The Information Technology Industry in the State of Ohio and its Regions - *1989 to 2000*

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Ohio Department of Development

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UUP
The Urban University Program

Ohio Economic Development Information Network
(The Ohio ES202 Network)

The Information Technology Industry in the State of Ohio and Its Regions: 1989 to 2000

Prepared for
Ohio's IT Alliance

By
The Ohio Economic Development Information Network
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October 2001

ACKNOWLEDGMENTS

The Ohio Economic Development Information Network wishes to recognize the assistance of those who worked on this project at the Maxine Goodman Levin College of Urban Affairs at Cleveland State University. David Crumb, a programmer/analyst, managed the ES202 database and assisted by creating datasets for each region of Ohio's IT Alliance. William Olson, a PhD student and Graduate Assistant, carefully reviewed preliminary drafts of the report, verifying the accuracy of the information presented and offering many valuable comments. Finally, Susan Petrone, applied her exemplary language skills to greatly improve the readability of our text.

The project was directed by Ziona Austrian, Director of the Economic Development Program at Cleveland State University's Maxine Goodman Levin College of Urban Affairs and Jane Dockery, Associate Director of the Center For Urban And Public Affairs at Wright State University. Jill Norton, a Research Associate at the Maxine Goodman Levin College of Urban Affairs' Economic Development Program, was responsible for coordinating efforts among the six participating universities.

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I. INTRODUCTION

This report was prepared for *Ohio's IT Alliance*, a statewide network of six regional IT groups located throughout Ohio and headquartered in Dayton. The study was conducted by the Ohio Economic Development Information Network, better known as the ES202 Network. The ES202 Network is a statewide group of ten urban and rural universities that develops and maintains a database of employment, payroll, and establishments at the zip code level throughout Ohio. ES202 Network researchers are engaged in industry and labor force research that utilizes this unique database.

STUDY PURPOSE

This study's purpose is to examine the status of the IT industry in Ohio and its six regions, measured in terms of employment and payroll. The study provides trend information on employment and payroll over the past 11 years in each of the 30 industry segments that comprise the IT industry in Ohio. Policy makers regard employment and earnings as important indicators of the economic health of a region, and total earnings can serve as a proxy for the standard of living in a region. This study does not include measures of productivity or sales in its analysis. It answers such questions such as: Which IT industry segments added jobs and which ones experienced job losses? Which segments provide the most jobs? Which segments provide the highest payroll per employee? How does IT growth (or decline) in each region and the state compare with national trends?

The study also identifies a list of IT industry segments in each region that are "winners" based on the following criteria: large industry segments, growing industry segments, high payroll per capita, and large number of establishments. A list of individual companies located in each region, obtained through Power Finder, Government and Public Agency Edition, 2000, is provided as a separate volume.

THE REGIONS OF OHIO'S IT ALLIANCE

Ohio's IT Alliance encompasses the entire state and includes six Regions Partner Organizations:

- The IT Alliance of Appalachia Ohio covers the Appalachia region. It includes 19 counties: Adams, Athens, Belmont, Gallia, Guernsey, Highland, Hocking, Jackson, Lawrence, Meigs, Monroe, Morgan, Muskingum, Noble, Perry, Pike, Scioto, Vinton, and Washington.

- The Circuit in the Cincinnati region. It consists of six counties: Brown, Butler, Clermont, Clinton, Hamilton, and Warren.

- The Northeast Ohio Software Association (NEOSA) covers the northeast region. It includes 20 counties: Ashland, Ashtabula, Carroll, Columbiana, Coshocton, Cuyahoga, Geauga, Harrison, Holmes, Jefferson, Lake, Lorain, Mahoning, Medina, Portage, Stark, Summit, Trumbull, Tuscarawas, and Wayne.

- The ITC in the Columbus region. It has 14 counties: Crawford, Delaware, Fairfield, Fayette, Franklin, Knox, Licking, Madison, Marion, Morrow, Pickway, Richland, Ross, and Union.

- The Greater Dayton IT Alliance covers the Dayton region. It includes the following nine counties: Champaign, Clark, Darke, Greene, Logan, Miami, Montgomery, Preble, and Shelby.

- The IT Alliance of Northwest Ohio in the Toledo region. The 20 counties that make up the region are: Allen, Auglaize, Defiance, Erie, Fulton, Hancock, Hardin, Henry, Huron, Lucas, Mercer, Ottawa, Paulding, Putnam, Sandusky, Seneca, Van Wert, Williams, Wood, and Wyandot.

DEFINITION OF THE IT INDUSTRY

This study uses the IT industry definition that was supplied by *Ohio's IT Alliance*. It includes industry segments within the manufacturing, communication and public utilities, wholesale, retail, and service sectors. Industry segments are based on four digit SICs. The following list provides names for each industry segment and Appendix A includes a detailed description of the types of businesses included in each.

SIC Codes	Description
IT Industry Segments within Manufacturing	
3571	Electronic Computers
3572	Computer Storage Devices
3575	Computer Terminals
3577	Computer Peripheral Equipment, NEC
3578	Calculating and Accounting Equipment
3661	Telephone and Telegraph Apparatus
3663	Radio and TV Communications
3669	Communications Equipment
3672	Printed Circuit Boards
3674	Semiconductors & Related Equipment
3695	Magnetic & Optical Recording Media
3823	Process Control Instruments
3825	Instruments to Measure Electricity
IT Industry Segments within Communication and Public Utilities	
4812	Radiotelephone Communications
4813	Telephone Communications, except Radiotelephone
4822	Telegraph & Other Message Communications
4841	Cable & Other Pay Television Services
IT Industry Segments within Wholesale Trade	
5045	Computers, Peripherals & Software
5065	Electronic Parts & Equipment
IT Industry Segments within Retail Trade	
5734	Computer & Software Stores
IT Industry Segments within Services	
7371	Computer Programming Services
7372	Prepackaged Software
7373	Computer Integrated Systems Design
7374	Data Processing & Preparation
7375	Information Retrieval Services
7376	Computer Facilities Management
7377	Computer Rental & Leasing
7378	Computer Maintenance & Repair
7379	Computer Related Services, NEC
8243	Data Processing Schools

DATA AND METHODOLOGY

This study utilizes the newly released database of employment and payroll estimates, which is based on ES202 data. The ES202 database is an administrative database created by each state, under federal mandate, for tax collection purposes. Nearly all employers with paid employees are required to file unemployment reports. Cleveland State University, on behalf of the Ohio ES202 Network, receives the data on a quarterly basis from the Ohio Department of Jobs and Family Services, Bureau of Employment Services. Unlike other databases, which contain only aggregate information, the ES202 database is unique in providing records of individual companies with information on location, employment, payroll, and industry classification. Using this rich and detailed database, the Network supports research and technical assistance projects throughout the state, both for individual regions and collaborative multi-regional projects.

In an effort to improve the quality of the ES202 data, the Network developed estimates at the zip code level based on individual records reported in the statewide database. Data is available from the first quarter of 1989 through the first quarter of 2000. Data on employment, payroll, and number of establishments for each of the 30 industry segments described previously was aggregated for each of the six regions.

The ES202 records on individual companies are confidential and cannot be released. Analysis using the estimates or aggregation of individual records requires by law a confidentiality check which assures that individual companies' information cannot be revealed by the analysis. Each of the regional data sets underwent a confidentiality check. Data cannot be released for an industry segment with fewer than three firms or when one firm accounts for 80 percent or more of total employment in a specific geography. Where data release was restricted at the four-digit level, researchers had the option to aggregate two or more four-digit industry segments or to analyze the industry segment at the two or three-digit level. In some cases, data is suppressed.

Data Limitations

Two important caveats in the ES202 data should be noted. First, the ES202 database consists of only those establishments that are subject to state unemployment insurance laws. This includes establishments with paid employees, but does not include sole

proprietorships or those working for family businesses without pay. As a result, this database may produce a lower count of establishments and employees than other available databases. In addition, establishments in the ES202 database are assigned to a single SIC category, while other databases may assign multiple SICs or use different criteria to assign SICs. These facts may also contribute to the ES202 database producing a lower count of establishments and employees in specific SICs when compared to other data sources. For instance, this report's companion volume listing individual IT companies is derived from a database that includes as many as four SIC categories for a single establishment. Accordingly, a large number of IT companies were identified relative to the number of establishments reported in the ES202 database.

Second, the database does not distinguish between full-time and part-time employees. Comparison of employment among industry segments may be distorted when there is a greater proportion of part-time workers in some industry segments than in others. Further, industry segments with greater proportions of part-time workers will have a lower average payroll per employee, because total payroll is distributed among more employees. According to national data from the Bureau of Labor Statistics, the sectors with the highest proportions of part-time employees are Retail Trade, where 35 percent of the workforce is part-time, and Services, where part-time employees account for 23 percent of total employment. However, it should be emphasized that many well-known and widely used employment and payroll databases suffer from this limitation.

REPORT STRUCTURE

The introduction is followed by an overview of statewide trends in employment and payroll in IT industry segments. Six individual sections review trends in each of the regions of Ohio's IT Alliance. These sections are written by researchers from a university located within the region (see Appendix B for a complete listing). The final section highlights the similarities and differences among the six regions.

II. THE STATE OF OHIO

IT EMPLOYMENT

The State of Ohio experienced an overall growth in the number of jobs in the IT industry. The sector, composed of 30 industry segments (at the 4-digit level), experienced an increase of 37 percent between 1989 and 2000, adding over 41,000 jobs. As can be seen in Table 2.1, this overall gain is a result of job losses in 12 industry segments that is more than offset by job growth in all other IT industry segments. Of the declining industry segments, nine are part of the manufacturing sector; however of the 18 growing industry segments, four are within manufacturing. Thus even though most of the job gains occurred in service-related IT industry segments, some manufacturing IT also experienced employment growth.

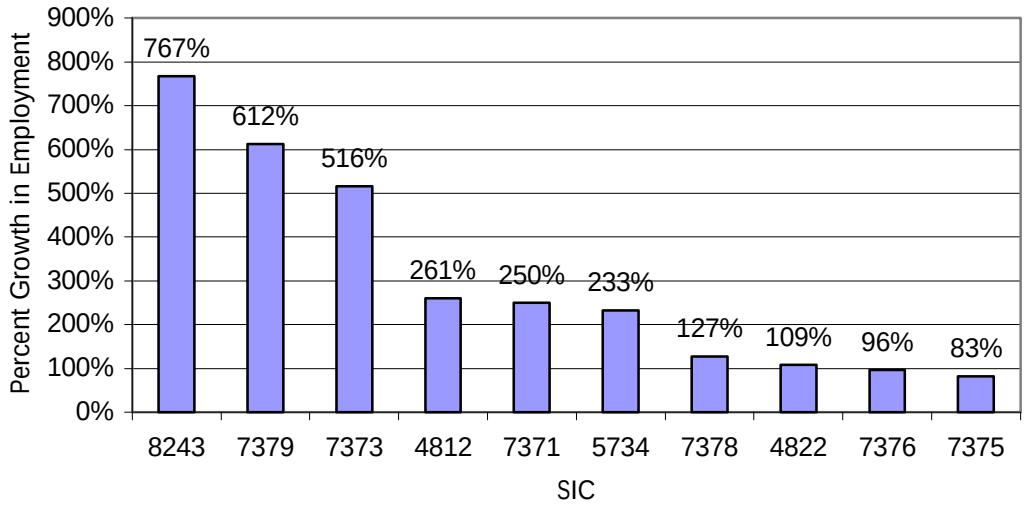
Table 2.1 State IT Employment, 1989:Q1 and 2000:Q1

SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
3571	Electronic Computers	2,139	256	-1,883	-88%
3572	Computer Storage Devices	S	S	S	-98%
3575	Computer Terminals	154	229	75	49%
3577	Computer Peripheral Equipment NEC	2,282	1,594	-688	-30%
3578	Calculating & Accounting Equipment	7,608	4,751	-2,857	-38%
3661	Telephone & Telegraph Apparatus	6,225	7,570	1,345	22%
3663	Radio & TV Communications	1,412	1,188	-224	-16%
3669	Communications Equipment	552	363	-189	-34%
3672	Printed Circuit Boards	1,512	1,981	469	31%
3674	Semiconductors & Related Equipment	1,124	875	-249	-22%
3695	Magnetic and Optical Recording Media	S	S	S	-99%
3823	Process Control Instruments	3,872	5,085	1,213	31%
3825	Instruments to Measure Electricity	2,674	2,502	-172	-6%
4812	Radiotelephone Communications	1,485	5,353	3868	261%
4813	Telephone Communications	32,776	25,722	-7,054	-22%
4822	Telegraph & Other Message Communications	108	226	118	109%
4841	Cable & Other Pay Television Services	4,358	6,176	1,818	42%
5045	Computers, Peripherals & Software	10,121	13,836	3,715	37%
5065	Electronic Parts & Equipment	7,171	8,249	1,078	15%
5734	Computer & Software Stores	1,997	6,648	4,651	233%
7371	Computer Programming Services	5,540	19,406	13,866	250%
7372	Prepackaged Software	3,197	4,410	1,213	38%
7373	Computer Integrated Systems Design	1,103	6,792	5,689	516%
7374	Data Processing & Preparation	5,317	4,449	-868	-16%
7375	Information Retrieval Services	5,330	9,744	4,414	83%
7376	Computer Facilities Management	736	1,447	711	97%
7377	Computer Rental & Leasing	434	320	-114	-26%
7378	Computer Maintenance & Repair	626	1,421	795	127%
7379	Computer Related Services, NEC	1,705	12,144	10,439	612%
8243	Data Processing Schools	106	919	813	767%
Total IT Employment		112,469	153,663	41,194	37%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.
An "S" indicates data is suppressed to avoid disclosing information about individual firms.

Figure 2.1 portrays the ten fastest growing IT industry segments in the State of Ohio. Five of these (SIC 7371, 7373, 7375, 7379, and 5734) are also among the state's largest IT industry segments (see Figure 2.2). Seven of the fastest growing segments in the state are within the service sector, two are within transportation, communications, and public utilities (Radiotelephone Communications and Telegraph and Other Message Communications), and one is within the retail sector (Computer and Software Stores).

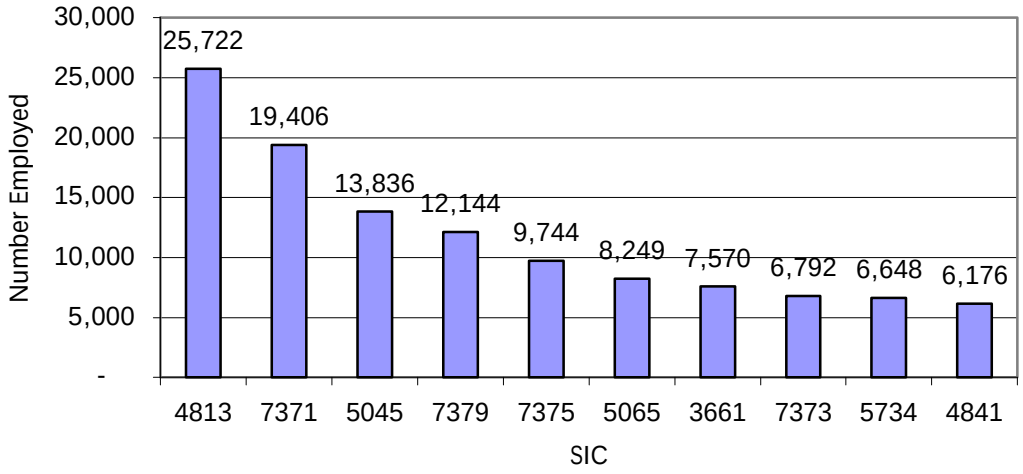
Figure 2.1
Fastest Growing IT Industry Segments in Ohio, 1989:Q1 to 2000:Q1



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

As shown in Figure 2.2, Telephone Communications (SIC 4813) is Ohio's largest IT employer. This industry segment includes establishments that provide cellular phone or paging services, which have proliferated nationwide. Only four of the 10 largest industry segments are in the service sector, all within computer and data processing services. The third and sixth largest are wholesale of Computers, Peripherals and Software and wholesale of Electronic Parts and Equipment. The largest ten industry segments account for over four-fifths of all IT employment in Ohio. As mentioned above, it is important to note that the second, third, fourth, eighth, and ninth largest IT industry segments in the state are also among the fastest growing.

Figure 2.2
Largest IT Industry Segments in Ohio, 2000:Q1



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

The State of Ohio is highly specialized in Calculating and Accounting Equipment (SIC 3578), due to an extremely high concentration of that industry segment in the Dayton Region and some concentration in the Toledo Region. The state is also specialized in Information Retrieval Services (SIC 7375), again due to concentration in the Dayton Region, as well as Process Control Instruments (SIC 3823), which is primarily concentrated in the Northeast Region.

NUMBER OF IT ESTABLISHMENTS

The number of IT establishments in the state more than doubled over the 11-year study period (see Table 2.2). With over 7,100 IT establishments in Ohio, the industry segments that accounted for more than 1,000 establishments each are Computer Programming Services (SIC 7371) with 1,341 establishments and Computer Related Services, NEC, (SIC 7379) with 1,258 establishments. These two industry segments did not account for the highest numbers in 1989, but they added the most establishments during the 1990s, which resulted in them having the most establishments by 2000.

Table 2.2 State IT Establishments, 1989:Q1 and 2000:Q1

SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
3571	Electronic Computers	8	16	8	100%
3572	Computer Storage Devices	S	S	S	0%
3575	Computer Terminals	3	2	-1	-33%
3577	Computer Peripheral Equipment NEC	27	26	-1	-4%
3578	Calculating & Accounting Equipment	10	11	1	10%
3661	Telephone & Telegraph Apparatus	8	16	8	100%
3663	Radio & TV Communications	10	21	11	110%
3669	Communications Equipment	11	9	-2	-18%
3672	Printed Circuit Boards	52	53	1	2%
3674	Semiconductors & Related Equipment	12	9	-3	-25%
3695	Magnetic & Optical Recording Media	S	S	S	0%
3823	Process Control Instruments	59	78	19	32%
3825	Instruments to Measure Electricity	33	33	0	0%
4812	Radiotelephone Communications	32	198	166	519%
4813	Telephone Communications	272	748	476	175%
4822	Telegraph & Other Message Communications	18	4	-14	-78%
4841	Cable & Other Pay Television Services	136	171	35	26%
5045	Computers, Peripherals & Software	542	712	170	31%
5065	Electronic Parts & Equipment	556	609	53	10%
5734	Computer & Software Stores	230	549	319	139%
7371	Computer Programming Services	377	1,341	964	256%
7372	Prepackaged Software	125	138	13	10%
7373	Computer Integrated Systems Design	128	317	189	148%
7374	Data Processing & Preparation	166	215	49	30%
7375	Information Retrieval Services	69	350	281	407%
7376	Computer Facilities Management	32	27	-5	-16%
7377	Computer Rental & Leasing	29	21	-8	-28%
7378	Computer Maintenance & Repair	83	123	40	48%
7379	Computer Related Services, NEC	253	1,258	1,005	397%
8243	Data Processing Schools	10	86	76	760%
Total IT Establishments		3,291	7,144	3,853	117%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

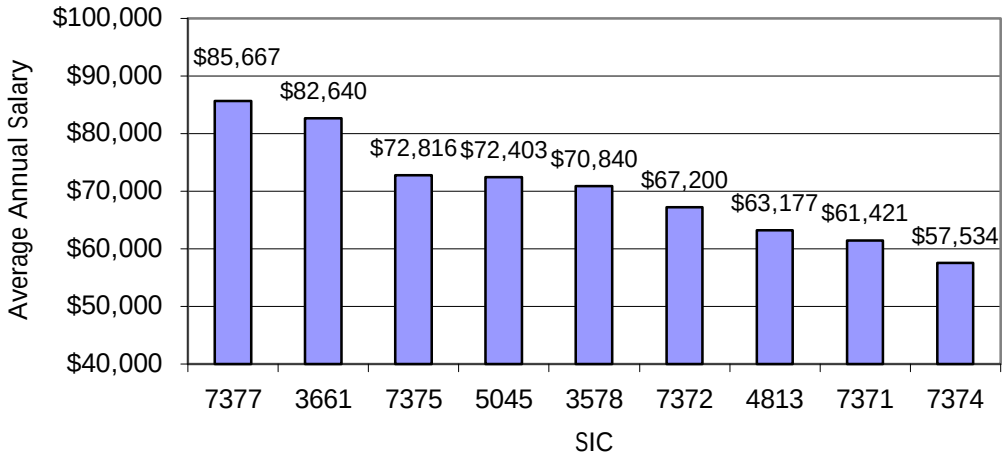
An "S" indicates data is suppressed to avoid disclosing information about individual firms.

PAYROLL PER EMPLOYEE IN IT INDUSTRY

The average payroll per employee in the IT industry in Ohio is nearly $60,000 – well above the average of all industries, which is slightly more than $33,000. This indicates that employment in the IT industry provides a higher standard of living for its employees. Furthermore, the average payroll per employee in the IT industry increased by 27 percent (after adjustment for inflation) between 1989 and 2000. Figure 2.3 shows that the five

industry segments with the highest payroll per employee offer annual salaries ranging from $70,000 to $85,000. Of these, two are within the manufacturing sector, Telephone and Telegraph Apparatus (SIC 3661) and Calculating and Accounting Equipment (SIC 3578). SIC 3661 is among the 10 largest industry segments and experienced growth over the decade. The one wholesale industry segment, Computers, Peripherals, and Software (SIC 5045), posted an average payroll per employee of over $72,000, was among the ten largest IT industry segments, and experienced job growth. The two industry segments within the service sector, Computer Rental and Leasing (SIC 7377) and Information Retrieval Services (SIC 7375), posted a payroll per employee of $85,667 and $72,816, respectively. SIC 7377 is a very small industry segment and experienced job losses, while SIC 7375 is among the state's largest and fastest growing IT industry segments.

Figure 2.3
Highest Paying State IT Industry Segments, 2000:Q1



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

As shown in Table 2.3, only four industry segments suffered losses in average payroll per employee, two within manufacturing – Electronic Computers (SIC 3571) and Magnetic and Optical Recording Media (SIC 3695) – one within communications and public utilities, Telegraph and Other Message Communications (SIC 4822), and one within the service sector, Computer Maintenance and Repair (SIC 7378). One of these, Telegraph and Other Message Communications (SIC 4822), is also the lowest paying IT industry segment in Ohio. After a large decline between 1989 and 2000, this segment paid on average just over $16,000.

Table 2.3 State IT Annualized Payroll per Employee, 1989:Q1 and 2000:Q1 (in 2000 dollars)

SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
3571	Electronic Computers	$52,926	$34,172	-$18,754	-35%
3572	Computer Storage Devices	S	S	S	62%
3575	Computer Terminals	$34,227	$50,465	$16,238	47%
3577	Computer Peripheral Equipment NEC	$45,468	$46,385	$917	2%
3578	Calculating & Accounting Equipment	$48,115	$70,840	$22,725	47%
3661	Telephone & Telegraph Apparatus	$48,934	$82,640	$33,706	69%
3663	Radio & TV Communications	$37,964	$47,825	$9,861	26%
3669	Communications Equipment	$29,359	$33,797	$4,438	15%
3672	Printed Circuit Boards	$24,468	$26,327	$1,859	8%
3674	Semiconductors & Related Equipment	$32,676	$37,200	$4,524	14%
3695	Magnetic & Optical Recording Media	S	S	S	-13%
3823	Process Control Instruments	$45,657	$54,770	$9,113	20%
3825	Instruments to Measure Electricity	$32,973	$32,936	- $37	<1%
4812	Radiotelephone Communications	$34,506	$52,808	$18,302	53%
4813	Telephone Communications	$52,181	$63,177	$10,996	21%
4822	Telegraph & Other Message Communications	$39,530	$16,266	-$23,264	-59%
4841	Cable & Other Pay Television Services	$30,368	$38,454	$8,086	27%
5045	Computers, Peripherals & Software	$56,712	$72,403	$15,691	28%
5065	Electronic Parts & Equipment	$42,867	$52,216	$9,349	22%
5734	Computer & Software Stores	$30,436	$39,600	$9,164	30%
7371	Computer Programming Services	$52,918	$61,421	$8,503	16%
7372	Prepackaged Software	$48,809	$67,200	$18,391	38%
7373	Computer Integrated Systems Design	$47,894	$55,684	$7,790	16%
7374	Data Processing & Preparation	$32,551	$57,534	$24,983	77%
7375	Information Retrieval Services	$45,481	$72,816	$27,335	60%
7376	Computer Facilities Management	$42,820	$50,595	$7,775	18%
7377	Computer Rental & Leasing	$50,823	$85,667	$34,844	69%
7378	Computer Maintenance & Repair	$42,790	$37,801	-$4,989	-12%
7379	Computer Related Services, NEC	$42,135	$56,066	$13,931	33%
8243	Data Processing Schools	$35,535	$38,575	$3,040	9%
Total IT Payroll Per Employee		$46,625	$59,341	$12,716	27%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

1989 dollars inflated using the average of the Consumer Price Index for the Cleveland Metropolitan Area for the months of January, February, and March 2000.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

THE STATE OF OHIO IN COMPARISON TO NATIONAL IT INDUSTRY

Although there was positive change in employment, payroll and establishments in Ohio's IT industry, growth rates in the state lagged behind growth rates nationwide (see Table 2.4). Between 1989 and 1999, IT employment in Ohio increased 33 percent compared to 39 percent across the United States. There were eight industry segments in which trends differed between the state and the nation, and in five of the eight, the State experienced

declines while the nation experienced growth. Those industry segments that experienced growth in Ohio while declining nationally were SIC 3661, the manufacture of Telephone and Telegraph Apparatus; SIC 3825, Instruments to Measure Electricity; and SIC 4822, Telegraph and Other Message Communications. There were four industry segments in which employment growth rates in Ohio far exceeded those for the nation: SIC 8243, Data Processing Schools; SIC 7379, Computer Related Services, NEC; SIC 7373, Computer Integrated Systems Design; and SIC 5734, Computer and Software Stores.

Table 2.4 Growth Rates in Ohio versus the United States: 1989:Q1 to 1999:Q1

		Employment		Payroll per Employee		Establishments	
SIC	Description	State of Ohio	United States	State of Ohio	United States	State of Ohio	United States
3571	Electronic Computers	-90%	-33%	-44%	67%	114%	28%
3572	Computer Storage Devices	-98%	21%	39%	52%	0%	38%
3575	Computer Terminals	26%	20%	65%	68%	1%	44%
3577	Computer Peripheral Equipment NEC	63%	17%	6%	24%	46%	37%
3578	Calculating & Accounting Equipment	-39%	-24%	147%	47%	27%	68%
3661	Telephone & Telegraph Apparatus	14%	-14%	27%	27%	125%	36%
3663	Radio & TV Communications	3%	6%	-10%	21%	127%	63%
3669	Communications Equipment	-36%	31%	16%	27%	-24%	57%
3672	Printed Circuit Boards	46%	23%	3%	2%	9%	24%
3674	Semiconductors & Related Equipment	-32%	6%	4%	53%	-49%	42%
3695	Magnetic & Optical Recording Media	-87%	-29%	-9%	19%	3%	31%
3823	Process Control Instruments	-8%	7%	6%	14%	17%	49%
3825	Instruments to Measure Electricity	6%	-30%	-7%	36%	9%	8%
4812	Radiotelephone Communications	226%	539%	17%	36%	475%	601%
4813	Telephone Communications	-22%	-1%	9%	17%	139%	158%
4822	Telegraph & Other Message Communications	64%	-26%	-64%	44%	-83%	-5%
4841	Cable & Other Pay Television Services	49%	67%	13%	46%	30%	34%
5045	Computers, Peripherals & Software	31%	32%	20%	32%	32%	94%
5065	Electronic Parts & Equipment	13%	10%	20%	21%	2%	33%
5734	Computer & Software Stores	213%	105%	20%	12%	115%	86%
7371	Computer Programming Services	231%	215%	9%	29%	220%	265%
7372	Prepackaged Software	32%	179%	38%	103%	-2%	93%
7373	Computer Integrated Systems Design	450%	109%	13%	28%	85%	144%
7374	Data Processing & Preparation	-18%	34%	27%	30%	13%	59%
7375	Information Retrieval Services	80%	174%	14%	123%	339%	501%
7376	Computer Facilities Management	73%	34%	18%	39%	-38%	26%
7377	Computer Rental & Leasing	-22%	-13%	51%	8%	1%	-19%
7378	Computer Maintenance & Repair	118%	73%	-18%	-10%	53%	74%
7379	Computer Related Services, NEC	578%	405%	28%	21%	346%	408%
8243	Data Processing Schools	754%	264%	-2%	32%	651%	382%
Total IT Industry		33%	39%	14%	34%	98%	138%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database; U.S. Department of Labor, Bureau of Labor Statistics, Covered Employment and Wages (ES202).

Average payroll per employee in the IT industry increased 34 percent nationwide, compared to 14 percent in the State of Ohio. While only one industry segment experienced a decline in average payroll nationally (SIC 7378), seven industry segments in Ohio experienced declines. The slower growth rate for the state's IT industry can also be explained by the fact that several industry segments in Ohio, while showing growth in average payroll, experienced it at a much slower pace than occurred nationally. There are few industry segments for which the increases in Ohio far exceeded those for the nation. SIC 3578, the manufacture of Calculating and Accounting Equipment is the best example of this. The lower growth rates in average payroll per employee may be seen by some in the industry as an advantage to the state in attracting and retaining IT firms.

The number of IT establishments in Ohio nearly doubled between 1989 and 1999 (a 98% increase), however this still lagged behind the growth rate in IT establishments across the United States (138%). Most industry segments experienced similar trends in the state and the nation, however there five instances in which trends diverged, and in four of those cases, the nation experienced increases in establishments while the state experienced losses. The one exception was in SIC 7377, Computer Rental and Leasing, where the number of establishments in Ohio held nearly constant, while falling 19 percent nationwide. There were a number of industry segments in which growth rates in Ohio far exceeded those nationwide, however they were segments with a very small base of establishments in 1989, therefore the rate of growth can be misleading.

SUMMARY

The IT industry, defined by 30 four-digit SICs, is a very small industry in terms of the number of jobs in Ohio. However, employment grew by 37 percent over the past decade, and the number of IT establishments more than doubled. The average payroll per employee is nearly $60,000, almost twice the average payroll per employee across all industry segments, indicating that the industry provides a good standard of living for its workers. Although growth in Ohio did not match the growth that occurred nationwide, trends were very positive and indicated an increased strength for the IT industry.

