tax reduction is for a working group involving the industry to identify tax burdens that most impede its development. The group could propose a reduction in the Unincorporated Business Tax (UBT), phasing out the second (remaining) personal income tax surcharge, or ending the remaining commercial rent tax.

The NY New Media Association in March 1999 led its list of policy initiatives with taxes it would like to see reduced or eliminated:

- a higher threshold for the UBT,
- extension of the Emerging Technologies Credit to individuals, partnerships and LLPs, and
- providing equitable treatment of investment in equipment under the tax code (faster depreciation, for example).

It also called for a recognition of the investment that New Media workers make in their own intellectual capital.

²³ Public Policy Institute, Business Council of NY State, March 1999.

²⁴ *Business Week*, March 1, 1999, based on data from Reliastar.

B. Quality-of-Life Costs

Robert Cringely, in his 1992 book on Silicon Valley, summed up the quality-of-life issue: “I live in California in a house that I can’t really afford... And [I think] New York is hell... Yet I have lots of friends who live in Manhattan and tell me it’s a wonderful place... [They] are certain they would die of boredom in Palo Alto.... Who’s right? We both are.”²⁵

One might argue that since 1992 the problems of housing affordability and commutation in Palo Alto have become worse whereas NYC’s biggest problems have ameliorated, but in fact one person’s quality life may be another person’s misery.

But the importance of quality-of-life issues for people whom the City wishes to attract leads to three observations:

- The objective of an economic-development program is not simply to strengthen NYC’s economy, but to make it a better place to live. “The bottom-line measure of how an economy is doing, and whether it is working for all, concerns its ability to provide people with real opportunities for a richer and better life. This is the litmus test by which policymakers should judge economic-development policies and practices.”²⁶
- Cutting taxes is not the only economic-development goal. The delivery of quality services, and the expenditure of money wisely to invest in infrastructure, are concerns of business leaders as much as ordinary citizens.
- To lure people to NYC to work, the options of living in an urban or suburban, or even rural environment need to be kept open for them.²⁷ If NYC is to attract and keep these valued workers, a regional orientation to economic development is called for.

C. Space Needs

Commercial real estate agents are in regular contact with small software firms and are acutely aware of their space-related needs, including lease flexibility. Buildings last longer than the technologies they house, and software start-ups need to be in a building that will accommodate growth and new systems without expensive construction or retrofitting. They need more than a structure; they need an infrastructure. Here is a representative list of these needs (along with low rent, a cancellation clause, subleasing rights, and flexibility on security deposits and credit checks!):

²⁵ Robert X. Cringely, *Accidental Empires: How the Boys of Silicon Valley Make Their Millions, Battle Foreign Competition, and Still Can’t Get a Date* (Reading, MA: Addison-Wesley, 1992), pp. 119-120.

²⁶ William Schweke with Brian Dabson and Carl Rist, *Improving Your Business Climate: A Guide to Smarter Public Investments in Economic Development* (Washington, DC: Corporation for Enterprise Development, 1996), p. vi.

²⁷ Quality-of-life costs may be seen either as the sacrifice of accepting a personally perceived lower quality of life to keep living costs affordable in NYC, or the personally borne extra expense of maintaining the same quality of life by paying more or commuting.

- Access to space and utilities on a 24-hour, 7-day basis.
- Tenant-controlled heat and air-conditioning.
- Additional air-conditioning capacity.
- Adequate electric power, approximately 8-10 watts per rentable square foot.
- Adequate internal wiring for communications, preferably a fiber-optic network.
- Voice communications systems, i.e., PABX, voice mail, voice response.
- Data communications networking, i.e., a local area network (LAN), wide area network (WAN), Intranet.
- Video distributing or conferencing systems.
- Premises distribution cabling.
- Local exchange and long distance services: a roof satellite dish along with local phone company connections.
- Technology center design and engineering.
- Implementation management and acceptance testing.²⁸

One solution to the problem of obtaining adequate space and connectivity at a reasonable price for start-up companies is to create incubator space in university or government locations for such companies; this is discussed at the end of this section. Another approach is to renovate underutilized buildings for use by software companies (e.g., space being vacated by industries that are in relative decline, like offset printing), and another is to subsidize facilities for start-up companies.

More broadly, software technicians have the option of the informal California lifestyle with very little commuting time in the Silicon Valley companies and few restrictions on dress. To compete with the life style, NYC's economic development strategy should have a regional component, i.e., cooperating with suburban neighbors to bring software personnel to the region.

D. Communication/Connectivity Needs

Another way of defining infrastructure needs is in terms of a need for communication. A start-up company that is software-dependent cited its infrastructure needs as centered on its need to communicate with the Internet as quickly as possible without incurring charges it cannot afford:

- The office (with three professionals) has a Windows NT server running an internal Local Area Network (LAN) using an Ethernet hookup and individual modems connecting with an Internet service provider.
- The LAN works fine, but the dial up Internet access is expensive, slow, and unreliable.
- A full T1 line would be ideal but is too expensive. A shared or partial T1 line might meet the need. An ISDN line is expensive and too slow. ADSL lines are promising but are not yet offered in Manhattan by Bell Atlantic. Connections to cable networks are another possibility.²⁹

²⁸ List based on memos from Harry J. Greeley, Cushman & Wakefield, NYC, February 2 and April 2, 1999.

²⁹ Zimran Ahmed, Community Wealth, NYC, e-mail communication of February 2, 1999.

Possible solutions to the communications problems include the following:

- Encourage entry of new firms into the business of providing high-speed communications lines. Con Edison, with its long experience working underground and its network of existing piping, is seeking to enter this field by creating a fiber-optic network. The cable networks have been focusing on the Internet market.
- Develop new trunk lines. Internet companies are locating near the Holland Tunnel because this is one of the first places that will to have large bandwidth cables available to tap into.
- Reduce costs by reducing or eliminating City and State taxes on phone and other cable lines in return for equivalent reductions in communication rates.
- Create a software-industry office that might, among other things, serve as an ombudsman on behalf of software companies vis-à-vis providers of high-speed communications. This role might be filled by an industry association, working with industry-friendly government offices.
- Encourage the Public Service Commission to generate more competition for small telecommunications users.
- Work with Bell Atlantic and telecommunications companies, to assist start-up companies with their telecommunications needs (e.g., faster installation of high-bandwidth T1 and T3 lines and ADSL technology) and also attempt to obtain for small Internet-related businesses the lower telephone rates now enjoyed by large companies.
- Explore the benefits of lowering the sales tax on telephone usage in return for lower message-unit costs or other charges.
- Work with the cable television companies on facilitating wide introduction of cable modems to open up interactivity to cable facilities.
- Work with Con Edison and other electricity companies to reduce electricity rates for companies for smaller companies. Con Edison's rates are four times higher per kilowatt-hour than those of utilities serving software companies in some competitive regions.

E. A Solution for Start-Ups: Incubators

The State University of NY at Stony Brook is a model for introducing an industrial incubator in a university environment. Basically, an incubator is a space within which a start-up company can grow, often at reduced rents. Besides low-cost physical space, an incubator may promote the growth of new businesses by providing a variety of assistance including business-support services such as phone, fax, and photocopying. A university connection adds intellectual resources and support services. A start-up in an incubator is also legitimated by virtue of having passed through a selection process to enter the incubator.³⁰

³⁰ Catherine Welsh, "An Exploration of Business Incubators," *Science Policy*, SUNY at Purchase, 1998.