III. THE NORTHEAST REGION

This section describes trends in IT employment and payroll in the Northeast Region of Ohio (the Cleveland region). The region includes the following 20 counties: Ashland, Ashtabula, Carroll, Columbiana, Coshocton, Cuyahoga, Geauga, Harrison, Holmes, Jefferson, Lake, Lorain, Mahoning, Medina, Portage, Stark, Summit, Trumbull, Tuscarawas, and Wayne. The discussion focuses on overall trends in IT, as well as trends within specific IT industry segments. Particular attention is given to those industry segments that are strong in the region and those that are experiencing higher rates of growth or decline.

IT EMPLOYMENT

Between 1989 and 2000, the Northeast Region of Ohio experienced significant job growth in the IT industry. There were 49,375 IT jobs in the region in 2000, compared to 38,309 in 1989. The 10,766 additional jobs represent a 28 percent increase over the 11-year period.

Table 3.1 shows employment in each IT industry segment in 1989 and 2000. Most of the employment growth in the IT industry occurred in Computer Programming Services (SIC 7371), which added 3,618 jobs between 1989 and 2000, followed by Computer Related Services, NEC (SIC 7379), which added 2,991 jobs during that time. Large gains were also experienced in Radiotelephone Communications (SIC 4812) 1,681 jobs; Computer Integrated Systems Design/Computer Facilities Management/Computer Rental and Leasing (SIC 7373/76/77) 1,353 jobs; Computer and Software Stores (SIC 5734) 1,129 jobs; Electronic Parts and Equipment (SIC 5065) 985 jobs; and Information Retrieval Services (SIC 7375) 849 jobs. There was also significant growth in Process Control Instruments (SIC 3823). In most cases, the employment growth in these industry segments also represents a large percentage increase in employment, indicating that they are not only adding many new jobs, but are growing at a fast rate as well. The job growth in Computer Related Services, NEC (SIC 7379) represented a 371percent increase, while Radiotelephone Communications (SIC 4812) grew by 266 percent, Computer Programming Services (SIC 7371) grew by 196 percent and Computer and Software Stores (SIC 5734) grew by194 percent. Computer Integrated Systems Design/Computer Facilities Management/Computer

Rental and Leasing (SIC 7373/76/77) experienced a 124 percent increase in jobs. The highest employment growth rate, however, can be seen in one of the smaller industry segments, Data Processing Schools (SIC 8243), which experienced a 486 percent increase.

Despite the overall increase in IT employment, a few industry segments experienced declines. As shown in Table 3.1, the largest decrease was in Telephone Communications (SIC 4813) where employment fell from 11,638 in 1989 to 7,693 jobs in 2000. Data Processing and Preparation Services (SIC 7374) also experienced large job losses, falling from 2,437 jobs in 1989 to 1,373 jobs in 2000. Other industry segments that experienced declines were the manufacture of Computer and Office Equipment (SIC 357), 398 jobs, and Prepackaged Software services (SIC 7372), 101 jobs.

Table 3.1 Northeast Region IT Employment

		Northeast Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	2,748	2,350	-398	-14%
366	Communications Equipment	1,435	1,940	505	35%
367	Electronic Components & Accessories	1,036	1,285	249	24%
3695	Magnetic & Optical Recording Media	0	0	0	0%
3823	Process Control Instruments	2,058	S	S	S
3825	Instruments to Measure Electricity	1,410	1,122	-288	-20%
4812	Radiotelephone Communications	631	2,312	1,681	266%
4813	Telephone Communications	11,638	7,692	-3,946	-34%
4822	Telegraph & Other Message Communications	S	S	S	-97%
4841	Cable & Other Pay Television Services	1,309	2,149	840	64%
5045	Computers, Peripherals & Software	3,893	4,212	319	8%
5065	Electronic Parts & Equipment	3,729	4,714	985	26%
5734	Computer & Software Stores	583	1,712	1,129	194%
7371	Computer Programming Services	1,850	5,468	3,618	196%
7372	Prepackaged Software	888	787	-101	-11%
7374	Data Processing & Preparation	2,437	1,373	-1,064	-44%
7375	Information Retrieval Services	760	1,609	849	112%
7378	Computer Maintenance & Repair	233	368	135	58%
7379	Computer Related Services, NEC	806	3,797	2,991	371%
7373/76/77	Computer Integrated Systems Design/ Computer Facilities Management/Computer Rental & Leasing	1,092	2,445	1,353	124%
8243	Data Processing Schools	S	S	S	486%
Total IT Employment		38,609	49,375	10,766	28%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.

SIC 366 is an aggregation of SIC 3661, 3663, 3669.

SIC 367 is an aggregation of SIC 3672, 3674.

As mentioned in the introduction, to avoid disclosing specific information about individual firms, four-digit industry segments have been summed to three-digit segments in some instances. In the Northeast Region, the data for IT manufacturing industry segments are shown at the three-digit level. This masks an important trend in the case of computer and office equipment (SIC 357). Although actual numbers cannot be released at the level of four-digit industry segment, it can be reported that the manufacture of Electronic Computers (SIC 3571) has suffered a very large loss in employment, while the manufacture of Calculating and Accounting Equipment (SIC 3578) experienced significant job growth. Similarly, the gain in employment in Communications Equipment (SIC 366) can be attributed to growth in the manufacture of Telephone and Telegraph Apparatus (SIC 3661) and Radio and TV Communications (SIC 3663), as there were declines in the manufacture of other Communications Equipment (SIC 3669). Likewise, employment gains in Electronic Components and Accessories (SIC 367) are a result of gains in Printed Circuit Boards (SIC 3672) that offset losses in Semiconductors and Related Equipment (SIC 3674).

NUMBER OF IT ESTABLISHMENTS

Between 1989 and 2000, there was a sharp increase in the number of establishments in the IT industry. There were 2,692 establishments in 2000, more than double the number in 1989. As might be expected, the industry segments that experienced the largest employment growth were among those that added the most establishments.

As shown in Table 3.2, Computer and Related Services, NEC (SIC 7379) experienced the most growth in the number of establishments, increasing from 96 to 482, followed by Computer Programming Services (SIC 7371), which grew from 140 to 470 establishments. Information and Retrieval Services (SIC 7375) had 133 establishments in 2000, compared to 11 in 1989, while Computer and Software Stores (SIC 5734) increased from 93 to 197. Radiotelephone Communications (SIC 4812) added 73 establishments over the 11-year period. Telephone Communications (SIC 4813) and Data Processing and Preparation (SIC 7374) experienced a large job loss, while the number of establishments in this industry segment increased – the obvious result being smaller establishments.

Table 3.2 Northeast Region IT Establishments

SIC	Description	Northeast Region 1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	18	21	3	17%
366	Communications Equipment	10	14	4	40%
367	Electronic Components & Accessories	25	29	4	16%
3695	Magnetic & Optical Recording Media	0	0	0	0%
3823	Process Control Instruments	26	S	S	S
3825	Instruments to Measure Electricity	10	16	6	60%
4812	Radiotelephone Communications	15	88	73	487%
4813	Telephone Communications	74	234	160	216%
4822	Telegraph & Other Message Communications	S	S	S	-83%
4841	Cable & Other Pay Television Services	48	72	24	50%
5045	Computers, Peripherals & Software	221	287	66	30%
5065	Electronic Parts & Equipment	243	271	28	12%
5734	Computer & Software Stores	93	197	104	112%
7371	Computer Programming Services	140	470	330	236%
7372	Prepackaged Software	51	41	-10	-20%
7374	Data Processing & Preparation	75	96	21	28%
7375	Information Retrieval Services	11	133	122	1109%
7378	Computer Maintenance & Repair	34	47	13	38%
7379	Computer Related Services, NEC	96	482	386	402%
7373/76/77	Computer Integrated Systems Design/ Computer Facilities Management/Computer Rental & Leasing	70	121	51	73%
8243	Data Processing Schools	S	S	S	367%
Total IT Establishments		1,272	2,692	1,420	112%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 366 is an aggregation of SIC 3661, 3663, 3669.
SIC 367 is an aggregation of SIC 3672, 3674.

PAYROLL PER EMPLOYEE IN IT INDUSTRY

Table 3.3 provides information on payroll per employee in 1989 and 2000. The average payroll per employee for IT workers was quite high at more than $54,000. This is well above the region's average payroll across all sectors, which is less than $33,000. Measured in real terms, payroll per employee in the IT industry increased 13 percent between 1989 and 2000. The Prepackaged Software industry segment (SIC 7372) had the highest payroll per employee in 2000 ($83,885), the result of an 81 percent increase over the 11-year period. Computers, Peripherals and Software (SIC 5045) ranked second, with a payroll per employee of $69,892, followed by Telephone Communications (SIC 4813), where workers earned an average of $63,072. Other high paying industry segments

include: Computer Integrated Systems Design/Computer Facilities Management/ Computer Rental and Leasing (SIC 7373/76/77); Computer Programming Services (SIC 7371); the wholesale of Electronic Parts and Equipment (SIC 5065); the manufacture of Computer and Office Equipment (SIC 357); and the manufacture of Process Control Instruments (SIC 3823).

Two industry segments experienced a decline in payroll per employee. Computer Maintenance and Repair (SIC 7378) fell from $44,398 to $41,805, a decline of six percent, and Computer and Information Retrieval Services (SIC 7375) fell from $43,991 to $42,940, a two percent drop.

Table 3.3 Northeast Region IT Annualized Payroll per Employee (in 2000 dollars)

		Northeast Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	$ 47,323	$ 55,201	$ 7,878	17%
366	Communications Equipment	$ 39,770	$ 49,354	$ 9,584	24%
367	Electronic Components & Accessories	$ 28,537	$ 29,814	$ 1,277	4%
3695	Magnetic & Optical Recording Media	$ 0	$ 0	$ 0	0%
3823	Process Control Instruments	$ 42,866	S	S	S
3825	Instruments to Measure Electricity	$ 35,913	$ 43,175	$ 7,262	20%
4812	Radiotelephone Communications	$ 39,765	$ 46,000	$ 6,235	16%
4813	Telephone Communications	$ 58,170	$ 63,072	$ 4,902	8%
4822	Telegraph & Other Message Communications	S	S	S	-97%
4841	Cable & Other Pay Television Services	$ 26,507	$ 35,899	$ 9,932	35%
5045	Computers, Peripherals & Software	$ 55,238	$ 69,892	$ 14,654	27%
5065	Electronic Parts & Equipment	$ 45,483	$ 56,614	$ 11,131	24%
5734	Computer & Software Stores	$ 31,721	$ 37,201	$ 5,480	17%
7371	Computer Programming Services	$ 54,356	$ 57,683	$ 3,327	6%
7372	Prepackaged Software	$ 46,321	$ 83,885	$ 37,564	81%
7374	Data Processing & Preparation	$ 33,245	$ 36,937	$ 3,692	11%
7375	Information Retrieval Services	$ 43,991	$ 42,940	- $ 1,051	-2%
7378	Computer Maintenance & Repair	$ 44,398	$ 41,805	- $ 2,593	-6%
7379	Computer Related Services, NEC	$ 43,782	$ 50,538	$ 6,756	15%
7373/76/77	Computer Integrated Systems Design/ Computer Facilities Management/Computer Rental & Leasing	$ 51,456	$ 59,058	$ 7,602	15%
8243	Data Processing Schools	S	S	S	39%
Total IT Payroll per Employee		$ 48,074	$ 54,264	$ 6,190	13%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

1989 dollars inflated using the average of the Consumer Price Index for the Cleveland Metropolitan Area for the months of January, February, and March 2000.

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SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.

SIC 366 is an aggregation of SIC 3661, 3663, 3669.

SIC 367 is an aggregation of SIC 3672, 3674.

THE NORTHEAST REGION IN COMPARISON TO THE STATE AND NATIONAL IT INDUSTRY

Regional IT Employment Relative to the State

The Northeast Region accounts for approximately one-third of the state's IT employment (see Table 3.4). Although this represents a significant portion of Ohio's IT jobs, it is mainly reflective of the region's large presence in the overall state economy. The region's share of IT employment is actually slightly lower than its share of total employment, which stands at approximately 38 percent.

Table 3.4 Northeast Region Share of Ohio IT Employment

		Northeast Region	
SIC	Description	1989:Q1	2000:Q1
357	Computer & Office Equipment	22%	34%
366	Communications Equipment	18%	21%
367	Electronic Components & Accessories	39%	45%
3695	Magnetic & Optical Recording Media	0%	0%
3823	Process Control Instruments	53%	S
3825	Instruments to Measure Electricity	53%	45%
4812	Radiotelephone Communications	43%	43%
4813	Telephone Communications	36%	30%
4822	Telegraph & Other Message Communications	S	S
4841	Cable & Other Pay Television Services	30%	35%
5045	Computers, Peripherals & Software	38%	30%
5065	Electronic Parts & Equipment	52%	57%
5734	Computer & Software Stores	29%	26%
7371	Computer Programming Services	33%	28%
7372	Prepackaged Software	28%	18%
7374	Data Processing & Preparation	46%	31%
7375	Information Retrieval Services	14%	17%
7378	Computer Maintenance & Repair	37%	26%
7379	Computer Related Services, NEC	47%	31%
7373/76/77	Computer Integrated Systems Design/ Computer Facilities Management/Computer Rental & Leasing	48%	29%
8243	Data Processing Schools	S	S
Total IT industry		34%	32%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

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SIC 366 is an aggregation of SIC 3661, 3663, 3669.

SIC 367 is an aggregation of SIC 3672, 3674.

The region's share of state employment declined in several IT industry segments, but these declines were offset by some significant gains, resulting in a fairly stable share between 1989 and 2000, dropping only two percent over the time period. In addition to its large share of total employment, the Northeast Region's sizable share of state IT employment can be attributed in part to its strength in the larger industry segments. The region has been home to a majority of Ohio's employment in Process Control Instruments (SIC 3823) and Electronic Parts and Equipment (SIC 5065). The region also accounts for a significant portion of the state's employment in other large industry segments, including Computer and Office Equipment (SIC 357); Telephone Communications (SIC 4813); Computers, Peripherals and Software (SIC 5045); Computer Programming Services (SIC 7371); and Data Processing and Preparation (SIC 7374).

IT Industry Specialization

Industry specialization or concentration is measured by location quotients (LQ). Location quotients measure the industry segment's share of the regional total employment divided by the national share of that industry segment. LQs greater than one indicate that an industry segment is more concentrated locally than it is nationally and generally indicate that it is exporting its product.

As Table 3.5 reveals, the concentration of the IT industry is very low relative to the nation, signifying that IT is not an area of specialization in Northeast Ohio. Furthermore, the location quotient for the Northeast Region's IT industry did not change between 1989 and 1999, indicating the concentration of the IT industry in the region has not increased.

When specific IT industry segments are analyzed, there are exceptions to the low concentration of employment. The manufacture of Process Control Instruments (SIC 3823) and Instruments to Measure Electricity (SIC 3825) are highly concentrated in the Northeast Region, and there is also some degree of specialization in the wholesale trade of Electronic Parts and Equipment (SIC 5065). In 1989, Radiotelephone Communications (SIC 4812) and Information Retrieval Services (SIC 7375) were more highly concentrated in the region than the nation, but by 2000, the concentration of these industry segments had fallen to a level below that for the nation.

Table 3.5 Northeast Region Industry Concentration: Location Quotients

SIC	Description	Northeast Region 1989:Q1	1999:Q1	Change
357	Computer & Office Equipment	0.38	0.69	0.31
366	Communications Equipment	0.31	0.44	0.13
367	Electronic Components & Accessories	0.17	0.21	0.04
3695	Magnetic & Optical Recording Media	0.00	0.00	0.00
3823	Process Control Instruments	1.88	S	S
3825	Instruments to Measure Electricity	0.84	1.13	0.29
4812	Radiotelephone Communications	1.36	0.77	-0.59
4813	Telephone Communications	0.78	0.56	-0.22
4822	Telegraph & Other Message Communications	S	S	-0.12
4841	Cable & Other Pay Television Services	0.67	0.71	0.04
5045	Computers, Peripherals & Software	0.75	0.68	-0.07
5065	Electronic Parts & Equipment	0.88	1.11	0.23
5734	Computer & Software Stores	0.50	0.67	0.17
7371	Computer Programming Services	0.81	0.83	0.02
7372	Prepackaged Software	0.56	0.17	-0.39
7374	Data Processing & Preparation	0.71	0.47	-0.24
7375	Information Retrieval Services	1.01	0.86	-0.15
7378	Computer Maintenance & Repair	0.42	0.41	-0.01
7379	Computer Related Services, NEC	0.62	0.64	0.02
7373/76/77	Computer Integrated Systems Design/ Computer Facilities Management/Computer Rental & Leasing	0.48	0.57	0.09
8243	Data Processing Schools	S	S	0.31
Total IT industry		0.63	0.63	0.00

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

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IT Industry Growth in the Region and the Nation

Although Northeast Ohio experienced gains in IT employment, establishments, and per capita payroll, the region grew at a slower rate than the nation as a whole between 1989 and 1999. As shown in Table 3.6, the rate of growth in IT employment in the region was not far below that for the nation, (32% versus 39%), however payroll per employee increased at a much slower rate (5% versus 34%), and growth in the number of establishments also occurred at a slower pace (101% versus 138%). IT manufacturing fared somewhat better in the region than nationwide, however this was offset by slower growth in several service sector industry segments and significant job loss in the largest IT industry segment, Telephone Communications (SIC 4813).

Table 3.6 Growth Rates in the Northeast Region versus the United States: 1989:Q1 to 1999:Q1

SIC	Description	Employment		Payroll per Employee		Establishments	
		Northeast Region	United States	Northeast Region	United States	Northeast Region	United States
357	Computer & Office Equipment	42%	-18%	1%	52%	61%	35%
366	Communications Equipment	31%	-2%	29%	23%	70%	52%
367	Electronic Components & Accessories	27%	11%	-6%	39%	16%	31%
3695	Magnetic & Optical Recording Media	0%-	-29%	0%	19%	0%	31%
3823	Process Control Instruments	S	7%	S	14%	S	49%
3825	Instruments to Measure Electricity	-10%	-30%	10%	36%	80%	8%
4812	Radiotelephone Communications	244%	539%	2%	36%	420%	601%
4813	Telephone Communications	-32%	-1%	-4%	17%	199%	158%
4822	Telegraph & Other Message Communications	-97%	-26%	-83%	44%	-97%	-5%
4841	Cable & Other Pay Television Services	68%	67%	19%	46%	46%	34%
5045	Computers, Peripherals & Software	14%	32%	14%	32%	33%	94%
5065	Electronic Parts & Equipment	32%	10%	14%	21%	10%	33%
5734	Computer & Software Stores	161%	105%	9%	12%	96%	86%
7371	Computer Programming Services	210%	215%	5%	29%	216%	265%
7372	Prepackaged Software	-19%	179%	93%	103%	-39%	93%
7374	Data Processing & Preparation	-15%	34%	19%	30%	23%	59%
7375	Information Retrieval Services	123%	174%	-8%	123%	936%	501%
7378	Computer Maintenance & Repair	61%	73%	-20%	-10%	44%	74%
7379	Computer Related Services, NEC	397%	405%	22%	21%	373%	408%
7373/ 76/77	Computer Integrated Systems Design/Computer Facilities Management Computer Rental & Leasing	109%	84%	10%	29%	49%	97%
8243	Data Processing Schools	588%	264%	26%	32%	367%	382%
Total IT Industry		32%	39%	5%	34%	101%	138%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database; U.S. Department of Labor, Bureau of Labor Statistics, Covered Employment and Wages (ES202).

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
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SIC 366 is an aggregation of SIC 3661, 3663, 3669.
SIC 367 is an aggregation of SIC 3672, 3674.

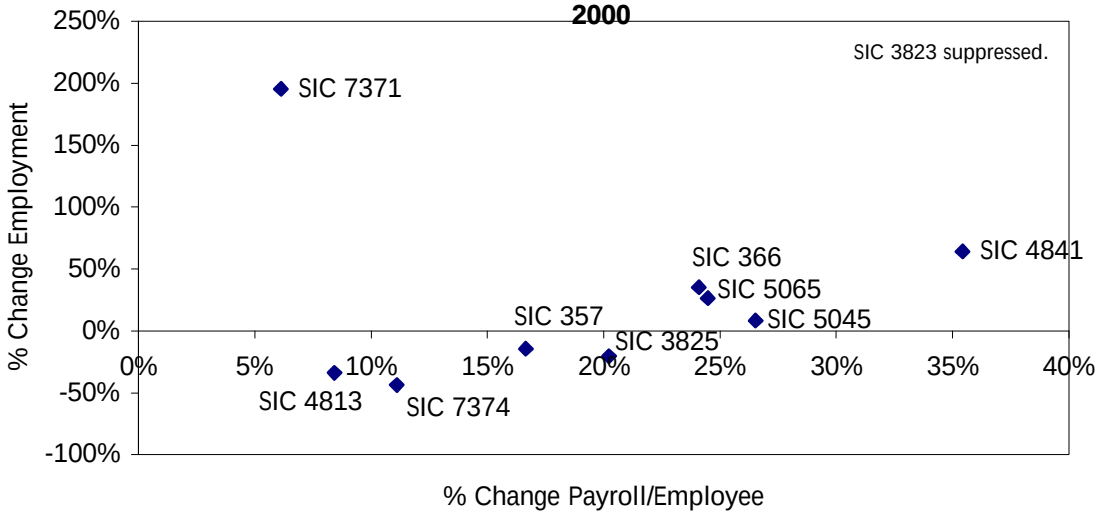
The slower growth rate in payroll per employee reflects a widening gap between the Northeast Ohio and the nation. In 1989, payroll per employee for the IT industry in the Northeast Region was $48,074, not far below the payroll per employee of $49,529 for the IT industry nationwide. By 1999, payroll per employee increased to $54,264 in the region, compared to $66,141 nationally. Although this might appear to be a cause for concern, modest growth in payroll per employee may provide a competitive advantage for the Northeast Region. An earlier study[1] of the IT industry in Northeast Ohio revealed that

[1] Ziona Austrian, "The Information Technology Cluster in Northeast Ohio: A Briefing Paper" (Maxine Goodman Levin College of Urban Affairs, Cleveland State University, 2001), 21.

the cost of doing business in the area is relatively low, due in part to lower payroll costs. This was very important to industry leaders and was perceived as a significant advantage in attracting and retaining IT companies.

Figure 3.1 depicts changes in the Northeast Region's largest IT industry segments, based on 1989 employment. The graph depicts growth or decline in both employment and payroll per employee in segments that had a strong presence in the past. While all of these industry segments have experienced increases in average payroll per employee, four experienced a decline in employment. Computer Programming Services (SIC 7371) experienced a high rate of employment growth, but more modest growth in payroll per employee. The opposite trend can be seen in the Cable and Other Pay Television Services (SIC 4841), where employment growth was modest but payroll per employee increased significantly. The manufacture of Computer and Office Equipment (SIC 357), Instruments to Measure Electricity (SIC 3825), Telephone Communication, except Radiotelephone (SIC 4813), and Data Processing and Preparation Services (SIC 7374) suffered job losses while experiencing growth in payroll per employee.

Figure 3.1
Change in Largest IT Industry Segments in the Northeast Region, 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

WINNING IT INDUSTRY SEGMENTS

By looking at industry segments across several dimensions, it is possible to identify those that are doing particularly well in the region. Table 3.7 identifies the top ten industry segments according to each of five indicators. Seven appear in at least four of the five columns and are highlighted for easy identification; they represent the winning IT industry segments in the Northeast Region. Computer programming services (SIC 7371) was among the largest in terms of total employment and showed a large job gain, both in actual numbers and percent increase. This industry segment was also among the highest paying and had a large number of establishments. Other industry segments showing strength in the region are: Calculating and Accounting Equipment (SIC 3578); Process Control Instruments (SIC 3823); Radiotelephone Communications (SIC 4812); Electronic Parts and Equipment (SIC 5065); Computer Integrated Systems Design (SIC 7373); and Computer Related Services, NEC (SIC 7379).

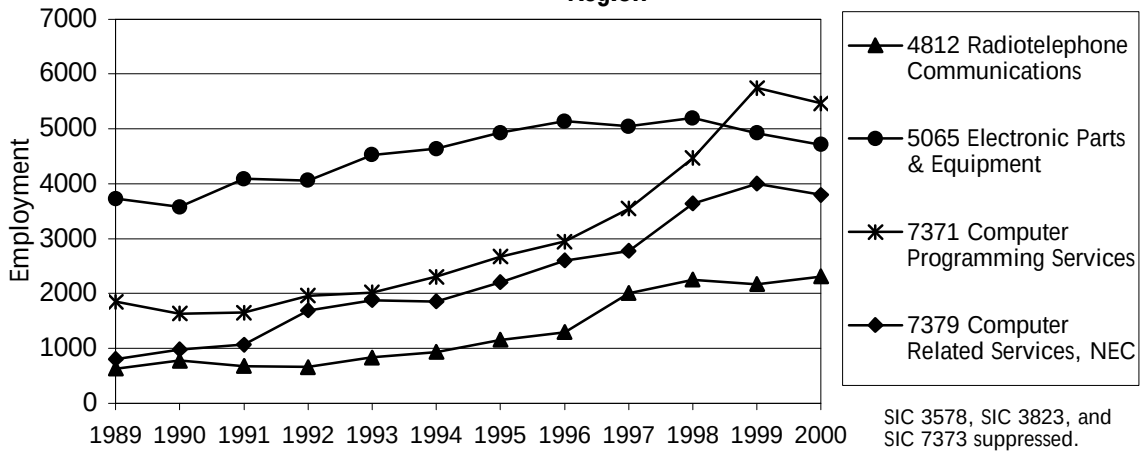
Table 3.7 Northeast Region "Winning" IT Industry Segments

Top Ten Industry Segments				
Largest Employment, 2000:Q1	**Largest Actual Change in Employment, 1989-2000**	**Largest Percent Change in Employment, 1989-2000**	**Highest Payroll per Employee, 2000:Q1**	**Largest Number of Establishments, 2000:Q1**
4813	**7371**	3663	7377	**7379**
7371	**7379**	8243	7372	**7371**
5065	**7373**	**7373**	5045	5045
5045	**3823**	**3578**	4813	**5065**
7379	**4812**	**7379**	**3578**	4813
3823	**3578**	**4812**	3663	5734
4812	5734	**7371**	**7371**	7375
7373	**5065**	5734	**7373**	**7373**
4841	7375	7375	**5065**	7374
3578	4841	**3823**	**3823**	**4812**

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.
Highlighted SICs are present in at least four columns. They represent the "winning" industry segments.

Figure 3.2 provides a more detailed look at employment trends in four of the seven highlighted industry segments and shows that growth has generally been steady, with the largest gains occurring in the later portion of the study period, although some industry segments began to show a slight decline between 1999 and 2000.

Figure 3.2
Employment Trends in "Winning" IT Industry Segments in the Northeast Region



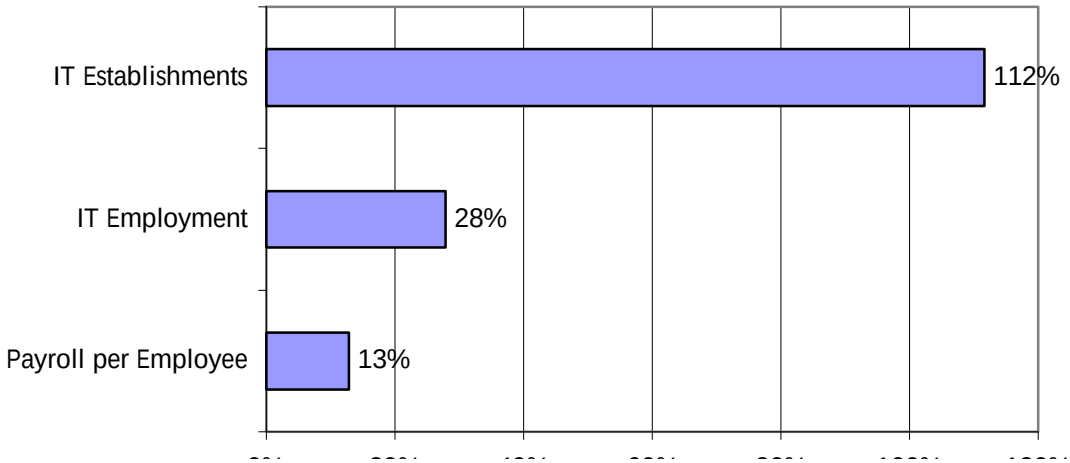
Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

SUMMARY

The IT industry in the Northeast Region appears to be healthy and growing. Although it represents a relatively small portion of total employment in the region, there was positive change in employment, establishments, and payroll per employee between 1989 and 2000.

Figure 3.3 presents an overview of broad changes in the IT industry between 1989 and 2000. IT employment in the Northeast Region of Ohio increased 28 percent during this time period. Most IT job growth occurred in industry segments within the service sector. The largest gains were in Computer Programming Services (SIC 7371), Computer Related Services, NEC (SIC 7379), and Radiotelephone Communications (SIC 4812). Despite the overall gain, some industry segments experienced job loss, most notably Telephone Communications (SIC 4813) and Data Processing and Preparation Services (SIC 7374). The number of IT establishments in the region has grown significantly (112%), far outpacing the growth in employment, demonstrating a trend toward smaller firms. The increase in payroll per employee was more modest – it rose 13 percent over the 11-year period. This moderate growth rate can be viewed as an advantage in the competition for companies.

Figure 3.3
Northeast Region IT Growth 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

Industry segments that have been identified as the "winners" in the region, according to five distinct indicators, include: the manufacture of Calculating and Accounting Equipment (SIC 3578); the manufacture of Process Control Instruments (SIC 3823); Radiotelephone Communications (SIC 4812); the wholesale of Electronic Parts and Equipment (SIC 5065); Computer Programming Services (SIC 7371); Computer Integrated Systems Design (SIC 7373); and Computer Related Services, NEC (SIC 7379).

The Northeast Region accounts for one-third of the IT employment in the State of Ohio, and this share remained fairly stable between 1989 and 2000. Relative to the nation, the concentration of the IT industry in the region is very low and has not changed. Although the region experienced positive growth in employment, establishments, and payroll per employee, the rates of growth were lower in the Northeast Region of Ohio than in nation.

IV. THE CINCINNATI REGION

This section describes changes in the Information Technology sector (IT) between 1989 and the beginning of 2000 for the Greater Cincinnati Region. In this analysis, the Cincinnati Region includes Brown, Butler, Clermont, Clinton, Hamilton, and Warren Counties in the State of Ohio. The IT industry segments in this region are defined by SIC code and by name in Table 4.1. In some cases, SICs have been aggregated in order to maintain confidentiality of businesses in the 4-digit sub-groups.

IT EMPLOYMENT

Table 4.1 identifies changes in IT employment for the Cincinnati Region. From the beginning of 1989 to the beginning of 2000, total IT employment grew from 19,785 to 27,738. This change represents growth in employment of 40 percent (Figure 4.1).

The largest number of IT employees in Cincinnati in both time periods is in SIC 4813, Telephone Communications. Although this industry segment experienced a 28% loss in employment during this time period, it remained the region's largest IT employer in 2000. Job loss in this large industry segment affects the overall growth rate for regional IT employment. Although a 40% increase appears healthy, the rate would be much higher if SIC 4813 were excluded from the analysis. The Cincinnati Region has experienced very high rates of growth in several IT industry segments.

The largest rate of growth in employment over this time period was in SIC 7379, Computer Related Services, NEC. This group consists of establishments primarily engaged in supplying computer related services not classified in other industry segments. Computer consultants operating on a contract or fee basis are classified in this industry segment as are data base developers, data processing consultants, disk and diskette conversion services, and disk and diskette re-certification services. This group experienced growth in employment of 1,188 percent, from 196 employees in 1989 to 2,524 at the beginning of 2000. There were also very large gains in SIC 7376/7377, Computer Facilities Management/ Computer Rental and Leasing; SIC 8243, Data Processing Schools; and SIC 4812, Radiotelephone Communications. All of the wholesale, retail, and service sector IT industry segments experienced increases in employment.

Most IT industry segments in the manufacturing sector experienced employment declines between 1989 and 2000. Due to confidentiality requirements, little data can be shown at the four-digit level, however the actual number of jobs lost in each industry segment was relatively low, as many were small even in 1989. The exception is an industry segment within SIC 36. SIC 3663, Radio and TV Communications is the largest IT manufacturing segment and it experienced considerable drop in employment between 1989 and 2000. Although IT manufacturing did not fare well over the 11-year time period, the losses do not compare to the more than 2,000 jobs lost in Telephone Communications.

Table 4.1 Cincinnati Region IT Employment

		Cincinnati Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	579	S	S	S
36	Electronic and Other Equipment and Components, except Computer Equipment	1,752	1,475	-277	-16%
3695	Magnetic & Optical Recording Media	0	0	0	0
3823	Process Control Instruments	S	S	S	-10%
3825	Instruments to Measure Electricity	52	S	S	S
4812	Radiotelephone Communications	S	977	S	S
4813	Telephone Communications	7,459	5,375	-2,084	-28%
4822	Telegraph & Other Message Communications	32	0	-32	-100%
4841	Cable & Other Pay Television Services	564	1,247	683	121%
5045	Computers, Peripherals & Software	2,820	3,735	915	32%
5065	Electronic Parts & Equipment	852	1,039	187	22%
5734	Computer & Software Stores	550	1,409	859	156%
7371	Computer Programming Services	1,355	3,495	2,140	158%
7372/7374	Prepackaged Software/Data Processing & Preparation	1,755	2,750	995	57%
7373	Computer Integrated Systems Design	339	756	417	123%
7375	Information Retrieval Services	419	683	264	63%
7376/7377	Computer Facilities Management/ Computer Rental & Leasing	145	1,060	915	631%
7378	Computer Maintenance & Repair	179	388	209	117%
7379	Computer Related Services, NEC	196	2,524	2,328	1188%
8243	Data Processing Schools	63	280	217	344%
Total IT Employment		19,785	27,738	7,953	40%

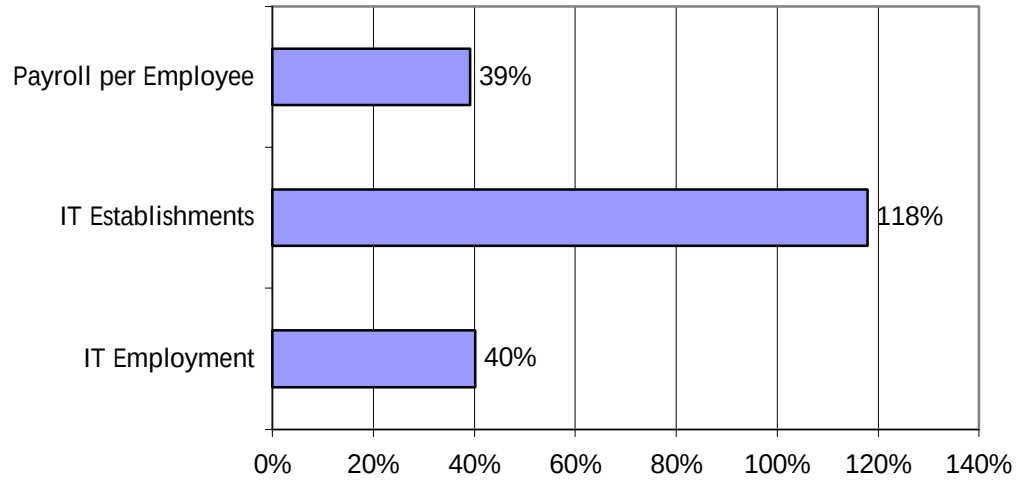
Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.

SIC 36 is an aggregation of SIC 3661, 3663, 3669, 3672, 3674.

Figure 4.1
Cincinnati Region IT Growth 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

PAYROLL PER EMPLOYEE IN IT INDUSTRY

Average annual payroll per employee in the IT industry grew by 39 percent from 1989 to 2000 (Figure 4.1). Average payroll in the industry at the beginning of 2000 was nearly $69,000 per year (Table 4.2). This figure represents above average pay for the region. The *Cincinnati-Hamilton, OH-KY-IN National Compensation Survey, September 2000* published by the U.S. Department of Labor Bureau of Labor Statistics indicates that mean annual earnings in the region were $35,190 in that year.

The region's two largest employers had the two highest average salaries. At over $95,000 per year, the wholesale of Computers Peripherals and Software (SIC 5045) had the highest payroll per employee. This industry segment had the second-largest number of employees. The largest industry segment in terms of employment, Telephone Communications (SIC 4813) had the second-highest payroll at $87,761. The lowest payroll at the beginning of 2000 is in industry segment 5734, Computer and Software Stores, a sub-category of the retail sector. Annualized payroll per employee in this group for the first quarter of 2000 is $33,478, below average annual earnings for all employees in the Cincinnati Region.

The largest percentage increase in payroll is found in industry segment 4841, Cable and Other Pay Television Services, which saw annualized payroll increase 74 percent during

this time period. Annualized payroll in this industry segment grew from the lowest in the IT industry at the beginning of 1989, at $27,107, to $47,200 in 2000 – still below the IT average, but no longer the lowest payroll in the IT industry. This industry segment also experienced a large gain in employment over the same time period.

Table 4.2 Cincinnati Region IT Annualized Payroll per Employee (in 2000 dollars)

		Cincinnati Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	$ 41,456	S	S	S
36	Electronic and Other Equipment and Components, except Computer Equipment	$ 34,593	$ 41,709	$ 7,116	21%
3695	Magnetic & Optical Recording Media	$ 0	$ 0	$ 0	0%
3823	Process Control Instruments	S	S	S	-23%
3825	Instruments to Measure Electricity	$ 31,554	S	S	S
4812	Radiotelephone Communications	S	$ 55,082	S	S
4813	Telephone Communications	$ 53,116	$ 87,761	$ 34,645	65%
4822	Telegraph & Other Message Communications	$ 42,127	$ 0	- $ 42,127	-100%
4841	Cable & Other Pay Television Services	$ 27,107	$ 47,200	$ 20,093	74%
5045	Computers, Peripherals & Software	$ 62,927	$ 95,266	$ 32,339	51%
5065	Electronic Parts & Equipment	$ 43,333	$ 39,152	- $ 4,181	-10%
5734	Computer & Software Stores	$ 31,795	$ 33,478	$ 1,683	5%
7371	Computer Programming Services	$ 57,812	$ 75,015	$ 17,203	30%
7372/ 7374	Prepackaged Software/ Data Processing & Preparation	$ 44,715	$ 65,984	$ 21,269	48%
7373	Computer Integrated Systems Design	$ 55,691	$ 71,341	$ 15,650	28%
7375	Information Retrieval Services	$ 56,615	$ 56,594	- $ 21	-<1%
7376/ 7377	Computer Facilities Management/ Computer Rental & Leasing	$ 40,727	$ 57,553	$16,826	41%
7378	Computer Maintenance & Repair	$ 48,114	$ 37,238	- $ 10,876	-23%
7379	Computer Related Services, NEC	$ 44,070	$ 68,276	$ 24,206	55%
8243	Data Processing Schools	$ 39,706	$ 37,523	- $ 2,183	-5%
	Total IT Payroll per Employee	$ 49,487	$ 68,859	$ 19,372	39%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

1989 dollars inflated using the average of the Consumer Price Index for the Cleveland Metropolitan Area for the months of January, February, and March 2000.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

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The largest payroll decrease in the region, both as a percentage and in total, is found in industry segment 7378, Computer Maintenance and Repair (with the exception of SIC 4822 which lost its presence in the region). Employees in this group saw annualized payroll decrease by 23 percent from the beginning of 1989 to the beginning of 2000, falling to $37,238. Where the annualized payroll per employee for this group in 1989 was about average for the IT industry at $48,114, the first quarter 2000 figure represents the second lowest annualized payroll per employee, above only the retail employee payroll. A possible explanation for the big decline in payroll for this group is that a large increase in the number of technicians qualified in computer repair greatly increased the supply of labor in this market, thereby driving down wages. However, this industry segment is not one of the top five by growth in employment, either in employment level or percentage growth.

NUMBER OF IT ESTABLISHMENTS

Table 4.3 shows the change in the number of establishments for the IT industry. Total IT establishments in the Cincinnati Region grew by 118 percent from the beginning of 1989 to the beginning of 2000 (Figure 4.1). A total of 1,233 establishments in the IT industry existed in the Cincinnati Region in the first quarter of 2000 (Table 4.3).

The largest number of establishments in the sector in 2000 is in industry segment 7379, Computer Related Services, NEC. This is the industry segment that saw the highest growth in employment over this time period as well as the highest growth by sheer number of establishments. The largest percentage growth in number of firms during the 1990s occurred in industry segment 4812, Radiotelephone Communications, which began with a very small number of firms in 1989. Many of the industry segments within the service sector experienced a high rate of growth in the number of establishments due to the very low number of firms at the start of the time period.

Industry segments within manufacturing often have a smaller number of establishments than other industry segments and this holds true in the IT industry. Even when aggregated to broader industry segments, the manufacturing segments have few establishments. Among service sector industry segments, SIC 7376/7377, Computer Facilities Management/ Computer Rental and Leasing, has the fewest number of establishments. This group

includes establishments primarily engaged in providing on-site management and operation of computer and data processing facilities on a contract or fee basis and establishments engaged in renting or leasing computers and related data processing equipment. This was the only industry segment within the service sector to experience a drop in the number of establishments, losing eight firms over this time period, a 44 percent decline from 1989. However, a reduction in the number of firms in an industry segment does not necessarily indicate decline during this time period, and employment in this group actually grew by 631 percent. A reduction in the number of firms could indicate the realization of economies of scale through consolidation.

Table 4.3 Cincinnati Region IT Establishments

		Cincinnati Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	6	S	S	S
36	Electronic and Other Equipment and Components, except Computer Equipment	10	14	4	40%
3695	Magnetic & Optical Recording Media	0	0	0	0
3823	Process Control Instruments	S	S	S	-10%
3825	Instruments to Measure Electricity	3	S	S	S
4812	Radiotelephone Communications	S	41	S	S
4813	Telephone Communications	26	111	85	327%
4822	Telegraph & Other Message Communications	3	0	-3	-100%
4841	Cable & Other Pay Television Services	13	20	7	54%
5045	Computers, Peripherals & Software	113	145	32	28%
5065	Electronic Parts & Equipment	70	95	25	36%
5734	Computer & Software Stores	46	96	50	109%
7371	Computer Programming Services	70	224	154	220%
7372/ 7374	Prepackaged Software/Data Processing & Preparation	58	64	6	10%
7373	Computer Integrated Systems Design	27	55	28	103%
7375	Information Retrieval Services	13	54	41	315%
7376/ 7377	Computer Facilities Management/ Computer Rental & Leasing	18	10	-8	-44%
7378	Computer Maintenance & Repair	22	24	2	9%
7379	Computer Related Services, NEC	52	240	188	362%
8243	Data Processing Schools	4	21	17	425%
Total IT Establishments		565	1,233	668	118%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 36 is an aggregation of SIC 3661, 3663, 3669, 3672, 3674.

THE CINCINNATI REGION IN COMPARISON TO THE STATE AND NATIONAL IT INDUSTRY

IT Industry Growth in the Region and the Nation

Many changes in IT employment, payroll per employee, and number of establishments in the Cincinnati Region between 1989 and 1999 have mirrored changes at the national level (see Table 4.4). Overall, growth in total IT employment in Cincinnati grew by 31 percent during this time period, just slightly lower than growth at the national level of 39 percent. Payroll per employee also grew somewhat slower in Cincinnati, increasing by 28 percent versus 34 percent in the rest of the nation. The number of IT establishments in Cincinnati increased by 93 percent, while the number of establishments in the US grew by 138 percent.

Table 4.4 Growth Rates in the Cincinnati Region versus the United States: 1989:Q1 to 1999:Q1

		Employment		Payroll per Employee		Establishments	
SIC	Description	Cincinnati Region	United States	Cincinnati Region	United States	Cincinnati Region	United States
357	Computer & Office Equipment	S	-18%	S	52%	S	35%
36	Electronic and Other Equipment and Components, exc. Computer Equipment	-7%	4%	-3%	32%	50%	39%
3695	Magnetic & Optical Recording Media	0%	-29%	0%	19%	0%	31%
3823	Process Control Instruments	-3%	7%	7%	14%	19%	49%
3825	Instruments to Measure Electricity	S	-30%	S	36%	S	8%
4812	Radiotelephone Communications	S	539%	S	36%	S	601%
4813	Telephone Communications	-27%	-1%	47%	17%	258%	158%
4822	Telegraph & Other Message Communications	-100%	-26%	-100%	44%	-100%	-5%
4841	Cable & Other Pay Television Services	163%	67%	39%	46%	46%	34%
5045	Computers, Peripherals & Software	15%	32%	49%	32%	22%	94%
5065	Electronic Parts & Equipment	26%	10%	24%	21%	6%	33%
5734	Computer & Software Stores	142%	105%	2%	12%	93%	86%
7371	Computer Programming Services	132%	215%	20%	29%	174%	265%
7372/7374	Prepackaged Software/Data Processing & Preparation	55%	80%	38%	84%	5%	76%
7373	Computer Integrated Systems Design	96%	109%	34%	28%	41%	144%
7375	Information Retrieval Services	44%	174%	-9%	123%	277%	501%
7376/7377	Computer Facilities Management/ Computer Rental & Leasing	348%	19%	44%	27%	-33%	-1%
7378	Computer Maintenance & Repair	113%	73%	-19%	-10%	5%	74%
7379	Computer Related Services, NEC	952%	405%	34%	21%	310%	408%
8243	Data Processing Schools	217%	264%	-19%	32%	400%	382%
Total IT Industry		31%	39%	28%	34%	93%	138%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database; U.S. Department of Labor, Bureau of Labor Statistics, Covered Employment and Wages (ES202).

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.

SIC 36 is an aggregation of SIC 3661, 3663, 3669, 3672, 3674.

IT Industry Specialization

This section provides a description of regional strengths in the IT industry. Table 4.5 reveals the location quotient (LQ) for each industry segment. The LQ indicates whether the Cincinnati Region is an importer or exporter of goods and services in that particular industry segment. An LQ less than one indicates that the region does not produce enough of the good or service locally to satisfy regional demand. An LQ greater than one indicates that the region produces more of the good or service than is necessary to satisfy local demand, and is therefore an exporter in that industry segment. This circumstance implies that the region has some degree of comparative advantage in the production of the particular good or service.

Table 4.5 Cincinnati Region Industry Concentration: Location Quotients

		Cincinnati Region		
SIC	**Description**	**1989:Q1**	**1999:Q1**	**Change**
357	Computer & Office Equipment	0.21	S	S
36	Electronic and Other Equipment and Components, except Computer Equipment	0.41	0.38	-0.03
3695	Magnetic & Optical Recording Media	0.00	0.00	0.00
3823	Process Control Instruments	S	S	-0.08
3825	Instruments to Measure Electricity	0.08	S	S
4812	Radiotelephone Communications	S	0.60	S
4813	Telephone Communications	1.30	0.97	-0.33
4822	Telegraph & Other Message Communications	0.34	0.00	-0.34
4841	Cable & Other Pay Television Services	0.75	1.20	0.45
5045	Computers, Peripherals & Software	1.41	1.25	-0.16
5065	Electronic Parts & Equipment	0.52	0.60	0.08
5734	Computer & Software Stores	1.22	1.46	0.24
7371	Computer Programming Services	1.53	1.14	-0.39
7372/7374	Prepackaged Software/Data Processing & Preparation	0.91	0.79	-0.12
7373	Computer Integrated Systems Design	0.54	0.51	-0.03
7375	Information Retrieval Services	1.44	0.77	-0.67
7376/7377	Computer Facilities Management/Computer Rental & Leasing	0.59	2.26	1.67
7378	Computer Maintenance & Repair	0.83	1.03	0.20
7379	Computer Related Services, NEC	0.39	0.82	0.43
8243	Data Processing Schools	1.21	1.07	-0.14
Total IT industry		0.83	0.80	-0.03

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

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The location quotient for the Cincinnati Region for the entire IT industry was 0.80 during the first quarter of 1999. This statistic indicates that the region is a relative importer of goods and services in this industry. Furthermore the LQ has decreased slightly since the beginning of 1989, indicating that IT firms in Cincinnati have not increased in their ability to satisfy regional demand, and the Cincinnati region must still import IT industry goods and services from other locations.

In 1989, the Cincinnati Region was an exporter in seven of 19 IT industry segments in which the region has a presence. In the first quarter of 2000 the number was also seven, however, they are not all the same industry segments. The LQ for SIC 7378, Computer Maintenance and Repair, increased from less than one to greater than one, as did that for SIC 7376/7377, Computer Facilities Management/Computer Rental and Leasing. This industry segment saw the greatest shift in status during the 1990s, with its LQ changing from only 0.59 to 2.26, representing the largest LQ in 2000. The smallest LQ for both years is in SIC 3825, Instruments to Measure Electricity (with the exception of SIC 3695 which does not operate in the Cincinnati Region).

Regional IT Employment Relative to the State

The Cincinnati Region accounts for 18 percent of IT industry employment in the State of Ohio, which is slightly higher than its share of total employment (15%). The share IT jobs held constant between 1989 and 2000, despite a 40% growth rate in employment. This indicates that growth is occurring at a faster rate in another part of the state. In 2000, the largest share of employment in the region is in Computer Facilities Management/Computer Rental and Leasing (SIC 7376/7377), with 59 percent of employment in this industry segment within Ohio. In the Cincinnati Region, this industry segment saw strong gains during the 1990s in employment and payroll even though the number of establishments fell during this time, suggesting improvements in efficiency or the realization of economies of scale. SIC 3825, Instruments to Measure Electricity has the lowest share of output in Ohio, which is not surprising given that this industry segment has the smallest location quotient.

Table 4.6 Cincinnati Region Share of Ohio IT Employment

SIC	Description	Cincinnati Region 1989:Q1	Cincinnati Region 2000:Q1
357	Computer & Office Equipment	5%	S
36	Electronic and Other Equipment and Components, except Computer Equipment	15%	12%
3695	Magnetic & Optical Recording Media	0%	0%
3823	Process Control Instruments	S	S
3825	Instruments to Measure Electricity	2%	S
4812	Radiotelephone Communications	S	18%
4813	Telephone Communications	23%	21%
4822	Telegraph & Other Message Communications	30%	0%
4841	Cable & Other Pay Television Services	13%	20%
5045	Computers, Peripherals & Software	28%	27%
5065	Electronic Parts & Equipment	12%	13%
5734	Computer & Software Stores	28%	21%
7371	Computer Programming Services	24%	18%
7372/7374	Prepackaged Software/Data Processing & Preparation	21%	31%
7373	Computer Integrated Systems Design	31%	11%
7375	Information Retrieval Services	8%	7%
7376/7377	Computer Facilities Management/Computer Rental & Leasing	12%	60%
7378	Computer Maintenance & Repair	29%	27%
7379	Computer Related Services, NEC	12%	21%
8243	Data Processing Schools	59%	30%
Total IT industry		18%	18%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
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WINNING IT INDUSTRY SEGMENTS

The "winning" IT industry segments are defined as those that achieve the greatest number of appearances in the top 10 rankings based on those categories listed in Table 4.7: largest employment in 2000, largest absolute change in employment from 1989 to 2000, greatest percent change in employment, highest payroll in 2000, and the most establishments in 2000. The large number of industry segments that appear in at least four of the five columns indicates that the same industry segments are doing well when measured by several criteria. In the Cincinnati Region, those industry segments are Radiotelephone Communications (4812); Computers, Peripherals and Software (5045); Computer and

Software Stores (5734); Computer Programming Services (7371); Prepackaged Software (7372); Computer Integrated Systems Design (SIC 7373); Computer Facilities Management (7376); and Computer Related Services, NEC (7379).

The majority of these industry segments fall within the broader group of computer and data processing services (SIC 737). Establishments in this industry segment provide a wide range of services on a contract or fee basis, including computer applications programming, software design, software documentation and training, modification of software or bundling of software and computer hardware, and online information retrieval. The lone communications segment that has been identified as a "winner" (Radiotelephone Communications) includes establishments providing cellular phone services and paging services. The wholesale of computers, peripherals, and software and retail stores specializing in computers and software were also among the winning industry segments.

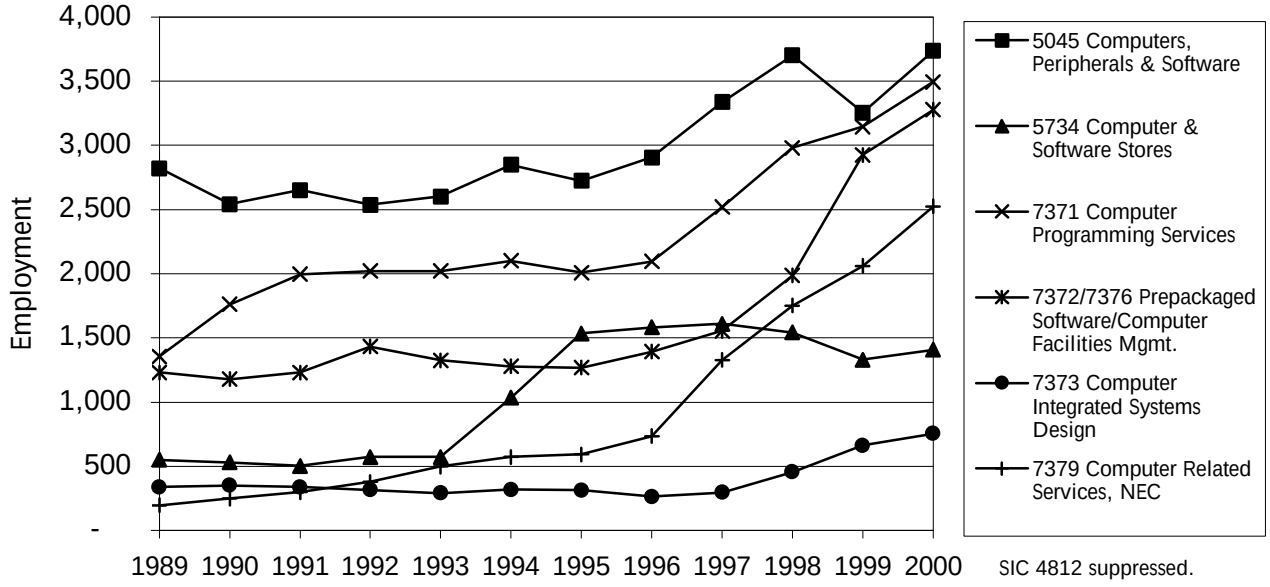
Table 4.7 Cincinnati Region "Winning" IT Industry Segments

Top Ten Industry Segments				
Largest Employment, 2000:Q1	**Largest Actual Change in Employment, 1989-2000**	**Largest Percent Change in Employment, 1989-2000**	**Highest Payroll per Employee, 2000:Q1**	**Largest Number of Establishments, 2000:Q1**
4813	**7379**	**7376**	**5045**	**7379**
5045	**7371**	**7379**	4813	**7371**
7371	**7372**	8243	**7371**	**5045**
7379	**5045**	**4812**	**7373**	4813
7372	**5734**	**7371**	**7372**	**5734**
5734	**7376**	**5734**	**7379**	5065
4841	4841	**7373**	3571	**7373**
5065	**4812**	4841	7377	7375
4812	**7373**	7378	**7376**	**4812**
7376	7375	**7372**	7375	**7372**

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.
Highlighted SICs are present in at least four of the five columns. They represent the "winning" industry segments.

Employment growth in the winning industry segments from 1989 to 2000 is illustrated in Figure 4.2. Growth was rapid in many industry segments, particularly after 1996. Among the fastest growing segments are Computer Programming Services, Prepackaged Software/Computer Facilities Management, and Computer Related Services, NEC.

Figure 4.2
Employment Trends in "Winning" IT Industry Segments in the Cincinnati Region

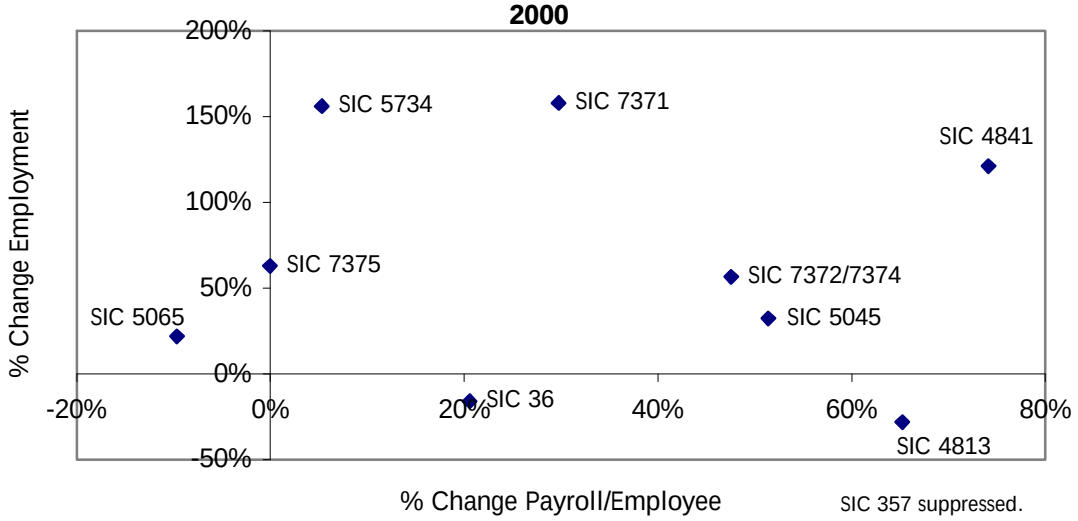


SIC 4812 suppressed.

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

Figure 4.3 depicts both employment and payroll trends for those industry segments that were the region's largest IT employers in 1989. Many of those industry segments continued to be strong, showing growth in both employment and payroll. Just three industry segments experienced employment losses- two within manufacturing (SIC 36 and 357) and the large Telephone Communications segment (SIC 4813). Only one industry segment, the wholesale of Electronic Parts and Equipment (SIC 5065), experienced a decline in payroll per employee.

Figure 4.3
Change in Largest IT Industry Segments in the Cincinnati Region, 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

SUMMARY

Overall, the Cincinnati Region has seen important gains in the IT industry during the study period. The region employs just under one-fifth of all IT workers in the State of Ohio, which can be expected from a region of its size, and the region's share of state IT employment has held constant over the past decade. Industry concentration analysis suggests that the Cincinnati Region has strengths in the business services category of the IT industry. This conclusion is also supported by the "winning" industry segments in the region, many of which are in the business services category.

V. THE COLUMBUS REGION

The Columbus Region has a strong and increasing presence in the IT industry. The Columbus Region is comprised of the following central Ohio counties: Crawford, Delaware, Fairfield, Fayette, Franklin, Knox, Licking, Madison, Marion, Morrow, Pickaway, Richland, Ross, and Union.

For the Columbus Region, data from the Employment and Payroll (ES202) estimates indicate that the IT industry plays an important and growing role. In the first quarter of 1989, the industry employed 26,068 workers in 555 establishments. In constant 2000 dollars, the industry paid over a billion dollars in wages, amounting to an average salary of $43,226. By the first quarter of 2000, the industry employed 47,205 workers in 1,642 different establishments. Payroll jumped to over $3 billion and an average salary of $64,529. In 1989, IT industry employment represented three percent of the total employment in the Columbus region. That share grew to nearly five percent by 2000. As this section documents, employment in the IT industry is growing at a much faster rate in the Columbus region than in the rest of the state or the country.

IT EMPLOYMENT

Table 5.1 reports employment in the Columbus region in the IT industry segments. Because of low numbers of firms or dominance by a single firm in a particular industry segment, a number of the four-digit industry segments were combined or suppressed for confidentiality reasons. Telephone Communications (SIC 4813) is the largest IT employer in the Columbus Region. With over 8,000 employees in 1989 and over 9,400 in 2000, it far exceeds any other single IT industry segment in terms of employment and enjoyed modest growth over the 11-year period. In the first quarter of 1989, SIC 3661, the manufacture of Telephone and Telegraph Apparatus, (employment suppressed) was the second largest employer, followed by the combined industry segments 7372/7375, Prepackaged Software/ Information Retrieval Services (2,562 employees); and SIC 7374, Data Processing and Preparation (1,750 employees). In total, the region employed 26,068 people in the IT industry in the first quarter of 1989.

Table 5.1 Columbus Region IT Employment

SIC	Description	Columbus Region			
		1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	625	415	-210	-34%
3661	Telephone & Telegraph Apparatus	S	S	S	20%
3663/3669	Radio & TV Communications/Communications Equipment	355	294	-61	-17%
367	Electronic Components & Accessories	278	239	-39	-14%
3695	Magnetic & Optical Recording Media	0	0	0	0
382	Process Control Instruments/Instruments to Measure Electricity	1,745	1,889	144	8%
4812	Radiotelephone Communications	S	1,630	S	S
4813	Telephone Communications	8,024	9,429	1,405	18%
4822	Telegraph & Other Message Communications	26	S	S	S
4841	Cable & Other Pay Television Services	1,057	1,085	28	3%
5045	Computers, Peripherals & Software	1,548	3,062	1,514	98%
5065	Electronic Parts & Equipment	978	1,092	114	12%
5734	Computer & Software Stores	S	S	S	312%
7371	Computer Programming Services	659	7,630	6,971	1,058%
7372/7375	Prepackaged Software/Information Retrieval Services	2,562	4,016	1,454	57%
7373	Computer Integrated Systems Design	123	1,137	1,014	824%
7374	Data Processing & Preparation	1,750	1,547	-203	-12%
7376-7378	Computer Facilities Management, Rental & Leasing, Maintenance & Repair	149	638	489	328%
7379	Computer Related Services, NEC	389	4,501	4,112	1,057%
8243	Data Processing Schools	0	222	222	NA
Total IT Employment		26,068	47,205	21,137	81%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 367 is an aggregation of SIC 3672, 3674.
SIC 382 is an aggregation of SIC 3823, 3825.

By the first quarter of 2000, employment in the industry increased by over 80% to 47,205 employees. Many of those gains occurred in the three-digit SIC 737, Computer Programming, Data Processing, and other Computer Related Services. Within that SIC were particularly large gains of 6,971 employees (1,058 % increase) in SIC 7371, Computer Programming Services, and 4,112 employees (a 1,057 % increase) in SIC 7379, Computer Related Services, NEC. The IT industry also had some industry segments that lost employment during the decade, mostly in the manufacturing sector, including SIC 357, Computer and Office Equipment; SIC 3663/3669, Radio and TV Communications/ Communications Equipment; and SIC 367, Electronic Components and Accessories. Jobs were also lost in SIC 7374, Data Processing and Preparation.

NUMBER OF IT ESTABLISHMENTS

Table 5.2 displays the number of IT establishments in the first quarter of 1989 and 2000 and the growth between those years. There were 555 IT establishments in the Columbus region in the first quarter of 1989. The industry segments with the largest number of establishments in 1989 were SIC 5065, Electronic Parts and Equipment (100 establishments); SIC 5045, Computers, Peripherals and Software (92 establishments); and SIC 7371, Computer Programming Services (66 establishments).

Table 5.2 Columbus Region IT Establishments

		Columbus Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	10	9	-1	-10%
3661	Telephone & Telegraph Apparatus	S	S	S	100%
3663/3669	Radio & TV Communications/ Communications Equipment	6	10	4	67%
367	Electronic Components & Accessories	10	6	-4	-40%
3695	Magnetic & Optical Recording Media	0	0	0	0
382	Process Control Instruments/Instruments to Measure Electricity	17	14	-3	-18%
4812	Radiotelephone Communications	S	31	S	S
4813	Telephone Communications	40	155	115	288%
4822	Telegraph & Other Message Communications	3	S	S	S
4841	Cable & Other Pay Television Services	18	27	9	50%
5045	Computers, Peripherals & Software	92	158	66	72%
5065	Electronic Parts & Equipment	100	107	7	7%
5734	Computer & Software Stores	S	S	S	198%
7371	Computer Programming Services	66	365	299	453%
7372/7375	Prepackaged Software/Information Retrieval Services	36	116	80	222%
7373	Computer Integrated Systems Design	22	74	52	236%
7374	Data Processing & Preparation	29	38	9	31%
7376-7378	Computer Facilities Management, Rental & Leasing, Maintenance & Repair	19	40	21	111%
7379	Computer Related Services, NEC	39	349	310	795%
8243	Data Processing Schools	0	17	17	NA
Total IT Establishments		555	1,642	1,087	196%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 367 is an aggregation of SIC 3672, 3674.
SIC 382 is an aggregation of SIC 3823, 3825.

The number of IT establishments nearly tripled to 1,642 by the first quarter of 2000. Consistent with employment increases, group 737 also saw some of the largest establishment growth rate increases. Within that industry segment, Computer Related Services (SIC 7379), saw a 795 percent increase in the number of establishments from 39 to 349. Computer Programming Services (SIC 7371) also saw a very large increase (299 establishments). Outside that industry segment, Telephone Communications (SIC 4813) and Computer and Software Stores (SIC 5734) saw the largest increases in the number of establishments.

For the most part, the same industry segments that saw employment declines also saw a drop in the number of establishments. The exceptions were SIC 3663/3669, Radio and TV Communications/Communications Equipment, and SIC 7374, Data Processing and Preparation, which both saw employment decline although the number of establishments increased. This could indicate saturation or the closure of large companies and an increase in the number of small companies. In one case, SIC 382, Process Control Instruments/Instruments to Measure Electricity, the number of establishments declined despite a small increase in employment.

PAYROLL PER EMPLOYEE IN IT INDUSTRY

Table 5.3 reports average payroll per employee in the IT industry in 1989 and 2000. The employment and payroll data come from the first quarter of each year and are annualized by multiplying the payroll per employee by four. The data are in constant 2000 dollars, and the 1989 figures are inflated using the average of the Consumer Price Index for the Cleveland Metropolitan Area.

Jobs in the IT industry pay well. The average salary paid in the Columbus region in the IT industry greatly exceeded that in the Columbus overall economy in 1989 ($45,226 versus $29,132). The highest paying industry segments in 1989 were SIC 5045, wholesale of Computers, Peripherals and Software ($57,786); SIC 4813, Telephone Communications ($47,739); SIC 382, manufacture of Process Control Instruments/Instruments to Measure Electricity ($46,626); and 7371, Computer Programming Services ($45,936). Even the lowest paying industry segment, Data Processing and Preparation, SIC 7374, was right around the average for all industries at $29,037 per year.

Table 5.3 Columbus Region IT Annualized Payroll per Employee (in 2000 dollars)

SIC	Description	Columbus Region 1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	$ 38,104	$ 43,996	$ 5,892	15%
3661	Telephone & Telegraph Apparatus	S	S	S	80%
3663/3669	Radio & TV Communications/ Communications Equipment	$ 31,130	$ 30,591	- $ 539	-2%
367	Electronic Components & Accessories	$ 31,429	$ 29,859	- $ 1,570	-5%
3695	Magnetic & Optical Recording Media	$ 0	$ 0	$ 0	0%
382	Process Control Instruments/Instruments to Measure Electricity	$ 47,626	$ 38,187	- $ 9,439	-20%
4812	Radiotelephone Communications	S	$ 64,510	S	S
4813	Telephone Communications	$ 47,739	$ 51,885	$ 4,146	9%
4822	Telegraph & Other Message Communications	$ 36,549	S	S	S
4841	Cable & Other Pay Television Services	$ 38,119	$ 38,026	- $ 93	<1%
5045	Computers, Peripherals & Software	$ 57,786	$ 73,022	$ 15,236	26%
5065	Electronic Parts & Equipment	$ 39,462	$ 49,357	$ 9,895	25%
5734	Computer & Software Stores	S	S	S	59%
7371	Computer Programming Services	$ 45,936	$ 60,454	$ 14,518	32%
7372/7375	Prepackaged Software/Information Retrieval Services	$ 43,559	$ 100,151	$ 56,592	130%
7373	Computer Integrated Systems Design	$ 39,872	$ 57,344	$ 17,472	44%
7374	Data Processing & Preparation	$ 29,037	$ 93,222	$ 64,185	221%
7376-7378	Computer Facilities Management, Rental & Leasing, Maintenance & Repair	$ 40,511	$ 42,018	$ 1,507	4%
7379	Computer Related Services, NEC	$ 40,193	$ 56,001	$ 15,808	39%
8243	Data Processing Schools	0	$ 34,580	$ 34,580	NA
Total IT Payroll per Employee		$ 45,226	$ 64,529	$ 19,303	43%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

1989 dollars inflated using the average of the Consumer Price Index for the Cleveland Metropolitan Area for the months of January, February and March 2000.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

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SIC is an aggregation of SIC 3672, 3674.

SIC 382 is an aggregation of SIC 3823, 3825.

Average payroll per employee rose to $64,529 in 2000, a 43 percent increase. The average for all industries in the Columbus region grew much more modestly (15%) to an average salary of $33,457 in 2000. The largest salary increase was in the industry segment that paid the least in 1989, Data Processing and Preparation, SIC 7374. The average salary increased by $64,185 to $93,222, or 221 percent, making the second-highest paying industry segment. This increase occurred in the face of lost jobs, as Table 5.1 indicates that the segment lost 203 jobs during that time. SIC 7372/7375, Prepackaged Software/Information Retrieval Services also had a large salary increase ($56,592).

THE COLUMBUS REGION IN COMPARISON TO THE STATE AND REGIONAL IT INDUSTRY

Regional IT Employment Relative to the State

In terms of employment in the IT industry, the Columbus region stacks up well relative to the rest of Ohio. Of the six regions, Table 5.4 reports that Columbus had 23 percent of the state's IT employment in the first quarter of 1989, while holding 18 percent of all jobs in Ohio. Columbus is particularly well represented in SIC 3661, Telephone and Telegraph Apparatus (share suppressed); SIC 7372/7275, Prepackaged Software/Information Retrieval Services (30%); SIC 7374, Data Processing and Preparation (33% share); and SIC 382, Process Control Instruments/Instruments to Measure Electricity (27%).

Table 5.4 Columbus Region Share of Ohio IT Employment

		Columbus Region	
SIC	Description	1989:Q1	2000:Q1
357	Computer & Office Equipment	5%	6%
3661	Telephone & Telegraph Apparatus	S	S
3663/3669	Radio & TV Communications/Communications Equipment	19%	19%
367	Electronic Components & Accessories	11%	8%
3695	Magnetic & Optical Recording Media	0%	0%
382	Process Control Instruments/Instruments to Measure Electricity	27%	25%
4812	Radiotelephone Communications	S	30%
4813	Telephone Communications	24%	37%
4822	Telegraph & Other Message Communications	24%	S
4841	Cable & Other Pay Television Services	24%	18%
5045	Computers, Peripherals & Software	15%	22%
5065	Electronic Parts & Equipment	14%	13%
5734	Computer & Software Stores	S	S
7371	Computer Programming Services	12%	39%
7372/7375	Prepackaged Software/Information Retrieval Services	30%	28%
7373	Computer Integrated Systems Design	11%	17%
7374	Data Processing & Preparation	33%	33%
7376-7378	Computer Facilities Management, Rental & Leasing, Maintenance & Repair	8%	20%
7379	Computer Related Services, NEC	23%	37%
8243	Data Processing Schools	0%	24%
Total IT industry		23%	31%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.

SIC 367 is an aggregation of SIC 3672, 3674.

SIC 382 is an aggregation of SIC 3823, 3825.

By the first quarter of 2000, the Columbus region had appreciably increased its share of IT employment to 31 percent, while its share of total employment held virtually constant at 19 percent. Some of this rise can be attributed to SIC 7371, Computer Programming Services. Its 1,058 percent increase in employment raised its share of Ohio's employment in the industry segment from 12 percent in 1989 to 39 percent in 2000. The 1,057 percent increase in employment in SIC 7379, Computer Related Services, also helped to raise its share of Ohio's employment from 23 to 37 percent.

IT Industry Specialization

The Columbus region also made gains during the 1990s in terms of employment in the IT industry relative to the rest of the country. Table 5.5 reports location quotients (LQ), which measure the concentration of employment in an industry segment in the Columbus region relative to employment concentration in that same industry segment in the U.S. An LQ of greater than one indicates that the region is relatively specialized in that segment.

In 1989, the location quotient for total employment in the IT industry the Columbus region was 0.95, indicating that that region was slightly underrepresented in IT employment. The region did, however, specialize in a number of industry segments, including SIC 3661, Telephone and Telegraph Apparatus (LQ suppressed); SIC 7372/7375, Prepackaged Software/ Information Retrieval Services (2.44); SIC 382, Process Control Instruments/Instruments to Measure Electricity (1.40); SIC 4841, Cable and Other Pay Television Services (1.21); SIC 4813, Telephone Communications (1.20); SIC 7374, Data Processing and Preparation (1.14); SIC 5734, Computer and Software Stores (LQ suppressed); and SIC 4812, Radiotelephone Communications (LQ suppressed). For industry segments in which the region had some employment, the segments in which the Columbus region was least specialized were SIC 367, Electronic Components and Accessories (0.10); SIC 7373, Computer Integrated Systems Design (0.17); and SIC 357, Computer and Office Equipment (0.19).

Table 5.5 Columbus Region Industry Concentration: Location Quotients

SIC	Description	Columbus Region 1989:Q1	1999:Q1	Change
357	Computer & Office Equipment	0.19	0.13	-0.06
3661	Telephone & Telegraph Apparatus	S	S	S
3663/3669	Radio & TV Communications/Communications Equipment	0.36	0.26	-0.10
367	Electronic Components & Accessories	0.10	0.07	-0.03
3695	Magnetic & Optical Recording Media	0.00	0.00	0.00
382	Process Control Instruments/Instruments to Measure Electricity	1.40	1.85	0.45
4812	Radiotelephone Communications	S	1.09	S
4813	Telephone Communications	1.20	1.26	0.06
4822	Telegraph & Other Message Communications	0.24	S	S
4841	Cable & Other Pay Television Services	1.21	0.72	-0.49
5045	Computers, Peripherals & Software	0.67	0.86	0.19
5065	Electronic Parts & Equipment	0.51	0.35	-0.16
5734	Computer & Software Stores	S	S	S
7371	Computer Programming Services	0.64	1.98	1.34
7372/7375	Prepackaged Software/Information Retrieval Services	2.44	1.22	-1.22
7373	Computer Integrated Systems Design	0.17	0.69	0.52
7374	Data Processing & Preparation	1.14	0.61	-0.53
7376-7378	Computer Facilities Management, Rental & Leasing, Maintenance & Repair	0.28	0.63	0.35
7379	Computer Related Services, NEC	0.66	1.32	0.66
8243	Data Processing Schools	0.00	1.02	1.02
Total IT industry		0.95	1.08	0.13

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 367 is an aggregation of SIC 3672, 3674.
SIC 382 is an aggregation of SIC 3823, 3825.

By the first quarter of 1999, the Columbus region became more specialized than the overall U.S. economy in the IT industry, with the location quotient increasing to 1.08. Helping to fuel the increase were SIC 7371, Computer Programming Services, which increased its location quotient 1.34 points from 0.64 to 1.98; SIC 3661, Telephone and Telegraph Apparatus (LQ suppressed); and SIC 8243, Data Processing Schools, which went from no employment in 1989 to a location quotient of 1.02 in 2000. Industry segments in which the Columbus region became less specialized during the 1990s were SIC 7372/7375, Prepackaged Software/Information Retrieval Services; SIC 4841, Cable and Other Pay Television Services; and SIC 7374, Data Processing and Preparation.

IT Industry Growth in the Region and the Nation

Table 5.6 further examines the changes that occurred during the 1990s. The table reports growth rates in employment, payroll per employee, and establishments between the first quarter of 1989 and the first quarter of 1999 for the Columbus region and for the U.S. economy as a whole. Note that the figures for the Columbus region differ somewhat from those reported in Table 5.1, Table 5.2, and Table 5.3 because those tables report data through the year 2000. Comparable data for the United States for 2000 are not yet available.

The employment columns help explain why Columbus became more specialized in the IT industry during the 1990s—employment in the IT industry grew 66 percent in the Columbus region during that time, while IT employment in the U.S. as a whole grew "only" 39 percent. In many cases, the employment patterns in the Columbus region mirrored those in the national economy, although to differing magnitudes. However, patterns diverged in a number of industry segments in which employment increased in the nation as a whole, but fell in Columbus: SIC 3663/3669, Radio and TV Communications/Communications Equipment; SIC 367, Electronic Components and Accessories; SIC 5065, Electronic Parts and Equipment; and SIC 7374, Data Processing and Preparation. In three industry segments, employment increased in Columbus but fell in the nation as a whole: SIC 3661, Telephone and Telegraph Apparatus; SIC 382, Process Control Instruments/Instruments to Measure Electricity; and SIC 4813, Telephone Communications.

While IT industry employment grew faster in the Columbus region than in the national economy, compensation for those jobs grew faster in national economy. Average payroll per employee in the IT industry grew 34 percent in the U.S. economy versus 15 percent in the Columbus region. Strikingly, salaries in SIC 7372/7375, Prepackaged Software/ Information Retrieval Services grew 110 percent from 1989 to 1999 nationally, but only 19 percent in Columbus. In addition, salaries actually fell in some industry segments while they rose nationally: SIC 3663/3669, Radio and TV Communications/Communications Equipment; SIC 382, Process Control Instruments/Instruments to Measure Electricity; SIC 367, Electronic Components and Accessories; and SIC 4841, Cable and Other Pay Television Services. Columbus did have large increases in salaries relative to the national

economy in SIC 7374, Data Processing and Preparation (83% versus 30%) and in SIC 5734, Computer and Software Stores (45% versus 12%).

Table 5.6 Growth Rates in the Columbus Region versus the United States: 1989:Q1 to 1999:Q1

		Employment		Payroll per Employee		Establishments	
SIC	Description	Columbus Region	United States	Columbus Region	United States	Columbus Region	United States
357	Computer & Office Equipment	-43%	-18%	18%	52%	-10%	35%
3661	Telephone & Telegraph Apparatus	12%	-14%	27%	27%	100%	36%
3663/3669	Radio & TV Communications/ Communications Equipment	-16%	11%	-7%	23%	50%	61%
367	Electronic Components & Accessories	-22%	11%	-12%	39%	-40%	31%
3695	Magnetic & Optical Recording Media	0%	-29%	0%	19%	0%	31%
382	Process Control Instruments/ Instruments to Measure Electricity	17%	-15%	-24%	25%	-18%	30%
4812	Radiotelephone Communications	S	539%	S	36%	S	601%
4813	Telephone Communications	8%	-1%	1%	17%	183%	158%
4822	Telegraph & Other Message Communications	S	-26%	S	44%	S	-5%
4841	Cable & Other Pay Television Services	4%	67%	-1%	46%	61%	34%
5045	Computers, Peripherals & Software	77%	32%	21%	32%	60%	94%
5065	Electronic Parts & Equipment	-22%	10%	30%	21%	-3%	33%
5734	Computer & Software Stores	299%	105%	45%	12%	155%	86%
7371	Computer Programming Services	917%	215%	16%	29%	371%	265%
7372/7375	Prepackaged Software/Information Retrieval Services	45%	178%	19%	110%	172%	168%
7373	Computer Integrated Systems Design	798%	109%	31%	29%	150%	144%
7374	Data Processing & Preparation	-25%	34%	83%	30%	3%	59%
7376-7378	Computer Facilities Management, Rental & Leasing, Maintenance & Repair	240%	44%	1%	7%	100%	46%
7379	Computer Related Services, NEC	948%	405%	34%	21%	649%	408%
8243	Data Processing Schools	NA	264%	NA	32%	NA	382%
Total IT Industry		66%	39%	15%	34%	153%	138%

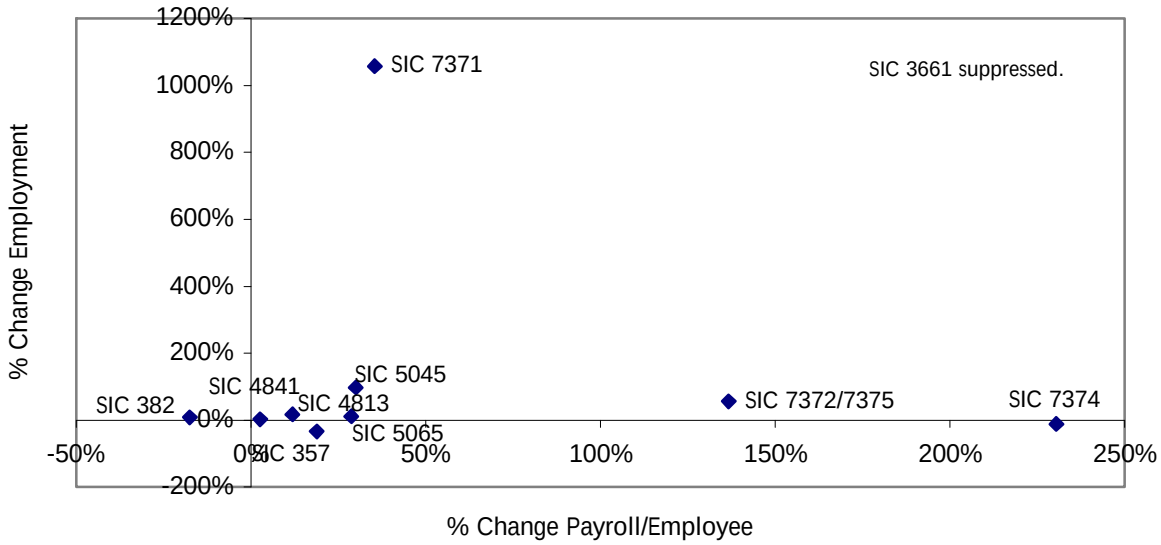
Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database; U.S. Department of Labor, Bureau of Labor Statistics, Covered Employment and Wages (ES202).

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 367 is an aggregation of SIC 3672, 3674.
SIC 382 is an aggregation of SIC 3823, 3825.

In terms of the growth rate in the number of business establishments, the Columbus region had faster growth than the national economy between 1989 and 1999: 153 percent versus 138 percent. Driving that growth were large increases in establishment growth in Columbus in SIC 7379, Computer Related Services (649%) and SIC 7371, Computer Programming Services (371%).

Figure 5.1 graphically displays the growth in employment and payroll per employee between the first quarters of 1989 and 2000 in the 10 largest industry segments in the Columbus region in 1989. The vertical axis displays the percent change in employment over the decade, and the horizontal axis displays the percent change in payroll per employee.

Figure 5.1
Change in Largest IT Industry Segments in the Columbus Region, 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network, based on the ES202 database.

For the most part, the industry segments that were Columbus' largest in 1989 also fared well during the 1990s. Only one of these large employment segments saw their average salaries decline over the decade (SIC 382). Three of the larger employers in 1989, SIC 3661, Telephone and Telegraph Apparatus; SIC 7372/7375, Prepackaged Software/ Information Retrieval Services; and SIC 7374, Data Processing and Preparation all had large percentage increases in payroll per employee and small changes in employment. SIC 7371, Computer Programming Services had a very large percentage increase in employment and solid growth in the average payroll per employee. Two of the industry segments did see a slight decline in employment over the decade: SIC 357, Computer and Office Equipment, and SIC 7374, Data Processing and Preparation.

WINNING INDUSTRY SEGMENTS

The primary IT industry segments in the Columbus region are listed in Table 5.7, which ranks the industry segments by largest employment in 2000, change in employment during the 1990s (actual and percentage changes), highest payroll per employee in 2000, and largest number of establishments. In each category, the top 10 industry segments are listed in order. Typically, the industry segments listed in the table show up in multiple categories. Eleven industry segments do not show up in any of the categories. These include the majority of the industry segments within the manufacturing sector, as well as Telegraph and Other Message Communications, Cable and Other Pay Television Services, and Data Processing Schools.

The winning industry segments are highlighted in Table 5.7. They are: SIC 4812, Radiotelephone Communications; SIC 5045, Computers, Peripherals and Software; SIC 5734, Computer and Software Stores; SIC 7371, Computer Programming Services; SIC 7373, Computer Integrated Systems Design; SIC 7375, Information Retrieval Services; and SIC 7379, Computer Related Services, NEC.

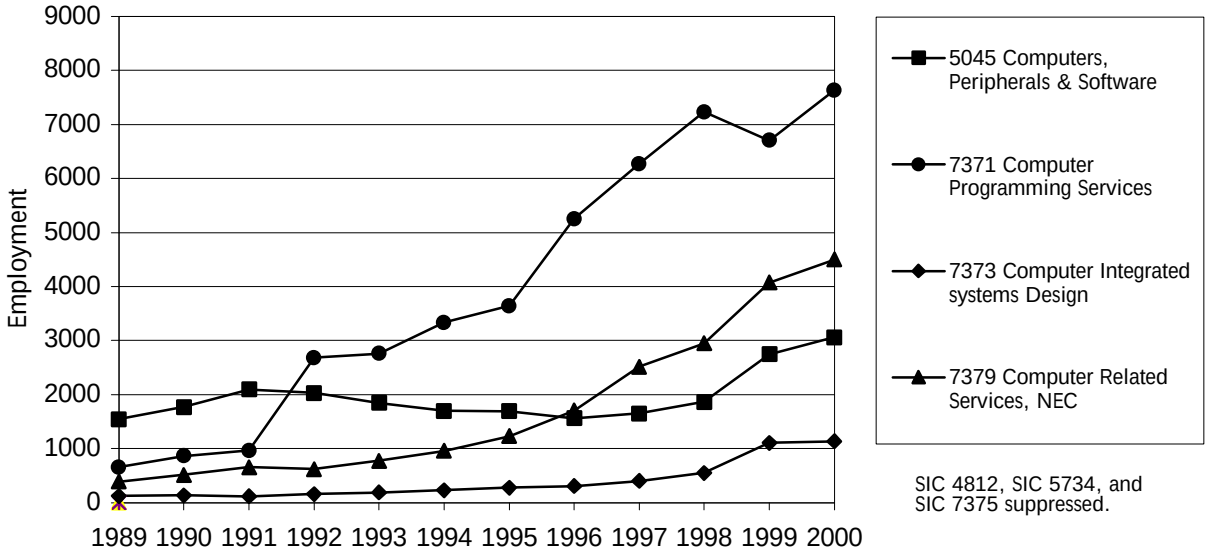
Table 5.7. Columbus Region "Winning" IT Industry Segments

Top Ten Industry Segments				
Largest Employment, 2000:Q1	**Largest Actual Change in Employment, 1989-2000**	**Largest Percent Change in Employment, 1989-2000**	**Highest Payroll per Employee, 2000:Q1**	**Largest Number of Establishments, 2000:Q1**
4813	**7371**	**7371**	**7375**	**7371**
7371	**7379**	**7379**	7374	**7379**
3661	**5734**	**7373**	3661	**5045**
7379	**5045**	3575	7377	4813
7375	**4812**	**4812**	**5045**	**5734**
5045	4813	7377	**4812**	5065
5734	**7375**	7376	3823	**7375**
4812	**7373**	**5734**	**7371**	**7373**
7374	3661	7378	7372	7374
7373	3825	3825	**7373**	7372

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database. Highlighted SICs are present in at least four of the five columns. They represent the "winning" industry segments.

Figure 5.2 graphs the employment trends between 1989 and 2000 for four of the seven winning industry segments. The data for SIC 4812, Radiotelephone Communications, SIC 5734, Computer and Software Stores, and SIC 7375, Information Retrieval Services are suppressed due to confidentiality concerns.

Figure 5.2
Employment Trends in "Winning" IT Industry Segments in the Columbus Region



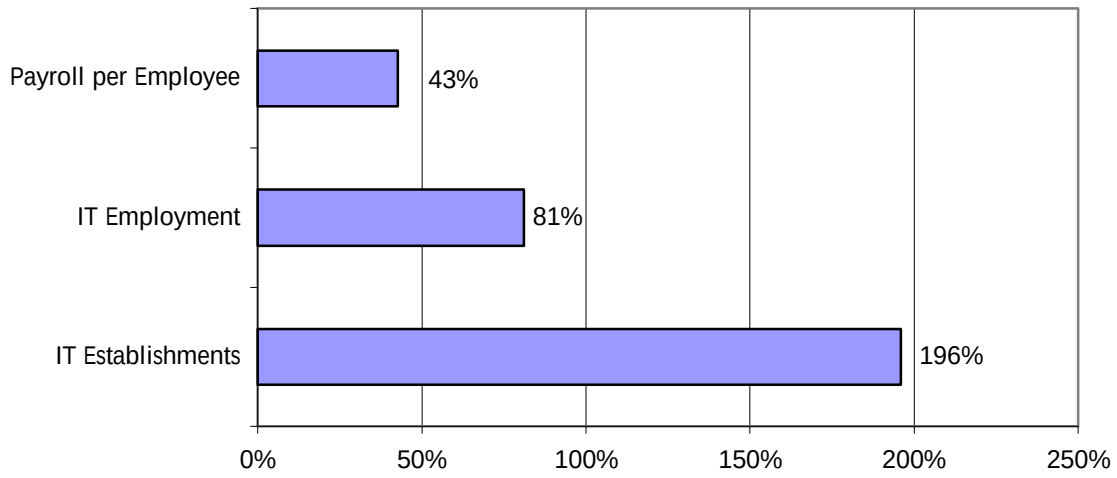
Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

All of these industry segments shown in Figure 5.2 had large employment gains over the decade. The graph highlights the very large employment gains in SIC 7371, Computer Programming Services, and in SIC 7379 Computer Related Services, NEC. The other industry segments showed employment increases over the decade that were more gradual.

SUMMARY

Figure 5.3 summarizes the growth of the IT industry in the Columbus Region between 1989 and 2000. As the graph shows, there was a healthy 196 percent increase in the number of establishments during the decade. Those new establishments and the previously existing establishments increased their employment by 81 percent over the period, and salaries increased by 43 percent.

Figure 5.3
Columbus Region IT Growth 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

The IT industry appears to be very healthy in the Columbus region. Establishments, employment, and pay are all growing rapidly, and the region's specialization of employment in these industry segments has increased to a point where the Columbus region is now more specialized in IT employment than the nation as a whole. The Columbus region's IT employment is also growing faster than IT employment in the rest of the state, growing from 23 percent of the state's IT employment in 1989 to 31 percent in 2000. On average, jobs in the IT industry pay much higher salaries than jobs in other sectors, so this increase in the share of IT employment in the Columbus region likely has many beneficial impacts on the central Ohio economy.

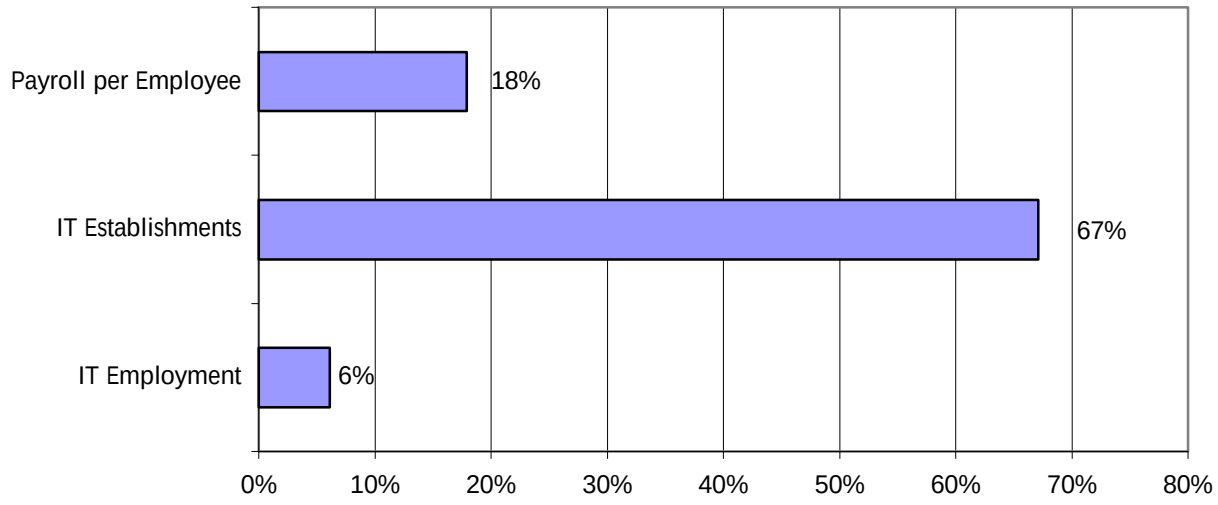
THE DAYTON REGION

The Dayton region has received recent media coverage for its high tech/IT industrial growth. An article from *InfoWorld* reads… "The Ohio Department of Development heavily promotes the state's economic and work force benefits, even assigning the moniker "eCorridor" to the [Dayton] region. The agency cites low energy costs, economic diversity, and a central location as the main attractions for new business" (*InfoWorld*, June 29, 2001). Furthermore, *InfoWorld* highlights Dayton alongside only seven other communities, among them Chicago, Los Angeles, and Portland, Oregon. According to a February 13, 2001 publication from the California-based Milken Institute titled *Knowledge Value Cities in the Digital Age*, Kotkin and DeVol list Dayton as a comeback city in the "rust belt revival."

Midwest Real Estate News, in its July 1, 2001article, "Downtown Revival Benefits Dayton, Miami Valley," presents downtown Dayton as an IT player using as an example the Relizon Company, a company created when Dayton-based Reynolds & Reynolds sold its business forms and document management division. Relizon will move 500 employees to a downtown office building and is expected to generate revenues of $1 billion this year. In adjacent Kettering, MCSi, a distributor of computer supplies and retailer/installer of audio-visual equipment, projects more than $1 billion in sales this year. The new facility in Kettering expects to create 214 new full-time jobs in the next three years.

In the context of this positive news, it is not surprising to see that the number of IT establishments in the Dayton region grew by 67 percent from 1989 to 2000, however employment increased just six percent and payroll per employee increased 18 percent after inflation adjustments (see Figure 6.1).

Figure 6.1
Dayton Region IT Growth 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network, based on the ES202 database.

The reader will not find complete consistency between the following analysis and the picture painted by these articles. One difference is that the IT industry, as defined by Ohio's IT Alliance, is a subset of the high technologies industry, excluding the engineering industry. The Dayton region actually has the highest concentration of engineers in the State of Ohio (Center for Urban and Public Affairs, Wright State University, 1996). Excluding the engineering industry from the IT analysis will therefore have an impact on the Dayton analysis that might go unnoticed in other regions of the state.

Definitions do not explain away the changes in Dayton's IT industry over time, which in general may come as a surprise. While downtown Dayton is referred to by Downtown Ohio, Inc. as a model for attracting IT, Dayton's share of Ohio's IT employment decreased from 17 percent to 13 percent from 1989 to 2000. Furthermore, while Wright-Patterson Air Force Base has downsized from 29,300 jobs in 1988 to 19,011 jobs in 1999, basically privatizing a significant number of IT jobs, the foundation of employment in this analysis does not present a growth of 10,000 jobs. Where have the changes occurred and what does this drop in the state's share of IT jobs mean? This analysis will answer those questions and more.

IT EMPLOYMENT

The Dayton region has witnessed tremendous job growth in several IT industry segments. The largest increase was in Computer Integrated Systems Design (SIC 7373), which experienced an increase in employment of 1,191 percent in the past eleven years (from 185 to 2,389 employees between 1989 and 2000). Other IT industry segments experiencing large growth in employment include Computer Related Services (SIC 7379) and Computer and Software Stores (SIC 5734) where current employment is 451 and growth exceeds 200 percent.

Table 6.1 Dayton Region IT Employment

		Dayton Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357/366	Computer & Office Equipment/ Communications Equipment	7,361	3,668	-3,693	-50%
367/3695/ 3823	Electronic Components & Accessories/ Magnetic & Optical Recording Media/ Process Control Instruments	1,294	700	-594	-46%
3825	Instruments to Measure Electricity	450	80	-370	-82%
4812	Radiotelephone Communications	S	S	S	-30%
4813	Telephone Communications	2,080	1,154	-926	-45%
4822	Telegraph & Other Message Communications	S	S	S	1,464%
4841	Cable & Other Pay Television Services	642	613	-29	-5%
5045	Computers, Peripherals & Software	1,337	2,296	959	72%
5065	Electronic Parts & Equipment	1,216	860	-356	-29%
5734	Computer & Software Stores	136	451	315	232%
7371	Computer Programming Services	1,429	2,267	838	59%
7372	Prepackaged Software	301	171	-130	-43%
7373	Computer Integrated Systems Design	185	2,389	2,204	1,191%
7374	Data Processing & Preparation	269	604	335	125%
7375 7376	Information Retrieval Services/Computer Facilities Management	2,227	3,913	1,686	76%
7377/7378/ 7379/8243	Computer Rental & Leasing/Computer Maintenance & Repair/Computer Related Services, NEC/Data Processing Schools	307	1,128	821	267%
Total IT industry		19,513	20,700	1,187	6%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.

SIC 366 is an aggregation of SIC 3661, 3663, 3669.

SIC 367 is an aggregation of SIC 3672, 3674.

On the other hand, considerable declines have occurred in certain IT industry segments over the study period. Employment in Calculating and Accounting Equipment (SIC 3578) has declined 51 percent. Employment in SIC 3695, Magnetic and Optical Recording Media, has declined 99 percent. This industry segment represented a specialty for the Dayton region years ago that has since faltered (see the section on IT industry specialization). Beyond those losses, there was significant decline in Telephone Communications and Instruments to Measure Electricity. Declines have also occurred in industry segments that may have supported the Defense Electronic Supply Company (DESC), which was merged into Columbus operations in the mid-1990s. Such related industry segments may have been in the manufacturing segments of Radio and TV Communications and Communications Equipment, and the wholesale distribution of Electronic Parts and Equipment. Industry segment trends here explain the loss of nearly 700 jobs from 1989 to 2000.

Taking into account all of the IT job gains and losses, the Dayton IT industry experienced an overall increase in employment of just six percent between 1989 and 2000.

PAYROLL PER EMPLOYEE IN IT INDUSTRY

The average payroll per employee in the IT industry was nearly $55,000 in 2000; a figure that far exceeds the average payroll for all industries, which was approximately $33,000. The overall change in payroll per employee rose at a higher rate than employment change—18 percent over the study period after adjusting for inflation. IT industry segments that showed increases sharply exceeding the overall industry average of 17 percent include:

- Semiconductors and Related Equipment (SIC 3674), increasing by 115 percent since 1989 (but currently has few employees),
- Radiotelephone Communications (SIC 4812), where payroll per employee increased 88 percent,
- Computer Maintenance and Repair (SIC 7378) where payroll per employee increased 61 percent,
- Calculating and Accounting Equipment (SIC 3578) where payroll per employee increased 50 percent, and
- Electronic Parts and Equipment (SIC 5065) where payroll per employee increased 48 percent.

Very few industry segments showed a decrease in payroll. In fact, only five IT industry segments demonstrated payroll changes that are not keeping pace with inflation. Table 6.2 presents payroll per employee industry segment groupings as necessitated to maintain the confidentiality of firms. The largest decrease was in Data Processing and Preparation (SIC 7374), where annual payroll per employee declined 18 percent. Other payroll decreases occurred in two manufacturing segments—Radio and TV Communications (SIC 3663) and Magnetic and Optical Recording Media (SIC 3695) each declining 13 percent; one wholesale trade industry segment, SIC 5045, declining 12 percent; and one communications industry segment, SIC 4822, declining 17 percent.

Table 6.2 Dayton Region IT Annualized Payroll per Employee (in 2000 dollars)

		Dayton Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357/366	Computer & Office Equipment/ Communications Equipment	$ 51,301	$ 72,414	$ 21,113	41%
367/3695/ 3823	Electronic Components & Accessories/Magnetic & Optical Recording Media/Process Control Instruments	$ 31,938	$ 26,535	- $ 5,403	-17%
3825	Instruments to Measure Electricity	$ 32,378	$ 48,632	$ 16,254	50%
4812	Radiotelephone Communications	S	S	S	88%
4813	Telephone Communications	$ 46,483	$ 57,057	$ 10,574	23%
4822	Telegraph & Other Message Communications	S	S	S	-17%
4841	Cable & Other Pay Television Services	$ 29,815	$ 33,687	$ 3,872	13%
5045	Computers, Peripherals & Software	$ 52,032	$ 45,597	- $ 6,435	-12%
5065	Electronic Parts & Equipment	$ 40,488	$ 59,713	$ 19,225	47%
5734	Computer & Software Stores	$ 25,679	$ 33,000	$ 7,321	29%
7371	Computer Programming Services	$ 50,938	$ 57,882	$ 6,944	14%
7372	Prepackaged Software	$ 51,172	$ 54,024	$ 2,852	6%
7373	Computer Integrated Systems Design	$ 45,693	$ 51,174	$ 5,481	12%
7374	Data Processing & Preparation	$ 51,753	$ 42,424	- $ 9,329	-18%
7375/7376	Information Retrieval Services/Computer Facilities Management	$ 47,363	$ 59,808	$ 12,445	26%
7377/7378/ 7379/8243	Computer Rental & Leasing/Computer Maintenance & Repair/Computer Related Services, NEC/Data Processing Schools	$ 38,040	$ 47,541	$ 9,501	25%
Total IT Payroll per Employee		$ 46,469	$ 54,795	$ 8,326	18%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

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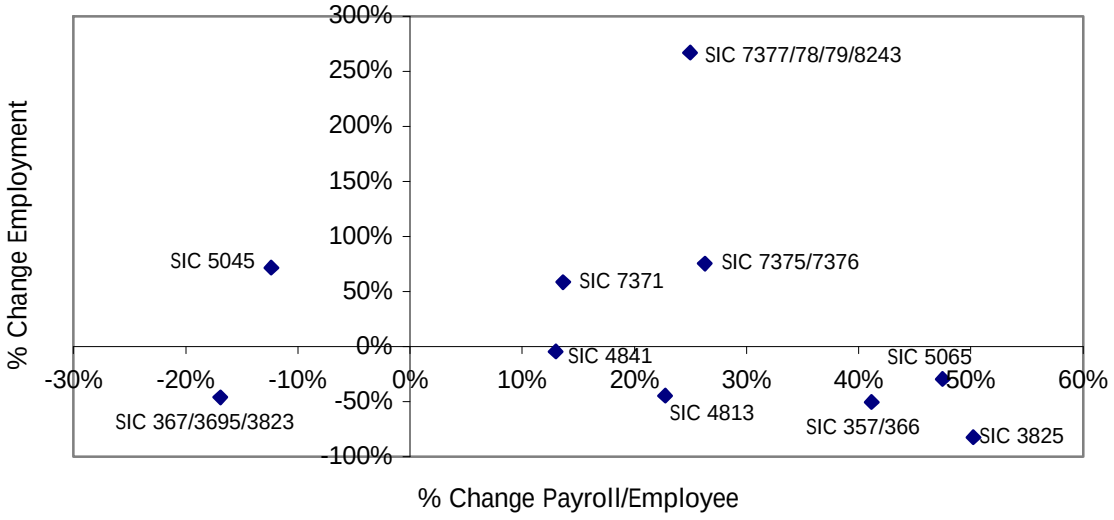
SIC 367 is an aggregation of SIC 3672, 3674.

Figure 6.2 illustrates employment and payroll trends in the industry segments that had the largest IT employment in 1989. The chart arranges employment changes on the vertical axis and payroll changes on the horizontal axis to illustrate the combined effect of employment and payroll on selected industry segments. Industry segments demonstrating increases in both employment and payroll are in the upper right quadrant in the chart. Several of the IT industry segments that dominated in 1989 experienced employment declines over the 11-year period, although most showed increases in payroll per employee. In only one case, the combined segments of Electronic Components and Accessories/Magnetic and Optical Recording Media/Process Control Instruments, were there declines in both employment and payroll per employee. The wholesale of Computers, Peripherals and Software is the only industry segment that experienced employment growth and payroll decline. All industry segments that experienced increases in employment and payroll were in the service sector

Figure 6.2
Change in Largest IT Industry Segments in the Dayton Region, 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

NUMBER OF IT ESTABLISHMENTS

The Dayton region has seen a substantial increase in the total number of IT establishments since 1989. Dayton's 482 IT companies in 1989 grew to 811 in 2000, resulting in an increase of 68 percent (see Table 6.3). Assimilating this finding into the prior analysis of trends in employment and payroll, a simple summary is that some major employers have sustained their organizations but have suffered job losses. At the same time, many new

organizations have emerged. Emerging firms, as might be expected, tend to be smaller, as is evidenced in the average firm size in 1989 versus 2000 (40 employees vs. 26, respectively). This emergence of new firms coincides with an edict from Wright-Patterson Air Force Base (WPAFB) in the mid-1980s that required companies obtaining base contracts to have a physical presence within 25 miles of WPAFB.

Table 6.3 Dayton Region IT Establishments

		Dayton Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357/366	Computer & Office Equipment/Communications Equipment	15	11	-4	-27%
367/3695/3823	Electronic Components & Accessories/Magnetic & Optical Recording Media/Process Control Instruments	24	27	3	13%
3825	Instruments to Measure Electricity	9	5	-4	-44%
4812	Radiotelephone Communications	S	S	S	433%
4813	Telephone Communications	23	60	37	161%
4822	Telegraph & Other Message Communications	S	S	S	-33%
4841	Cable & Other Pay Television Services	13	19	6	46%
5045	Computers, Peripherals & Software	72	74	2	3%
5065	Electronic Parts & Equipment	89	80	-9	-10%
5734	Computer & Software Stores	24	57	33	138%
7371	Prepackaged Software	70	170	100	143%
7372	Prepackaged Software	16	15	-1	-6%
7373	Computer Integrated Systems Design	24	53	29	121%
7374	Data Processing & Preparation	16	32	16	100%
7375/7376	Information Retrieval Services/Computer Facilities Management	27	51	24	89%
7377/7378/7379/8243	Computer Rental & Leasing/Computer Maintenance & Repair/Computer Related Services, NEC/Data Processing Schools	56	138	82	146%
Total IT Establishments		482	811	329	68%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 366 is an aggregation of SIC 3661, 3663, 3669.
SIC 367 is an aggregation of SIC 3672, 3674.

The growing IT industry segments are primarily service related while the stabilized or declining industry segments are manufacturing and wholesale trade related, with the exception of SIC 7372, Prepackaged Software, which declined by six percent, and SIC 7377, Computer Rental and Leasing. The service industry segment showing the greatest increase in new establishments is Computer Programming Services, SIC 7371 (which also had the highest percent increase in employment over the study period). This industry

segment grew from 70 firms in 1989 to 170 firms in 2000. All service related IT industry segments have increased the number of establishments substantially, with the exception noted above regarding SICs 7372 and 7377. One retail trade segment, Computer and Software Stores, increased the number of establishments by 138 percent, from 24 in 1989 to 57 in 2000. Telephone Communications added 37 establishments between 1989 and 2000 (a 161% increase).

THE DAYTON REGION IN COMPARISON TO THE STATE AND NATIONAL IT INDUSTRY

Regional IT Employment Relative to the State

This part of the analysis examines Dayton's share of Ohio's IT employment for each of the IT industry segments. Dayton's share of Ohio's IT employment increased substantially in Computer Integrated Systems Design (SIC 7373), Data Processing and Preparation (SIC 7374), and the wholesale trade of Computers, Peripherals and Software (SIC 5045).

Table 6.4 Dayton Region Share of Ohio IT Employment

		Dayton Region	
SIC	Description	1989:Q1	2000:Q1
357/366	Computer & Office Equipment/Communications Equipment	38%	23%
367/3695/ 3823	Electronic Components & Accessories/Magnetic & Optical Recording Media/Process Control Instruments	18%	9%
3825	Instruments to Measure Electricity	17%	3%
4812	Radiotelephone Communications	S	S
4813	Telephone Communications	6%	4%
4822	Telegraph & Other Message Communications	S	S
4841	Cable & Other Pay Television Services	15%	10%
5045	Computers, Peripherals & Software	13%	17%
5065	Electronic Parts & Equipment	17%	10%
5734	Computer & Software Stores	7%	7%
7371	Computer Programming Services	26%	12%
7372	Prepackaged Software	9%	4%
7373	Computer Integrated Systems Design	17%	35%
7374	Data Processing & Preparation	5%	14%
7375/7376	Information Retrieval Services/Computer Facilities Management	37%	35%
7377/7378/ 7379/8243	Computer Rental & Leasing/Computer Maintenance & Repair/Computer Related Services, NEC/Data Processing Schools	11%	8%
Total IT industry		17%	13%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 366 is an aggregation of SIC 3661, 3663, 3669.
SIC 367 is an aggregation of SIC 3672, 3674.

On the other hand, Dayton's share of Ohio's IT employment has declined in 11 of the 16 IT industry segments shown in Table 6.4. In five of the eleven cases, the share dropped by at least half. The most significant losses occurred in Computer and Office Equipment/ Communications Equipment (SIC 357/366); Radiotelephone Communications (SIC 4812); Electronic Components and Accessories, Magnetic and Optical Recording Media, and Process Control Instruments (SIC 367/3695/3823); and Computer Programming Services (SIC 7371). Overall, Dayton's share of state IT employment declined from 17 percent in 1989 to 13 percent in 2000, although its share of IT employment remained higher than its share of total employment in Ohio, which was 11 percent in 1989 and 10 percent in 2000.

IT Industry Growth in the Region and the Nation

Compared to national employment trends in the IT industry, the Dayton region has not grown as quickly as the nation. Employment in the region increased by just 7% between 1989 and 1999, compared to 39% nationwide. However, the region is far outpacing national increases (percentage-wise) in Computers, Peripherals and Software (SIC 5045), Computer and Software Stores (SIC 5734), and Computer Integrated Systems Design (SIC 7373).

Growth in employment in Dayton has been slower than in the nation for Computer Programming Services (SIC 7371), Information Retrieval Services/Computer Facilities Management (SIC 7375/7376), and Cable and Other Pay Television Services (SIC 4841). Furthermore, Dayton has declined at a rate greater than the nation for Computer and Communications Equipment (SIC 357/366), Instruments to Measure Electricity (SIC 3825), and Telephone Communications (SIC 4813). Dayton has declined where the U.S. has gained in Electronic Components and Accessories, Magnetic and Optical Recording Media, and Process Control Instruments (SIC 367/3695/3823), Radiotelephone Communications (SIC 4812), Electronic Parts and Equipment (SIC 5065), and Prepackaged Software (SIC 7372).

Table 6.5 Growth Rates in the Dayton Region versus the United States: 1989:Q1 and 1999:Q1

		Employment		Payroll per Employee		Establishments	
SIC	Description	Dayton Region	United States	Dayton Region	United States	Dayton Region	United States
357/366	Computer & Office Equipment/ Communications Equipment	-46%	-12%	62%	40%	15%	43%
367/3695/ 3823	Electronic Components & Accessories/ Magnetic & Optical Recording Media/ Process Control Instruments	-40%	9%	-21%	35%	11%	36%
3825	Instruments to Measure Electricity	-83%	-30%	50%	36%	-33%	8%
4812	Radiotelephone Communications	S	539%	S	36%	S	601%
4813	Telephone Communications	-41%	-1%	3%	17%	135%	158%
4822	Telegraph & Other Message Communications	S	-26%	S	44%	S	-5%
4841	Cable & Other Pay Television Services	18%	67%	-6%	46%	62%	34%
5045	Computers, Peripherals & Software	65%	32%	-11%	32%	13%	94%
5065	Electronic Parts & Equipment	-31%	10%	35%	21%	-19%	33%
5734	Computer & Software Stores	209%	105%	31%	12%	126%	86%
7371	Computer Programming Services	62%	215%	18%	29%	133%	265%
7372	Prepackaged Software	-41%	179%	21%	103%	-4%	93%
7373	Computer Integrated Systems Design	1121%	109%	11%	28%	69%	144%
7374	Data Processing & Preparation	24%	34%	-36%	30%	47%	59%
7375/7376	Information Retrieval Services/Computer Facilities Management	80%	123%	25%	104%	52%	321%
7377/7378/ 7379/ 8243	Computer Rental & Leasing/Computer Maintenance & Repair/Computer Related Services, NEC/Data Processing Schools	234%	274%	21%	19%	102%	309%
Total IT Industry		7%	39%	21%	34%	55%	138%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

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SIC 366 is an aggregation of SIC 3661, 3663, 3669.

SIC 367 is an aggregation of SIC 3672, 3674.

Payroll gains in Dayton also have not kept pace with the national rate, although the disparity is not as great as with employment. Between 1989 and 1999, average payroll per employee increased 21% in the region, while growing 34% nationally. Five industry segments in the region showed declining payroll—Electronic Components and Accessories/Magnetic and Optical Recording Media/Process Control Instruments (SIC 367/3695/3823), Telegraph and Other Message Communications (SIC 4822), Cable and Other Pay Television Services (SIC 4841), Computers, Peripherals and Software (SIC 5045), and Data Processing and Preparation (SIC 7374). Just six industry segments experienced growth rates greater than the U.S.—Computers and Office Equipment (SIC 357/366), Instruments to Measure Electricity (SIC 3825), Radiotelephone Communications (SIC 4812), Electronic Parts and Equipment (SIC 5065), Computer and Software Stores (SIC

5734), and Computer Rental and Leasing/Computer Maintenance and Repair/Computer Related Services, NEC/Data Processing Schools (SICs 7377/78 /79/8243).

Analyzing national trends in business establishments to Dayton's trends exhibits only two industry segments establishing businesses at a rate that exceeds the nation—Cable and Other Pay Television Services (SIC 4841) and Computer and Software Stores (SIC 5734). Five industry segments experience a decline in the number of establishments in the region, while only one industry segment showed a decline nationally.

IT Industry Specialization

A location quotient is a measure of specialization. The location quotient is a calculation that seeks to identify industry segments that are concentrated within a specified location. Analysts have asserted that a concentration of a particular industry segment indicates specialization and indicates that a location has certain assets or a mix of assets that provide a competitive advantage attractive to an industry. The location quotient is computed by dividing a region's proportion of employment in an industry segment by the national proportion. A location quotient greater than one (1.0) indicates that a region has a higher concentration of employment in a specific industry segment than the national average.

Of the 16 industry segments analyzed for this section, 11 are less concentrated in the Dayton region today than they were in 1989 (see Table 6.6). This fact is reflected in the change in the LQ for the IT industry overall from 1989 to 1999. In 1989, the LQ for the overall IT industry in Dayton was 1.13, but by 1999, the LQ was 0.94. This indicates that the IT industry was more concentrated in the Dayton Region than the nation as a whole, but this is no longer the case. As stated earlier in this report, the exclusion of engineering from this analysis (i.e., the fact that this is not an analysis of high tech but of IT) has pronounced effects on such an indicator of Dayton's specialization.

Due to data confidentiality requirements, industry segments must be described and presented in a aggregate fashion, but the detailed data are used for insight. As an example, the Calculating and Accounting Equipment industry segment, SIC 3578, is especially concentrated in Dayton, so much so that data for this industry segment must be protected

by combining it with other communications and computer equipment industry segments. The LQ for this singular segment, SIC 3578, is very high but has lost ground due to employment losses over the study period—in fact, its concentration has fallen by 30 percent, but is still unmatched in Ohio and likely unmatched in the U.S. The concentration of the combined SIC 357/366 was more than twice as concentrated as the national average in 1989 (2.22), but in 2000 was 1.35.

The other manufacturing group presented in Table 6.6, Electronic Components and Accessories (SIC 367), Magnetic and Optical Recording Media (SIC 3695), and Process Control Instruments (SIC 3823), has experienced a similar decline in concentration as the first group. However, this second manufacturing group is not nearly as concentrated as the first.

Table 6.6 Dayton Region Industry Concentration: Location Quotients

SIC	Description	Dayton Region		
		1989:Q1	1999:Q1	Change
357/366	Computer & Office Equipment/Communications Equipment	2.22	1.48	-0.74
367/3695/ 3823	Electronic Components & Accessories/ Magnetic & Optical Recording Media/Process Control Instruments	0.62	0.37	-0.25
3825	Instruments to Measure Electricity	0.95	0.25	-0.70
4812	Radiotelephone Communications	S	S	S
4813	Telephone Communications	0.50	0.32	-0.18
4822	Telegraph & Other Message Communications	S	S	S
4841	Cable & Other Pay Television Services	1.17	0.90	-0.27
5045	Computers, Peripherals & Software	0.92	1.25	0.33
5065	Electronic Parts & Equipment	1.02	0.70	-0.32
5734	Computer & Software Stores	0.42	0.68	0.26
7371	Computer Programming Services	2.23	1.24	-0.99
7372	Prepackaged Software	0.68	0.16	-0.52
7373	Computer Integrated Systems Design	0.40	2.56	2.16
7374	Data Processing & Preparation	0.28	0.25	0.03
7375/7376	Information Retrieval Services/Computer Facilities Management	6.68	5.87	-0.81
7377/7378/ 7379/ 8243	Computer Rental & Leasing/Computer Maintenance & Repair/Computer Related Services, NEC/Data Processing Schools	0.50	0.48	-0.02
Total IT industry		1.13	0.94	-0.19

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.

SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.

SIC 366 is an aggregation of SIC 3661, 3663, 3669.

SIC 367 is an aggregation of SIC 3672, 3674.

Two communications industry segments have experienced opposing trends. While actual values have been suppressed, Radiotelephone Communications (SIC 4812) was highly concentrated in the Dayton Region in 1989, but had a very low location quotient in 1999. Although this industry segment experienced some employment loss, the sharp decline in its location quotient appears to be more attributable to a rapid growth in this segment elsewhere, as opposed to a significant decline in the region. The reverse trend can be seen in Telegraph and Other Message Communications. In 1989, there was no regional specialization in this industry segment, however the location quotient was high in 1999 (value suppressed). Again, this seems to reflect changes on the national level more so than changes on the local level. Despite a large percentage gain, the industry segment is rather small, however, growth in the region occurred at a time when there were significant losses across the U.S.

Although not to the same magnitude, similar opposing trends can be seen in the two wholesale trade industry segments. In 1989, Computers, Peripherals, and Software (SIC 5045) was less concentrated than the nation (0.92), but by 1999 was had a concentration greater (1.25) than the nation. Electronic Parts and Equipment (SIC 5065) was more concentrated in 1989 (1.02) than in 1999 (0.70).

The service sector shows some interesting trends. SIC 7371 is not nearly as concentrated in Dayton in 2000 as it was in 1989, but its employment increased by 59 percent over the study period. This finding indicates that Dayton, due to a strong defense and private sector presence in IT in the 1980s, was likely ahead of many other communities at that time, as reflected in the LQ of 2.23. Since 1989, the need for computer programming services has proliferated to nearly every industry, making it a more general industry than a specialty in the late 1980s. In other words, Dayton has not necessarily fallen behind, but other communities are catching up. SIC 7375, Information Retrieval Services, and SIC 7376, Computer Facilities Management, appear to function in a similar vein as SIC 7371. Employment in these two industry segments combined has increased by 76 percent since 1989, but the concentration has diminished slightly (e.g., the LQ was 6.68 in 1989 and 5.87 in 2000). At 0.16 Dayton has a much smaller share than the national average in SIC 7372, Prepackaged Software. But SIC 7373, Computer Integrated Systems Design, has dramatically moved in the opposite direction. Having an LQ of .40 in 1989, the LQ in

2000 was 2.56 (for a 540% increase in concentration over time). Computer Rental and Leasing, Maintenance and Repair, and Data Processing Schools (SICs 7377, 7378, and 8243) have only a minor presence in Dayton, however, miscellaneous Computer Services (SIC 7379) employs over four times the number today than it did in 1989.

WINNING IT INDUSTRY SEGMENTS

Taking into account trends in employment, payroll, and business establishment, we present Table 6.7 to sum up the impact of these variables. In this table, industry segments are ranked by: employment, actual (i.e., numerical) change in employment, percent change in employment, payroll per employee, and number of establishments.

The resulting list presents five industry segments appearing in at least four of the five categories. These include Computers, Peripherals, and Software (SIC 5045); Computer Programming Services (SIC 7371); Computer Integrated Systems Design (SIC 7373); Information Retrieval Services (SIC 7375); and Computer Related Services, (SIC 7379).

Table 6.7 Dayton Region "Winning" IT Industry Segments

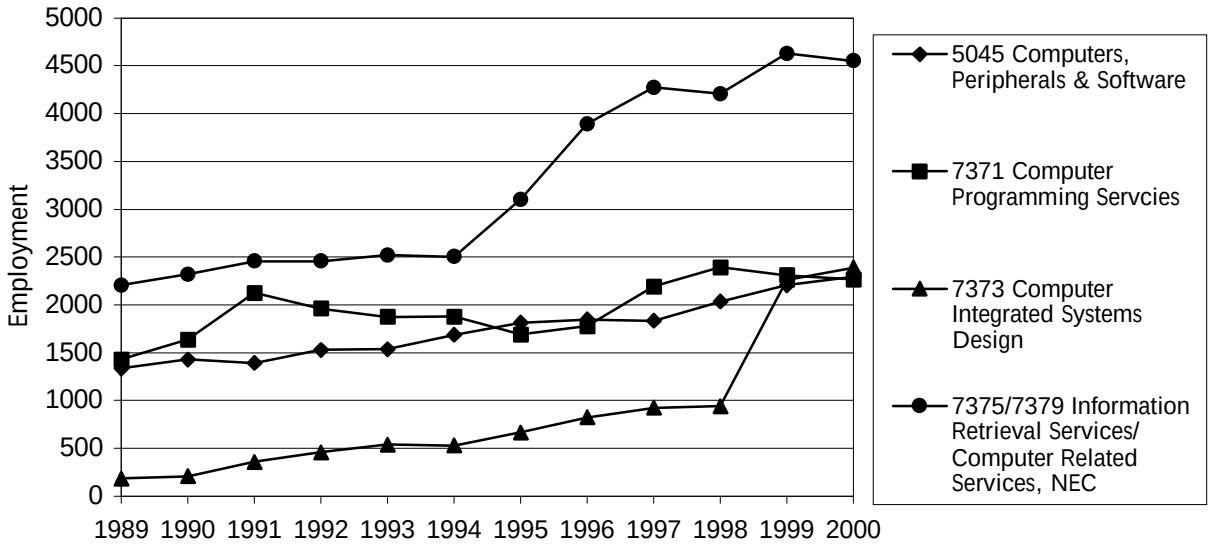
Top Ten Industry Segments				
Largest Employment, 2000:Q1	**Largest Actual Change in Employment, 1989-2000**	**Largest Percent Change in Employment, 1989-2000**	**Highest Payroll per Employee, 2000:Q1**	**Largest Number of Establishments, 2000:Q1**
7375	**7373**	4822	3674	**7371**
3578	**7375**	**7373**	3578	**7379**
7373	**5045**	**7379**	**7375**	5065
5045	**7371**	5734	5065	**5045**
7371	**7379**	7374	**7371**	4813
4813	7374	**7375**	4813	5734
7379	5734	**5045**	7372	**7373**
5065	4822	**7371**	**7373**	**7375**
3577	3672	3672	4812	7374
4841	8243	3823	3577	4841

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.
Highlighted SICs are present in at least four of the five columns. They represent the "winning" industry segments.

Clearly, there is a core set of industry segments in the Dayton region that anchor IT. Most of them are service-related, while one is from the wholesale trade industry segment and likely supports the other industry segments on the winners list. These industry segments

have demonstrated longevity as depicted in Figure 6.3 which shows steady upward trends in general. Efforts to assist these industry segments would most effectively strengthen the core segments to sustain Dayton as a prominent region in the eCorridor.

Figure 6.3
Employment Trends in "Winning" IT Industry Segments in the Dayton Region



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

III. THE APPALACHIA REGION

IT EMPLOYMENT

Employment in the IT industry in the Appalachia Region of Ohio was slight in 1989 and it declined to an even smaller number by 2000. The ES202 Database listed just over 1,400 jobs in IT the industry in 2000, a decline of 46 percent from 1989 when IT employment was quite modest at 2,664 (Table 7.1). When an industry segment consists of a very small number of establishments, the loss of one large firm can result in a very substantial percentage decline in employment. Most of the decline in employment between 1989 and 2000 was in manufacturing, a fact obscured in Table 7.1 because data from the ES202 files cannot be released for an industry segment with fewer than three firms and/or when a single firm accounts for 80 percent or more of total employment. In an attempt to meet the three-firm minimum for release of ES202 data, we have grouped the four-digit SIC codes into broader groups. In some cases, aggregation of four-digit industry segment classifications to three-digit or two-digit groups is sufficient to achieve an industrial grouping with more than two firms and with fewer than 80 percent of total employment concentrated in a single firm.[2]

In contrast to industry segments within the manufacturing sector, IT firms in Wholesale Trade (SIC 50) experienced modest growth. Even though data for IT retail firms (SIC 5734) is suppressed for 1989, it can be stated that employment increased substantially in that area. Likewise, employment in Computer Related Services (SIC 737) increased very substantially. There was no firm in the Appalachia Region classified as a Data Processing School (SIC 8243) during either 1989 or 2000. That SIC is included in the tables because one or more establishments did exist during one or more years between 1989 and 2000, but not in sufficient numbers to meet the minimum requirements for releasing the data. There were job gains in Radiotelephone Communications (SIC 4812), however this was

[2] SIC 50 is an aggregation of SIC 5045 and SIC 5065, while SIC 737 sums SIC 7371 through SIC 7379. In other cases, there are fewer than three firms and/or 80 percent or more of total employment in a single firm, even after aggregation. This is the case in SIC 3823 and SIC 3825, as well as in the SIC 357 group, which is the sum of SIC 3577 and SIC 3578. The SIC 36 group (which is the sum of SIC 3661 through SIC 3674) consisted of fewer than three firms in 1989, but included four firms in 2000; thus data are provided only for 2000. Data for SIC 5734 is suppressed for 1989 because a single firm accounted for 80 percent or more of total employment during that year, and data for SIC 4822 is suppressed in 1989 because there were fewer than three establishments that year.

offset by significant job loss in Telephone Communications (SIC 4813) where there was a decline of over 500.

Table 7.1 Appalachia Region IT Employment

		Appalachia Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	S	S	S	-99%
36	Electronic and Other Equipment & Components, Except Computer Equipment	S	91	S	S
3695	Magnetic & Optical Recording Media	0	0	0	0%
3823	Process control instruments	S	S	S	-100%
3825	Instruments to Measure Electricity	S	S	S	-33%
4812	Radiotelephone Communications	17	93	76	447%
4813	Telephone Communications	1,029	520	-509	-49%
4822	Telegraph & Other Message Communications	S	0	S	S
4841	Cable & Other Pay Television Services	173	229	56	32%
50	Wholesale Trade - Durable Goods	63	83	20	32%
5734	Computer & software stores	S	135	S	S
737	Computer Programming, Data Processing, & Other Computer Related Services	100	265	165	165%
8243	Data processing schools	0	0	0	0%
Total IT Employment		2,664	1,439	-1,225	-46%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data is suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3577, 3578.
SIC 36 is an aggregation of SIC 3661, 3669, 3672, 3674.
SIC 50 is an aggregation of SIC 5045, 5065.
SIC 737 is an aggregation of SIC 7371 through 7379.

NUMBER OF IT ESTABLISHMENTS

Between 1989 and 2000 there was a sharp increase in the number of IT establishments. The addition of 78 establishments represents a 76 percent increase over 1989 (Table 7.2). Many of these new establishments were in Telephone Communications (SIC 4813), which saw an increase in establishments despite a large decline in employment. Computer Related Services (SIC 737) also added many establishments, and they were mostly small firms with a small number of employees. There was a modest increase in the number of IT establishments in Wholesale Trade.

Table 7.2 Appalachia Region IT Establishments

SIC	Description	Appalachia Region 1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	S	S	S	-33%
36	Electronic & Other Equipment & Components, Except Computer Equipment	S	S	S	S
3695	Magnetic & Optical Recording Media	0	0	0	0%
3823	Process control instruments	S	S	S	-100%
3825	Instruments to Measure Electricity	S	S	S	0%
4812	Radiotelephone Communications	3	8	5	167%
4813	Telephone Communications	35	57	22	63%
4822	Telegraph & Other Message Communications	S	0	S	S
4841	Cable & Other Pay Television Services	22	15	-7	-32%
50	Wholesale Trade - Durable Goods	14	19	5	36%
5734	Computer & software stores	S	20	S	S
737	Computer Programming, Data Processing, & Other Computer Related Services	12	55	43	358%
8243	Data processing schools	0	0	0	0.0%
Total IT Establishments		102	180	78	76%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

The symbol "S" indicates data are suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3577, 3578.
SIC 36 is an aggregation of SIC 3661, 3669, 3672, 3674.
SIC 50 is an aggregation of SIC 5045, 5065.
SIC 737 is an aggregation of SIC 7371 through 7379.

PAYROLL PER EMPLOYEE IN IT INDUSTRY

As shown in Table 7.3, there was a slight increases in the payroll per employee in the IT industry between 1989 and 2000 (after the 1989 figures are inflated to 2000 dollar equivalents). The increases were greatest in Radiotelephone Communications (SIC 4812) and Telephone Communications (SIC 4813). There was a modest increase in payroll per employee in Cable and Other Pay Television Services (SIC 4841), and a slight increase in Computer and Software Stores (actual value suppressed). The Telephone Communications segment had the highest payroll per employee ($61,170) and this far surpassed the other IT industry segments. Because this segment also accounts for the greatest number of IT employees in the region, the average payroll per employee in the entire IT industry is relatively high. At over $40,000, the average payroll is much higher than the average payroll across all industries, which is less than $22,000.

Table 7.3 Appalachia Region IT Annualized Payroll per Employee (in 2000 dollars)

		Appalachia Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357	Computer & Office Equipment	S	S	S	-17%
36	Electronic & Other Equipment and Components, Except Computer Equipment	S	$ 24,906	S	S
3695	Magnetic & Optical Recording Media	0	0	0	0
3823	Process control instruments	S	S	S	-100%
3825	Instruments to Measure Electricity	S	S	S	56%
4812	Radiotelephone Communications	$ 21,825	$ 31,954	$ 10,129	46%
4813	Telephone Communications	$ 44,846	$ 61,170	$ 16,324	36%
4822	Telegraph & Other Message Communications	S	$ 0	S	S
4841	Cable & Other Pay Television Services	$ 23,069	$ 28,994	$ 5,925	26%
50	Wholesale Trade - Durable Goods	$ 26,703	$ 24,289	- $ 2,414	-9%
5734	Computer & software stores	S	$ 23,751	S	S
737	Computer Programming, Data Processing, & Other Computer Related Services	$ 43,128	$ 32,397	- $ 10,731	-25%
8243	Data processing schools	0	0	0	0%
Total IT Payroll per Employee		$ 37,472	$ 40,513	$ 3,041	8%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

1989 dollars are inflated using the average Consumer Price Index for the Cleveland Metropolitan Area for the months of January, February, and March 2000.

The symbol "S" indicates data are suppressed to avoid disclosing information about individual firms.

SIC 357 is an aggregation of SIC 3577, 3578.

SIC 36 is an aggregation of SIC 3661, 3669, 3672, 3674.

SIC 50 is an aggregation of SIC 5045, 5065.

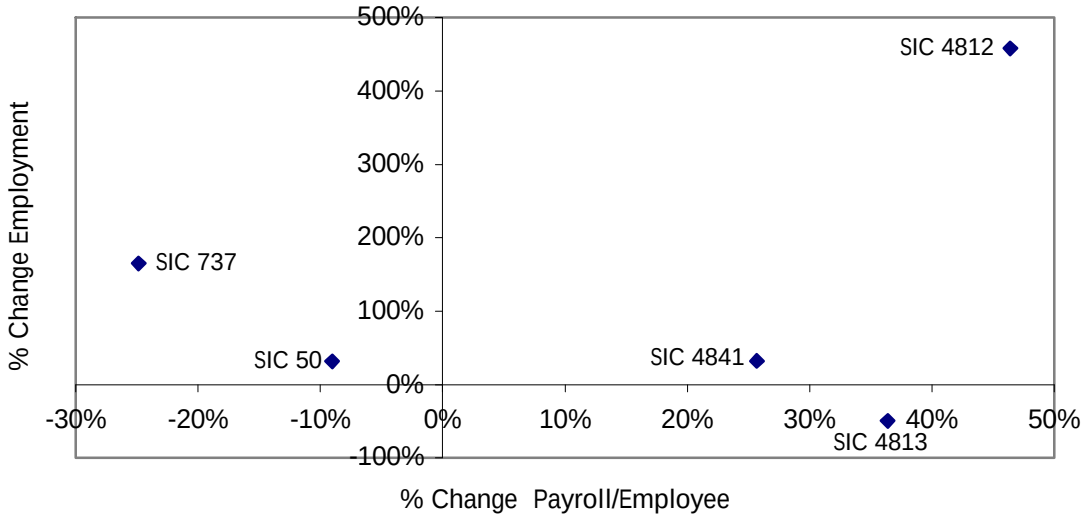
SIC 737 is an aggregation of SIC 7371 through 7379.

The largest declines in payroll per employee were in SIC 36- Electronic and Other Equipment and Components, except Computer Equipment (actual value suppressed) and SIC 737- Computer Related Services, which dropped from $43,128 to $32,397 annually. That decline of almost $11,000 amounted to a loss of about 25 percent. It seems likely that the large increase in firms and employees in this industry segment consisted of firms with relatively lower paying positions. The average payroll per employee in Wholesale Trade also declined, but by a smaller percentage, from $26,703 to $24,289. In view of the rapid increase in the number of establishments and employees in both Computer Related Services and Wholesale Trade, a modest decline in average annualized income per worker would not necessarily be cause for concern. New firms may be in businesses that generate lower incomes for employees, but still provide incomes that are higher than would otherwise have been available in the region. Also, to the extent that a rapid growth

in employment is accounted for by a large increase in entry-level positions, we might expect the average payroll per employee to decline in the short term, but still increase substantially over the longer term as employees mature on the job.

Figure 7.1, based on those industry segments with the largest employment in 1989, plots the percentage change in employment with percentage change in payroll per employee. Radiotelephone Communications (SIC 4812) and Cable and Other Pay Television Services (SIC 4841) are the only IT industry segments to post positive growth in employment and payroll per employee over the 11-year period. In the case of Wholesale Trade (SIC 50), the decline in payroll per employee was quite modest, but Computer Related Services (SIC 737) incomes declined by about one-quarter. As explained previously, this high percentage decline must be taken within the context of the relatively higher 1989 average payroll, and it may reflect a large number of entry-level persons who will experience high rates of income growth in the future. Nevertheless, Figure 7.1 is at best a cause for concern of the status and future of IT industry segments in the Appalachia Region.

Figure 7.1
Change in Largest IT Industry Segments in the Appalachia Region, 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network, based on the ES202 database.

THE APPALACHIA REGION IN COMPARISON TO THE STATE AND NATIONAL IT INDUSTRY

Regional IT Employment Relative to the State

The Appalachia Region accounts approximately five percent of all Ohio employment and an even smaller share of employment in the IT industry. Moreover, the percentage of IT employment declined, from 2.4 percent in 1989 to less than one percent, by 2000 (Table 7.4). As noted previously, the decline is mostly accounted for by the loss of a small number of firms in the manufacturing sector, for which data are mostly suppressed. There was also a declining share in the communications industry segments, with the exception of Radiotelephone Communications.

In the Wholesale Trade (SIC 50) and Computer Related Services (SIC 737) the percentage of total state employment held firm, but at a very low percentage of about 0.4 percent. With over 12 percent of the total population of Ohio and five percent of total employment, the Appalachia regional share of IT employment is extremely low.

Table 7.4 Appalachia Region Share of Ohio IT Employment

		Appalachia Region	
SIC	Description	1989:Q1	2000:Q1
357	Computer & Office Equipment	S	S
36	Electronic & Other Equipment & Components, Except Computer Equipment	S	0.8%
3823	Process control instruments	S	S
3695	Magnetic & Optical Recording Media	0	0
3825	Instruments to Measure Electricity	S	S
4812	Radiotelephone Communications	1.1%	1.7%
4813	Telephone Communications	3.1%	2.0%
4822	Telegraph & Other Message Communications	S	0.0%
4841	Cable & Other Pay Television Services	4.0%	3.7%
50	Wholesale Trade - Durable Goods	0.4%	0.4%
5734	Computer & software stores	S	2.0%
737	Computer Programming, Data Processing, & Other Computer Related Services	0.4%	0.4%
8243	Data processing schools	0.0%	0.0%
Total IT industry		2.4%	0.9%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

The symbol "S" indicates data are suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3577, 3578.
SIC 36 is an aggregation of SIC 3661,3669, 3672, 3674.
SIC 50 is an aggregation of SIC 5045, 5065.
SIC 737 is an aggregation of SIC 7371 through 7379.

IT Industry Specialization

Another way of looking at the regional share of employment in the IT industry s is to examine the location quotient for that industry (Table 7.5). The location quotient is a measure of the share of total employment in a region that is in a particular industry in comparison to the share of total employment in the larger unit, or nation in this case. A location quotient of 1.0 indicates that the percentage of total employment in an industry is equal to the national average. Quotients greater than 1.0 indicate a proportionally higher percentage of total employment in that sector, and quotients of less than 1.0 indicate a lower percentage.

Table 7.5 Appalachia Region Industry Concentration: Location Quotients

		Appalachia Region		
SIC	**Description**	**1989:Q1**	**1999:Q1**	**Change**
357	Computer & Office Equipment	S	S	S
36	Electronic & Other Equipment & Components, Except Computer Equipment	S	0.05	S
3695	Magnetic & Optical Recording Media	0	0	0
3823	Process control instruments	S	S	S
3825	Instruments to Measure Electricity	S	S	S
4812	Radiotelephone Communications	0.34	0.30	-0.04
4813	Telephone Communications	0.65	0.32	-0.33
4822	Telegraph & Other Message Communications	S	0.00	S
4841	Cable & Other Pay Television Services	0.83	0.56	-0.27
50	Wholesale Trade - Durable Goods	0.06	0.05	0.01
5734	Computer and software stores	S	0.40	S
737	Computer Programming, Data Processing, & Other Computer Related Services	0.08	0.08	0.00
8243	Data processing schools	0.00	0.00	0.00
Total IT industry		0.41	0.18	-0.23

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

The symbol "S" indicates data are suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3577, 3578.
SIC 36 is an aggregation of SIC 3661, 3669,3672, 3674.
SIC 50 is an aggregation of SIC 5045,5065.
SIC 737 is an aggregation of SIC 7371 through SIC 7379.

The location quotients for IT industry segments in the Appalachia Region are all very low. Computer and Office Equipment (SIC 357) had the highest LQ in 1989 (value suppressed), but after significant job losses, this was not the case in 2000. Cable and Other Pay

Television Services had the second-highest LQ in 1989 and the highest in 2000, despite the fact that this industry segment also experienced job losses. Although low, the LQs for these industry segments, along with Radiotelephone Communications and Telephone Communications, are much higher than those for the other IT segments. For example, the quotient of 0.07 for Computer Related Services (SIC 737) indicates that the regional percentage share of employment in that industry segment is only seven percent of the national average.

IT Industry Growth in the Region and the Nation

Whereas employment in the IT industry increased 39 percent nationally between 1989 and 1999, it declined in the Appalachia Region by nearly the same percentage (Table 7.6: note that Table 7.6 compares 1989 data to 1999 data, rather than to 2000 data as in Tables 7.1, 7.2, and 7.3). The table indicates job loss in several manufacturing and communications industry segments. The positive growth rates in employment in Computer Related Services (SIC 737), exceeding the growth rates at the national level, must be viewed in the context of the very small base in 1989.

The change in average payroll per employee was positive for the communications industry segments (Radiotelephone Communications, Telephone Communications, and Cable and Other Pay Television Services). This was also true of Computer and Software Stores, although the actual value is suppressed. The change in average payroll per employee was negative the wholesale trade industry segments (SIC 50) as well as Computer Related Services (SIC 737). The larger manufacturing industry segments (SIC 357 and SIC 36) also experienced declines in payroll per employee, although the values are again suppressed. The average payroll per employee declined nine percent across all IT industry segments while increasing 34 percent nationwide. The only area in which the Appalachia Region experienced positive growth between 1989 and 2000 was in the number of establishments, however the 67 percent increase in the region did not come close to matching the 138 percent rate of growth that occurred nationally. Again, when interpreting this information, it is important to note that there was a very small base of establishments in Appalachia in 1989.

Table 7.6 Growth Rates in the Appalachia Region versus the United States: 1989:Q1 to 1999:Q1

SIC	Description	Employment		Payroll per Employee		Establishments	
		Appalachia Region	United States	Appalachia Region	United States	Appalachia Region	United States
357	Computer & Office Equipment	-73%	-18%	-42%	52%	0%	35%
36	Electronic & Other Equipment & Components, Except Computer Equipment	S	4%	S	32%	S	39%
3695	Magnetic & Optical Recording Media	0%	-29%	0%	19%	0%	31%
3823	Process control instruments	-100%	7%	-100%	14%	-100%	49%
3825	Instruments to Measure Electricity	-45%	-30%	-38%	36%	0%	8%
4812	Radiotelephone Communications	482%	539%	49%	36%	167%	601%
4813	Telephone Communications	-49%	-1%	10%	17%	54%	158%
4822	Telegraph & Other Message Communications	S	-26%	S	44%	S	-5%
4841	Cable & Other Pay Television Services	16%	67%	43%	46%	-32%	34%
50	Wholesale Trade - Durable Goods	5%	22%	-11%	37%	29%	61%
5734	Computer & software stores	S	105%	S	12%	S	86%
737	Computer Programming, Data Processing, & Other Computer Related Services	155%	146%	-31%	45%	308%	223%
8243	Data processing schools	NA	264%	NA	32%	NA	382%
Total IT Industry		-38%	39%	-9%	34%	67%	138%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database; U.S. Department of Labor, Bureau of Labor Statistics, Covered Employment and Wages (ES202).

The symbol "S" indicates data are suppressed to avoid disclosing information about individual firms.

SIC 357 is an aggregation of SIC 3577, 3578.

SIC 36 is an aggregation of SIC 3661, 3669, 3672, 3674.

SIC 50 is an aggregation of SIC 5045, 5065.

SIC 737 is an aggregation of SIC 7371 through SIC 7379.

WINNING IT INDUSTRY SEGMENTS

An examination of several measures of size and growth should allow identification of those IT industry segments that are doing well or at least better in a region. The goal was to list the top 10 IT segments in each of five measures of size and growth and select from that list those five that rank high in all five measures. Although there is limited IT presence in the Appalachia Region, four industry segments have been identified as the region's winners: Radiotelephone Communications (SIC 4812), Cable and Other Pay Television Services (SIC 4841), Computer Programming Services (SIC 7371), and Computer Related Services, NEC (SIC 7379).

Table 7.7 Appalachia Region "Winning" IT Industry Segments

Top Industry Segments				
Largest Employment, 2000:Q1	**Largest Actual Change in Employment, 1989-2000**	**Largest Percent Change in Employment, 1989-2000***	**Highest Payroll per Employee, 2000:Q1**	**Largest Number of Establishments, 2000:Q1**
4813	5734	3669	3577	4813
4841	**4812**	**7371**	4813	**7371**
5734	**7371**	**4812**	**7379**	5734
7375	3669	**7379**	7372	**4841**
4812	**4841**	5045	3825	**7379**
7371	**7979**	5734	**7371**	5065
3669	5045	7375	**4812**	5045
5065	7375	**4841**	7373	7375
7379	7372		**4841**	**4812**
5045	3672		3669	7373

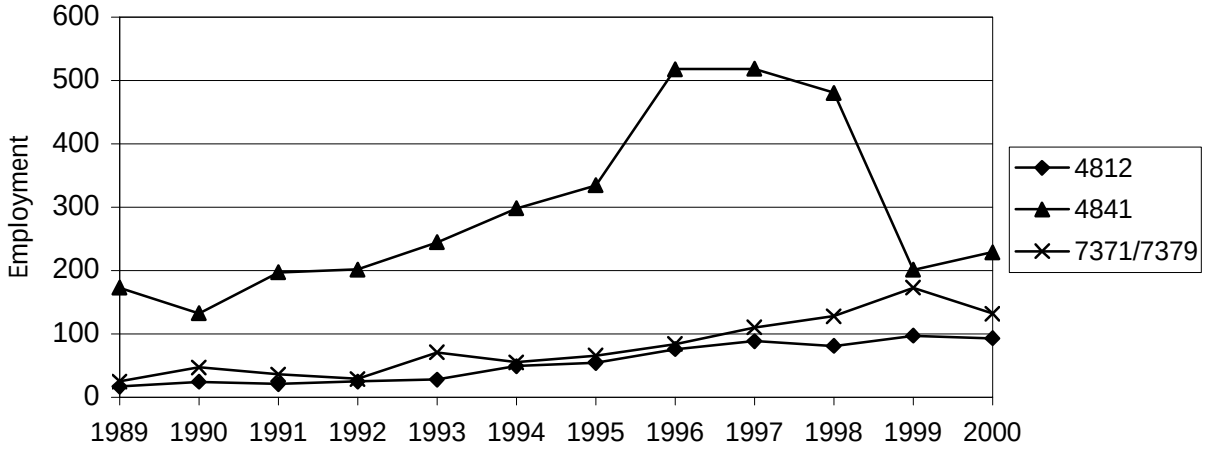
Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

Highlighted SICs are present in all five columns. They represent the "winning" industry segments.

* Fewer than ten industry segments have been identified in this category due a number of industry segments with an undefined percent change in employment (due to an increase from 0 in 1989 to positive employment in 2000).

Trends are somewhat more apparent when data are examined for each year over the 11-year period (Figure 7.2). SIC 4812 and SICs 7371/7379 (aggregated to maintain confidentiality) show gradual increases in employment throughout the 1990s. Employment trends in SIC 4841 follow a much different pattern. Job growth was rapid between 1990 and 1996, however there was a large drop between 1998 and 1999. Employment levels in 2000 were higher than in 1989, but significant job loss in the late 1990s raises the question as to whether it is truly a "winning" industry segment.

Figure 7.2
Employment Trends in "Winning" IT Industry Segments in the Appalachia Region

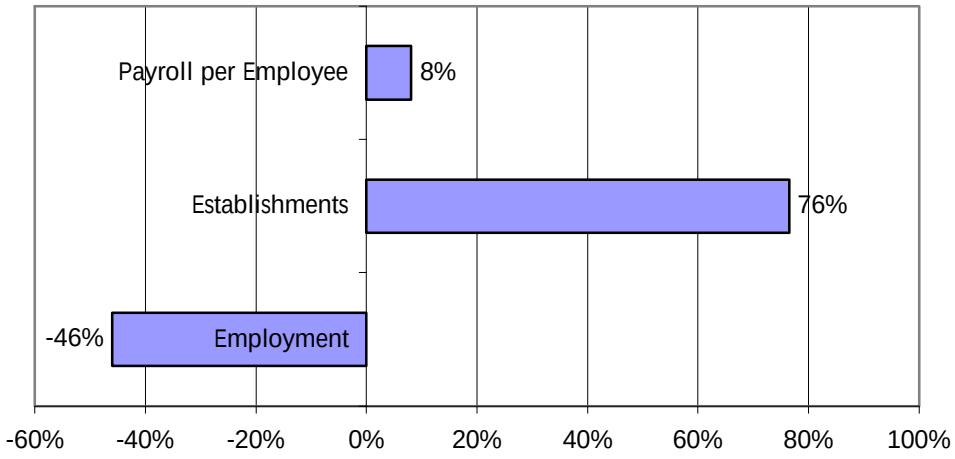


Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

SUMMARY

Between 1989 and 2000 there has been a significant increase in IT industry establishments in the Appalachia Region of Ohio (Figure 7.3). Indeed, the number of establishments increased by 76 percent. This optimistic appraisal of IT industrial development in the Appalachia Region is not supported by changes in IT employment. Total IT employment declined by 46 percent between 1989 and 2000. Moreover, payroll per employee grew only eight percent. It should be noted that the decline in employment was the result of closure of a small number of large firms. In addition, the small increase in payroll per employee may be the result of a large influx of entry-level persons into industry segments within the service sector. Furthermore, required data suppression may distort the IT industrial situation in the region. Nevertheless, the data strongly suggest that the IT industry is poorly developed in Appalachia.

Figure 7.3
Appalachia Region IT Growth 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Net based on the ES202 database.

If the ES202 Database tells the complete story of IT development, then it would appear that

bypassed by previous technological waves. The ES202 Database portrays a picture of the IT industrial base in the

data strongly suggest that the Appalachia Region has not garnered a significant share of the benefits of this new leading industrial sector, a fact that is disturbing but not surprising in

s relatively less developed region. Nevertheless, it is important to consider the

possibility that the very low employment in the IT industry, as recorded in the ES202 Database, may be in part an artifact of the settlement pattern in the Appalachia Region and the methodology used to classify industry segments in that database. Inasmuch as growth of the IT industry will play an important role in determining the future economic health of a region, it seems apropos to consider the limitations of the ES202 Database and how those limitations might affect the classification of firms and workers in the IT industry in the Appalachia Region.

The ES202 Database undercounts the number of firms and workers in the IT industry for two very important reasons, and that undercount is likely to be more exaggerated in the Appalachia Region than in the state as a whole. First, the ES202 Database considers only those firms that are covered under the Ohio Unemployment Compensation Law (OUCL). Second, the ES202 Database assigns a single SIC code to an establishment, so that only establishments that are highly specialized in IT activities would be so classified. Each of these factors is discussed in detail below.

Small owner-operated firms that employ family members and contract labor are not required to participate in the Unemployment Compensation Law. Obviously, many IT firms are not counted in the ES202 Database. To the extent that small family businesses are distributed randomly throughout the state, the exclusion of this class of firms from the database would not change the relative position of the various regions with respect to each other. If, however, one region has a larger share of total establishments that are small and family operated, then exclusion of those firms would cause the regional share of total business to be understated. There is good reason to believe that small family operated firms do have a more dominant position in the rural and small-town environment of Appalachia than in the state as a whole. In contrast to most other Ohio regions, the Appalachia Region has a rural and small town settlement pattern. This region also has a relatively sparse transport network, which helps to account for the relative isolation and poverty. Although suburban populations of cities located outside Appalachia have spread into the eastern and north-central areas, there are no large cities located within the region.

It is not likely that a large computer manufacturing firm would locate in the Appalachia Region, which is relatively remote from the major markets and relatively poorly served by

-owned firms do assemble computers and

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would find it difficult to remain in business in a small town. But individuals do provide those services in Appalachia, as they do in small towns throughout the country. Wher the failure to include non-

percentage of IT firms and employment in urban regions, the same methodology may exclude most or all firms and employment in small towns and rural areas.

The ES202

Ohio University, which is located within the Appalachia Region, is classified as an "Educational Institution" (SIC 8211); the fact that the university includes units that are ged primarily in "Computer Related Services" is not reported in the ES202 Database. Likewise, many wholesale and retail establishments in the region sell computers and

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those items and are therefore not classified within the IT SIC groups. Obviously, the same

ES202 data would not necessarily affect one region any more than another. That is, a

region would, other things being equal, strongly suggest a relative absence of IT employment generally. There is, however, good reason to believe t not equal, so that the undercount of IT firms and employment in the Appalachia Region will be greatly exaggerated by the methods used to collect the data.

Enterprises that are sufficiently specialized in IT activities to receive that the ES202 Database are not likely to locate in small towns and rural areas. For example, only a large city will usually be able to support a wholesale or retail firm that is devoted ftware. Obviously, an establishment that provides a good or service that is purchased infrequently must have a

establishments that are highly specialized in IT goods and services in rural areas and small

medical facilities. That does not mean, however, that such goods and services are

completely unavailable in small towns. Computer hardware and software is available in one corner of the drug or hardware stores in Appalachia and in small towns throughout the country, sometimes as a part of the business and sometimes as a franchise of a Radio Shack or some other national chain. Likewise, technical colleges and training centers located in small towns may offer course work in data processing, but only a large city could afford to maintain a training center that offered those services exclusively. Obviously, the ES202 Database will undercount IT firms and workers in urban areas as well. However in cities, that undercount may represent a small percentage of all IT firms and employees, whereas in small towns the same methodology may exclude most or all firms and employees.

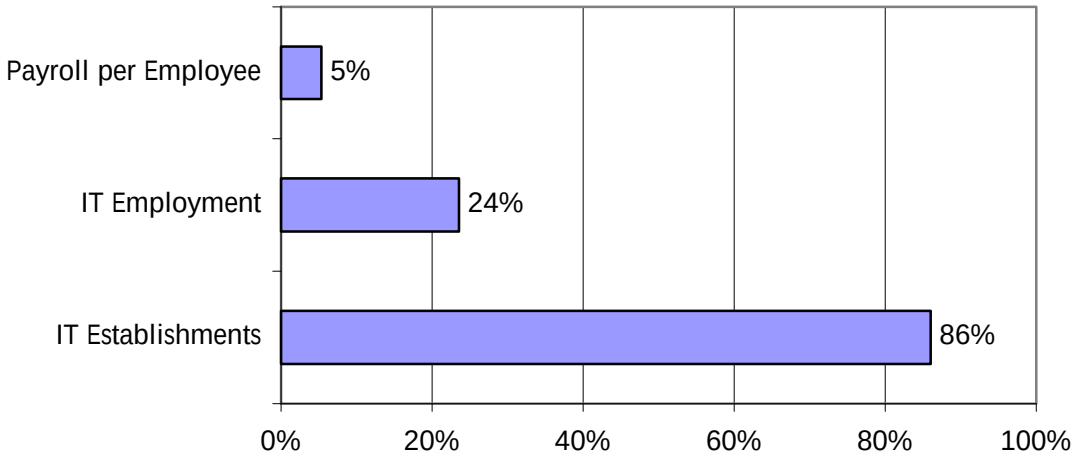
Notwithstanding the fact that ES202 data will tend to understate the IT industry in the Appalachia Region, the relative absence of such industry is almost certainly very real. The relative isolation, poverty, and low educational levels that often prevail in the Appalachia Region have not been conducive to the growth of industry generally, and the IT industry has not been an exception to that rule. This is most unfortunate given the fact that the IT industry need not be tied so closely to the national transportation grid. In contrast to most industry segments, in which accessibility to the national market was often a prime locational constraint, many types of IT industry segments are relatively foot-loose and can take advantage of lower costs of living and other amenities of small towns. In the past Appalachia has offered, without much success, the advantages of relatively low cost labor and land as an inducement for industry segments to locate in the region. Those advantages are not likely to be very important in most segments of the IT industry (although assembly of computer hardware may be an important exception). The costs of labor and land are usually not the critical factors in IT industrial location. Far more important is the availability of highly skilled workers. The promotion of educational opportunities for young people in the Appalachia Region, along with the amenities and low cost of living in the small towns in the region, might act to stimulate the development of the IT industry.

VIII. THE TOLEDO REGION

The IT Alliance of Northwest Ohio covers the Toledo region. The 20 counties that make up the region are: Allen, Auglaize, Defiance, Erie, Fulton, Hancock, Hardin, Henry, Huron, Lucas, Mercer, Ottawa, Paulding, Putnam, Sandusky, Seneca, Van Wert, Williams, Wood, and Wyandot. This section examines trends in IT employment, payroll, and number of establishments over the 1989-2000 study period.

General trends for the Toledo Region are shown in Figure 8.1. While the number of establishments increased significantly during the study period, employment growth was more modest, and payroll per employee remained approximately constant in real terms. Establishments rose from 315 to 586, an 86 percent increase. Employment rose from 5,831 to 7,206, a 24 percent increase. Payroll per employee averaged $38,270 in 1989 (expressed in 2000 dollars) while this average payroll increased by five percent to $40,336 in 2000.

Figure 8.1
Toledo Region IT Growth 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

PAYROLL PER EMPLOYEE IN IT INDUSTRY

Despite the small growth in overall average pay per employee, there was a wide variation over the individual industry segments shown in Table 8.1. Pay per employee ranged from a low of $18,707 in one manufacturing segment (suppressed for confidentiality), to a high of $47,832 in the communications sector during 1989 (also suppressed). In 2000, there was a similar spread with a low of $18,736 in the same manufacturing industry segment to a high of $52,371 in SIC 4813, Telephone Communications. In terms of actual changes, Computer Related Services not included elsewhere led the way with an increase of $15,552, followed closely by Prepackaged Software with an increase of $14,431. The largest decrease in pay per employee was in the manufacture of Electronic Computers, where the decline was $12,236. Overall, the IT industry had an average payroll per employee approximately $10,000 higher than the average payroll for all industries.

Table 8.1 Toledo Region IT Annualized Payroll per Employee (in 2000 dollars)

		Toledo Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357	Industrial & Commercial Machinery & Computing Equipment	$ 42,392	$ 32,340	- $ 10,052	-24%
36	Electronic & Other Electrical Equipment & Components, Except Computer Equipment	$ 22,612	$ 21,757	- $ 855	-4%
36	Magnetic & Optical Recording Media	$ 0	$ 0	$ 0	0%
3823	Process Control Instruments	S	S	S	-2%
3825	Instruments to Measure Electricity	$ 26,575	$ 23,997	- $ 2,578	-10%
4812	Radiotelephone Communications	$ 21,707	$ 31,880	$ 10,173	47%
4813	Telephone Communications	$ 43,682	$ 52,371	$ 8,689	20%
4822	Telegraph & Other Message Communications	S	S	S	S
4841	Cable & Other Pay Television Services	$ 30,886	$ 38,611	$ 7,725	25%
50	Wholesale Trade- Durable Goods	$ 39,528	$ 39,501	- $ 27	<1%
5734	Computer & Software Stores	$ 22,737	$ 29,809	$ 7,072	31%
737	Computer Programming, Data Processing, & other Computer Related Services	$ 37,119	$ 38,999	$ 1,880	5%
8243	Data Processing Schools	0	$ 36,075	$ 36,074	NA
Total IT Payroll per Employee		$ 38,270	$ 40,336	$ 2,066	5%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.
1989 dollars inflated using the average of the CPI for the Cleveland Metropolitan Area for the months of January, February, and March 2000.

The symbol "S" indicates data are suppressed to avoid disclosing information about individual firms.

SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.

SIC 36 is an aggregation of SIC 3661, 3663, 3669, 3672, 3695.

SIC 50 is an aggregation of SIC 5045, 5065.

SIC 737 is an aggregation of SIC 7371, 7372, 7373, 7374, 7375, 7376, 7377, 7378, 7379.

IT EMPLOYMENT AND THE NUMBER OF IT ESTABLISHMENTS

Employment and establishment growth presented in Tables 8.2 and 8.3 often mirror each other, as would be expected. That is, many of the industry segments that show the largest employment growth in Table 8.2 are also those that exhibited large growth in establishments. There are several exceptions, however. SIC 3825 and SIC 4813 experienced employment losses while the number of establishments grew or held constant. SIC 4841 gained employment while losing establishments.

Table 8.2 Toledo Region IT Employment

		Toledo Region			
SIC	Description	1989:Q1	2000:Q1	Actual Change	Percent Change
357	Industrial & Commercial Machinery & Computing Equipment	106	180	74	70%
36	Electronic & Other Electrical Equipment & Components, Except Computer Equipment	129	87	-42	-33%
36	Magnetic & Optical Recording Media	0	0	0	0%
3823	Process Control Instruments	S	S	S	S
3825	Instruments to Measure Electricity	273	163	-110	-40%
4812	Radiotelephone Communications	35	154	119	340%
4813	Telephone Communications	2,546	1,551	-995	-39%
4822	Telegraph & Other Message Communications	S	0	S	S
4841	Cable & Other Pay Television Services	613	853	240	39%
50	Wholesale Trade- Durable Goods	856	992	136	16%
5734	Computer & Software Stores	103	538	435	422%
737	Computer Programming, Data Processing, & other Computer Related Services	1,084	2,545	1,461	135%
8243	Data Processing Schools	0	44	44	NA
Total IT Employment		5,831	7,206	1,375	24%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data are suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 36 is an aggregation of SIC 3661, 3663, 3669, 3672, 3695.
SIC 50 is an aggregation of SIC 5045, 5065.
SIC 737 is an aggregation of SIC 7371, 7372, 7373, 7374, 7375, 7376, 7377, 7378, 7379.

Table 8.3 Toledo Region IT Establishments

SIC	Description	Toledo Region 1989:Q1	2000:Q1	Actual Change	Percent Change
357	Industrial & Commercial Machinery & Computing Equipment	4	5	1	25%
36	Electronic & Other Electrical Equipment & Components, Except Computer Equipment	5	10	5	100%
36	Magnetic & Optical Recording Media	0	0	0	0%
3823	Process Control Instruments	S	S	S	50%
3825	Instruments to Measure Electricity	4	4	0	0
4812	Radiotelephone Communications	4	14	10	250%
4813	Telephone Communications	74	131	57	77%
4822	Telegraph & Other Message Communications	S	0	S	S
4841	Cable & Other Pay Television Services	22	18	-4%	-18%
50	Wholesale Trade- Durable Goods	84	86	2	2%
5734	Computer & Software Stores	20	60	40	200%
737	Computer Programming, Data Processing, & other Computer Related Services	93	243	150	161%
8243	Data Processing Schools	0	9	9	NA
Total IT Establishments		315	586	271	86%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data are suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 36 is an aggregation of SIC 3661, 3663, 3669, 3672, 3695.
SIC 50 is an aggregation of SIC 5045, 5065.
SIC 737 is an aggregation of SIC 7371, 7372, 7373, 7374, 7375, 7376, 7377, 7378, 7379.

THE TOLEDO REGION IN COMPARISON TO THE STATE AND NATIONAL IT INDUSTRY

IT Industry Specialization

Industry specialization or concentration is measured by location quotients (LQ). Location quotients measure the industry's share of the regional total employment divided by the national share of that industry. LQs greater than one indicate that an industry is more concentrated locally than it is nationally and generally indicate that the industry is exporting its product.

Table 8.4 shows that the Toledo Region is not highly concentrated in IT firms. The exception, SIC 3578, Calculating and Accounting Equipment, must be suppressed for confidentiality, but it indicates specialization. This table indicates that the Toledo Region

has a smaller proportion of employment devoted to Information Technology than the nation on average. Overall, the region saw a decrease from 0.30 to 0.28 in the location quotient for the IT industry in the Toledo Region. The largest increases in the location quotient were for: SIC 3578, Calculating and Accounting Equipment; SIC 5734, Computer and Software Stores; and SIC 8243, Data Processing Schools. The largest declines occurred in: SIC 7376, Computer Facilities Management; SIC 7372, Prepackaged Software; and SIC 7371, Computer Programming Services.

Table 8.4 Toledo Region Industry Concentration: Location Quotients

		Toledo Region		
SIC	**Description**	**1989:Q1**	**1999:Q1**	**Change**
357	Industrial & Commercial Machinery & Computing Equipment	0.05	0.10	0.05
36	Electronic & Other Electrical Equipment and Components, Except Computer Equipment	0.04	0.04	0.00
36	Magnetic & Optical Recording Media	0.00	0.00	0.00
3823	Process Control Instruments	S	S	0.06
3825	Instruments to Measure Electricity	0.50	0.55	0.05
4812	Radiotelephone Communications	0.23	0.20	- 0.03
4813	Telephone Communications	0.53	0.40	- 0.13
4822	Telegraph & Other Message Communications	S	S	S
4841	Cable & Other Pay Television Services	0.98	0.78	- 0.20
50	Wholesale Trade- Durable Goods	0.28	0.29	0.01
5734	Computer & Software Stores	0.27	0.74	0.47
737	Computer Programming, Data Processing, & other Computer Related Services	0.28	0.25	- 0.03
8243	Data Processing Schools	0.00	0.39	0.39
Total IT industry		0.30	0.28	- 0.02

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data are suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 36 is an aggregation of SIC 3661, 3663, 3669, 3672, 3695.
SIC 50 is an aggregation of SIC 5045, 5065.
SIC 737 is an aggregation of SIC 7371, 7372, 7373, 7374, 7375, 7376, 7377, 7378, 7379.

Regional IT Employment Relative to the State

Table 8.5 presents the share of total Ohio employment in each of the IT industry segments in 1989 and 2000. Overall, the Toledo Region's share of state employment in the IT industry remained constant at five percent, while the region's share of total employment is considerably higher at 13 percent. Of the 21 industry segments with employment in 2000, 13 of them exhibited an increase in the share of total state IT employment, while eight showed a decreased share.

Table 8.5 Toledo Region Share of Ohio IT Employment

SIC	Description	Toledo Region 1989:Q1	Toledo Region 2000:Q1
357	Industrial & Commercial Machinery & Computing Equipment	1%	3%
36	Electronic & Other Electrical Equipment and Components, Except Computer Equipment	1%	1%
36	Magnetic & Optical Recording Media	0%	0%
3823	Process Control Instruments	S	S
3825	Instruments to Measure Electricity	10%	7%
4812	Radiotelephone Communications	2%	3%
4813	Telephone Communications	8%	6%
4822	Telegraph & Other Message Communications	S	S
4841	Cable & Other Pay Television Services	14%	14%
50	Wholesale Trade- Durable Goods	5%	4%
5734	Computer & Software Stores	5%	8%
737	Computer Programming, Data Processing, & other Computer Related Services		
8243	Data Processing Schools	0%	5%
Total IT industry		5%	5%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

An "S" indicates data are suppressed to avoid disclosing information about individual firms.
SIC 357 is an aggregation of SIC 3571, 3572, 3575, 3577, 3578.
SIC 36 is an aggregation of SIC 3661, 3663, 3669, 3672, 3695.
SIC 50 is an aggregation of SIC 5045, 5065.
SIC 737 is an aggregation of SIC 7371, 7372, 7373, 7374, 7375, 7376, 7377, 7378, 7379.

IT Industry Growth in the Region and the Nation

Table 8.6 provides a comparison of trends in the Toledo Region with those in the nation, showing the percentage change in employment, payroll per employee, and establishments for both the Toledo Region and the nation over the period 1989 to 1999. (National data was not available for 2000.) Although there are 30 IT industry segments, there are only 21 IT segments in which the Toledo Region had employment in 1989. In the region, 16 of the 21 segments exhibited positive employment growth during the 1989 to 1999 period. There are four cases where Northwest Ohio differs from the national trend in terms of growth versus decline in employment: SICs 3571, 3578, 3672 and 7376. In two cases, SICs 3571 and 3578, the region had positive employment growth whereas the national trend in these two industry segments showed a decline in employment. The other two cases where the region diverged from the national trends were in SICs 3672 and 7376, where there was a decline in employment in the region and growth in national employment.

Table 8.6 Growth Rates in the Toledo Region versus the United States: 1989:Q1 to 1999:Q1

SIC	Description	Employment		Payroll per Employee		Establishments	
		Toledo Region	United States	Toledo Region	United States	Toledo Region	United States
3571	Electronic Computers	13%	-33%	-36%	67%	0%	28%
3572	Computer Storage Devices	0%	21%	0%	52%	0%	38%
3575	Computer Terminals	0%	20%	0%	68%	0%	44%
3577	Computer Peripheral Equipment NEC	NA	17%	NA	24%	NA	37%
3578	Calculating & Accounting Equipment	218%	-24%	0%	47%	-50%	68%
3661	Telephone & Telegraph Apparatus	NA	-14%	NA	27%	NA	36%
3663	Radio & TV Communications	NA	6%	NA	21%	NA	63%
3669	Communications Equipment	NA	31%	NA	27%	NA	57%
3672	Printed Circuit Boards	-67%	23%	-4%	2%	-25%	24%
3674	Semiconductors & Related Equipment	21%	6%	-4%	53%	0%	42%
3695	Magnetic & Optical Recording Media	0%	-29%	0%	19%	0%	31%
3823	Process Control Instruments	28%	7%	-10%	14%	50%	49%
3825	Instruments to Measure Electricity	-28%	-30%	26%	36%	0%	8%
4812	Radiotelephone Communications	411%	539%	72%	36%	300%	601%
4813	Telephone Communications	-28%	-1%	40%	17%	54%	158%
4822	Telegraph & Other Message Communications	S	-26%	S	44%	S	-5%
4841	Cable & Other Pay Television Services	27%	67%	68%	46%	5%	34%
5045	Computers, Peripherals & Software	15%	32%	5%	32%	24%	94%
5065	Electronic Parts & Equipment	30%	10%	1%	21%	0%	33%
5734	Computer & Software Stores	431%	105%	-2%	12%	150%	86%
7371	Computer Programming Services	44%	215%	-18%	29%	192%	265%
7372	Prepackaged Software	9%	179%	62%	103%	-44%	93%
7373	Computer Integrated Systems Design	586%	109%	-10%	28%	113%	144%
7374	Data Processing & Preparation	45%	34%	6%	30%	0%	59%
7375	Information Retrieval Services	160%	174%	-30%	123%	625%	501%
7376	Computer Facilities Management	-82%	34%	59%	39%	-75%	26%
7377	Computer Rental & Leasing	NA	-13%	NA	8%	NA	-19%
7378	Computer Maintenance & Repair	817%	73%	-9%	-10%	120%	74%
7379	Computer Related Services, NEC	499%	405%	39%	21%	200%	408%
8243	Data Processing Schools	NA	264%	NA	32%	NA	382%
Total IT Industry		27%	39%	33%	34%	74%	138%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database; U.S. Department of Labor, Bureau of Labor Statistics, Covered Employment and Wages (ES202).

An "S" indicates data are suppressed to avoid disclosing information about individual firms.

In comparing payroll trends in the Toledo Region and the nation, it is evident that payroll growth in real terms was negative in many industry segments in the region, while there was only one with negative growth nationally. The largest discrepancy was in SIC 7375, Information and Retrieval Services, where payroll per employee declined 30 percent in the region and increased 123 percent nationally.

Five industry segments in the Toledo Region showed payroll growth greater than that in corresponding national segments: Radiotelephone Communications (SIC 4812), Telephone Communications (SIC 4813), Cable and Other Pay Television Services (SIC 4841), Computer Facilities Management (SIC 7376), and Computer Related Services, NEC (SIC 7379). Despite the fact that a real decline in payroll per employee took place in many Toledo Region industry segments, there is little difference between the regional and national growth rates when averaging across all segments. This is a result of positive growth in the region's two largest segments (SIC 4813 and SIC 4841).

In terms of establishments, the nation surpassed the region with 138 percent growth over the study period while the region had a growth of 74 percent. Nationally, 28 of the 30 industry segments exhibited positive growth in establishments over this period, while 11 of the 21 segments in the region experienced positive growth. The number of establishments in five industry segments held constant, showing neither growth or decline.

In summary, Table 8.6 shows that growth rates in the nation surpassed the region in terms of IT employment and establishments during the study period. Payroll per employee grew at a comparable rate.

WINNING IT INDUSTRY SEGMENTS

Table 8.7 attempts to summarize the evolution of the IT industry in the Toledo Region by showing the 10 largest industry segments in terms of 2000 employment, the largest change in employment over the 1989 to 2000 period, the largest percent change in employment over the study period, payroll per employee, and number of establishments.

Seven industry segments that appeared in at least four of five columns in Table 8.7 are highlighted in gray. These seven industry segments could be labeled "IT industry winners" in that they exhibited high levels of employment, high levels of payroll, a large number of establishments, and large changes in employment measured in both absolute terms and percentage terms. The IT industry winners in the Toledo Region are: Cable and Other Pay Television Services (SIC 4841); Electronic Parts and Equipment (SIC 5065); Computer and Software Stores (SIC 5734); Computer Programming Services (SIC 7371); Data Processing

and Preparation (SIC 7374); Information Retrieval Services (SIC 7375); and Computer Related Services not included elsewhere (SIC 7379).

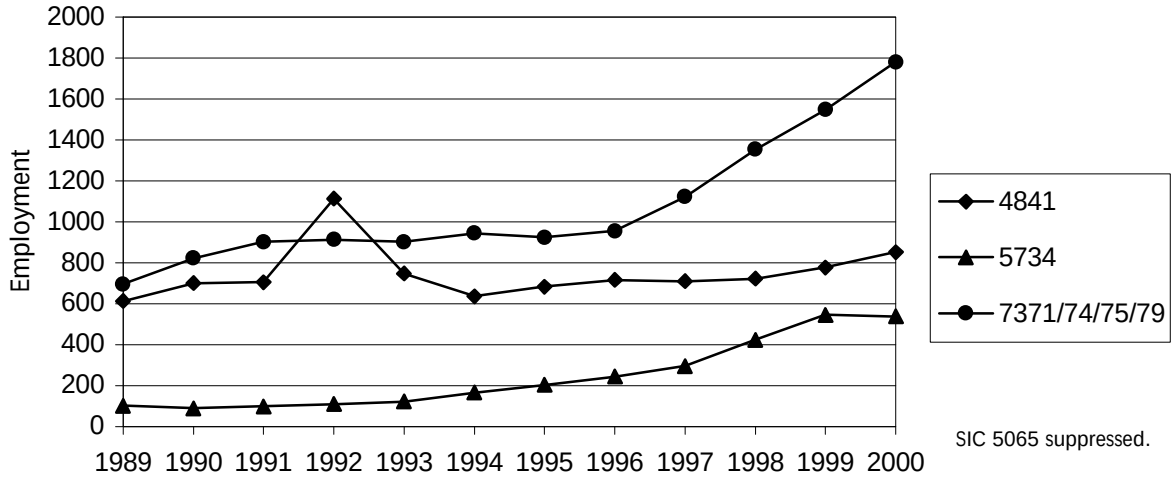
Table 8.7 Toledo "Winning" IT Industry Segments

Top Ten Industry Segments				
Largest Employment, 2000:Q1	**Largest Actual Change in Employment, 1989-2000**	**Largest Percent Change in Employment, 1989-2000**	**Highest Payroll per Employee, 2000:Q1**	**Largest Number of Establishments, 2000:Q1**
4813	**5734**	7378	4813	4813
4841	**7375**	7373	**7379**	**7371**
7374	**7374**	**7379**	5045	**7379**
5734	**7379**	**5734**	7372	**5734**
5065	7373	4812	7376	**5065**
5045	**4841**	3578	**7371**	5045
7371	**7371**	**7375**	3823	**7375**
7375	**5065**	**7374**	**7375**	7373
7379	4812	**7371**	**4841**	**4841**
7372	7378	**5065**	8243	**7374**

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.
Highlighted SICs are present in at least four of the five columns. They represent the "winning" industry segments.

Figure 8.2 shows the level of employment in the winning industry segments for the years 1989 through 2000. SICs 7371, 7374, 7375 and 7379 are aggregated to avoid disclosure of information on specific firms. All segments experienced gradual increases, with the exception of the Computer Services industry segments, which grew rapidly after 1996.

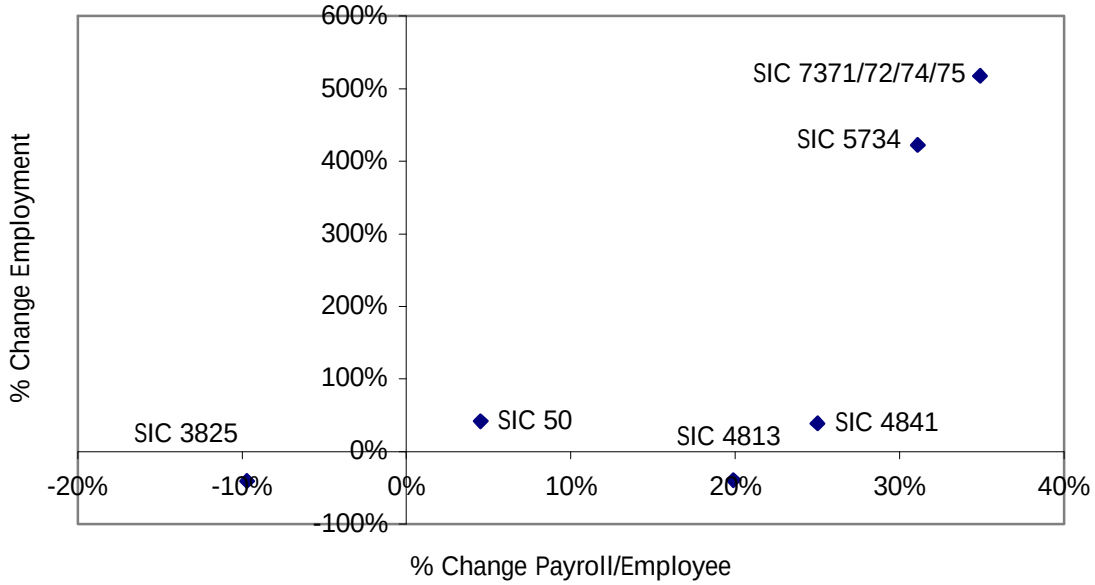
Figure 8.2
Employment Trends in "Winning" IT Industry Segments in the Toledo Region



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

Figure 8.3 shows a scatter plot of the percentage change in payroll per employee (on the horizontal axis) versus the percentage change in employment (on the vertical axis) for the largest IT industry segments measured in terms of 1989 employment.

Figure 8.3
Change in Ten Largest IT Industry Segments in the Toledo Region, 1989 to 2000



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

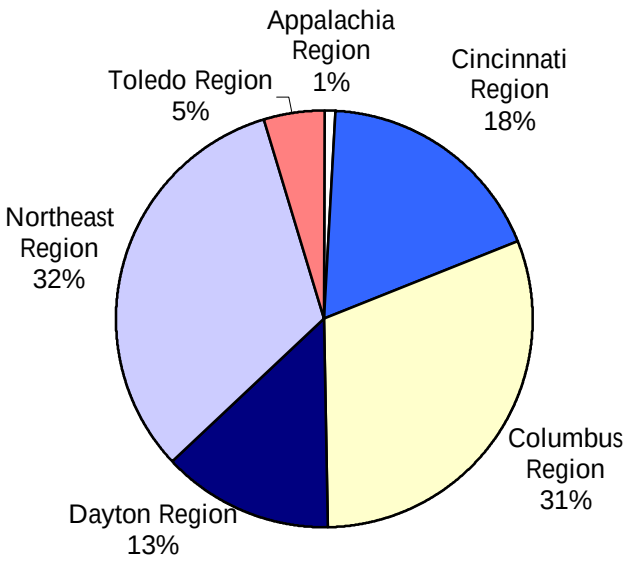
Four of the six industry segments depicted on this graph experienced positive growth in both employment and payroll per employee. However, one segment (SIC 4813) experienced growth in average payroll per employee while showing a decline in employment, and one segment (SIC 3835) experienced declines in both employment and payroll per employee. Computer Service industry segments (SIC 7371/7372/7375) and Computer and Software Stores (SIC 5734) experienced the highest rates of growth in employment and payroll per employee.

IX. A COMPARISON OF OHIO'S IT REGIONS

IT EMPLOYMENT

IT employment is growing in all regions of Ohio, with the exception of the Appalachia Region, where the IT industry have a very limited presence. However, the IT industry is not distributed evenly among the six regions. This is expected, as these regions represent economies of varying size. The Northeast Region (32%) and Columbus Region (31%) account for nearly two-thirds of the state's IT employment. The Cincinnati and Dayton Regions account for 18 percent and 13 percent, respectively. The Toledo Region is home to only five percent of Ohio's IT employment, and the Appalachia Region has one percent (see Figure 9.1).

Figure 9.1
Total IT Employment 2000:Q1



Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

In three regions, the share of IT employment exceeded the share of total employment in Ohio, while in three regions the share of IT employment lagged behind the share of total employment. The Columbus Region has the highest proportion of IT employment relative to the region's share of total employment, accounting for 31% of IT jobs while home to just 19% of all jobs. The Dayton Region has a slightly higher share of IT employment (13%) than total employment (10%). Similarly, the Cincinnati Region has 18 percent of IT

employment and 15 percent of total employment. Other regions in the state have a smaller share of IT employment than their share of total employment. The Northeast Region has 32 percent of the state's IT employment, while accounting for 38 percent of total employment. The Toledo Region has just five percent of IT employment, compared to 13 percent of total employment, and the Appalachia Region is home to just one percent of IT jobs, while having five percent of all jobs in Ohio.

As shown in Table 9.1, the Columbus Region experienced the most growth in IT employment, both in terms of absolute numbers and rate of increase. The region added over 21,000 jobs between 1989 and 2000. The Northeast Region, the region with the most IT jobs, grew at a much slower rate (28%), however, it added a significant number of jobs over the 11-year period, with 10,766 more employees in 2000 than in 1989. The Cincinnati Region added 7,953 jobs during that time period, an increase of 40 percent. The Toledo Region added 1,375 jobs, an increase of 24 percent. With the addition of 1,187 jobs, growth in the Dayton Region was a moderate 6 percent. IT employment in the Appalachia Region dropped by 1,225, a 46 percent decline.

Table 9.1 Total IT Employment, 1989:Q1 and 2000:Q1

	1989:Q1	2000:Q1	Actual Change	Percent Change
Appalachia Region	2,664	1,439	-1,225	-46%
Cincinnati Region	19,785	27,738	7,953	40%
Columbus Region	26,068	47,205	21,137	81%
Dayton Region	19,513	20,700	1,187	6%
Northeast Region	38,609	49,375	10,766	28%
Toledo Region	5,831	7,206	1,375	24%
State of Ohio	112,469	153,663	41,194	37%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

NUMBER OF IT ESTABLISHMENTS

All regions experienced growth in the number of IT establishments (see Table 9.2). It is interesting to note that the average number of employees per establishment has declined (from 34.2 in 1989 to 21.5 in 2000). This might be expected, as the IT industry segments experiencing the most growth are in the service sector, and these tend to be smaller in size than establishments in other sectors.

Table 9.2 Total IT Establishments, 1989:Q1 and 2000:Q1

	1989:Q1	2000:Q1	Actual Change	Percent Change
Appalachia Region	102	180	78	76%
Cincinnati Region	565	1,233	668	118%
Columbus Region	555	1,642	1,087	196%
Dayton Region	482	811	329	68%
Northeast Region	1,272	2,692	1,420	112%
Toledo Region	315	586	271	86%
State of Ohio	3,291	7,144	3,853	117%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

PAYROLL PER EMPLOYEE IN IT INDUSTRY SEGMENTS

In each of Ohio's IT regions, the average payroll per employee for the IT industry far exceeded the average payroll for all industries, indicating that the IT industry provides a higher standard of living for its employees. As shown in Table 9.3, payroll per employee in 2000 was highest in the Cincinnati Region ($68,859). The Columbus Region followed with a payroll per employee of $64,529 and this region also experienced the highest rate of payroll growth between 1989 and 2000 (43%). The Dayton Region had an annual payroll per employee of $54,794 (an 18% increase) and the Northeast Region followed closely with $54,264 (a 13% increase). Payroll per employee increased slightly in the Appalachia Region (8%) and the Toledo Region (5%). These regions also had the lowest payroll per employee in the state. In 1989 and 2000, only two regions had a payroll per employee that was higher than the state average. The Cincinnati Region had a higher payroll per employee for both years. In 1989, the Northeast Region posted a higher payroll per employee, but in 2000 it fell below the state average and the Columbus Region surpassed the state.

Table 9.3 Annualized Payroll per Employee, 1989:Q1 and 2000:Q1 (in 2000 dollars)

	1989:Q1	2000:Q1	Actual Change	Percent Change
Appalachia Region	$ 37,472	$ 40,513	$ 3,041	8%
Cincinnati Region	$ 49,487	$ 68,859	$ 19,372	39%
Columbus Region	$ 45,226	$ 64,529	$ 19,303	43%
Dayton Region	$46,469	$ 54,794	$ 8,325	18%
Northeast Region	$ 48,074	$ 54,264	$ 6,190	13%
Toledo Region	$ 38,270	$ 40,336	$ 2,066	5%
State of Ohio	$ 46,625	$ 59,341	$ 12,716	27%

Source: Employment and payroll estimates developed by the Ohio ES202 Network based on the ES202 database.

WINNING IT INDUSTRY SEGMENTS

Many IT industry segments are represented among the "winning industry segments" in the six Ohio IT regions, indicating different areas of strength in each region. The winning industry segments come from all major sectors, however the majority are within the service sector. Two industry segments, both in the broader group of Computer Related Services, were winners in every region. Computer Programming Services (SIC 7371) and Computer Related Services (7379) were strong in all areas of the state. It is recommended that Ohio's private, nonprofit, and public sectors encourage and support the continued growth of companies in these industry segments throughout the state.

The Northeast Region was the only region that identified segments within the manufacturing sector. The manufacture of Calculating and Accounting Equipment (SIC 3578) and Process Control Instruments (SIC 3823) were among the strong industry segments in the region. The identification of SIC 3823 is consistent with the industrial cluster of instruments and controls identified for the Greater Cleveland area. Five regions identified wholesale IT industry segments as winners. Wholesale of Computer, Peripherals, and Software (SIC 5045) was a winner in the Cincinnati, Columbus and Dayton regions. Wholesale of Electronics Parts and Equipment (SIC 5065) was a winner in the Northeast, and Toledo regions.

Analyzing the "winning" industry segments to compare among Ohio's IT regions reveals that some industry segments have shown strong performance in all regions, while others are especially competitive in only some of the regions and should continue to develop there.

INDUSTRY SPECIALIZATION

Industry specialization or concentration, as measured by location quotients (LQs), indicates whether an industry is more or less concentrated locally than it is nationally. LQs greater than one signify industry specialization. Among Ohio's IT regions, the Dayton Region had the highest location quotient in 1989 (1.13), but as other areas "caught up" to Dayton, the LQ declined over the next decade. The Columbus Region had the highest location quotient in 2000 (1.08). These are the only regions in Ohio with a higher concentration of IT industry than the nation as a whole.

The high location quotient for the Dayton Region can be primarily attributed to its very strong specialization in the manufacture of Calculating and Accounting Equipment (SIC 3578). The region also specializes in: Information Retrieval Services (SIC 7375); Computer Integrated Systems Design (SIC 7373); Computer Facilities Management (SIC7376); wholesale trade of Computers, Peripherals and Software; Computer Programming Services (SIC 5045); and the manufacture of Printed Circuit Boards (SIC 3672). The Columbus Region also specializes in several IT industry segments, including: Process Control Instruments/ Instruments to Measure Electricity (SIC 382); Radiotelephone Communications (SIC 4812); Telephone Communications (SIC 4813); Computer Programming Services (SIC 7371); Prepackaged Software/Information Retrieval Services (SIC 7372/7375); Computer Related Services, NEC (SIC 7379); and Data Processing Schools (SIC 8243).

Although the LQ for the Cincinnati Region ranked third among the six regions, this region showed specialization in the largest number of industry segments: Computer Rental and Leasing (SIC 7377); Computer Facilities Management (SIC 7376); Computer and Software Stores (SIC 5734); Prepackaged Software (SIC 7372); wholesale of Computers, Peripherals and Software (SIC 5045); Computer Programming Services (SIC 7371); Data Processing Schools (SIC 8243); Computer Maintenance and Repair (SIC 7378); and Cable and Other Pay Television Services (SIC 4841).

The Northeast Region specializes in two IT industry segments, Process Control Instruments (SIC 3823) and wholesale of Electronic Parts and Equipment (SIC 5065). The Toledo Region specializes in one IT industry segment, the manufacture of Calculating and Accounting Equipment (SIC 3578), although not to the extent of the Dayton Region. The Appalachian Region does not have any IT specialization.

SUMMARY

As expected, the Ohio's IT regions differ significantly from one another, but all are showing positive trends. IT employment and payroll per employee have increased in all regions, with the exception of the Appalachia Region, where the IT industry is very small. All regions are showing growth in the number of IT establishments and payroll per employee.

The Northeast and Columbus Regions account for a large portion of Ohio's IT employment, followed by the Cincinnati Region and Dayton Region. IT employment in the Toledo Region is small, and there is very little in the Appalachia Region. The Columbus region has experienced the most growth in IT employment and has the second highest payroll per employee. In 2000, the Columbus Region was the only one of the six regions to have a higher concentration of IT industry than exists nationally, as Dayton fell to a level just below that point. Across all regions, computer related services industry segments showed particular strength, especially Computer Programming Services (SIC 7371) and Computer Related Services, NEC (SIC 7379).

OHIO'S IT ALLIANCE TARGET INDUSTRY SIC CODE DEFINITIONS

3571: ELECTRONIC COMPUTERS

Establishments primarily engaged in manufacturing electronic computers. Electronic computers are machines which: 1) store the processing program or programs and the data immediately necessary for execution of the program; (2) can be freely programmed in accordance with the requirements of the user; (3) perform arithmetical computations specifies by the user' and (4) execute, without human intervention, a processing program which requires them to modify their execution by logical decision during the processing run. Included in this industry are digital computers, analog computers, and hybrid digital/analog computers. Establishments primarily engaged in manufacturing machinery or equipment which incorporate computers or a central processing unit for the purpose of performing functions such as measuring, displaying, or controlling process variables are classified based on the manufactured end product.

Computers: digital, analog, and hybrid
Minicomputers
Mainframe computers
Personal computers
Microcomputers

3572: COMPUTER STORAGE DEVICES

Establishments primarily engaged in manufacturing computer storage devices.

Auxiliary computer storage units
Magnetic storage devices for computers
Computer storage units
Optical storage devices for computers
Disk drives, computer
Recorders, tape: for computers
Drum drives, computer
Tape storage units, computer

3575: COMPUTER TERMINALS

Establishments primarily engaged in manufacturing computer terminals. Establishments primarily engaged in manufacturing point-of-sale, funds transfer, and automatic teller machines are classified in Industry 3578.

Cathode ray tube (CRT) teleprinter, multistation
Multistation CRT/teleprinters
Computer terminals
Teleprinters (computer terminals)

3577: COMPUTER PERIPHERAL EQUIPMENT, NEC

Establishments primarily engaged in manufacturing computer peripheral equipment, not elsewhere classified, including printers, plotters, and graphic displays. Establishments primarily engaged in manufacturing modems and other communications interface equipment are classified in Industry 3661.

Card punching and sorting machines
Card-type conversion equipment, computer peripheral equipment
Computer output to microfilm units, computer peripheral equipment
Computer paper tape punchers and devices, computer peripheral equipment
Decoders, computer peripheral equipment
Disk pack inspectors, computer peripheral equipment
Document entry conversion devices, computer peripheral
Graphic displays, except graphic terminals: computer peripheral equipment
Input/output equipment, computer: except terminals
Key-disk or diskette equipment, computer peripheral equipment
Key-tape equipment: reel, cassette, or cartridge
Keying equipment, computer peripheral equipment
Keypunch/verify cards, computer peripheral equipment
Magnetic ink recognition devices, computer peripheral equipment
Key punch/verify cards, computer peripheral equipment
Media to media data conversion equipment, computer peripheral
Optical scanning devices, computer equipment
Plotter controllers, computer peripheral
Plotters, computer
Printers, computer peripheral equipment
Punch card equipment: card readers, tabulators, collators, sorters, and interpreters
Tape cleaners, magnetic: computer peripheral equipment
Tape print units, computer peripheral equipment

3578: CALCULATING AND ACCOUNTING MACHINES, EXCEPT ELECTRONIC COMPUTERS

Establishments primarily engaged in manufacturing point-of-sale devices, funds transfer devices, and other calculating and accounting machines, except electronic computers. Included are electronic calculating and accounting machines which must be paced by operator intervention, even when augmented by attachments. These machines may include program control or have input/output capabilities.

Accounting machines, operator paced
Adding machines
Automatic teller machines (ATM)
Billing machines
Bookkeeping machines
Calculating machines, operator paced
Cash registers, including adding machines with cash drawers
Change making machines
Coin counters
Funds transfer devices
Point-of-sale devices
Registers, credit account

3661: TELEPHONE AND TELEGRAPH APPARATUS

Establishments primarily engaged in manufacturing wire telephone and telegraph equipment. Included are establishments manufacturing modems and other telephone and telegraph communications interface equipment. Establishments primarily engaged in manufacturing cellular radio telephones are classified in Industry 3663.

Auto-transformers for telephone switchboards
Carrier equipment, telephone and telegraph
Communications headgear, telephone
Data sets, telephone and telegraph
Facsimile equipment
Headsets, telephone
Message concentrators
Modems
Multiplex equipment, telephone and telegraph
PBX equipment, manual and automatic
Switchboards, telephone and telegraph
Switching equipment, telephone
Telegraph office switching equipment
Telephone answering machines
Telephone central office equipment, dial and manual
Telephone dialing devices, automatic
Telephone sets, except cellular radio telephone
Telephone station equipment and parts,wire
Telephones, sound powered (no battery)
Telephones underwater
Toll switching equipment, telephone

3663: RADIO AND TELEVISION BROADCASTING AND COMMUNICATIONS EQUIPMENT

Establishments primarily engaged in manufacturing radio and television broadcasting and communications equipment. Important products of this industry are closed-circuit and cable television equipment; studio equipment; light communications equipment; transmitters, transceivers and receivers (except household and automotive); cellular radio telephones; communication antennas; receivers; RF power amplifiers; and fixed and mobile radio systems. Establishments primarily engaged in manufacturing household audio and video equipment are classified in Industry 3651; those manufacturing intercommunications equipment are classified in Industry 3669; and those manufacturing consumer radio and television receiving antennas are classified in Industry 3679.

Airborne radio communications equipment
Amplifiers: RF power and IF
Antennas, transmitting and communications
Broadcast equipment (including studio), radio and television
Cable television equipment
Cameras, television
Carrier equipment, radio communications
Cellular radio telephones
Citizens' band (CB) radios
Closed circuit television equipment
Digital encoders
Encryption devices
Light communications equipment
Marine radio communications equipment
Microwave communications equipment
Mobile communications equipment
Multiplex equipment, radio
Pagers (one-way)
Phototransmission equipment
Radio and television switching equipment
Radio receiver networks
Radio transmitting and communications antennas and ground equipment
Receivers, radio communications
Satellites, communications
Space satellite communications equipment
Studio equipment, radio and television broadcasting
Telemetering equipment, electronic
Television monitors
Television transmitting antennas and ground equipment
Transceivers
Transmitter-receivers, radio
Transmitting apparatus, radio and television

3669: COMMUNICATIONS EQUIPMENT, NOT ELSEWHERE CLASSIFIED

Establishments primarily engaged in manufacturing communications and related equipment, not elsewhere classified. Important products of this industry are intercommunication equipment, traffic signaling equipment, and fire and burglar alarm apparatus.

Burglar alarm apparatus, electric
Fire alarm apparatus, electric
Fire detection systems, electric
Highway signals, electric
Intercommunications equipment, electronic
Marine horns, electric
Pedestrian traffic control equipment
Railroad signaling devices, electric
Signaling apparatus, electric
Signals: railway, highway, and traffic- electric
Sirens, electric: vehicle, marine, industrial, and air raid
Smoke detectors
Traffic signals, electric

3672: PRINTED CIRCUIT BOARDS

Establishments primarily engaged in manufacturing printed circuit boards.

Circuit boards, television and radio: printed
Printed circuit boards
Printed circuits
Wiring boards

3674: SEMICONDUCTORS AND RELATED DEVICES

Establishments primarily engaged in manufacturing semiconductors and related solid-state devices. Important products of this industry are semiconductor diodes and stacks, including rectifiers, integrated microcircuits (semiconductor networks), transistors, solar cells, and light sensing and emitting semi-conductor (solid-state) devices.

Computer logic modules
Controlled rectifiers, solid-state
Diodes, solid state (germanium, silicon, etc.)
Fuel cells, solid-state
Gunn effect devices
Hall effect devices
Hybrid integrated circuits
Infrared sensors, solid-state
Laser diodes
Light emitting diodes
Light sensitive devices, solid-state
Magnetic bubble memory device
Magnetohydrodynamic (MHD) devices
Memories, solid-state
Metal oxide silicon (MOS) devices
Microcircuits, integrated (semiconductor)
Microprocessors
Modules, solid-state
Molecular devices, solid-state
Monolithic integrated circuits (solid-state)
Optical isolators
Parametric diodes
Photoconductive cells
Photoelectric cells, solid-state (electronic eye)
Photoelectric magnetic devices
Photovoltaic devices, solid-state
Random access memories (RAMS)
Read only memories (ROMS)
Rectifiers, solid-state
Schottky diodes
Semiconductor circuit networks
Semiconductor devices (solid state integrated circuits)
Silicon wafers, chemically doped
Solar cells
Solid-state electronic devices
Strain gages, solid-state
Stud bases or mounts for semiconductor devices
Switches, silicon control
Thermionic devices, solid-state
Thermoelectric devices, solid-stare
Thin film circuits
Thyristors
Transistors
Tunnel diodes
Ultraviolet sensors, solid state
Variable capacitance diodes
Wafers (semiconductor devices)
Zener diodes

3695: MAGNETIC AND OPTICAL RECORDING MEDIA

Establishments primarily engaged in manufacturing blank tape, disk, or cassette magnetic or optical recording media for use in recording audio, video, or other signals. Establishments primarily engaged in manufacturing blank or recorded records and prerecorded audio tapes are classified in Industry 3652; those manufacturing prepackaged computer software are classified in Services, Industry 7372; and those manufacturing prerecorded video tape cassettes and disks are classified in Services, Major Group 78.

Audio range tapes, blank
Computer software tape and disks, blank: rigid and floppy
Instrumentation type tape, blank
Magnetic recording tape, blank: reels, cassettes, and disks
Optical disks and tape, blank
Video recording tape, blank

3823: INDUSTRIAL INSTRUMENTS FOR MEASUREMENT, DISPLAY, AND CONTROL OF PROCESS VARIABLES; AND RELATED PRODUCTS

Establishments primarily engaged in manufacturing industrial instruments and related products for measuring, displaying (indicating and/or recording), transmitting, and controlling process variables in manufacturing, energy conversion, and public service utilities. These instruments operate mechanically, pneumatically, electronically, or electrically to measure process variables, such as temperature, humidity, pressure, vacuum, combustion, flow, level, viscosity, density, acidity, alkalinity, specific gravity, gas and liquid concentration, sequence, time interval, mechanical motion, and rotation. Establishments primarily engaged in manufacturing electrical integrating meters are classified in Industry 3825; those manufacturing residential and commercial comfort controls are classified in Industry 3822; those manufacturing all liquid-in-glass and bimetal thermometers and glass hydrometers are classified in Industry 3829; those manufacturing recorder charts are classified in Industry Group 275; and those manufacturing analytical and optical instruments are classified in Industry segments 3826 and 3827.

Absorption analyzers, industrial process type: e.g., infrared, X-ray
Analyzers, industrial process type
Annunciators, relay and solid-state types: industrial display
Boiler controls: industrial, power, and marine type
Buoyancy instruments, industrial process type
Chromatographs, industrial process type
Combustion control instruments, except commercial and household furnace type
Computer interface equipment for industrial process control
Controllers for process variables: electric, electronic, and pneumatic
Coulometric analyzers, industrial process type
Data loggers, industrial process type
Density and specific gravity instruments, industrial process type
Differential pressure instruments, industrial process type
Digital displays of process variables
Draft gauges, industrial process type
Electrodes used in industrial process measurement
Electrolytic conductivity instruments, industrial process type
Flow instruments, industrial process type
Fluidic devices, circuits, and systems for process control
Gas and liquid analysis instruments, industrial process type
Gas flow computers, industrial process type
Humidity instruments, industrial process type
Hydrometers, industrial process type
Industrial process control instruments
Infrared instruments, industrial process type
Level and bulk measuring instruments, industrial process type
Liquid analysis instruments, industrial process type
Liquid concentration instruments, industrial process type

Liquid level instruments, industrial process type
Magnetic flow meters, industrial process type
Manometers, industrial process type
Moisture meters, industrial process type
Nuclear reactor controls
Panelboard indicators, recorders and controllers: receiver type
Potentiometric self-balancing instruments, except X-Y plotters
Pressure gauges, dial and digital
Pressure instruments, industrial process type
Primary elements for process flow measurement: orifice plates
Programmers, process type
Pyrometers, industrial process type
Refractometers, industrial process type
Resistance thermometers and bulbs, industrial process type
Telemetering instruments, industrial process type
Temperature instruments: industrial process type, except glass and bimetral
Thermal conductivity instruments, industrial process type
Thermistors, industrial process type
Thermocouples, industrial process type
Thermometers, filled system: industrial process type
Time cycle and program controllers, industrial process type
Transmitters of process variables, standard signal conversion
Turbidity instruments, industrial process type
Turbine flow meters, industrial process type
Viscosimeters, industrial process type
Water quality monitoring and control systems

3825: INSTRUMENTS TO MEASURE ELECTRICITY

Establishments primarily engaged in manufacturing instruments for measuring the characteristics of electricity and electrical signals, such as voltmeters, ammeters, wattmeters, watt-hour meters, demand meters, and equipment for testing the electrical characteristics of electrical, radio, and communication circuits and of internal combustion engines. Establishments primarily engaged in the manufacturing of electronic checkout, monitoring, evaluating, and other electronic support equipment for electronic navigational, radar, and sonar systems are classified in Industry 3812, and those manufacturing similar equipment for communications systems classified in Industry Group 366.

Alternator and generator testers
Ammeters
Ampere-hour meters
Analog-to-digital converters, electronic instrumentation type
Analyzers for testing electrical characteristics
Audiometers, except medical
Automotive ammeters and voltmeters
Battery testers, electrical
Bleed control cabinets (engine testers)
Bridges, electrical: e.g., Kelvin, Wheatstone, vacuum tube, and
Current measuring equipment
Decade boxes: capacitance, inductance, and resistance
Demand meters, electric
Digital panel meters, electricity measuring
Digital test equipment, electronic and electrical circuits and equipment
Digital-to-analog converters, electronic instrumentation, type
Diode and transistor testers
Distortion meters and analyzers
Elapsed time meters, electronic
Electron tube test equipment
Electronic test equipment for testing electrical characteristics
Energy measuring equipment, electrical
Field strength and intensity measuring equipment, electrical
Frequency meters: electrical, mechanical, and electronic
Frequency synthesizers
Function generators
Galvanometers, except geophysical
Ignition testing instruments
Impedance measuring equipment
Indicating instruments, electric
Instrument relays, all types
Instrument shunts
Instruments for measuring electrical quantities
Instruments, electric: for testing electrical characteristics
Integrated-circuit testers
Integrating electricity meters
Internal combustion engine analyzers, to test electrical characteristics
Laboratory standards, electric: resistance, inductance, and capacitance
Logic circuit testers
Measuring equipment for electronic and electrical circuits and
Measuring instruments and meters, electric

Meters, electric: pocket, portable, panelboard, and graphic recording
Meters, power factor and phase angle
Microwave test equipment
Multimeters
Network analyzers
Ohmmeters
Oscillators, audio frequency and radio frequency (instrument types)
Oscillographs and oscilloscopes
Potentiometric instruments, except industrial process type
Power measuring equipment, electrical
Pulse (signal) generators
Radar testing instruments, electric
Radio apparatus analyzers for testing electrical characteristics
Radio set analyzers, electrical
Radio tube checkers, electrical
Radio frequency measuring equipment
Recorders, oscillographic
Reflectometers, sliding shorts
Resistance measuring equipment
Semiconductor test equipment
Signal generators and averages
Spark plug testing instruments, electric
Spectrum analyzers
Standard cells
Standards and calibration equipment for electrical measuring, except
Standing wave ratio measuring equipment
Stroboscopes
Sweep generators
Sweep oscillators
Synchroscopes
Tachometer generators
Test equipment for electronic and electrical circuits and equipment
Test sets, ignition harness
Time code generators
Transformers, instrument: portable
Tube testers
Volt-ohm milliammeters
Voltmeters
Watt-hour and demand meters, combined
Watt-hour and time switch meters, combined
Watt-hour meters, electric
Wattmeters
Waveform measuring and/or analyzing equipment

4812: RADIOTELEPHONE COMMUNICATIONS

Establishments primarily engaged in providing two-way radiotelephone communications services, such as cellular telephone services. This industry also includes establishments primarily engaged in providing telephone paging and beeper services and those engaged in leasing telephone lines or other methods of telephone transmission, such as optical fiber lines and microwave or satellite facilities, and reselling the use of such methods to others. Establishments primarily engaged in furnishing telephone answering services are classified in Services, Industry 7389.

Beeper (radio pager) communications services
Cellular telephone services
Paging services: radiotelephone
Radiotelephone communications

4813: TELEPHONE COMMUNICATIONS, EXCEPT RADIOTELEPHONE

Establishments primarily engaged in furnishing telephone voice and data communications, except radiotelephone and telephone answering services. This industry also includes establishments primarily engaged in leasing telephone lines or other methods of telephone transmission, such as optical fiber lines and microwave or satellite facilities, and reselling the use of such methods to others. Establishments primarily engaged in furnishing radiotelephone communications are classified in Industry 4812, and those furnishing telephone answering services are classified in Services, Industry 7389.

Data telephone communications
Local telephone communications, except radio telephone
Long distance telephone communications
Voice telephone communications, except radio telephone

4822: TELEGRAPH AND OTHER MESSAGE COMMUNICATIONS

Establishments primarily engaged in furnishing telegraph and other nonvocal message communications services, such as cablegram, electronic mail, and facsimile transmission services.

Cablegram services
Electronic mail services
Facsimile transmission services
Mailgram services
Photograph transmission services
Radio telegraph services
Telegram services
Telegraph cable services
Telegraph services
Teletypewriter services
Telex services

4841: CABLE AND OTHER PAY TELEVISION SERVICES

Establishments primarily engaged in the dissemination of visual and textual television programs, on a subscription or fee basis. Included in this industry are establishments which are primarily engaged in cablecasting and which also produce taped program materials. Separate establishments primarily engaged in producing taped television or motion picture program materials are classified in Services, Industry 7812.

Cable television services
Closed circuit television services
Direct broadcast satellite (DBS) services
Multipoint distribution systems (MDS) services
Satellite master antenna systems (SMATV) services
Subscription television services

5045: COMPUTERS AND COMPUTER PERIPHERAL EQUIPMENT AND SOFTWARE

Establishments primarily engaged in the wholesale distribution of computers, computer peripheral equipment, and computer software. These establishments frequently also may sell related supplies, but establishments primarily engaged in wholesaling supplies are classified according to the individual product (for example, computer paper in Industry 5112). Establishments primarily engaged in the wholesale distribution of modems and other electronic communications equipment are classified in Industry 5065. Establishment primarily engaged in selling computers and computer peripheral equipment and software for other than business or professional use are classified in Retail Trade, Industry 5734.

Computer terminals-wholesale
Computers-wholesale
Disk drives-wholesale
Keying equipment-wholesale
Peripheral equipment computer-wholesale
Printers computer-wholesale
Software computer-wholesale

5065: ELECTRONIC PARTS AND EQUIPMENT, NOT ELSEWHERE CLASSIFIED

Establishments primarily engaged in the wholesale distribution of electronic parts and electronic communications equipment, not elsewhere classified, such as telephone and telegraphic equipment; radio and television broadcasting and communications equipment; and intercommunications equipment. Establishments primarily engaged in the wholesale distribution of radio and television receiving sets, phonographs, and other household sound or video equipment are classified in Industry 5064.

Amateur radio communications equipment-wholesale
Capacitors, electronic-wholesale
Cassettes, recording-wholesale
Cathode ray picture tubes-wholesale
Citizens' band radios-wholesale
Coils, electronic-wholesale
Communications equipment, except household-wholesale
Condensers, electronic-wholesale
Connectors, electronic-wholesale
Diodes-wholesale
Diskettes-wholesale
Electronic parts-wholesale
Electronic tubes: receiving, transmitting, and industrial-wholesale
Intercommunications equipment, electronic-wholesale
Magnetic recording tape-wholesale
Modems-wholesale
Public address equipment-wholesale
Radio parts and accessories-wholesale
Rectifiers, electronic-wholesale
Resistors, electronic-wholesale
Semiconductor devices-wholesale
Tapes, audio and video recording-wholesale
Telegraph equipment-wholesale
Telephone equipment-wholesale
Television receiving and transmitting tubes-wholesale
Transformers, electronic-wholesale
Transmitters-wholesale
Transistors-wholesale

5734: COMPUTER AND COMPUTER SOFTWARE STORES

Establishments primarily engaged in the retail sale of computers, computer peripheral equipment, and software. Establishments primarily engaged in the sale of computers, computer peripheral equipment and software for business or professional use are classified in Wholesale Trade, Industry 5045.

Computer printer stores-retail
Computer software stores-retail
Computer stores-retail
Peripheral equipment, computer stores-retail

7371: COMPUTER PROGRAMMING SERVICES

Establishments primarily engaged in providing computer programming services on a contract or fee basis. Establishments of this industry perform a variety of additional services, such as computer software design and analysis; modifications of custom software; and training in the use of custom software.

Applications software programming, custom
Computer code authors
Computer programming services
Computer programs or systems software development, custom
Computer software systems analysis and design, custom
Computer software writers, free-lance
Programming services, computer: custom
Software programming, custom

7372: PREPACKAGED SOFTWARE

Establishments primarily engaged in the design, development, and production of prepackaged computer software. Important products of this industry include operating, utility, and applications programs. Establishments of this industry may also provide services such as preparation of software documentation for the user-installation of software for the user; and training the user in the use of the software. Establishments primarily engaged in providing preparation of computer software documentation and installation of software on a contract or fee basis are classified in Industry 7379, and those engaged in training users in the use of computer software are classified in Industry 8243. Establishments primarily engaged in buying and selling prepackaged computer software are classified in Trade; those providing custom computer programming services are classified in Industry 7371; and those developing custom computer integrated systems are classified in Industry 7373.

Applications software, computer prepackaged
Computer software publishers, prepackaged
Games, computer software: prepackaged
Operating systems software, computer: prepackaged
Software, computer: prepackaged
Utility software, computer: prepackaged

7373: COMPUTER INTEGRATED SYSTEMS DESIGN

Establishments primarily engaged in developing or modifying computer software and packaging or bundling the software with purchased computer hardware (computers and computer peripheral equipment) to create and market an integrated system for specific application. Establishments in this industry must provide each of the following services: (1) the development or modification of the computer software; (2) the marketing of purchased computer hardware; and (3) involvement in all phases of systems development from design through installation. Establishments primarily engaged in selling computer hardware are classified in Wholesale Trade, Industry 5045, and Retail Trade, Industry 5734; and those manufacturing computers and computer peripheral equipment are classified in Manufacturing, Industry Group 357.

CAD/CAM systems services
Computer-aided design (CAD) systems services
Computer-aided engineering (CAE) systems services
Computer-aided manufacturing (CAM) systems services
Local area network (LAN) systems integrators
Network systems integration, computer
Office automation, computer systems integration
Systems integration, computer
Turnkey vendors, computer systems
Value-added resellers, computer systems

7374: COMPUTER PROCESSING AND DATA PREPARATION AND PROCESSING SERVICES

Establishments primarily engaged in providing computer processing and data preparation services. The service may consist of complete processing and preparation of reports from data supplied by the customer or a specialized service, such as data entry or making data processing equipment available on an hourly or time-sharing basis.

Calculating service, computer
Computer time-sharing
Data entry service
Data processing services
Data verification service
Key punch service
Leasing of computer time
Optical scanning data service
Rental of computer time
Service bureaus, computer
Tabulating service, computer

7375: INFORMATION RETRIEVAL SERVICES

Establishments primarily engaged in providing on-line information retrieval services on a contract or fee basis. The information generally involves a range of subjects and is taken from other primary sources. Establishments primarily engaged in performing activities, such as credit reporting, direct mail advertising, stock quotation services, etc., and who also create data bases are classified according to their primary activity. Establishments primarily engaged in collecting data bases from primary sources and reformatting or editing them for distribution through information retrieval services are classified in Industry 7379.

Data base information retrieval services
Information retrieval services, on-line
On-line data base information retrieval services
Remote data base information retrieval services

7376: COMPUTER FACILITIES MANAGEMENT SERVICES

Establishments primarily engaged in providing on-site management and operation of computer and data processing facilities on a contract or fee basis. Establishments primarily engaged in providing computer processing services at their own facility are classified in Industry 7374.

Computer facilities management services

7377: COMPUTER RENTAL AND LEASING

Establishments primarily engaged in renting or leasing computers and related data processing equipment on the customers' site, whether or not also providing maintenance or support services. Establishments primarily engaged in both manufacturing and leasing computers and related data processing equipment are classified in Division D, Manufacturing, and separate establishments owned by the manufacturer and primarily engaged in leasing are classified in Division F, Wholesale Trade. Establishments primarily engaged in finance leasing of computers and related data processing equipment are classified in Finance, Industry 6159. Establishments primarily engaged in leasing computer time are classified in Industry 7374.

Computer hardware rental or leasing, except finance leasing or by the manufacturer
Computer peripheral equipment, rental and leasing
Leasing of computers, except finance leasing or by the manufacturer
Rental of computers, except finance leasing or by the manufacturer

7378: COMPUTER MAINTENANCE AND REPAIR

Establishments primarily engaged in the maintenance and repair of computers and computer peripheral equipment.

Computer peripheral equipment repair and maintenance
Computer repair and maintenance

7379: COMPUTER RELATED SERVICES, NOT ELSEWHERE CLASSIFIED

Establishments primarily engaged in supplying computer related services, not elsewhere classified. Computer consultants operating on a contract or fee basis are classified in this industry. Establishments primarily engaged in producing prepackaged software are classified in Industry 7372; and those engaged in offering data processing courses or training in computer programming and in computer and computer peripheral equipment operation, repair, and maintenance are classified in Industry 8243.

Computer consultants
Data base developers
Data processing consultants
Disk and diskette conversion services
Disk and diskette recertification services
Requirements analysis, computer hardware
Tape recertification service

8243: DATA PROCESSING SCHOOLS

Establishments primarily engaged in offering data processing courses or training in computer programming and in computer and computer peripheral equipment operation, maintenance, and repair. Schools offering an academic degree in computer sciences are classified in Industry Group 822.

Computer operator training
Computer repair training
Computer software training
Data processing school

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